

ISCC CARBON FOOTPRINT CERTIFICATION



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Table of Abbreviations

Abbreviation	Name
AF	Allocation Factor
AP	Acidification Potential
CB	Certification Body
CCS	Carbon Capture and Storage
CCU	Carbon Capture and Utilization
CHP	Combined Heat and Power Systems
CF	Carbon Footprint
CFC	Carbon Footprint Certification
CH ₄	Methane
CO	Carbon Monoxide
CO ₂	Carbon Dioxide
CO ₂ e	Carbon Dioxide Equivalent
CoC	Chain of Custody
EAC	Energy Attribute Certificate
EAF	Electric Arc Furnace
EoL	End-of-Life
EF	Emission Factor
EP	Eutrophication Potential
FU	Functional Unit
GHG	Greenhouse Gas
GoO	Guarantee of Origin

GWP	Global Warming Potential
H ₂	Hydrogen
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
ISCC	International Sustainability and Carbon Certification
kg	Kilograms
KPI	Key Performance Indicator
kWh	Kilowatt-hour
LCA	Life Cycle Assessment
LCI	Life Cycle Inventory
LCIA	Life Cycle Impact Assessment
LULUCF	Land-Use, Land-Use Change and Forestry
MeOH	Methanol (in text)
MJ	Megajoule
NDC	Nationally Determined Contribution
MB	Mass Balance
MB-CoC	Mass Balance under Chain of Custody
MTBE	Methyl Tertiary-Butyl Ether
MWh	Megawatt-hour
NGO	Non-Governmental Organization
N ₂ O	Nitrous Oxide
ODP	Ozone Depletion Potential
PACT	Partnership for Carbon Transparency

PCF	Product Carbon Footprint
PCR	Product Category Rules
PEFCR	Product Environmental Footprint Category Rules
PO ₄	Phosphate
PPA	Power Purchase Agreement
PU	Processing Unit
REC	Renewable Energy Certificate
RED	Renewable Energy Directive
SBTi	Science Based Targets initiative
SiO ₂	Silicon Dioxide
SO ₂	Sulphur Dioxide
t	tons
TfS	Together for Sustainability
UNFCCC	United Nations Framework Convention on Climate Change

Summary of Changes

ISCC is pleased to publish the update of the ISCC CFC System document (version 1.4). Part I of this document focuses on the methodological basis. ISCC CFC welcomes innovative technological solutions for reducing greenhouse gas (GHG) emissions, such as e.g. carbon capture and utilization (CCU) and carbon capture and storage (CCS) – published in Part II.

Summary of changes made in version 1.4	Chapter
New chapter on governance and CB requirements	3
Extension of the chapter certification process and verification guidance (formally: audit process and verification guidance) <ul style="list-style-type: none"> • Check eligibility of set-up with ISCC before registration • Information on onsite vs. off-site audits 	6
New chapter on logos and claims	8
Update CCU chapter on requirements for eligible CCU products in dependence on 100:0 and 0:100 approach. Addition of requirements for PCF calculation system boundaries for specific CCU products.	10.1. and 10.2.
New chapter on PLUS/ CFC combination <ul style="list-style-type: none"> • Consideration of biogenic carbon uptake • Mass balance approach and PCF combination 	11
New chapter on Renewable Energies <ul style="list-style-type: none"> • Use of renewable energies for utilities • Information on emission factor selection • Eligible proofs of renewable energies 	12

Part I: ISCC CFC – Basics

1 Introduction

The Paris Agreement invites its signatory states to develop a long-term strategy for a decarbonization of their societies by 2050. Many countries have already published and implemented such strategies aiming to stepwise minimize greenhouse gas (GHG) emissions and to achieve net zero emissions by 2050. This may be achieved by combining different measures such as reduction of fossil resource consumption, increase use of alternative and carbon-neutral feedstocks, permanent carbon storage, carbon utilization or carbon offsetting measures.

*Paris Agreement
and long-term
strategies*

Based on the Paris Agreement, many companies have started to implement long-term strategies and measures to decarbonize their business, supply chains, processes, and products as soon as possible, and at the same time to ensure long-term economic success. Part of this process is the determination and calculation of the relevant GHG emissions. Frameworks such as the Science Based Targets initiative (SBTi¹) define and promote best practice in target setting and are supporting companies on this. Thus, the reporting of carbon footprints (CF) for individual production steps, products, value chains and entire companies has become increasingly important in recent years. The reporting of such data for companies is requested by many stakeholders, e.g. regulators, financial institutions, customers, and Non-Governmental Organizations (NGOs), to receive measurable and comparable information on relevant emissions. CFs for products is a key indicator for environmentally friendly products and an important indicator for the comparability of products for many customers. In addition, brand owners are asking their suppliers for detailed information on carbon emissions for their products, aiming to minimize the overall carbon emission of final products and their supply chain.

*Companies are
implementing
long-term
decarbonization
strategies*

ISCC (International Sustainability and Carbon Certification) is a certification system that inter alia offers solutions for the implementation of decarbonization measures along complex supply chains. This document describes the overall guidelines for the “*ISCC Carbon Footprint Certification (CFC)*” which can be used by system users to certify a Product Carbon Footprint (PCF) for different processes, feedstocks, and products. *Part I* of this document focuses on the methodological basis.

ISCC CFC welcomes innovative technological solutions for reducing GHG emissions, such as carbon capture and storage (CCS) and the use of renewable energies. These and the corresponding emissions calculation are described in further explicit subchapters, explaining how the relevant emissions can be determined, and the certified products can be presented in a credible manner (see *Part II*).

¹ SBTi: <https://sciencebasedtargets.org>

ISCC EU and ISCC PLUS focus on the certification of sustainable and circular feedstocks and products along complex supply chain ensuring the chain of custody, traceability and supporting claims on the sustainability characteristics of final products, whereas ISCC CFC is verifying GHG emissions for feedstocks, processes and products. ISCC CFC is an independent certification scheme. An eligible combination of ISCC PLUS and ISCC CFC is explained in [Part II](#) of this document. ISCC CFC will be further developed by ISCC and its stakeholders. It is foreseen that the module will in future integrate additional processes and methodologies to determine GHG emission reductions supporting the decarbonization of industries, except those approaches already being developed and published (see [Part II](#)).

ISCC CFC can be combined or stay as stand-alone certificate

A comparable and reproducible calculation of GHG emissions or Product Carbon Footprints (PCFs) is important. Wherever possible, ISCC aims to harmonize ISCC CFC with established norms and standards (e.g. ISO 14040/44 and especially ISO 14067, Together for Sustainability (TfS) PCF guideline, GHG protocol). However, since these norms do not always exhibit fully transparent, reproducible and unique guidelines for individual processes and leave room for interpretation, ISCC introduces additional unique guidelines for the developed certification and CF calculation approaches to improve and ensure comparability and reproducibility of the PCF results. The following [Table 1](#) quickly shows how ISCC CFC is guided by ISO 14040/ 44/ 67, and the relevant further development ISCC CFC is bringing:

ISCC CFC guided by ISO 14040/ 44/ 67

Transparent, reproducible & credible – following ISO, TfS & GHG protocol

	ISO 14040/ 44/ 67	TfS	ISCC CFC
PCF calculation	✓	✓	✓
4 phases	✓	✓	✓
External, third-party revision	✓	(✓)	✓
Pre-defined system boundaries	x	x	✓
Database recommendation	x	x	✓
Impact assessment methodology recommendation	x	x	✓
System documents incl. individual project/ product description & mitigation technologies	x	✓	✓
Audit procedures	x	x	✓
Audit/ revision report	✓	(✓)	✓
Auditor trainings	x	x	✓
Certificate update required (if e.g. recipe, production, EFs etc. change – resulting in different PCF; and for masses)	x	x	✓
Third party certified PCF	(✓)	(✓)	✓

Table 1: Comparison ISO 14040/ 44/ 67 & ISCC CFC (Legend: checkmark in parenthesis: partial fulfilment with certain restrictions; details on the individual lines will follow within this document)

1.1 Reason and goal for ISCC CFC

ISCC CFC refers to the impact category “Global Warming Potential” (GWP) or “Climate Change” – explicitly those that influence Climate Change (in kg of CO₂ equivalents (CO₂e)) – caused by a product and its production. Even if environmental impacts are calculated under ISCC CFC, the PCF, which is the quantitative indication of ISCC CFC, does not provide an absolute or precise prediction of additional environmental impacts of the product under consideration. An exact prediction is not possible due to the relative approach, uncertainties regarding the data basis and uncertainties in the data selection and potential software solutions used.

Take home message: The aim of ISCC CFC is to maximize transparency, reproducibility, and credibility – by standardized methodologies. ISCC CFC focus is to limit the variability and selection options of the known and named standards.

The aim of ISCC CFC is to maximize transparency, reproducibility, and credibility. The PCFs determined under ISCC CFC shall be identically assessed, transparent and comparable. This explains why ISCC CFC and its PCF support pre-defined reference flows and functional units (FUs), further referring to one final impact assessment methodology (IPCC, described in detail below) and allows the use of a specific, comparability-increasing, database (as e.g. ecoinvent, GaBi/ LCA for Experts/ Sphera, described in detail below) - in addition to the preferred use of primary data (described in detail below).

The strictly defined requirements regarding reference flows, databases, and impact assessment methodologies should lead to less variability in results.

The ISCC carbon footprint certificates of all CFC certified entities are published on the ISCC webpage comparable to ISCC EU and PLUS certificates. ISCC CFC certification requires a verification process, called as ISCC CFC audit.

1.2 The difference between PCF and scope 1- 3 emissions

The PCF and the company-related scope 1, 2 and 3 emissions are two different approaches to recording and evaluating GHG emissions. Both play an important role in climate accounting, but they differ in their focus, methodology, and the framework they consider. The PCF measures the total GHG emissions generated during the entire or a partial life cycle of a product. This includes all emissions from raw material extraction (feedstock), production, and transportation to the use and disposal of the product. The PCF helps to quantify the climate impact of individual products, reduce it, and make products more climate friendly. It is also useful for communicating with customers, who are increasingly interested in the environmental compatibility of products. The definition of scope 1, 2, and 3 emissions was developed by the GHG Protocol to record a company's GHG emissions². They cover direct and indirect emissions and provide a comprehensive overview of a company's climate impact.

*PCF ≠
scope 1, 2, 3
emissions*

Scope 1 represents direct emissions. These include all direct GHG emissions that originate from sources that the company itself owns or controls. Examples include emissions from the burning of fossil fuels in company vehicles or

² The Greenhouse Gas Protocol. ISBN: 1-56973-568-9. Link: <https://ghgprotocol.org/sites/default/files/standards/ghg-protocol-revised.pdf>
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production facilities. These are therefore internal emissions over which the company has direct control.

Scope 2 is designated as indirect energy-related emissions. These are indirect emissions caused by the consumption of purchased energy, such as electricity, steam, heating or cooling. Although these emissions are not generated directly by the company, they are caused by the company's energy consumption. In short, these are energy-related emissions caused by the purchase and consumption of energy.

Scope 3 are further indirect emissions. These include all other indirect emissions that occur along the company's supply chain but are not included in scope 2. These include emissions from upstream activities (e.g. raw material production, logistics) and downstream activities (e.g. use and disposal of products by customers). Scope 3 therefore covers the entire supply chain, including suppliers, customers, and other indirect sources of emissions.

The most important difference in connection with ISCC CFC is that the PCF considers the life cycle of a product from raw material extraction to theoretical disposal. In the case of ISCC CFC, the current focus is up to the factory gate – named cradle-to-gate. In future, the system boundaries might be expanded up to cradle-to-grave (if wished for and needed), including the End-of-Life (EoL) and with that circularity aspects. Scope 1, 2 and 3, on the other hand, consider emissions in the context of a company's operations and its supply chain³.

³ The Greenhouse Gas Protocol. ISBN: 1-56973-568-9. Link:
<https://ghgprotocol.org/sites/default/files/standards/ghg-protocol-revised.pdf>
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2 Basics and scope of application

ISCC CFC is based on the ISO standards ISO 14040, ISO 14044, and explicitly ISO 14067. Further, TfS, SBTi and the GHG Protocol are considered in the methodological development.

The aim of ISCC CFC is to increase transparency, reproducibility and credibility in PCF assessments and accounting. ISCC CFC focus is to limit the variability and selection options of the known and named standards, guidelines, and directives as e.g. ISO 14040/ 44/ 67, TfS and the GHG protocol. To reach the named goal, no new CF methodology is developed.

The application of ISCC CFC, based on the afore mentioned approaches, serves to:

- Provide transparent, clearly reproducible, and credible CFs.
- Enhance the integrity of the quantification of GHG emissions.
- Support emission management and strategic support for environmental issues.
- Enable companies to account and communicate verified PCFs.
- Limit emissions and support reduced-emission innovations.
- Optimize processes, production, and recycling.

ISCC CFC can support the communication and reporting of CO₂ emissions, serve as a transparent and reproducible source and basis in GHG markets, and support risk management.

Evaluation

PCFs of feedstocks (raw materials), intermediates and products can be evaluated under ISCC CFC.

In general, this includes any physical product that is not classified as a service. However, services or services that trade the above-mentioned products and goods can obtain an ISCC CFC trader certificate, whereby the PCF of the product or goods does not change within the scope of the trader. Emissions resulting from transport or storage are borne by the next processing or purchasing entity as the end consumer (see [7.1 Trader](#)).

At present, certificates can only be issued under ISCC CFC for products or services whose technologies are already described [Part II](#). This can cover any products or services, but must, for example, apply one of the mitigation technologies described.

Take home message: Certificates can be issued under ISCC CFC for products or services whose technologies are already described in Part II of this system document. This can cover any products or services, but must, for example, apply one of the mitigation technologies described.

3 Governance and CB requirements

3.1 Governance

For the ISCC Carbon Footprint Certification, the same approach as laid down in the system document *ISCC PLUS 102 – Governance* is followed for:

- Documentation
 - System Documents
 - Guidance Documents
 - System Updates
 - Public Consultation
 - Document revision and stakeholder feedback
 - Audit Procedures
- Transparency
- Quality and Risk Management
- Conflict Resolution
- Non-conformities and Sanctions

Regarding “Quality and Risk Management”, ISCC has developed a specific training programme for auditors, CBs, System Users and other interested stakeholders. The programme covers a wide range of topics relevant to the ISCC CFC. ISCC offers trainings both in person and online, making them accessible to a global audience. The trainings are used to provide consistent audit processes, to update participants on the latest requirements and to facilitate stakeholder feedback and discussion. ISCC trainings may be set up as required. An overview of all current ISCC trainings is available on the ISCC website. Participation in specific training modules is a mandatory requirement for auditors to conduct ISCC audits or certain aspects of ISCC audits (see section [3.2 Requirements for Certification Bodies and Auditors](#)).

Regarding “Non-conformities and Sanctions”, the following additional non-conformities and sanctions are applicable for ISCC CFC:

- Intentional falsification of the PCF value (is a critical non-conformity).

3.2 Requirements for Certification Bodies and Auditors

Recognition or Accreditation of CBs

CBs must be accredited to ISO 17065 and additionally accredited to ISO 14065. The CB cooperating with ISCC must submit exhausting information

regarding the stage of their accreditation and/or recognition process. ISCC reserves the right to suspend the cooperation with the CB if there are indications that the process may not be completed within a reasonable time.

Activities under any ISCC certification system, particularly conducting audits and issuing certificates, may be carried out only if the CB has the above-mentioned valid recognitions/ accreditations. Notification of any changes regarding the recognition of the CB by a competent government agency or an accreditation body must be given by the CB to ISCC without delay.

The body responsible for recognition or accreditation is also tasked with monitoring the CB's compliance with the preconditions for its recognition or accreditation. Monitoring of the CB by national authorities or accreditation bodies is further complemented and supported by ISCC in the framework of the ISCC Integrity

[Application, Recognition and Publication by ISCC](#)

CBs that already have a Cooperation Agreement with ISCC for the ISCC EU and ISCC PLUS schemes can be recognised by the ISCC as a cooperating CB for ISCC CFC. For the CBs that would like to begin a cooperation with ISCC, the process steps are followed as laid down in the system document *ISCC PLUS 103 – Requirements for Certification Bodies and Auditors* under Chapter 3.3.

[Requirements for Reviewers and Certificate Decision-makers](#)

The CB must assign at least one person to review all information and results related to the evaluation. The review shall be carried out by person(s) who have not been involved in the evaluation process. The qualifications for the technical reviewer are as following:

- Mandatory participation and valid Attestation for ISCC Auditors from ISCC CFC Training and other ISCC training courses which might be necessary for the certification systems reviewed. The mandatory training rotation rule (i.e., renewing the Attestation for ISCC Auditors every three years) does not apply to technical reviewers.
- Mandatory participation to System Update Webinars or access to recorded session.
- The technical reviewer shall accompany an audit as observer every two years, unless the reviewer is also an auditor qualified to conduct ISCC audits who fulfils all requirements for ISCC qualified auditors.
- Good proficiency in English⁴.

⁴ Level B2 on Common European Framework of Reference for Languages (CEFR).
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The CB must define the entity (e.g. person or committee) responsible for making the certification decision at the CB. This entity must be qualified to make the certification decision and must not have been involved in the evaluation and audit process of the System User to be certified. The qualifications for the decision-making entity are the same as the requirements for the technical reviewer stated above. The review and the certification decision can be completed concurrently by the same person or group of persons.

Requirements for Auditors

All auditors must meet general requirements and qualifications in order to conduct ISCC CFC audits. When planning and conducting any ISCC CFC audit, the auditor must fulfil the following general requirements:

- Identify and understand the activities and processes undertaken by the audited System User, its overall organisation with respect to the ISCC CFC requirements and the effective implementation of relevant control systems.
- Identify the risks based on the System User's activities and information provided by the System User.
- Based on the result of the risk evaluation, define the intensity of the audit and assurance level applied pursuing to the principles of ISAE 3000 (revised)
- Draw up and carry out a verification plan, corresponding to the risk analysis and the scope and complexity of the System User's activities, including relevant evidence, upon which the audit decision will be based. The ISCC audit procedures may be used for this.
- Request that the System User provide any missing elements of audit trails, explain deviations, or revise claims or calculations before reaching a final certification decision.

Considering the activities mentioned above, the following requirements apply to all ISCC CFC auditors:

1. Technical knowledge, and a good understanding of the audited activities of the System User, relevant to ISCC CFC, including knowledge on Life Cycle Assessments and Product Carbon Footprints, sufficient for identifying, assessing, and managing the risks during each audit the auditor performs.

2. Good proficiency in English⁵ and working language skills in the corresponding native/ working language of the site where the audit is conducted⁶.
3. Personal and professional behaviour in the scope of ISO 19011 (e.g. ethical, open-minded, diplomatic, observant, culturally sensitive, etc.). Auditors should follow the six “principles of auditing” according to ISO 19011 when conducting ISCC CFC audits. Those principles are: integrity, fair presentation, due professional care, confidentiality, independence, and evidence-based approach.
4. Auditors should comply with the requirements of ISAE 3000 (revised) when conducting an ISCC CFC audit⁷.
5. The auditor should plan and conduct the audit taking into consideration the nature, timing, and extent of evidence-gathering procedures to ensure a substantive level of assurance for making decisions regarding compliance with ISCC CFC requirements. The auditor must establish at least a “limited assurance level” in context with the nature and complexity of the System User’s activities. A “limited assurance level” implies a reduction in risk to an acceptable level as the basis for a negative form of expression by the auditor.
6. Auditors are not permitted to make the final certification decisions regarding audits they have performed themselves.
7. Auditors are not permitted to carry out any activities which may affect their independence or impartiality, and specifically must not carry out consultancy activities for the ISCC System Users whom they audit for compliance with ISCC CFC requirements.

Auditors conducting ISCC CFC audits are required to meet the following general qualifications:

1. At least 2 years of work experience within the relevant field, accumulating 3 years of work experience overall.
2. At least 40 hours of audit training (e.g. according to ISO 19011).
3. For an auditor: Four complete audits for a total of at least 20 days of audit experience under the direction and guidance of a competent audit team leader. These audits must have been completed within the past three consecutive years.

⁵ Level B2 on Common European Framework of Reference for Languages (CEFR).

⁶ If the auditor cannot conduct the audit in the native/working language of the site where the audit is conducted, an independent translator must be involved. If necessary, the documents to be reviewed must be translated independently, ideally in advance of the audit. Regardless of the language in which the audit was conducted, the audit report shall always be written in English.

⁷ ISO 19011:2011 Guidelines for auditing management systems.

4. For an audit team leader: Three complete audits for a total of at least 15 days of audit experience under the direction and guidance of an auditor who is competent as an audit team leader. The audits must have been completed within the past two consecutive years.
5. Knowledge of how to handle, evaluate, and assess the plausibility of data sources.
6. Knowledge of traceability verification and relevant databases, chain of custody options, supply chain logistics, particularly mass balance calculation and verification, bookkeeping, and related areas.
7. Competence in group certification and sampling principles (if applicable during an audit).
8. Successful completion of the ISCC CFC Training before the first ISCC CFC audit can be conducted. After the initial participation in the ISCC CFC Training, the completion of the ISCC CFC Training must be repeated at least every three years.
9. For the combination of ISCC PLUS and ISCC CFC, the successful completion of the ISCC PLUS Training is an additional requirement. (Please consult *ISCC PLUS 103 – Requirements for certification bodies and auditors.*)
10. Competence regarding ISCC CFC is ensured either by conducting or witnessing at least one ISCC CFC audit or by participating in training courses organised by the CB or by ISCC covering operational and content updates of ISCC CFC within a 12-month period.

4 ISCC CFC certification concept and documents

This chapter introduces the certification concept of ISCC CFC. It hence describes which entities could get certified, the basic features of an ISCC CFC certification and the required documentation. In addition, the chapter introduces various document templates and documentation ISCC provides to simplify the process of PCF calculation and certification for both the system user and the auditor.

4.1 System basics: The ISCC CFC certification concept

With the help of [Figure 1](#), we will guide you through the ISCC CFC system basics and the required documentation of an ISCC CFC certification.



Figure 1: Certification under ISCC CFC and relevant documents

In general, there are two options for CFC certification:

- Inputs/ Feedstocks A/ B/ C of the to-be certified site are not CFC certified (see example in [Figure 1](#)). In this case, one of the technological (mitigation) chapters in [Part II](#) must be applied in order to obtain an ISCC CFC certificate at all. This means that the certified entity must apply a mitigation measure: for example, CCS, CCU or renewable energy.
- If inputs/ feedstocks A, B and/ or C are already CFC-certified, the so-called downstream certification process for processing units or traders applies (see [7 Downstream entities](#)).

As described above, the inputs/ feedstocks A/ B/ C (left side of [Figure 1](#).) can, but do not have to be certified under ISCC CFC. We provide detailed information on emission factors (EFs) and PCFs in [5.2 Data as the basis –](#)

LCI. This approach differs from that of ISCC PLUS, where the whole supply chain needs to be certified to trace non-conventional feedstocks through supply chains.

All certificates and their associated documents refer to a site but focus on one/several specific product(s) that is produced at this site.

Take home message: Certificates can be issued under ISCC CFC for products at Processing Unit (PU), Trader (with and without Storage) and Warehouses.

The product to be certified within the scope of ISCC CFC of a site is therefore audited. In order to carry out the audit process, we provide so-called **audit procedures**, which are explicitly tailored to the corresponding technology/methodology. The audit procedures can currently be requested by the system user or auditor on request and are therefore not publicly available or accessible.

Important information: With the roll out of ISCC CFC, it is also integrated in the ISCC HUB. Early 2026, audit procedures can be filled in via APS, as it is done for e.g. ISCC EU or ISCC PLUS.

If the audit is successful, a **certificate** is issued. The certificate contains information about the product and the system boundaries but does not necessarily publicly disclose the value of the certified PCF. However, one could add it to the certificate on a voluntary basis. The certificate is uploaded to the ISCC HUB and can be viewed publicly on the ISCC website along with a summary audit report. To ensure that a customer of ISCC CFC certified materials receives all relevant information a **PCF declaration** is provided by the CFC certified entity to its customers containing all relevant information about the certified and delivered product including the actual PCF value. It is mandatory to pass this PCF declaration with the delivery of an ISCC CFC certified material to the recipient of the material (together with the delivery note, comparable to the ISCC PLUS Sustainability Declaration). The template of the PCF declaration document is provided in the client section of the ISCC website. The certified PCF on the PCF declaration is one of the relevant distinctions between ISCC CFC and, for example, ISO or Tfs.

The certificate is valid for one year (validity period of the certificate). The CF calculation (PCF in kg CO₂e/ kg FU) can be reviewed on a yearly basis, but it is also sufficient to review the CF every three years (validity period of the PCF calculation). This means after an initial CFC certification the PCF calculation needs to be reviewed at the third re-certification audit, which is illustrated in the following [Figure 2](#) exemplarily for the first audit in 2025.

*Validity periods
for ISCC CFC
certificate and
PCF
calculation:
Annual mass
balance
verification and
GHG revision
every 3 years*

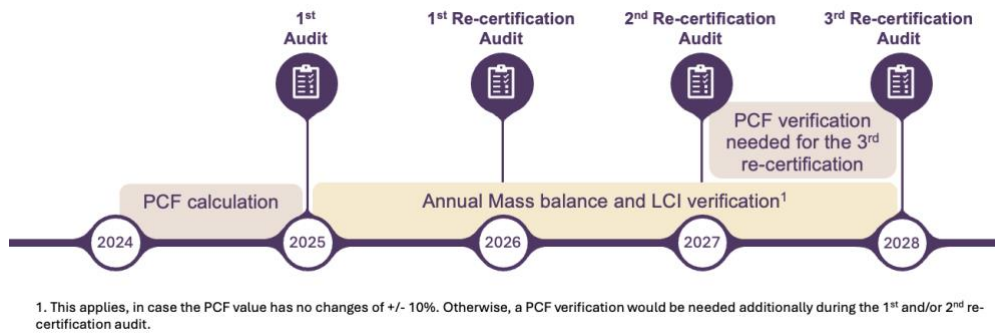


Figure 2: Exemplary illustration of validity periods.

However, if there are changes of +/- 10% from the initial PCF value due to changes in e.g. the production process, in the recipe (i.e., PCF of used raw materials), shutdowns, plant turnarounds, a change in supplier (data), a change in software and/or database solution to calculate the PCF (e.g. relevant updates in the IPCC methodology or in specific emission factors, identified e.g. via supplier datasheets or ISO reviews etc.), an adjusted calculation must be reviewed at the regular yearly recertification audit after the changes had happened within the three-year validity period of the PCF calculation. If the PCF value should be updated during its three-year validity period due to e.g. the usage of another more appropriate EF for input materials, this can be done as well at a regular yearly recertification audit with the appropriate verification. If the PCF calculation is updated within the three-year validity period, this marks the start of a new three-year validity period. The mass balance of the certified products is verified yearly at the recertification audits. This includes the comparison of sold production volumes with required inputs like CO₂, renewable energy or CFC certified input materials.

Take home message: Certificates are valid for one year. The CF can be reviewed on annual basis, but it is also sufficient to review the CF every three years. If there are changes of +/- 10% from the initial PCF value being certified, it needs the annual revision.

The calculated PCF is always calculated retrospectively and therefore refers to a period before the audit date. This means that the calculated PCF applies from the audit date and is valid for the upcoming one to three certification periods (each one year). The material produced in a certification period is connected with the PCF valid in this certification period. This means that if an update of the PCF was done at a recertification audit and if certified material from the certification period before this recertification audit with PCF update is still available in the following certification period, the PCF for this material remains unchanged.

4.2 ISCC CFC documents and required documentation

First of all, this document, the so-called **system document**, describes all basics of ISCC CFC, detailed methodological/ technical approaches and

information and requirements regarding the timeliness of data, for example. This system document is publicly available and can be used at any time and has no access restrictions.

4.2.1 Audit procedures

The aim of the audit is to have external third parties (certification body (CB)) check the PCF calculation for its accuracy and plausibility (used and explained data, emission factors, masses and energies etc.). Furthermore, the masses (produced and sold; incoming and outgoing) of ISCC CFC certified material are checked.

*GHG/LCA
expert
knowledge
required for
revision/ audit*

There is a specific audit procedure for the ISCC CFC audit, which allows the auditor to query generic information as well as subject-specific topics. All CFC certified system users are checked with regard to their inputs (feedstock and intermediate) and their outputs (products and waste & residues, and emissions). In cases where the CF changes (for all production units), the life cycle inventory (LCI), selected processes, and EFs are also verified during the audit. Specific aspects such as mitigation technologies like carbon capture or the use of renewable energies, are treated with separate additional questions. All so called system users, processing units (PU) or traders, producing or dealing ISCC CFC certified material need to get certified.

The information required and named in the following chapter (see [5 Methodological approach](#)) have to be entered into the audit procedure by the CB. The aspects and questions relevant for ISCC CFC are queried via this audit procedure and no further written version is required.

4.2.2 ISCC CFC certificate

The ISCC CFC certificate is issued after a successful audit/ verification of the PCF calculation by the CB. The issued certificate is an official document that is always published in the ISCC webpage via the ISCC HUB. With the official upload, the certificate becomes valid and the PCF or purely the information about the material certified with ISCC CFC may be communicated by the system user.

The ISCC CFC certificate shall contain information about the defined system boundaries (cradle-to-gate), about the certified product and the defined FU/ reference flow, which is related to the PCF. The certificate also contains annual information on the data sets used and whether the data is mainly primary or secondary data. Additionally, it is up to the system user to decide whether the publicly available certificate includes the PCF value or not.

4.2.3 PCF declaration

After a successful audit and the official upload of the certificate - with or without an indication on the certificate for the PCF – it is mandatory to pass on the PCF value to customers of the system user/ certificate holder if required by

the customer. This information is passed on as part of a so-called PCF declaration.

Among other information the named PCF declaration needs to provide the following information (only partially included in certification certificate):

- Information on date of issuance and the CB name who issued,
- Information on supplier and recipient, unique number of PCF declaration,
- Type of product,
- FU and/ or reference flow (quantified material),
- PCF in kg CO₂e / FU,
- Information whether the PCF includes a calculated uptake of biogenic carbon,
- The amount of biogenic uptake in kg CO₂e per kg of product,
- Quantity of product with given PCF delivered,
- System boundaries.

4.2.4 CO₂ declarations

For the audit, it may be necessary for the system user to complete and provide so-called **CO₂ declarations** – so far in use in CFC's CCU and CCS approach (see chapter below in *Part II*) with regard to the use and calculation of credits (information and assurance from both the CO₂ capturer and the CO₂ user about who includes which emissions or credits in their own calculation). These self-declarations can be requested in the same way as audit procedures and are not publicly accessible.

The CO₂ declarations of ISCC CFC differ from the CO₂ self-declarations of the other ISCC schemes, hence only CO₂ declarations of CFC can be used under ISCC CFC.

Take home message: Only the certificate and the summary audit report will be uploaded and visible at the ISCC website. The certificate, the audit procedures and summary audit report are needed to be uploaded in the ISCC HUB. PCF declarations must be provided by the system user to their customer – no upload in the ISCC HUB needed. CO₂ self-declarations must be provided by all relevant parties – no upload on the ISCC HUB needed.

5 Methodological approach

Take home message: The following chapter might be repetition for LCA/PCF experts; for sake of completeness, ISCC decided to include this informative section.

The approach of ISCC CFC harmonizes the named established norms and guidelines:

- ISO 14040,
- ISO 14044,
- ISO 14067,
- TFS,
- GHG Protocol,
- ISO 22095.

Deviations or stricter standardizations compared to the ISO standards, for example, are explained in the respective subchapters. These “restrictions” under ISCC CFC serve to limit the selection options in the calculation process and thus improve the comparability and reproducibility of the PCFs, without the need to define a completely new methodology of PCF calculation.

5.1 Goal and scope

All aspects – being relevant for ISCC CFC certification – are described in this document. In addition, the ISCC CFC audit procedures shall be used by auditors to conduct ISCC CFC audits. No formal goal and scope is required for the audit itself, but evidence is required: the audit procedures must be followed, and a clear PCF calculation must be presented to the auditor, showing emission factors and the calculation methods.

5.1.1 Aim and purpose

ISCC CFC does not require the aim and purpose to be stated, but it can be useful for the CF implementer to clearly define the aim and the addressees of the study. Why is the study being carried out, what will the results be used for, and to whom and in what form will they be communicated? Should the PCF be shown in the final appendix of the certificate or is it not intended for public communication?

5.1.2 Scope

In contrast to aim and purpose, the scope for auditing ISCC CFC must be specified and is also checked in the audit procedures.

The following aspects for the auditing of ISCC CFC must be specified under scope:

- Product system to be audited,
- FU or reference flow - the quantity to which the CF relates,
- System boundary,
- Allocation procedure,
- Possible cut-off criteria,
- Selected impact assessment,
- Data requirements (sources of secondary data),
- Temporal reference period,
- Spatial situation (country/ location of production),
- Software solution used to calculate the CF.

The calculation and analysis of the CF is an iterative method. During data collection and accounting, various aspects of the scope of the study may require modification to achieve the original objective of the study. Changes within the assessment are possible at any time. However, the CF to be certified must be finalized and made available to the auditors without any further changes – otherwise a new audit needs to be done.

5.1.3 System boundary

In general, CFs or PCFs are created by defining product systems as models that describe the most important elements of physical systems. The system boundary defines the process modules to be included in the system. Ideally, the product system should be modelled in such a way that the inputs and outputs at its boundaries are raw or primary flows. In this way, an accurate CF based on primary data can be mapped with a high degree of accuracy across an entire supply chain.

When setting the system boundary, several life cycle stages, process modules and flows should be taken into account (see [Figure 3](#)), as e.g. the following:

- Extraction of raw materials (primary),
- Use of secondary materials (including potential burdens of reuse, recycling, and energy recovery),
- Inputs and outputs of the main manufacturing and processing steps,
- Distribution/ transport,

- Production and use of energy sources, electricity, heating or cooling,
- Utilities and auxiliaries,
- Disposal of waste generated in the process and of products,
- Production of consumables,
- Production, maintenance, and decommissioning of production facilities,
- Additional processes, such as lighting and heating.

ISCC CFC focuses on the cradle-to-gate system boundaries. Other possible system boundaries are not excluded. The integration of EoL modelling and credit attribution⁸ is considered, for example in the case of carbon capturing and utilization. For your specific case, please specify which aspects are mapped in the system boundaries and which, if any, cut-off criteria are not considered in more detail.

5.1.4 Functional unit and reference flow

A functional unit (FU) defines the quantification of the specified functions of the product. The main purpose of a FU is to create a reference to which the input and output data are normalized. Therefore, the FU must be clearly defined and measurable.

Once the FU has been selected, the reference flow must be defined. Comparisons between systems must be made based on the same function(s) quantified with the same FU(s) in the form of their reference flows.

Reference flows are the measured outputs of processes that are required to fulfil the function to which the input and output flows are related (see [Figure 4](#)). It is important to define the reference flow in each product system to fulfil the intended function, i.e. the quantity of products necessary to fulfil the function.

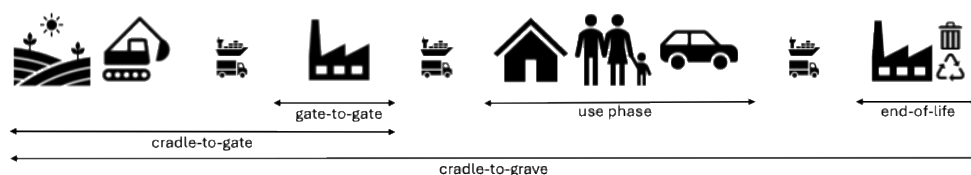


Figure 3: System boundaries – ISCC CFC focus: cradle-to-gate

⁸ Attribution is used in two contexts: 1) assigning credits of a process or product system to the product (or system) under consideration, and 2) assigning inputs with certified characteristics (e.g. origin from a non-conventional feedstock) to products within a process operating under a mass balance system (e.g. under ISCC PLUS).

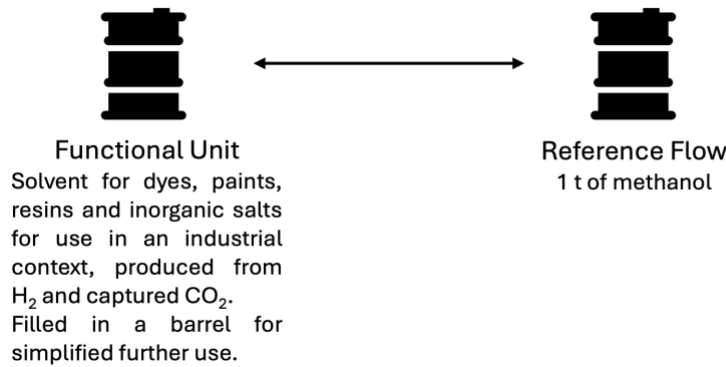


Figure 4: Simplified example FU (function) vs. reference flow (mass)

5.1.5 Cut-off criteria

Cut-off criteria are the definition of material quantities or energy flows associated with process modules or product systems that are to be excluded from a study. In the best case, there are no cut-off criteria, and all material quantities and energy flows are taken into account in the analysis.

The following cut-off criteria apply to ISCC CFC:

Material quantities (mass)

Using mass as a criterion requires the inclusion in the study of all inputs that contribute more than 1% to the mass input of the product system being modelled must be included (ISO 14040/ 44/ 67).

Important: If the initial identification of inputs is based solely on the mass contribution, this can lead to important inputs being omitted from the study. Accordingly, the energy cut-off criteria should also be considered in this process.

Energy flows

Using energy as a criterion, all inputs that contribute more than 1% of the energy input of the product system must be included in the study.

For ISCC CFC, this requirement also applies to infrastructures for manufacturing products. For example, the construction of facilities and equipment used for production, do not necessarily have to be included in the PCF – if assumptions and explanations are given (see chapters above and named cut-off possibilities).

Take home message: Using mass as a criterion requires the inclusion in the study of all inputs that contribute more than 1% to the mass or energy input of the product system being modelled must be included.

5.1.6 Allocation

Operations rarely produce a single output or rely on the linearity of raw material inputs and outputs. Most operations produce more than one product and use intermediate products or waste and residues as raw materials. It should be noted that allocation procedures are necessary when dealing with systems that produce or utilize multiple products. Allocation is the partitioning of the input or output flows of a process between the product under consideration and one or more other products. Under ISCC CFC, we differentiate between products, which are valuable and to which emissions are allocated, and waste and residues that are considered to have zero emissions. Products may cover main products, co-products and by-products as a sub-category of co-products.

Side information

Main Products: Main products are defined as products that the process is operated for and optimized to produce⁹.

By-product: Product output from a unit process that is an unavoidable but not desired. A product, resulting from a production process, the primary aim of which is not the production of that product may be regarded as not being waste but as being a by-product if the following conditions are met:

- Further use of the substance or object is certain;
- The substance or object can be used directly without any further processing other than normal industrial practice;
- The substance or object is produced as an integral part of a production process; and
- Further use is lawful, i.e. the substance or object fulfils all relevant product, environmental and health protection requirements for the specific use and will not lead to overall adverse environmental or human health impacts¹⁰.

Co-Product: Any of two or more product outputs coming from the same unit process or product system¹¹. Co-products may be main products or by-products.

Waste and residues: Substances or objects which the holder intends or is required to dispose of.

The sum of the inputs and outputs of a process module assigned by allocation must be equal to the inputs and outputs of the process module before allocation. Processes that are used together with other product systems must be labelled and handled according to the following step by step procedure¹²:

⁹ Together for Sustainability, v 2.1, 2024

¹⁰ DIRECTIVE 2008/98/EC, Waste framework directive

¹¹ ISO 14040

¹² following ISO 14040/ 44/ 67 and TfS

Step 1 – Avoiding allocation (preferred solution)

Formally, the first step is not part of allocation, but should be considered in the allocation process - always avoid allocation if possible. The preferred solution by ISCC is the subdivision of the process modules: The shared production process is divided into sub-processes so that products are produced separately and input and output data relating to these sub-processes are collected. The process only needs to be subdivided to the point where the products and their function are isolated.

*ISCC CFC preference:
avoid allocation
by subdivision*

Step 2 – Use and apply allocation (avoid if possible)

If allocation cannot be avoided by the named subdivision of systems, emissions are allocated based on the underlying physical relationships between the products or the economic value. A physical factor should accurately reflect the underlying physical relationship between the products and emissions. For example, if the weight of the output determines the quantity of emissions, allocation should not be based on the energy content, but on the mass of the output.

Prerequisites:

- A physical relationship can be established.
- Changes in the physical output of the products correlates with changes in emissions of the shared process.

Examples of physical factors are mass, volume, energy content of heat and electricity, number of units produced, protein content of food-by-products (BPs), and chemical composition.

The same allocation methods should be applied to similar inputs and outputs to ensure consistency. If there is no suitable physical property for allocation, economic allocation or alternative allocations need to be considered.

*ISCC CFC decision tree for allocation:
no allocation >
physical allocation >
economic allocation*

Besides the named guidance provided by ISCC, the rules in already published so called Product Category Rules (PCRs) should be used, as named by TfS (TfS, ISO 14000 series, Partnership for Carbon Transparency (PACT), GHG, Product Environmental Footprint Category Rules (PEFCR)). TfS, as example, accepted PCRs especially for the chemical sector as e.g. for steam cracker¹³.

5.1.7 Benchmarking and claims

ISCC is not in the position to define benchmarks for products certified under ISCC CFC. Hence, in general ISCC CFC is not making use of benchmarks or reference values (global and self-calculated). That being said, ISCC only focuses on the individual absolute PCF – independent of other values (with

¹³ PlasticsEurope recommendation on Steam Cracker allocation, 2017
© ISCC System GmbH

the exception of silicon metal, see below). Further information on claims can be found in chapter [8 Logos and Claims](#).

Take home message: No benchmarking or reference values under ISCC CFC. No claims under ISCC – it is just about the absolute PCF value.

5.2 Data as the basis – LCI

The LCI is the compilation and quantification of inputs and outputs of a given product over the course of its life cycle. The process of creating a LCI is iterative. As data is collected and the system is studied in more detail, new data requirements or limitations may be identified that require a change in data collection procedures so that the objectives of the study can still be met.

Consequently, within ISCC CFC, all feedstocks (including energy) (in LCA (Life Cycle Assessment) often named as input) are considered and quantified to produce the desired product (output). Energy inputs and outputs must be treated like any other input or output. The energy inputs and outputs must include the energy required for the provision of energy carriers, the energy content of non-energy feedstocks and the process energy used in the system to be modelled. Transportation routes, processing steps or similar steps that generate emissions through actions are also included.

To include all aspects in the LCI or data collection, it can be advantageous to use a visual representation. This visual representation is also known as a flow chart and is intended to improve process understanding.

The process modules and their interrelationships are shown in this system flow diagram. Each process module should first be described in order to determine where the process module begins and ends with regard to the supply of feedstocks or intermediate products.

The PCF calculation is based on actual data gathered from the ISCC system user and data sourced from databases and literature.

Data gathering is relevant for the process inputs defined in the PCF calculation equation including e.g. energy consumption, other process inputs and output data like process emissions, wastes, products and BPs. Relevant parameters, which cannot be measured directly, shall be calculated based on the input and output flows of the process.

Actual data measured and gathered at the system user's site must be documented and provided to the auditor for verification (not uploaded to the ISCC HUB). This can include production controlling sheets, production reports, production information systems, delivery notes, weighbridge protocols, contracts, invoices, and others. The calculation period should cover a full twelve-month period. It must be as up to date as possible, not older than three years (make use of the most recent and representative production year). In cases of exceptional maintenance measures and unstable production conditions a shorter period (for inputs and respective outputs) may be

considered if it better reflects the relevant timeframe. The respective period for data gathering and thus for the calculation of GHG emissions must be transparently displayed in the calculation.

5.2.1 Data categories

The data selected for the PCF depends on the objective and the scope of the study, as well as on the defined FU and its reference flows (goal and scope, and system boundaries). Furthermore, a distinction is made in the nature of the data as to whether it is primary data or secondary data:

- Primary data is collected and measured at the production sites which are assigned to the process modules within the system boundary.
- Secondary data can be taken and calculated from other peer-reviewed/ credible sources (e.g. publications, databases).

ISCC CFC is demanding primary data for PCF calculation. In case primary data is not available, secondary data (incl. design data) can be processed. A PCF assessment can be done even before the production itself started, being based on design data. Design data is allowed to be used at the initial and the first recertification audit. However, six months after the initial audit and at the recertification audit a revision of the design data and a comparison to the actual production data needs to be done. An update of the PCF is required using the primary production data if it significantly varies (+/- 10%) from the design data value. The comparison of the design data with actual production data can occur with actual data from a limited period, e.g. even on a one-month basis or up to a few months depending on the timeframe of operation. The used actual data (one or more months period) needs to be seen as representative by the system user and as plausible by the auditor/ CB.

Take home message: Primary data is preferred to be used under ISCC CFC. Database values as well as secondary literature values are also allowed. The system user must be able to justify each selected value and emission factor to the auditor. The auditor selects data sets that account for at least 5% of the total PCF individually and at least 50% of the total PCF in total, important is that each emission factor, for materials, accounting for >5% of the entire mass need to be reviewed.

On-site data gathering

The following data for the calculation of PCFs for products must be gathered on-site. They will form the basis for the calculation of GHG emissions. All input values must be gathered for the same reference time period (identical start and end date). In the example below the period of 1 year is used.

- Amounts of carbon monoxide (CO), CO₂ and other feedstock inputs introduced into the process (e.g. per t of CCU product per year) as well as their specific source (e.g. syngas process)

- Source and amount of electricity used for the operations (e.g. MWh per year)
- Source and amount of process heat used for the operations (e.g. MWh per year)
- Type and amount of additional process inputs (e.g. t per year)
- Amount of products produced (incl. mitigation technologies) (e.g. t per year)
- Amount of BPs produced (e.g. t per year)
- Amount of process wastes (e.g. t per year). Waste streams might be clustered in case the EF for their treatment processes is the same.
- Amount and composition of flue gas and other direct process emissions, especially in relation to climate relevant emissions (e.g. CO₂, CH₄, N₂O, etc. in t per year). If these emissions cannot be measured directly, they shall be calculated based on the process inputs and outputs.

Missing data and estimated data (including e.g. assumptions made, approximate data sets) must be documented. For all process modules and for each data source where missing data is identified, the treatment of missing data and data gaps must result in

- A "non-zero value", which is explained,
- A "zero value", if justified, or in
- A calculated value based on recorded values from process modules using similar technology.

If data has been taken from published sources (secondary data), the source must be referenced. As the data is taken from various sources - both site-specific as well as publicly available data sources, measures should be taken during data collection to ensure a consistent and coherent understanding of the product system to be modelled.

The following types of data for the calculation of GHG emissions can be gathered from reviewed databases and literature as well as from official statistics:

- EFs for the production and supply of the process chemicals,
- EFs for the supply of the feedstock (raw materials),
- EFs for the production and supply of additional process inputs,
- EFs for electricity and other energy sources in kg CO₂e per unit of energy used,

- EFs for the treatment of wastes and residues.

If no ISCC CFC certified input material is used [7 Downstream entities](#) and if no primary data/ measurement data are available, EFs can be sourced from and are accepted by the auditor from the sources in the following (no on-site visits required under other schemes/reviews):

- ISO 14040/ 44/ 67 critical reviews,
- TfS revision trust-level 3,
- TfS revision trust-level 2, with an additional auditor revision of the activity data used for that TfS calculation,
- LCI databases such as, e.g. ecoinvent, GaBi (Sphera), GREET or country-based databases (e.g. Japan IDEA) etc.; the used database needs to be named in the audit procedures,
- Publications from international, competent organizations such as Intergovernmental Panel on Climate Change (IPCC), International Energy Agency (IEA) or governments,
- Other reviewed sources of data, such as E3 database, GEMIS database incl. justification for that data source and the used EF,
- Peer-reviewed, scientific publications.

For all the above points, the auditors must check whether the method meets the standards and covers the entire life cycle, for example whether the data is geographically representative and up to date. This review must be carried out on an exemplary basis. The auditor selects data sets that account for at least 5% of the total PCF individually and at least 50% of the total PCF in total, important is that each emission factor, for materials, accounting for >5% of the entire mass need to be reviewed.

[EFs for energy](#)

EFs for energy follow in principle the above-mentioned sequence.

The use of energy from renewable sources can contribute to the reduction of associated upstream emissions. Please consult chapter [12 Renewable Energies](#) for further information on the use of renewable energy.

All data used to calculate the PCF should be as up-to-date and geographically appropriate as possible. Measured data from the production must be used. In case this data is not available, alternative data sources must be used. Calculated data must not be older than three years. Only in cases where a secondary data was used and the data set was not updated by the third-party provider (e.g. database), older data sets can be used whereby proof of this must be provided.

Geographically appropriate data must be used. In cases this is not possible, a detailed justification and an alternative data set that is as appropriate as possible must also be used.

Data accuracy is crucial for ISCC CFC. The objective is to be able to specify the PCF as representatively, comprehensively and in as much detail as possible. Further details on uncertainties can be found in the following section and in [Table 2](#) in particular.

5.2.2 Data quality

Take home message: The following chapter might be repetition for LCA/PCF experts; for sake of completeness, ISCC decided to include this informative section.

The quality of the input data used to calculate a PCF is a key determining factor, greatly influencing the overall uncertainty associated with the PCF result. It is therefore important to understand how the quality of the data used for the calculations has been evaluated by the authors of a PCF calculation and verified by the auditors as part of the auditing process under ISCC CFC. Thus, system users are required to evaluate the quality of their input data, according to a standardized approach, explained in the following table, which follows a state-of-the-art approach in LCA.

Data sources must be evaluated based on distinct attributes: "reliability", "completeness", "temporal correlation", "geographic correlation", and "further technological correlation". Furthermore, each attribute is categorized into five levels of quality, ranging from 1 to 5. Consequently, every individual input and output exchange documented in a data origin is assigned a set of five indicator ratings, known as a pedigree matrix.

A simplified example for the application of the data quality evaluation scheme is shown below the table (see [Table 3](#)).

Score Indicator	1	2	3	4	5
Reliability of the data	Verified data based on actual measurements	Verified data partly based on assumptions or non-verified data based on actual measurements	Non-verified data partly based on qualified estimates	Qualified estimate (e.g. by industrial expert)	Non-qualified estimate or unknown origin of data
Completeness of data	Representative data from all processes relevant for the product considered, over a period of 12 months.	Representative data from a smaller number of processes (>50%) relevant for the product considered, over a period of 12 months.	Representative data from only some processes (<50%) relevant for the product considered or >50% of processes but from shorter periods.	Representative data from only one process relevant for the product considered or some sites but from shorter periods.	Representativeness unknown or incomplete data from a small number of processes and from shorter periods
Temporal correlation	Less than 2 years of difference to the time period of the dataset.	Less than 3 years of difference to the time period of the dataset.	Less than 4 years of difference to the time period of the dataset.	Less than 5 years of difference to the time period of the dataset.	Age of data unknown or more than 5 years of difference to the time period of the dataset.
Geographical correlation	Data from area under study.	Average data from larger area in which the area under study is included.	Data from area with similar production conditions.	Data from area with slightly similar production conditions.	Data from unknown or distinctly different area.
Further technological correlation	Data from enterprises, processes and materials under study.	Data from processes and materials under study (i.e. identical technology) but from different enterprises.	Data from processes and materials under study but from different technology.	Data on related processes or materials.	Data on related processes on laboratory scale or from different technology.

Table 2: Indicators of data quality, modified from Weidema, 1998¹⁴

¹⁴ Weidema, B.P. Multi-user test of the data quality matrix for product life cycle inventory data. Int. J. LCA 3, 259–265 (1998). <https://doi.org/10.1007/BF02979832>

Example: Application of data quality indicators

The following example shown in *Table 3* makes use of *Table 2* and can be seen as template for future projects and individual assessment.

Case description: 2.5 year ago, the engineering department estimated based on experience with the same process in a similar region that the demand of electric energy would be 0.89 kWh per kg of reference product produced.

Evaluating the data quality of this information, its data quality can be determined as (3,1,2,3,1), given an additional explanation for the indicator and scope selection. The explanation for the result is shown in the following *Table 3*.

Data quality indicator for the amount of electricity used	Pedigree-Score (according to <i>Table 2</i>)	Explanation
Reliability of the data	3	Data from engineering and from assumptions based on experiences with similar processes in other production units.
Completeness of data	1	Engineering data and assumptions for all process and sub-process units involved in the production of the product under study.
Temporal correlation	2	The data from engineering was developed 2.5 years ago.
Geographical correlation	3	Data from engineering and assumptions based on experiences with production units in an area with similar production conditions.
Further technological correlation	1	The data has been developed for this specific process.

Table 3: Example for data accuracy/ uncertainty - using the indicators of data quality (Table 2)

5.3 Extrapolation of emissions – LCIA

In the life cycle impact assessment (LCIA) phase of the PCF calculation, the objective is to assess the potential environmental impacts of the product system based on the LCI results. In accordance with ISO 14040/ 44/ 67, the LCI results are first classified by assigning the relevant elementary flows to the impact category climate change. Subsequently, these flows are characterised using characterisation factors, i.e. global warming potentials (GWPs) for a specified time horizon, to calculate the impact category indicator result for climate change, expressed in kg CO₂ equivalents.

In ISCC CFC practice, this typically means that the system user either commissions a PCF study or performs the calculation independently, with a

focus on the impact category climate change, whereby the characterization factors are obtained from recognised databases or secondary literature.

The selection of data sources, the modelling of processes, and the choice and application of characterisation factors and background processes may introduce subjective elements into the LCIA phase (see detailed technical description). Therefore, transparency is a key requirement of the impact assessment, ensuring that methodological choices, assumptions and data sources are clearly documented and justified. This level of transparency is also requested in the ISCC CFC audit procedure and must be supported by detailed and traceable justifications.

Depending on the LCIA method applied, the procedures for classification and characterization may vary. Classification involves the assignment of elementary flows to relevant impact categories, whereas characterisation quantifies the relative contribution of these flows to an impact category by applying characterisation factors, for example by expressing GHG emissions relative to a reference substance such as CO₂. In order to minimize variability in the impact assessment results, ISCC CFC encourages the restriction of applicable impact assessment methodologies. This approach enhances transparency and comparability of results, in line with the general requirements for data quality and methodological consistency.

Where possible, the most recent methodology published by the Intergovernmental Panel on Climate Change (IPCC)¹⁵ should be applied for the characterisation of climate change impacts within ISCC CFC.

5.3.1 Midpoint indicator - CF

As part of the classic LCA according to ISO 14040/ 44, there is a larger number of indicators, so-called midpoint indicators, which are calculated and analysed in a comprehensive LCA. For the sake of completeness, we will briefly discuss the following midpoint indicators as examples of the complete LCA.

Eutrophication potential (EP)

Eutrophication describes the accumulation of nutrients such as nitrogen and phosphorus in water bodies, which leads to excessive algae growth and oxygen depletion. This over-fertilization can disturb the balance of ecosystems, harm fish and other aquatic life, and impair water quality. The EP is expressed differently depending on the LCIA method but is often expressed in kg phosphate equivalents (kg PO_{4e}).

¹⁵ IPCC Report AR6: <https://www.ipcc.ch/report/ar6/wg1/chapter/chapter-7/#7.6> Section 7.6.1.1

Acidification potential (AP)

Acidification refers to the release of acidic substances, such as sulphur and nitrogen oxides, which convert to acids in the atmosphere and fall as acid rain. This can damage soils, water bodies, and vegetation, as well as lower the pH value in ecosystems, causing long-term damage to biodiversity. AP is measured in kg sulphur dioxide equivalents (kg SO₂e).

Ozone depletion potential (ODP)

The ODP measures the ability of chemicals to deplete the ozone layer in the stratosphere. Substances such as chlorofluorocarbons are known to do this. The depletion of the ozone layer leads to increased levels of ultraviolet radiation on earth, which increases health risks such as skin cancer and negative effects on plants and animals. The ODP is measured in kg of R11 equivalents (kg CFC-11e).

However, within the framework of ISCC CFC - as the name suggests - we only focus on the CF and therefore only on one very specific impact category: Climate Change or GWP-100 (i.e. over a period of 100 years). The GWP, often also known as CF or CO₂ footprint, quantifies the GHG emissions of a product or activity that contribute to the greenhouse effect and thus to Climate Change. Increased GHG concentrations lead to global warming, which results in climatic changes, rising sea levels, and extreme weather events. The CF is expressed in kg CO₂e.

To calculate the CF, the concepts of classification and characterization are used as part of a LCA. In the classification phase, all relevant emissions and influences that occur during the life cycle of a product are identified and assigned to the corresponding environmental impacts (impact categories). For the CF, all emissions that contain climate-relevant gases such as carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O) are assigned to the "GWP" category. In the characterization phase, the identified emissions are assigned a specific weight based on their potential to contribute to global warming. This is done by applying so-called characterization factors. CO₂ has a characterization factor of 1, as it serves as a reference value. CH₄, however, has a higher characterization factor as it is about 29.8 times more effective than CO₂ in increasing global temperatures over a period of 100 years (depending on the used impact assessment methodology). N₂O has a factor of around 273, which means that one kg of N₂O corresponds to 273 kg of CO₂, respectively.

The CF calculation, which is determined and subsequently certified under ISCC CFC, is therefore always carried out as follows - analogous to ISO 14067: First, all emissions that occur in the various phases of the product life cycle (raw material extraction, production, transportation) are recorded. These emissions are then assigned to the environmental impact category "GWP" (classification), based on the type of GHG emitted. The individual GHG are converted into CO₂e by applying the characterization factors

(characterization). Finally, all emissions converted into CO₂e are added together to determine the total CF of the product or activity.

5.4 Results and interpretation

The evaluation is the phase of the LCA or PCF in which the results are considered. The evaluation phase should provide results that are consistent with the defined objective and scope and that are used to derive conclusions, explain limitations and make recommendations. The evaluation should reflect the fact that the results of the impact assessment are based on a relative approach. The results of this evaluation can be presented in the form of conclusions and recommendations to decision makers, in accordance with the objective and scope of the study conducted.

A relevant aspect in the interpretation of the results, especially for decision-makers, is the focus analysis or hot-spot analysis. This is a statistical procedure that identifies the data that makes the greatest contribution to the indicator value - i.e. the GWP under ISCC CFC. This data can then be analysed with higher priority to ensure that sound decisions are made. Furthermore, these so-called hot spots can also be revised in a sensitivity analysis (not mandatory, optional for ISCC CFC) to provide the best possible decision support regarding a product or even an entire production.

Under ISCC CFC, the PCF is output as an absolute figure in kg CO₂e per FU/reference flow as part of the interpretation. The presentation on the final certificate is voluntary - except for the product silicon metal.

5.5 Optional: Sensitivity analysis

The sensitivity analysis in general is a method for investigating how sensitively the results of a model or calculation react to changes in the input parameters – for ISCC CFC this is not a mandatory part. It helps to identify the uncertainties and weaknesses of the model by showing which variables have the greatest influence on the result. In practice, the input parameters are systematically varied to see how strongly these changes influence the result. This allows important influencing factors to be identified and better understood. In the context of a LCA or just a PCF, sensitivity analysis is used to check how robust the results of an environmental assessment are. Since a LCA/PCF is based on many assumptions and estimates, sensitivity analysis helps to understand how changes in these assumptions could affect the final result. Under ISCC CFC, the conduction of a sensitivity analysis is recommended, but not mandatory.

Take home message: The sensitivity analysis is not mandatory for ISCC CFC.

6 Certification process and verification guidance

To start the ISCC registration process for CFC certifications, the CB needs to provide a description of the set-up and the to be certified product/material to ISCC. Important: Only once ISCC approves the set-up's eligibility under ISCC CFC, the CB can continue the registration and certification process.

The following verification approach is required for all individual calculations:

- Every CB that reviews and verifies individual GHG emission calculations (i.e. PCF) needs to have at least one GHG/ LCA expert auditor who is responsible for verifying the methodology and the input data prior to the audit. To become a GHG/ LCA expert, the auditor needs to take part in the ISCC CFC training and write a test based on the respective training.
- The methodology used and the calculation itself must be done according to the ISCC CFC guidelines and presented in a reproducible and transparent way, which allows the auditor to verify the calculation. This includes a transparent presentation of the actual calculation, which allows the CB to follow the equations, input- and outputs as well as the emission factors and characterization factors used.
- The ISCC CFC system user must select an independent CB/ auditor to audit the PCF under ISCC CFC in accordance with the audit procedures provided by ISCC.
- The ISCC system user must make the GHG emission calculation available to the CB (e.g. in a spreadsheet software or via software solutions).
- The GHG/ LCA experts of the CB check information (e.g. methodology, emission factors (EFs), lower heating values, other standard values) prior to the on-site certification audit. If they have any questions and/ or require any corrections, the CB can contact the system user directly for clarification.
- During the certification audit, the auditor verifies all relevant information concerning the calculation of actual GHG values, with a specific focus on the plausibility of the input data (e.g. type of heat, amount of input materials, plant capacity, mass of products produced).
- If the CB requests any corrections in the PCF calculation, system users must provide an updated GHG calculation to the CB so that a final confirmation can take place. Corrective measures shall be implemented within 40 days.
- System users are only allowed to use the ISCC CFC certified PCF after the CB has explicitly confirmed that it is correct.
- If a system user wishes to update a calculation which has already been verified, the system user must contact the CB. It is the responsibility of

the CB to decide if an on-site audit is necessary to verify compliance with ISCC requirements.

In any case, the CB needs to provide ISCC with updated certification documents (ISCC CFC certificate, audit procedures).

The system user must provide records and evidence of the following data which will be verified during the audit:

- Evidence of relevant data for in- and outputs of the production process (e.g. production reports, sustainability information, invoices (e.g. energy)).
- Sources of EF (e.g. scientifically peer-reviewed literature, LCA databases such as ecoinvent) including the year of publication and their applicability (with respect to time and region). In the case of input materials, it is important to indicate the source of the PCF/ EF used (default value, ISO critical review, ISCC certified) (see [5.2 Data as the basis – LCI](#)). This is particularly relevant for long supply chains with several energy-intensive steps.
- Sources/ explanation as a basis for the allocation of inputs and outputs to (by-)products.

Take home message: A robust and transparent verification process is mandatory for all individual GHG emission calculations under the ISCC CFC scheme. These calculations must be conducted in accordance with ISCC CFC guidelines and reviewed by certified GHG/ LCA expert auditors. The methodology and input data must be traceable and reproducible, supported by credible sources. Only after the audit and the issuance of the certificate, the certified and verified PCF can be used and PCF declaration issued. Any updates or corrections must be coordinated with the certification body, ensuring full compliance with ISCC procedures. High data quality, methodological transparency, and auditor expertise are critical for successful verification.

6.1 Audit – onsite vs. remote

The following explains how and in what form audits for ISCC CFC are to be carried out. We define both general and specific aspects, as well as the distinction between mass balance and PCF auditing.

General considerations

In principle, the auditing under ISCC CFC - analogous to all other ISCC schemes - must take place on an annual basis. However, a distinction must be made between the review of the life cycle inventory and mass balance and the review of the PCF itself, including the emission factors applied. While the

verification of the mass balance and life cycle inventory is carried out annually, the PCF calculation can remain valid up to three years (see below).

Mass balance and life cycle inventory verification

Take home message: The audit of the life cycle inventory and mass balanced systems is required on an annual basis within an onsite audit (analogue to PLUS MB audit).

Relevant aspects which would need to be checked within this annual onsite audit:

- How much of certified product is sold with certified PCF?
- Comparison of masses of sold certified products to needed input flows and/or credit attribution
- For CCU projects in detail:
 - 100:0: The amount of captured CO₂ vs. attributed CCU credits to sold products; consideration of capturing and transport burdens; verification if user incorporated respective amount of CO₂ into their products.
 - 0:100: The amount of captured CO₂ entering user production vs. amount of sold products with incorporated CO₂; consideration of capturing and transport burdens; consideration of unconverted CO₂ for calculation of the CCU credit.
- For CCS projects in detail: The amount of net stored CO₂ vs. attributed CCS credits to sold products.
- For renewable energy projects in detail: The sourced renewable energy in kWh vs. attributed renewable energy to sold products. Was sufficient renewable energy sourced for the amount of sold products? Details on the requirements for renewable energy can be found in chapter [12 Renewable Energies](#).
- For the PLUS-CFC combination: ISCC PLUS mass balance audit is done in separate ISCC PLUS certification. The ISCC PLUS mass balance audit covers inter alia the verification of needed certified input material amounts compared to sold certified products and the verification of considered conversion factors. Hence the CFC audit of PLUS products focuses on the PCF calculation of PLUS products. The mass balance of the PCF calculation needs to match the separately certified ISCC PLUS mass balance.
- The verification of correct issuance of PCF declarations, e.g.: were the PCFs correctly indicated?

PCF verification

For the PCF calculation revision/ audit, there might be three potential reasons:

- it is the initial CFC certification – which is done onsite,
- it is a re-certification after latest three years from the past certification onwards – which is done onsite,
- there were changes in the production, the database, the suppliers and others, named in chapter *4.1 System basics: The ISCC CFC certification concept*, which make an update of the PCF necessary – which can be done remotely.

Take Home Message: The PCF verification must be included in the initial CFC certification and at least every three years, unless there are major changes (named under chapter 4.1).

	Onsite	Remote
Annual Audit (incl. mass balance and LCI verification)	Yes	No
Earlier Revision of PCF	Not mandatory	Possible, up to the auditor

Relevant aspects which would need to be checked within the remote PCF audit:

- Is the PCF methodology in line with the CFC requirements (see individual chapters and audit procedures)
- Is there a given completeness of considered inputs and respective emissions
- Is the assessment giving timely and geographically fitting Emission Factors

In addition, in this remote review, specific activity data is named and listed, which need to be verified onsite together with the next upcoming onsite mass balance audit, as:

- The verification of input mass flows: Onsite verification, if amounts of input masses are correctly considered: e.g. Weigh bridge tickets, amounts via pipelines, etc.
- The verification of needed amounts of energy inputs: Verification of considered energy inputs in kWh e.g. via energy meters.
- The verification of direct emissions: System users need to show onsite, that the amount of considered direct emissions is correct, e.g. by measurements.

- Onsite verification at recertifications with any change in the production process incl. raw materials and energy supply, which can physically be verified on site, and lead to respective update needs for the PCF.

Specific aspects

- ISCC CFC and ISCC PLUS combination: A parallel audit is possible.
- For traders already being PLUS certified an initial CFC certification can be conducted remotely. The trading entity needs to contact its CB respectively. The setup of an additional mass balance for the ISCC CFC certified material can be verified remotely by the auditor. Issuance of ISCC CFC certificate can be handled within the certification period similar to adding additional traded materials within a PLUS certification. A full CFC audit is required at the next PLUS recertification audit. This means that the validity period of the initial CFC certificate ends already at the time of the expiration date of the existing PLUS certificate.
- In case of a recertification of the silicon metal approach, a remote audit is possible, since this approach does not include a mass balance – this under the requirement, that the PCF is not going to change.

7 Downstream entities

Downstream entities handling CFC certified material need to be ISCC CFC certified, if they want to forward PCF information of the certified products under ISCC CFC. A downstream entity is every unit following a CFC certified entity, which is certified according to the above-described certification approaches for different decarbonization measures (e.g. CCS, CCU) (see [Figure 5](#)). Depending on the purpose of the downstream unit, two different CFC certification scopes are applicable, which differ in certification and audit requirements: Traders and PUs processing CFC certified material.

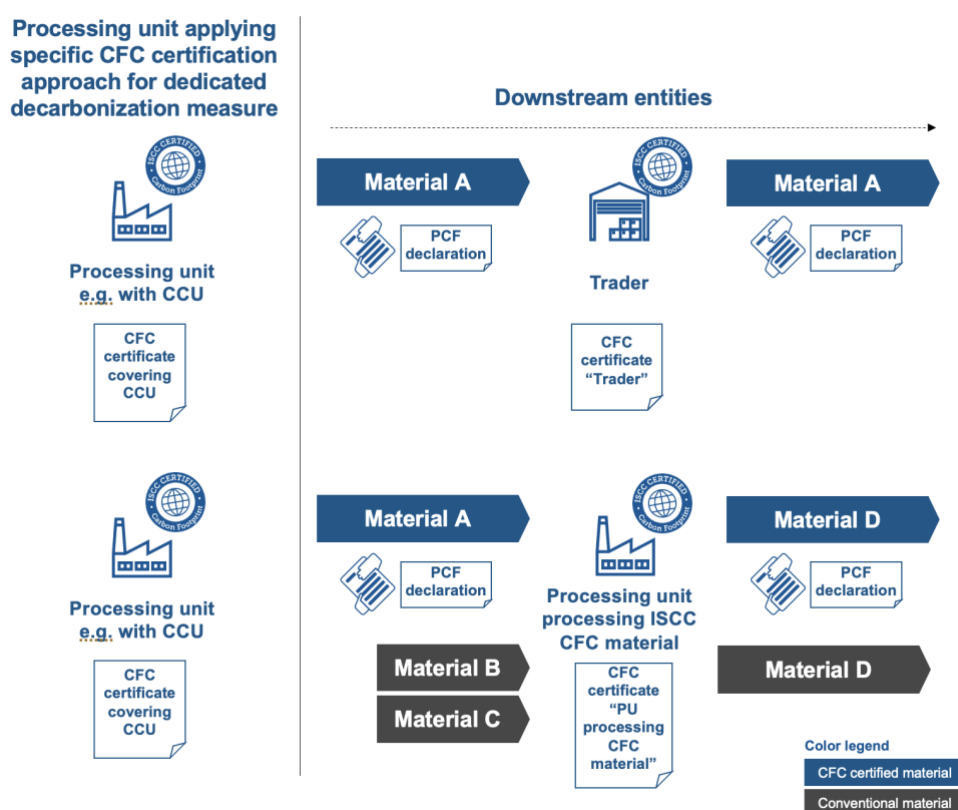


Figure 5: ISCC CFC certificate for downstream entities handling CFC certified material: Trader and PU processing CFC material

7.1 Trader

7.1.1 Certification requirements and handling of CFC certified material

Trading entities trading CFC certified material need to have an own CFC trader certificate (trader of gaseous material as well as liquids or solid materials). CFC traders need to implement a mass balance for ISCC CFC certified material, including the documentation for incoming and outgoing ISCC CFC certified material, e.g. methanol. Same mass balance principles apply as for ISCC PLUS certified traders. ISCC CFC certified traders receive and issue ISCC CFC PCF declarations with the respective amounts of certified CFC material. If an ISCC CFC certified trader also trades ISCC PLUS or EU certified material (via own EU/ PLUS certificate), they need to implement

separate mass balances for CFC, EU and PLUS certified material (also in case of the same chemical material, e.g. MeOH).

7.1.2 Emission calculation

Trading entities will not do an individual (product) CF calculation. They issue PCF declarations with the same PCF value as received from the previous PU, which is the “cradle-to-gate” PCF of the upstream PU, which produces the CFC material (see [Figure 6](#)). The following PU downstream the trading entity needs to consider all transport and storage emissions between upstream PU producing CFC material and the gate of the downstream PU.

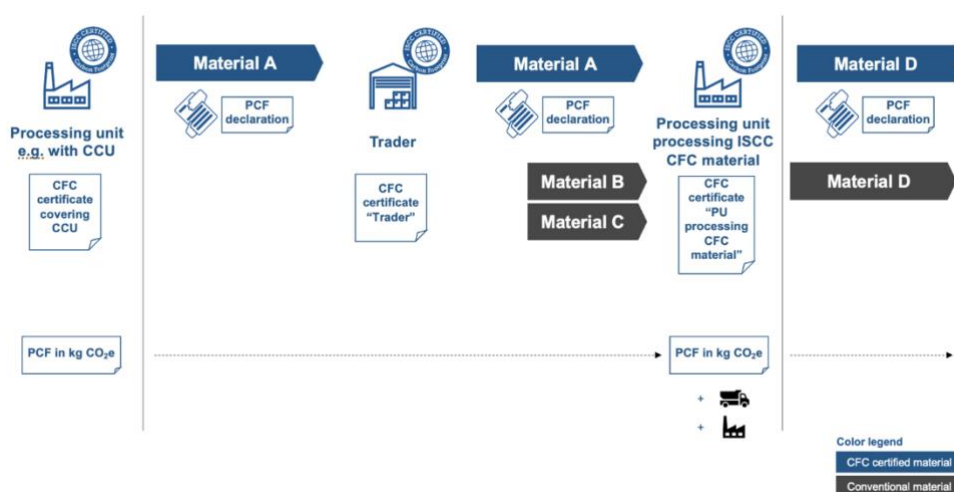


Figure 6: ISCC CFC Trader: Emissions of storage and transport needs to be considered in PCF calculation of downstream PU processing CFC material

7.1.3 Verification needs for the audit

Issuance of ISCC CFC certificate need to be based on a respective audit. During the audit incoming and outgoing amounts of CFC certified material need to be verified. If a trader is already ISCC PLUS certified, these traders must set up an additional mass balance for CFC certified materials.

7.2 PU processing ISCC CFC material

7.2.1 Certification requirements and handling of CFC certified material

The PU processing ISCC CFC material needs to be physically supplied with ISCC CFC certified material and needs to use the CFC certified material in its production to produce a (new) product. Respective PCF claims for this (new) product can only be made under ISCC CFC, if this PU processing ISCC CFC material is certified under ISCC CFC. The downstream PU needs to have an own CFC certificate as “Processing unit processing ISCC CFC material” and receives ISCC CFC PCF declarations for its ISCC CFC certified input material and issues ISCC CFC PCF declarations for its products, which incorporate ISCC CFC certified input material.

The PU processing ISCC CFC material can be a co-processing site: CFC material is co-processed with conventional input materials of fossil origin (non-certified material) in the same assets. Due to this co-processing nature a mass balance needs to be set up to attribute CFC certified input material volumes to dedicated product volumes. To align mass balance with common LCA principles, the mass balance/ attribution needs to follow the following requirements:

- CFC input material must be part of the input materials needed to produce the respective product (chemical/ technical feasibility).
- Attribution of CFC input material (input feedstock) to products (output) needs to follow chemical reaction of the production. This means that the share of CFC material in the product is limited to that part of the product which is derived from specific CFC input material (no compensation of input characteristics allowed, see [11 Combining ISCC PLUS & ISCC CFC](#)).
- Amount of CFC product is limited by amount of CFC certified input material and its consumption factor during the production of specific CFC product.
- Material losses during production need to be considered either via consumption factors or conversion factors.

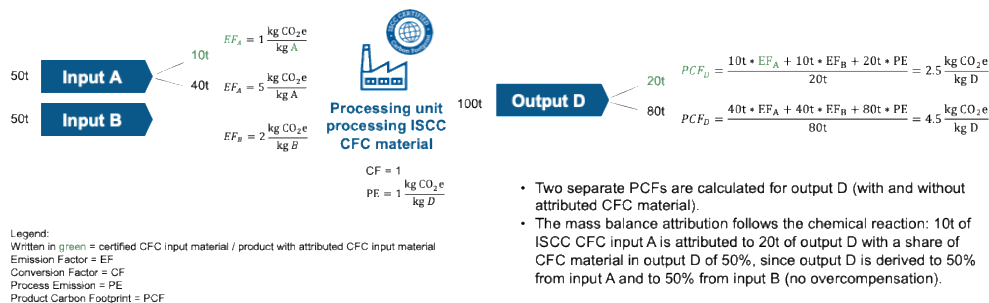


Figure 7: Example of mass balance attribution and emission calculation of ISCC CFC certified downstream material in a multi-input/ single-output process.

7.2.2 Emission calculation

The ISCC CFC certification of the PU processing CFC material covers the PCF calculation of its product(s) which incorporate CFC input material. The system boundaries for this PCF calculation are cradle- or gate-to-gate. Due to coprocessing nature of conducted process, separate PCFs for products of PU with and without attributed CFC input material need to be calculated (although being the same chemical/ material). For the EF of the incoming batches of CFC certified input material its ISCC CFC certified PCF must be used. The PCF calculation for the products of the PU processing CFC material needs in general to follow TfS/ ISO 14067. All emissions from feedstocks/ inputs, which are physically used during production, all emissions of processing operations

as well as all emission from transportation and storage need to be considered according to Tfs/ ISO 14067.

7.2.3 Verification requirements for the audit

During the audit for a PU, which processes ISCC CFC material, it needs to be verified, if the PCF calculation of its products incorporating CFC material and the attribution of CFC input material to the respective products follow the requirements outlined in this chapter. For the verification of the mass balance the amounts of incoming CFC certified material, the conversion/ consumption factor (losses of material, chemical reaction to justify used attribution) and the amounts of outgoing products with CFC certified PCF need to be verified.

8 Logos and Claims

This chapter outlines the logo option and specific requirements to make claims for ISCC CFC-certified entities under the ISCC CFC. It complements the terms and requirements set out in the system document *ISCC 208 Logos and Claims*, which remains the main reference for all ISCC logo and claim usage.

8.1 Logo Option

ISCC provides the ISCC banner for companies wishing to use an ISCC logo in business-to-business communication, such as on websites, in press releases, in sustainability report, or on social media. The ISCC banner and its related requirements are outlined in the *ISCC 208 Logos and Claims* document.

The ISCC seal, as provided on ISCC certificates, can only be used by ISCC and on ISCC certificates. The use of the ISCC seal by any other party is strictly prohibited.

For certified brand owners interested in using an on-product logo in end consumer-facing communication (e.g. on-product communication), please contact ISCC at licence@iscc-system.org.

8.2 Claims under ISCC CFC

Claims under the ISCC CFC must comply with the general marketing requirements set forth in the *ISCC 208 Logos and Claims* document. For the ISCC CFC-specific requirements, the outlined points below need to be applied:

- ISCC CFC claims are restricted to the absolute PCF value. Following, the ISCC CFC communication refers solely to the absolute PCF (in kg CO₂e). The System User can communicate the absolute value exactly as verified. However, they must not derive or imply claims such as “low carbon”, “reduced emissions” or similar, based on the value provided.¹⁶
- No benchmarks or reference values are provided. As such, benchmarks or reference values are not verified by ISCC. Therefore, when communicating these values, companies must not imply any association with ISCC CFC or suggest that the values have been verified.
- In the example of renewable energies (*12 Renewable Energies*), a final PCF for material with the attributed renewable energy is issued. Claims for the product can only be made in relation to the PCF. No

¹⁶ Such claims are currently only allowed for silicon metal, see chapter 0

claims can be made for the product itself or its feedstock under ISCC CFC (e.g. no claims like “obtained from renewable energy”).

The mandatory information for claims under ISCC CFC – including the absolute carbon footprint – is as follows:

- The absolute carbon footprint of the analysed product, expressed in kg CO₂e,
- The mitigation technology employed (i.e. Carbon Capture and Utilisation (CCU), Carbon Capture and Storage (CCS), Renewable Energies, ISCC PLUS material),
- Whether the PCF has been calculated using a mass balance approach.

Example of a permissible ISCC CFC claim:

Example CCU 100:0: The ethylene oxide exhibits an ISCC CFC-certified cradle-to-gate PCF of x kg CO₂e per kg product. During its production, CO₂ emissions are captured allowing under the ISCC CFC CCU 100:0 approach a compensation of site-specific processing emissions. The site-specific baseline PCF without compensation of site-specific processing emissions is y kg CO₂e per kg product.

Example PLUS/ CFC combination¹⁷: The ISCC PLUS-certified bio-attributed Polyethylene (credit-based mass balance) has an ISCC CFC-certified cradle-to-gate carbon footprint of x kg CO₂e per kg product (PCF excl. biogenic carbon uptake). The bio-attributed Polyethylene exhibits an attributed biogenic carbon uptake of y kg CO₂e per kg product.

8.3 Boilerplates:

If a company wishes to introduce ISCC or specifically ISCC CFC scheme in its external communication (e.g. press releases or social media posts), the following boilerplates may be used.

Boilerplate ISCC:

Founded in 2010 through a multi-stakeholder initiative, the ISCC is a globally applicable and leading certification system designed to enhance traceable, sustainable, deforestation-free, and climate-friendly supply chains. ISCC certifications are widely recognised and cover sustainable agricultural biomass, biogenic wastes and residues, non-biological renewable materials and recycled carbon-based materials. The development and implementation of different certification standards is ISCC’s tool to promote its mission to

¹⁷ Unless specified in applicable regulations or standards, the claim for ISCC PLUS and CFC certified bio-attributed products shall not include any claims on the attributed biogenic carbon “content”, as the term “content” implies a physical composition that cannot be guaranteed in a mass balance system.

mitigate climate change and bring more traceability into global markets and supply chains.

[Boilerplate ISCC CFC:](#)

Launched in 2025, the ISCC CFC is an internationally applicable certification scheme designed to verify and validate greenhouse gas emissions and PCF calculations for products, processes, and raw materials. ISCC CFC adds specific requirements to ensure comparability, transparency, and credibility of results. It enables companies to communicate climate impact data that is transparent, comparable, and independently verified. The certification currently covers cradle-to-gate assessments, with the option to extend to cradle-to-grave including circularity considerations. ISCC CFC can be obtained as a stand-alone certification or in combination with other ISCC schemes, such as ISCC PLUS. Independent certification bodies verify the assessment. Through ISCC CFC, companies can provide reliable, standardized, and audit-ready carbon footprint information, thereby fostering credible climate action and improved transparency in global supply chains.

Part II: Mitigation. Technological specialties under ISCC CFC

Since the start of the certification process in 2023, ISCC CFC has been carrying out intensively supervised and jointly developed case studies. The aim of this was and is to set up transparent, reproducible, and comprehensible PCF models together with the industries and to establish a certain standard for the initial products being certified under ISCC CFC – to ensure greater comparability of the PCFs. In the following, the individual specific approaches and products are presented in detail with their modelling – all subsequent identical products from system users must follow the published approaches.

9 Carbon Capture and Storage (CCS)

Prerequisite: CO₂ that can lead to credits under ISCC CFC via CCS or CCU should not be produced specifically for the capturing process but should lead to an overall reduction in CO₂ emissions. The primary requirement for an ISCC CFC certificate with captured and utilized or stored CO₂ is only possible if no new emissions are generated and an overall improvement is achieved.

9.1 Introduction

CCS is the permanent storage of CO₂ in a geological site. This emission reduction process is designed to prevent large amounts of CO₂ from being released into the atmosphere. Permanent CO₂ storing can take place in natural underground reservoirs utilizing natural geological barriers to isolate the CO₂ from the atmosphere¹⁸.

The whole process can be divided into three major steps:

Three process steps

- Capture: Separation of CO₂ from other gases and compression of the gas for transport purposes;
- Transport: Compressed CO₂ (“dense phase”, liquid-like state) can be transported to a suitable site for geological storage e.g. via pipelines, ship or truck;
- Injection and storage: Transported CO₂ is injected into deep, underground rock formation.

CCS is an option in the portfolio of actions that could be used to reduce GHG emissions from the continued use of fossil fuels¹⁹. Under the ISCC CFC module, companies can get certified for the service of permanently storing CO₂. This service of storing CO₂ generates “CCS credits” in the amount of the net quantity of CO₂ being stored. The net amount is the total amount of CO₂ being stored minus the emission (CO₂) occurring for the capturing, transport, injection, and the permanent storage of the CO₂ in the geological site (CCS unit). The CCS credits being generated can be considered for the PCF calculation of fossil-based products and processes, following the guidelines given in this chapter.

Under the ISCC CFC scheme, companies can consider using CCS to minimize carbon emissions of fossil-based products and to supply a more environmentally friendly product. The reduction of the CO₂ emissions for processing shall be applied to the CF of such a product. Due to the attribution of the CO₂ credits within the supply chain this approach is different from offsetting.

¹⁸ IPCC: Carbon dioxide transport, injection and geological storage, in: IPCC Guidelines for National Greenhouse Gas Inventories, 2006, https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_5_Ch5_CCS.pdf

¹⁹ IPCC, 2006.

This chapter provides guidelines for the certification of CCS under the ISCC CFC module and the accounting of CCS credits being generated for the permanent storage of CO₂. The requirements apply to all elements of the supply chain covering the PU from which the CO₂ is captured and the storage facility and the storage facility (CCS unit) itself. Further, this document also applies for downstream elements in the supply chain (e.g. PUs, traders) as guidelines for allocating CCS credits as well as for the avoidance of potential “double-counting” of CCS credits and carbon credits, e.g. under regulatory emission reduction schemes and ISCC simultaneously.

9.2 Certification approach for CCS supply chains

In the following the certification approach for CCS supply chains (including the respective certification requirements for the different elements of the supply chain) is described based on an exemplary supply chain including CCS (see [Figure 8](#)).

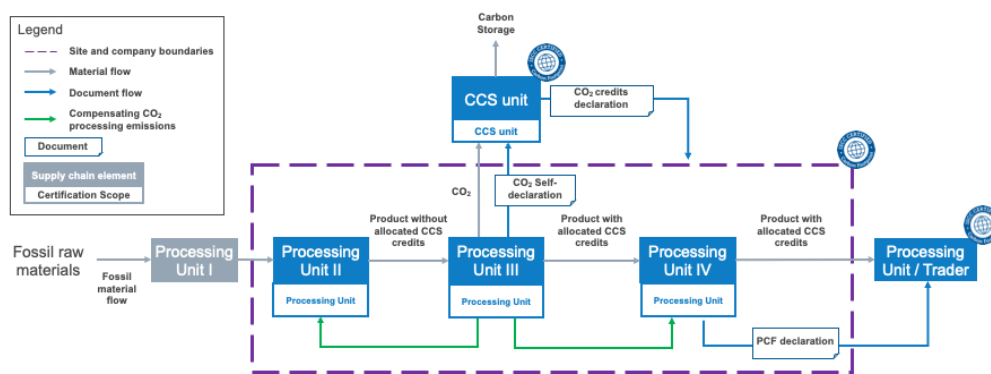


Figure 8: Example supply chain with a CCS unit in the chemical industry

9.2.1 CO₂ capturing and physical delivery to CCS unit

The CO₂ is captured at a PU (see [Figure 8](#): PU III) in the supply chain processing fossil-based raw materials and products. The CO₂ is a waste stream and without capturing the CO₂ would have been emitted to the atmosphere (direct emissions of PU III). In this example the CO₂ is of fossil (post-industrial) origin captured from industrial processes, which use fossil sources to deliberately produce electricity, heat, or materials (e.g. cement, iron and steel or the petrochemical industry). The CO₂ can also be of biogenic origin, when resulting from processing biomass at PU III.) In the example in [Figure 8](#) PU III is the Capturer for CO₂. The captured CO₂ must be quantified and transported to the CCS unit. A contract must be in place for the supply of the CO₂ from the PU to the CCS unit and a respective CO₂ self-declaration must be issued. The PU generating and capturing the CO₂ needs to be certified under ISCC (certification scope “Processing Unit”, PU III in [Figure 8](#)). The Capturer needs to provide a CO₂ self-declaration on the captured amount of CO₂ and emission occurring for the capturing.

PU capturing
CO₂

9.2.2 CO₂ storage at CCS unit

The CCS unit needs to be certified under ISCC (certification scope “CCS unit”). Only a certified CCS unit may issue a “CO₂ credits declaration” to the company that covers the PU generating and capturing the CO₂. In the “CO₂ credits declaration” the CCS unit confirms the amount of CCS credits, which is the amount of CO₂ permanently stored minus the amount of CO_{2e} emissions occurring for the capture, transport, injection, and permanent storage of the CO₂. Additionally, the CCS unit confirms in this declaration that they do not hold any rights or credits from the CO₂ stored.

9.2.3 PU allocating the CO₂ credits

The CCS credits can be allocated to products of the PU from which the CO₂ has been captured or to products of downstream PUs, if these fulfil all following requirements:

- The downstream PU must be physically linked to the PU capturing the CO₂. Physical link means that there must be a physical flow of intermediate materials between the PU from which the CO₂ has been captured and the PU allocating CCS credits (as depicted in [Figure 8](#)). Additionally, the products, to which the CCS credits are allocated to must be produced via this intermediate material flow (chemical/technical feasibility).
- The downstream PU must be operated by the company also operating the PU generating and capturing the CO₂ (within same corporate company structure).
- The downstream PU must be located on the same site as the unit capturing the CO₂ (same chemical park).

The PU allocating the CCS credits needs to be certified under ISCC (certification scope Processing Unit, PU III or IV in [Figure 8](#)), and can use the CCS credits within its PCF for a respective amount of outgoing product. The CCS credits can be allocated to one or several of the outputs of the PU.

If for the handling of product batches with allocated CCS credits the same infrastructure is used as for batches of the same type of product without allocated CCS credits, system users must comply with ISCC PLUS requirements for mass balancing (chain of custody option: mass balance). In comparison to the mass balancing requirements laid down in the ISCC PLUS system document, it is not allowed to conduct a multi-site-credit transfer for materials with allocated CCS credits to ensure the required physical link between the CCS unit and the products with allocated CCS credits (see description of physical link above, which is a crucial requirement for certification of CCS supply chains under ISCC CFC).

9.3 Methodology for the calculation of CCS credits

The methodology for the calculation of CCS credits must take the IPCC guidelines into account²⁰. All process steps for CCS (capturing, transport, injection, and storage) must be considered for calculating the CCS credits. For all three steps, leakages and uncontrolled CO₂ fluxes must be monitored, measured, and considered to determine the net CO₂ storage. The following equation describes how to determine the amount of CCS credits:

IPCC guidelines

Formula 1: CCS credits

$$CCS\ credits = CO_{2,stored} - E_{Capturing} - E_{Transport} - E_{Injection\ and\ storage}$$

The PU from which the CO₂ is captured must provide data for CO_{2e} emissions for capturing and transport. The CCS unit must provide data for CO_{2e} emissions for transport, injection, and storage as well as the amount of CO₂ stored. The operator of the CCS unit must provide data on annual CO₂ storage, leakages and any CO₂ fluxes through the seabed or ground surface. Additionally, the operator of the CCS unit is providing the calculation of the CCS credits.

9.4 Generation and attribution of CCS credits

Only CO₂ that is captured within the supply chain of the respective product and physically transported to a CCS unit is eligible to generate CCS credits attributable to that product. CCS credits are supply-chain-specific and cannot transferred, sold, or assigned to other products supply chains under ISCC.

To evaluate the impact of the CCS credits, a cradle-to-gate PCF baseline calculation must be provided for the product(s) to which the CCS credits are allocated. The PCF baseline calculation shows the PCF without consideration of any CCS credits (as defined in *Formula 1*, including both benefits and burdens of the capturing process), representing the PCF without mitigation measure, and must be site-specific for the certified PUs (usage of primary data within this system boundaries). Therefore, site-specific PCF calculation of the intermediate products of the certified company must be available (all processes and PUs of which emissions shall be compensated as depicted in *Figure 8*) must be available. The PCF baseline calculation is verified during the ISCC CFC certification process.

*Site-specific
PCF baseline
calculation
required*

The site-specific PCF baseline calculation together with the CCS credits stored via the physically connected CCS unit represent the emission inventory of the considered CCS supply chain within the system boundaries. Under the certification approach for CCS supply chains of ISCC CFC the CCS credits can be allocated to specific products of the considered CCS supply chain within this system boundaries. In other words: The CCS credits can only be assigned to products of the same production site, which uses products produced at the plant capturing the CO₂ as a material input / feedstock. The

²⁰ IPCC, 2006, https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_5_Ch5_CCS.pdf
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total sum of the calculated PCFs needs to be equal to the emission inventory of the supply chain within the system boundaries. Products without allocated CCS credits need to show the baseline PCF result.

The attribution of CCS credits is only allowed to products of the processing unit, which captures CO₂, or downstream PUs of the same site and company (see [9.2.3 PU allocating the CO₂ credits](#)). Additionally, the attribution of CCS credits is limited to compensate at most the site-specific process emissions (scope 1 and 2 as well as scope 3 of fuels used to produce energy, not scope 3 feedstock emissions) of the PUs involved in the supply chain at the certified site and from the same corporate company structure to produce the product to which the CCS credits are attributed. While a CO₂ credit shall only be allocated to products of the processing unit, where the CO₂ is captured, or their downstream products produced at the same site and from the corporate company structure, the emissions that can be compensated may originate also from upstream processing units within that supply chain, at the same site and of the same corporate company structure (emissions of PU II, III, and IV for the product of PU IV and emissions of PU II and PU III for the product of PU III in [Figure 8](#)). It is not allowed to compensate emissions originating upstream or downstream the site generating the CCS credits, which means that the cradle-to-gate PCF cannot be smaller than the sum of the feedstock emissions entering the system boundaries (i.e., no compensation of feedstock emissions or processing emissions outside of the site generating the CCS credits and no compensation of emissions originating from use phase or EoL).

*Attribution limit
of CCS credits*

Information on the attribution mechanism used must be transparently available for the downstream supply chain, e.g. the PCF declaration discloses the baseline PCF together with the PCF that uses CCS credits. The products, for which CCS credits are applied in the PCF calculation, must be listed on the Annex of the certificate of the respective PU and a respective site-specific PCF baseline calculation must be in place.

In all cases the balance of CCS credits stored, and CCS credits assigned must be closed, meaning that the sum of assigned CCS credits cannot exceed the amount of CCS credits stored (see calculation of CCS credits stored in [9.3 Methodology for the calculation of CCS credits](#)) within a mass balance period. In case the calculation of CCS credits is done on a yearly basis, a conservative estimate of the emissions from capturing, transport and injection based on the previous years can be used to determine the CCS credits for a respective mass balance period (i.e. 3 months). The balance of CCS credits needs to be reconciled, when the emissions from capturing, transport and injection are available for the respective year. Therefore, all certified entities need to conduct an individual balance of CCS credits (e.g. the CCS unit needs to conduct a balance of CCS credits stored and issued to the PU(s) allocating the CCS credits and a PU allocating CCS credits need to conduct a balance of CCS credits received from the CCS unit and allocated to its product(s)). The CCS unit needs to hold a valid ISCC certificate to generate CCS credits under ISCC CFC (CO₂ stored prior to ISCC certification cannot generate CCS credits under ISCC) and the maximum time frame for a balancing period is

*Requirements
on carbon
balance*

three months. The PU allocating CCS credits must document separately the product quantities with assigned CCS credits from product quantities without assigned CCS credits.

9.5 Expiration of CCS credits

CCS credits expire if they are not attributed to products after 60 months (5 years) from the month of capturing²¹. These savings can only be accounted from the first day of certification. If there is a gap between two certification periods, any CCS credits expire. The amounts of produced material with allocated CCS credit shall be treated on a mass balance base with a mass balance period of three months ending to each quarter of a year. It is possible to go into deficit within a mass balance period (to go short), i.e. to sell more material with a PCF, using CCS credits, than is available. This, however, is only possible under the condition that at the end of the mass balance period the amount of material with the corresponding PCF generated is balanced to the amount withdrawn. If there is remaining material with a PCF, using CCS credits at the end of a mass balance period, the surplus in the bookkeeping can be transferred into the next mass balance period. At the end of a mass balance period the quantity bookkeeping either must be balanced or have a surplus in bookkeeping that can be carried forward. Transferring surpluses in the bookkeeping is possible if a valid certificate is in place. If there is a gap between two certification periods, any surpluses vanish. A negative mass balance is not permitted under ISCC and treated as a non-conformity. If a negative mass balance occurs at the end of a mass balance period, the certified company must inform the CB immediately and without being requested.

Take home message: CCS credits under the ISCC CFC scheme are subject to strict temporal and certification-based constraints: they expire 60 months after capture of not attributed and are only valid during continuous certification periods. Materials with a PCF that takes CCS credits into account must be managed using a three-month mass balance system.

9.6 Mandatory information to be transferred within the supply chain

In the following, mandatory information is described, which needs to be transferred between different entities of the CCS supply chain (see [Figure 8](#)):

CO₂ self-declaration

- Information on supplier (CO₂ Capturer) and recipient (CFC certified CCS unit)

²¹ In case of future restriction on credit expirations by governmental authorities, the time frame of 60 months might be subject to change

- Amount of CO₂ delivered from CO₂ Capturer to CCS unit
- GHG emissions related to capturing

CO₂ credits declaration

- CCS unit storing the CO₂ and issuing the CCS credits declaration (incl. address and certificate number)
- CFC certified company that covers capturing of CO₂ and is receiving the CCS credits
- Quantity of issued CCS credits
- Confirmation that CO₂ is physically received from CO₂ Capturer at CCS unit, injected and permanently stored
- Confirmation that CCS unit does not hold any rights or credits from the CO₂ stored

The PCF declaration needs to give the information outlined in chapter 0. In addition, for CCS the baseline PCF of the product without the consideration of the CCS credits needs to be given. In addition, in the PCF declaration, it needs be declared, that the product with allocated CCS credits is a downstream product from the unit capturing the CO₂ (physically link between PU capturing the CO₂ and PU producing the product with allocated CCS credits).

9.7 Requirements for CCS units

CCS units can be certified for the “service” of permanent CO₂ storage. A prerequisite for this is that the CCS unit has a valid storage permit issued by the respective national/ international competent authority. The CCS unit shall have implemented a quality management system or shall be monitored by the respective competent authority documenting and ensuring that²²:

CCS unit needs a valid storage permit

- The geological formation for CO₂ storing is defined
- The CO₂ is permanently stored
- The amount of CO₂ being stored is verified by an independent third party
- The energy consumption for CO₂ injection and storing is monitored and reported
- The injection and storage facility is monitored and the monitoring program should include:
 - Measurement of background fluxes of CO₂

²² Requirements in line with DIR 2009/31/EC on the geological storage of CO₂
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- Continuous measurement of the mass of CO₂ injected
- Determination of CO₂ emission from injection system
- Determination of any CO₂ fluxes through the seabed or ground surface
- Post-injection monitoring
- Incorporation of improvements in monitoring techniques over time
- Regular reports by the operator to the competent authority are issued and regular inspections from third party verifiers that controlling the entire technical process of CO₂ storing are conducted

9.8 Double claiming of CO₂ credits

The double claiming of environmental attributes such as CO₂ emission credits is not allowed under ISCC. The amount of CO₂ emission credits being generated via the storage of CO₂ in the CCS unit can only be assigned to one defined volume of material under ISCC. The same CCS credit can hence not be assigned twice or multiple times to different products of the supply chain. The CCS credits can also not be separated, transferred, or sold individually without the product they were assigned to. Thus, in case the CCS credits are used under ISCC, those cannot be used to generate e.g. carbon credits on the voluntary market.

*Double claiming of
CO₂ credits is not
allowed*

10 Carbon Capture and Utilization (CCU)

Prerequisite: CO₂ that can lead to credits under ISCC CFC via CCS or CCU should not be produced specifically for the capturing process but should lead to an overall reduction in CO₂ emissions. The primary requirement for an ISCC CFC certificate with captured and utilized or stored CO₂ is only possible if no new emissions are generated and an overall improvement is achieved.

CCU refers to technologies and processes that capture CO₂ emissions from industrial sources or directly from the atmosphere and convert it into useful products or energy sources. Unlike CCS, where the captured CO₂ is stored underground, CCU focuses on repurposing the CO₂. CCU can contribute to emission reductions by capturing CO₂ from existing point sources of emissions and consequently avoiding the release into the atmosphere and/ or by substituting products or energy carriers with CCU products.

*Introduction to
CCU*

The relevant steps for CCU can be structured as follows:

- Capture and upgrading: Capturing and compression of CO₂.
- Transport: If the compressed CO₂ is not used onsite, it is transported to another production unit or entity, where it is used as an input to produce another product (e.g. synthetic fuels, chemicals, building materials, etc.).
- Utilization: The CO₂ is used as an input and (partly) converted into a product or an energy carrier. During this process, the previously captured CO₂ might be converted completely or partly, with the share of unconverted CO₂ being released into the atmosphere or captured again.
- Downstream processes and EoL: The produced product might be further processed in downstream activities. Finally, at the end of the lifetime of the product, it might be burned (e.g. for energy production) or recycled.

CCU is discussed as an emission reduction measure, complementing the use of renewable energy and efficiency improvements, though its scalability and long-term sustainability depends on technological advancements and the market demand for CO₂-based products.

Under the ISCC CFC module, benefits from CCU activities can be integrated in PCF calculations. This can include the effect of capturing CO₂ on the process which had previously emitted the CO₂, as well as the PCF of products produced from captured CO₂. A core element in this regard is the balance and the flow of the captured CO₂ from the capturing process over the conversion into new materials and products until the final release of CO₂ into the atmosphere at the EoL of the CCU product. The benefit from capturing CO₂ can be determined by considering the amount of captured CO₂, the emissions associated with the capturing process and the transport of the CO₂, the

Applicability

amount of CO₂ or carbon which is stored in a CCU product, potential emissions from unconverted CO₂ into the atmosphere, and finally, the release of CO₂ at the EoL of the CCU product. ISCC CFC allows for different ways to allocate the PCF benefits of CCU activities between the capturing unit and the unit producing the CCU product.

This chapter provides guidelines for the certification of PCFs for CCU based products under the ISCC CFC module. The requirements of the certification approach apply to the described supply chain elements, covering the PU from which the CO₂ is captured (capturing unit), the transport of the captured CO₂ to the downstream PU incorporating the CO₂ (CO₂ User) as well as the EoL of the CCU product.

10.1 Certification approach for PCF involving CCU activities

This section describes the certification approach for the PCF of CCU products.

As depicted in [Figure 9](#), the certification of the PCF of the CCU product covers two processing units (PUs): One PU with attached CO₂ capturing unit and one PU converting the CO₂ to the CCU product. The PU capturing the CO₂ will be the CO₂ Capturer and the PU converting the CO₂ into CCU products is the User of the CO₂.

*Elements of
CCU value
chains relevant
for the PCF
certification*

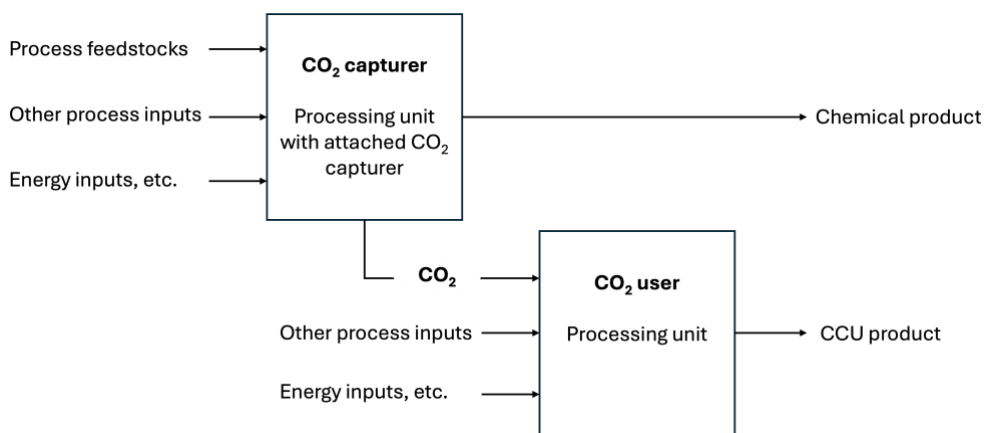


Figure 9: Covered elements of CCU supply chain

10.1.1 CO₂ capturing and subsequent supply to a PU

The CO₂ is captured at the CO₂ Capturer (see [Figure 9](#)). The CO₂ is a waste stream and without capturing the CO₂ would have been emitted to the atmosphere. In general, the CO₂ can be of fossil or biogenic origin (see [10.1.2 Eligible CO₂ sources](#)). The captured CO₂ must be quantified and transported (e.g. via pipelines, ship, or truck) to the subsequent unit which produces the CCU product (CO₂ User). The CO₂ Capturer issues a CO₂ self-declaration for the CO₂ User. This CO₂ self-declaration includes information on the captured CO₂ and a statement, whether the benefit of the emission capturing has already been integrated into the PCF calculation for the products at the PU which has emitted the CO₂ (100:0 or 0:100 approach, see chapter "The 100:0 and 0:100 CCU approaches"). This decision and the corresponding

statements define the consideration of the climate impacts of the CCU CO₂ in the PCF of the CCU product.

ISCC provides templates for the ISCC documents issued within the supply chain. The information to be included in the declarations are further specified in [10.1.3 Certification concept for the CO₂ benefit in PCF calculations](#).

10.1.2 Eligible CO₂ sources

The CCU CO₂ used in the downstream PU producing the CCU product needs to come from one of the following eligible sources:

- Atmospheric CO₂ from direct air capture (eligible for CCU 0:100).
- Post-industrial (fossil) CO₂ captured from industrial processes, which use fossil sources to deliberately produce electricity, heat, or materials (e.g. cement, iron and steel, petrochemical industry) and would have otherwise been emitted to the atmosphere.
- Biogenic CO₂ which originates from biomass. The biomass must originate from sustainable sources, verified by a certification scheme recognized under the renewable energy directive framework or equivalent standards. Disclaimer: The explicit assessment methodology of biogenic carbon may follow in the next system document update.

Three eligible sources of CO₂

CO₂ produced deliberately for the usage in the CCU process is not eligible under this CCU certification approach of ISCC CFC.

10.1.3 Certification concept for the CO₂ benefit in PCF calculations

Capturing and utilizing CO₂ emissions can provide benefits in the PCFs of products produced at the processing unit with attached capturing unit or at the PU which converts the captured CO₂.

The ISCC CFC approach allows for two options to incorporate the benefit of the CO₂ capturing:

- 100:0. The benefit of capturing the emissions is claimed by the processing unit with attached capturing unit (e.g. it is integrated into the PCF of the products of this unit)
- 0:100. The benefit is claimed by the unit producing the CCU product and it is integrated into the PCF of the CCU product.

ISCC CFC considers two approaches to integrate CCU benefits in PCFs

10.1.3.1 The 100:0 and 0:100 CCU approaches

In the **100:0 approach**, the capturer of the CCU CO₂ considers their process CO₂ emissions as captured and not emitted. The CO₂ capturer can then allocate CCU credits (amount of emissions eligible to be accounted in the PCF calculation at the CO₂ capturer unit) to dedicated product volumes. The CCU

The capturing unit claims the benefit under 100:0

credits are limited to the amount of captured carbon, minus the emissions from the capturing process²³. The PCFs at the capturing unit can be compensated in maximum by that part of the PCF, which is coming from process emissions, along the direct value chain on the same site as the CO₂ source (Figure 10). The user of CO₂ has to account the emissions as emitted (+1).

Any accounting of reductions towards upstream emissions (i.e., feedstock extraction emissions) in the PCF calculation is not possible. The products with a PCF, considering the CCU credits, need to be produced in a process whose process emissions were captured. In the 100:0 approach the CO₂ does not carry a CCU credit. Hence the user cannot claim any emission benefit from incorporating the CO₂ in their production.

In the **0:100 approach**, the capturer of the CO₂ considers their captured process CO₂ emissions as emitted, and the captured CO₂ carries a CCU credit²⁴. The following processing entity using the captured CO₂ can consider the CCU credits in the PCF calculation of their products reflecting the amount of incorporated CO₂ (Figure 10).

The user of the captured CO₂ claims the benefit under 0:100

Under both activities, the credits for the CO₂ benefit of the CCU activity can be assigned to a specific product and can either be stated separately or already included in the PCF. It must be claimed, which of those two options is applied. Credits would expire, if not assigned to a specific product, analogous to the CCS approach.

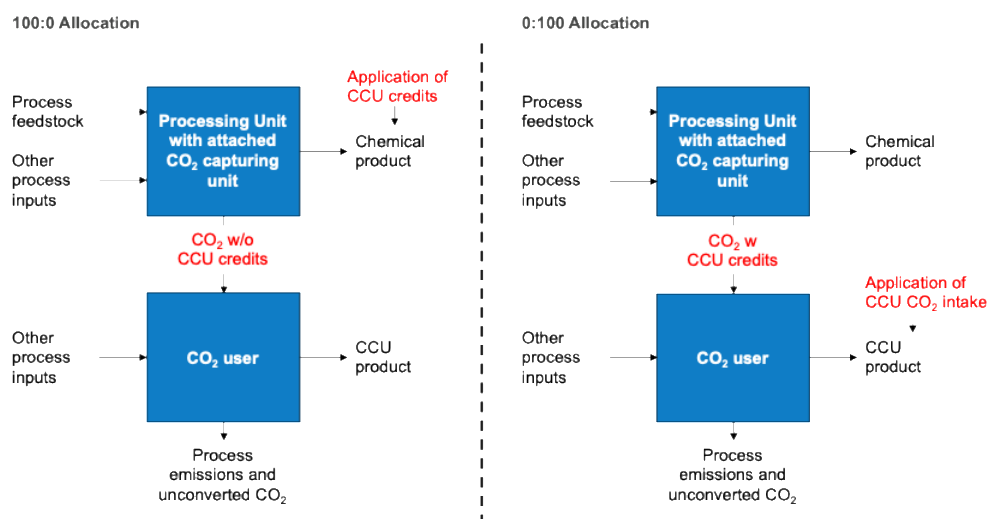


Figure 10: 100:0 and 0:100 approach – handling emissions and credits

10.1.3.2 Certification concepts of the 100:0 and 0:100 approach

In case of the 100:0 and the 0:100 approach the unit, which considers the CO₂ credit in the PCF calculation and wants to consider the CCU credits in the

²³ The emission burdens associated with the capturing of the CO₂ need to be considered in the PCF calculation of the capturer unit for the 100:0 approach.

²⁴ In case of the 0:100 approach the emission burdens associated with the capturing of the CO₂ need to be considered in the PCF calculation of the user unit.

PCFs for their products, need to be certified under ISCC CFC and a proper documentation of the consideration of the CO₂ credit need to be applied to avoid double counting of the CO₂ credit (see [Figure 11](#)).

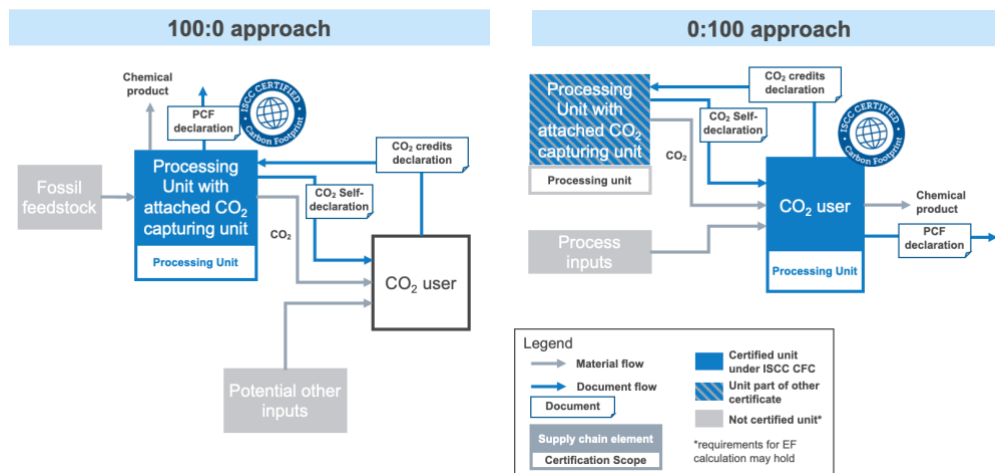


Figure 11: Certification concepts for 0:100 and 100:0 approaches

For the 0:100 approach the CO₂ user unit needs to be certified under the scope “Processing Unit” ([Figure 11](#)). The PU capturing the process CO₂ does not need to be certified. The Capturer issues a CO₂ self-declaration to the CO₂ User. This CO₂ self-declaration includes information on the captured CO₂ and a confirmation that the CO₂ credit for the CO₂ captured and transported to the user unit has not been considered already in the PCF calculation for the products at the PU which emits the CO₂. All CO₂ Captures will be audited during the audit of the CO₂ User. The auditor of the CO₂ User needs to be able to verify at the capturing unit, that the CO₂ credit has not already been considered in PCF calculation of the capturing unit products. In the CO₂ credits declaration, the user confirms the application of the credit for the incorporated CO₂.

An alternative certification concept for the CO₂ supply in the 0:100 approach to the CO₂ user may be via a separately ISCC PLUS certified “Collecting Point” (collecting the CO₂ from associated Points of Origin with respective CO₂ self-declarations) or ISCC PLUS certified “Trader”. In this case the CO₂ user would only be certified as “Processing Unit” under CFC and receive the CO₂ from the ISCC PLUS certified “Collecting Point” or “Trader” with an ISCC PLUS sustainability declaration.

For the 100:0 approach the PU with attached CO₂ capturing unit needs to be certified under ISCC CFC. The CO₂ is physically transported from the capturer unit to the user without a credit. In this approach a verification at the CO₂ user is needed to ensure that the CO₂ is (a) incorporated into products produced at the user unit and (b) that there is no credit applied for the incorporated CO₂ in the PCF calculation of the user unit products. This can be ensured, if the user unit is also CFC certified and a respective verification happens at the audit of the user unit. Alternatively, if the user unit has no own CFC certification, the user shall be able to show the auditor during the audit of the

capturing unit products, that (a) and (b) is fulfilled for the respective amounts of CO₂ transported from capturer to user without a credit. In addition, the user unit issues a self-declaration to the CO₂ capturing unit, declaring that the user unit does not consider any credits in their own PCF calculation for the incorporated CO₂ (CO₂ credits declaration).

The documents shared within the supply chain need to provide the following information:

CO₂ self-declaration

- Information on supplier (CO₂ Capturer) and recipient (CO₂ User)
- Information on CO₂ source
- Amount of CO₂ delivered from CO₂ Capturer to CO₂ User
- GHG emissions related to CO₂ capturing
- Delivered CO₂ amount, with CCU credit already applied at the capturer (100:0, CO₂ forwarded without CCU credit)
- Delivered CO₂ amount, whose CCU credit has not been applied at the capturer (0:100, CO₂ forwarded with CCU credit)

CO₂ credits declaration

- Information on supplier (CO₂ Capturer) and recipient (CO₂ User)
- Amount of delivered CO₂ from the capturer, that has been incorporated into products produced at the user unit without the consideration of a CCU credit in the PCF calculations of the products produced at the user unit (100:0). Potential amounts of unconverted CO₂ need to be deducted.
- Amount of delivered CO₂ from the capturer, that has been incorporated into products produced at the user unit with considered CCU credit in the PCF calculations of the products produced at the user unit (0:100).

The PCF declaration needs to give the information outlined in chapter 4 *ISCC CFC certification concept and documents*. In addition, for the CCU 0:100 approach the baseline PCF of the product without the consideration of the CO₂ credits needs to be given. Analogous to CCS, the baseline PCF captures the PCF without any CCU credits (as defined in *Formula 2*, including both benefits and burdens of the CCU process), reflecting the PCF without the mitigation measure.

Expiration of CCU credits

CCU credits expire if they are not allocated to products 60 months (5 years) from the month of capturing²⁵. These credits can only be accounted from the first day of certification. If there is a gap between two certification periods, any CCU credits expire. The amounts of produced material with allocated CCU credits shall be treated on a mass balance base with a mass balance period of three months ending to each quarter of a year. It is possible to go into deficit within a mass balance period (to go short), i.e. to sell more material with a PCF, using CCU credits, than available. This, however, is only possible under the condition that at the end of the mass balance period the amount of material with the corresponding PCF generated is balanced to the amount withdrawn. If there is remaining material with a PCF, using CCU credits, at the end of a mass balance period, the surplus in the bookkeeping can be transferred into the next mass balance period. At the end of a mass balance period the quantity bookkeeping either must be balanced or have a surplus in bookkeeping that can be carried forward. Transferring surpluses in the bookkeeping is possible if a valid certificate is in place. If there is a gap between two certification periods, any surpluses vanish. A negative mass balance is not permitted under ISCC and treated as a non-conformity. If a negative mass balance occurs at the end of a mass balance period, the certified company must inform the CB immediately and without being requested.

It is not allowed to conduct a multi-site-credit transfer for materials with assigned CCU credits.

10.1.3.3 CO₂ mass balance system and two-PCF-approach for CO₂ capturing unit

Due to different options for claiming the CO₂ credit, the capturer of CO₂ shall maintain a CO₂ mass balancing system that accounts for different categories of process CO₂ emissions. As depicted in [Figure 12](#), the CO₂ mass balance system at the CO₂ capturer's end, shall evaluate if their process CO₂ emissions need to be considered as a) emitted or b) 100:0 CO₂ (without credit) or c) 0:100 CO₂ (with credit). CO₂ which has been captured but emitted again due to the absence of a user (case a above), needs to be accounted in the PCF calculation of the capturing unit including the emissions associated with the capturing step.

A CO₂ mass balance for different types of process emissions supports the verification

²⁵ In case of future restriction on credit expirations by governmental authorities, the time frame of 60 months might be subject to change.

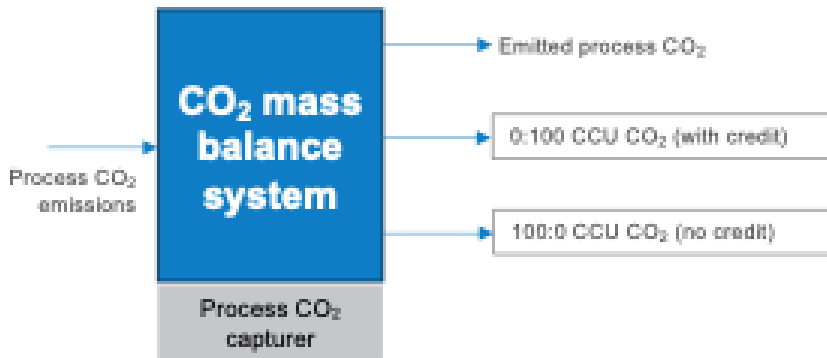


Figure 12: Flow chart of potential CO₂ emissions, utilization with or without a credit at the CO₂ capturing unit

Since the CO₂ can be sent to the user unit either under 100:0 or 0:100 approach, the products of the capturer of the process CO₂ emissions can have two different CF values. Therefore, a baseline and an optimized PCF for products at the capturing unit shall be implemented. The assessment of the PCFs follows ISO 14040/ 44/ 67 and TfS, and the methodological guidelines defined in this document.

A so-called baseline PCF does not include any credits for the captured CO₂. For product volumes associated with this baseline PCF, the full process emissions per kg of product need to be considered, leading to higher emissions compared to PCF, considering the CCU credit. The PCF, incl. CCU credits, considers the benefit of captured CO₂ process emissions, leading to a PCF with compensated process emissions. The two-PCF-approach hence exhibits two distinct PCFs for the same product of the capturing unit: one considering the default processing emissions at the unit capturing the CO₂ (baseline PCF) and one considering the compensated processing emissions at the unit capturing the CO₂ (see [Figure 13](#)).

*Baseline and PCFs,
considering the
CCU credit*

The CO₂ mass balance system at the capturing unit is used to determine the amount of product that can be sold with the optimized PCF at the CO₂ capturing unit. Only captured CO₂ transported without a credit to a user, who incorporates this CO₂ in their products and does not consider the CO₂ credit in their own PCF calculation, generates CO₂ credits at the capturer. These credits can be assigned to product volumes at the capturing unit within their PCF calculation by the amount of processing emissions (100:0 approach).

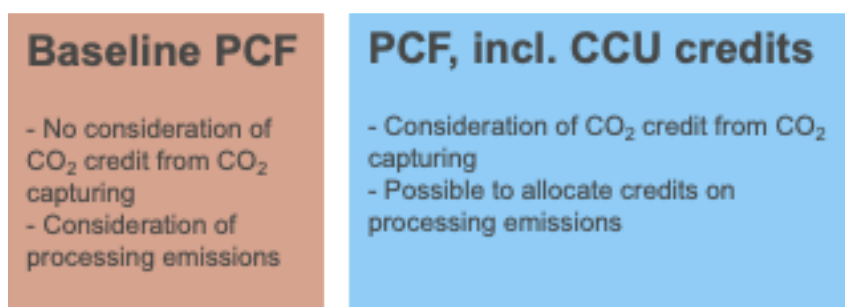


Figure 13: Schematics of a 2-PCF approach for products with and without consideration of process emissions at the capturing unit – guided by ISO 14040/ 44/ 67 and Tfs

10.1.4 Eligible CCU products

For the application of a CCU credit under both approaches (0:100 and 100:0), the captured CO₂ needs to be incorporated into the CCU product (= products from CO₂ user unit).

For the 0:100 approach there is no further requirement on the type nor the fate of the CCU product. The certification of PCFs at the PU producing CCU products (=0:100 approach) covers the PCF of any type of CCU product with incorporated CCU CO₂. The certification includes the verification of the eligibility of the CCU CO₂ as well as the verification of the calculated PCF of the CCU products. However, for the CCU 0:100 approach there are additional requirements on the PCF system boundaries for specific types of CCU products, see [10.2 Methodology for the calculation of the CF of products](#).

For the 100:0 approach, only CCU products are eligible, where the captured and incorporated CO₂ is chemically bound in the molecular structure of the stable CCU product. Hence, incorporating CO₂ in e.g. carbonated beverages does not qualify for applying the 100:0 approach and considering the CCU credit at the capturer.

In cases, where CCU credits go to CCU products and products of the capturer (e.g. 50:50), the above-mentioned conditions and consequences regarding the CCU product apply equally.

10.2 Methodology for the calculation of the CF of products

This chapter defines specifications in the calculation of the PCF for CCU products and includes guidance for the attribution of the CCU benefit under the 100:0 and 0:100 approaches.

In general, the methodology for calculating the PCFs of the CO₂ capturing unit products and of the CCU products follows cradle-to-gate system boundaries. However, for CCU products, where the captured CO₂ is not chemically bound in the molecular structure of the stable CCU product (e.g. CO₂ in carbonated beverages), the PCF of these CCU products needs to follow cradle-to-grave system boundaries (0:100 approach, since PCF of user unit products are certified).

Figure 14 introduces the basic calculation procedures for the incorporation of the CCU benefit in the CF of the products produced at the CO₂ Capturer (left side of the calculation tree) or the CCU utilizing unit (right side of the calculation tree).

The assignment of the CCU benefits under 100:0 and 0:100 follows different procedures

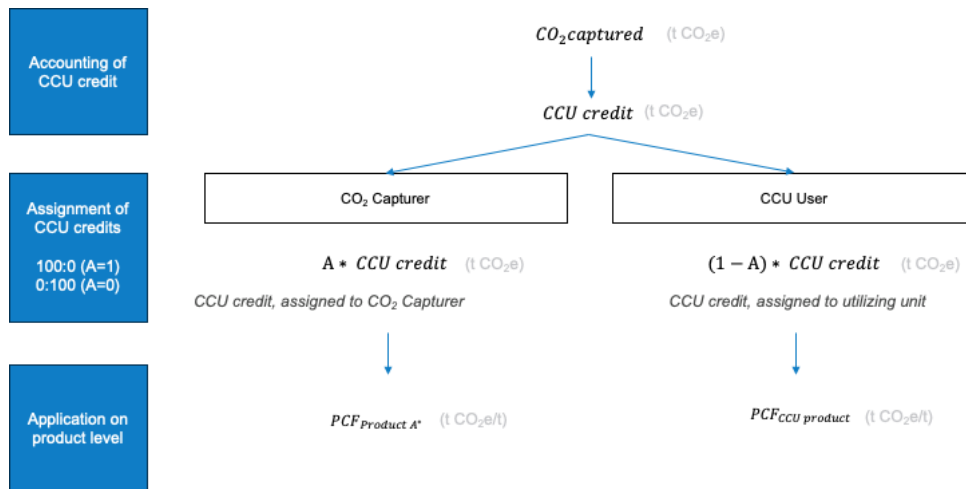


Figure 14: Calculation tree for application of CCU credits on PCFs

Both approaches as well as the parameters included in Figure 14 are further defined and explained in the following paragraphs.

10.2.1 Accounting of CCU credits

At first, the amount of CO₂ captured and utilized/incorporated in CCU products ($CO_2\text{captured}$) must be identified and documented in t CO₂e.

To calculate the CCU credit (in t CO₂e), Formula 2 shall be applied. Thereby, the CCU credit comprises the $CO_2\text{captured}$ as negative and adds on the upstream emissions as burdens, lowering the CCU credit slightly. The upstream emissions include emissions for the capturing, compressing and further inputs needed for the concentration of CO₂, as well as process related emissions. The CCU credit can be calculated on a yearly basis. It is important to set the time frame once and stay with the chosen period throughout the entire calculation.

Calculating the CCU credit

Formula 2: CCU credit

$$CCU\ credit = -CO_2\text{captured} + E_{CCU\ CO_2\text{upstream emissions}}$$

$CCU\ credit$	Credit, considering the amount of captured and utilized CO ₂ , minus the upstream emissions [t CO ₂ e / e.g. year, certification period]
$CO_2\text{captured}$	Amount of captured of CO ₂ [t CO ₂ e] This term represents a credit for the avoided emissions from capturing the CO ₂ (see 10.1.3.1).
$E_{CCU\ CO_2\text{upstream emissions}}$	Emissions from capturing and supply of the CCU CO ₂ to the CCU product PU [t CO ₂ e] This includes emissions from the use of energy for CO ₂ capturing, compressing, the production and use of

	process chemicals for purification/ concentration of the CO ₂ as well as the transport of CCU CO ₂ .
--	--

10.2.2 Attribution of credits under 100:0 and 0:100

In the second step, the CCU credit is attributed to either the site of the CO₂ Capturer (100:0) or to the site, where the captured CO₂ is utilized (0:100).

Attribution limits of CCU credits

One substantial difference in that regard is that, while in the 100:0 approach, the credit can be attributed to processing emissions of different products, which are physically connected and downstream the capturing unit (compare [Figure 15](#)), the attribution of the credit for CCU products (0:100) is based on the amount of CCU CO₂ which is incorporated in the CCU product. The conditions for attribution of credits are the same as under CCS (see [9.4 Generation and attribution of CCS credits](#)).

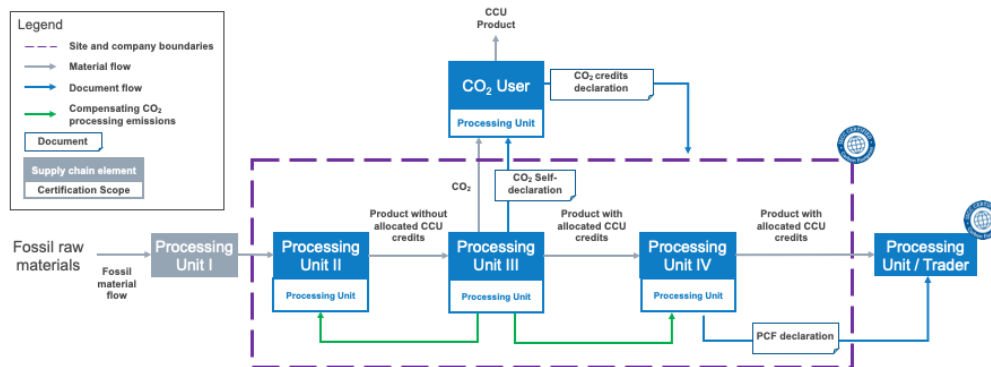


Figure 15: Assignment of credits and flow of documentation for the PCF calculation of CCU value chains

To allocate the CCU credit between those two entities, the allocation factor A is applied. The following formulas are used to assign the CCU credits.

Formula 3: Assignment of CCU credits to CO₂ capturer

$$CCU \text{ credit, assigned to CO}_2 \text{ point of origin} = A * CCU \text{ credit}$$

and

Formula 4: Assignment of CCU credits to CCU utilizing unit

$$CCU \text{ credit, assigned to CCU utilizing unit} = (1 - A) * CCU \text{ credit}$$

A	Allocation factor, to allocate the CCU credit to the CO ₂ Capturer or to the CCU utilizing unit [-] $A = 1$, for the 100:0 approach and $A = 0$ for the 0:100 approach.
-----	--

10.2.3 Application of CCU credits on product level and PCF calculation

In the third step, the credits are applied at the product level. Starting with the 100:0 approach, left side of [Figure 14](#), [Formula 5](#) explains how to calculate

the PCF of product α , whereby product α is produced downstream at the same site, as the CO₂ capturer.

In this case, the *Applied CCU credit* covers the CCU credit, which can be applied to the PCF of product α . Unlike before, the *Applied CCU credit* is no longer referring to the total amount of CCU credit but is set in relation to the mass of product α . To avoid double counting, the total *Applied CCU credit* cannot exceed ($A * CCU credit$). Furthermore, the *Applied CCU credit* can only be applied to the processing emissions of product α ($E_{P\alpha}$), and therefore must be smaller or equal $E_{P\alpha}$.

$E_{P\alpha}$ is covering the emissions from the process emissions of the CO₂ utilization site, namely production, supply and use of process inputs like process chemicals, process energy or energy carriers (in other words emissions covered under scope 1 and 2 of corporate sustainability accounting frameworks).

Formula 5: Simplified example product α on site (CO₂ source of origin)

$$PCF_{Product \alpha} = (Applied\ CCU\ credit + E_{P\alpha}) + E_{Feedstock\ for\ \alpha}$$

with

$$Mass_{Product \alpha}(t\ of\ product) * Applied\ CCU\ credit(t\ CO_2e/t\ of\ product) \leq A * CCU\ credit(tCO_2e)$$

↔

$$Applied\ CCU\ credit \leq A * CCU\ credit / Mass_{Product \alpha}$$

$PCF_{Product \alpha}$	<i>Emissions, related to the production of α [t CO₂e / t of product] The necessary condition for α: Same site and downstream of capturing unit.</i>
<i>Applied CCU credit</i>	<i>The CCU credit [t CO₂ / t] must fulfil the following conditions:</i> <ul style="list-style-type: none"> • <i>The applied CCU credit cannot exceed the emissions for processing of P_{α} :</i> $Applied\ CCU\ credit \leq E_{P\alpha}$ • <i>And the total applied CCU credit cannot exceed the CCU credit, which has been assigned to the site at CO₂ source of origin:</i> $Mass_{Product \alpha} * Applied\ CCU\ credit \leq A * CCU\ credit$ <p style="text-align: center;">↔</p> $Applied\ CCU\ credit \leq A * CCU\ credit / Mass_{Product \alpha}$
$E_{P\alpha}$	<i>Emissions, related to processes to produce α, which can cover several process units on that side.</i>

	<p>[t CO₂e / t of product]</p> <p>This includes emissions from the use of process inputs such as energy, or process chemicals and the upstream emissions associated with their production and supply. Furthermore, direct process emissions shall be included here. This covers emissions accounted under scope 1 and 2 in corporate sustainability accounting frameworks</p>
$E_{Feedstock\ for\ \alpha}$	Emissions, related to feedstock inputs for α , entering the site [t CO ₂ e / t of product]

Under the 0:100 approach, (right side of [Figure 14](#)), the entity, where the CO₂ is incorporated in the CCU product, shall calculate the PCF of the CCU product as shown in [Formula 6](#).

To calculate $PCF_{CCU\ product}$, three parameters must be considered. The *Incorporated CCU credit* determines the amount of CO₂, which is incorporated in the CCU product. In addition, it must be ensured that $Mass_{CCU\ Product}$ times *Incorporated CCU credit*, which is measured in tCO₂e per t of product, does not exceed the credits, that have been assigned to that entity $((1 - A) * CCU\ credit)$.

Additionally, the emissions to produce the CCU product, without any credit accounting ($E_{CCU\ product}$) must be included. [Formula 7](#) provides guidance on how to calculate $E_{CCU\ product}$. The amount of unconverted CO₂ is not included in the calculation, because, under the 0:100 approach, the total amount of captured CO₂ has already been accounted as emitted by the capturing unit.

Formula 6: Emissions of the CCU product

$$PCF_{CCU\ product} = Incorporated\ CCU\ credit + E_{CCU\ product}$$

$PCF_{CCU\ product}$	Emissions from the production of the CCU product [t CO ₂ e / t]
<i>Incorporated CCU credit</i>	The <i>Incorporated CCU credit</i> [t CO ₂ / t] comprises the amount of incorporated CO ₂ in the specific CCU product. And must fulfil: $Mass_{CCU\ Product} * Incorporated\ CCU\ credit \leq (1 - A) * CCU\ credit$
$E_{CCU\ product}$	See Formula 7 below.

The emissions from production of the CCU product ($E_{CCU\ product}$) shall be calculated as depicted in [Formula 7](#). In general, $E_{CCU\ product}$ shall cover feedstock ($E_{Feedstock}$), as well as processing emissions (E_P), necessary to produce the CCU product.

Formula 7: Emissions from production of the CCU product

$$E_{CCU\ product} = E_{Feedstock} + E_P + E_{unconverted\ CO_2}$$

$E_{CCU\ product}$	Emissions from the production of the CCU product, without any credit accounting [t CO ₂ e / t]
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$E_{Feedstock}$	<i>Emissions, related to feedstock inputs for the CCU product, entering the site [t CO₂e / t of product]</i>
E_P	<i>Emissions, related to processes to produce the CCU product, which can cover several process units on that side. This includes emissions from the use of process inputs such as energy, or process chemicals and the upstream emissions associated with their production and supply. Furthermore, direct process emissions shall be included here. This covers emissions accounted under scope 1 and 2 in corporate sustainability accounting frameworks [t CO₂e / t of product]</i>
$E_{unconverted CO_2}$	<i>Emissions of unconverted CCU CO₂. This term shall be set to zero in the 0:100 case to avoid counting of CO₂ emissions twice. In the 0:100 approach the capturer already considers all captured CO₂ as emitted. This as emitted reported CO₂ amount includes the released unconverted CO₂ at the user.</i>

Finally, when the CCU products are further processed or used downstream, it is important to include the re-release of the CCU CO₂ which bound in the CCU product in the PCF of downstream products or applications (e.g. in cradle-to-grave assessments).

10.2.4 Allocation specialties for CCU

In case the process which converted the captured CO₂ is a multi-output process, the GHG emissions calculated with the approach shall be allocated between the process products. A prerequisite for the consideration of heat as a product is that the heat is utilized in other processes. Emissions arising from downstream processing and from transport and distribution of the CCU product shall not be included prior to allocation, as these emissions are not related to the co-products. The allocation of GHG emissions between products classified as waste or residues is not permitted²⁶.

Additionally, the attribution of the CCU credit is only possible, in case carbon of the CCU CO₂ has also been fixated in these co-products and, in case the 0:100 approach has been chosen.

The CO₂ credit can only be attributed under certain preconditions

The general approach for allocating the calculated emissions between all eligible process outputs, shall follow the requirements and procedures defined in [5.1.6 Allocation](#). One example is the allocation involved in the calculation of H₂ from syngas processes. For this process, the allocation between H₂ and potential co-products shall be based on the LHV.

Additionally, in case the carbon of the captured CCU CO₂ is fixated in both, main and co-product, the credit calculated under the term *Incorporated CCU credit* shall be allocated based on a mass balance considering the masses of the CO₂ intake into the process and the amount of fixated carbon in main and co-product.

²⁶ For the classification of waste and residues, please refer to ISCC 202-5
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10.2.5 Data basis

The PCF calculation is based on actual data gathered from the ISCC system user and data sourced from databases and literature.

Data gathering is relevant for the process inputs defined in the PCF calculation equation in [5.2 Data as the basis – LCI](#) including e.g. energy consumption, other process inputs and output data like process emissions, wastes, products and BPs. Relevant parameters, which cannot be measured directly, shall be calculated based on the input and output flows of the process. When gathering the on-site data, the requirements in [5.2.1 Data categories](#) shall be followed. In addition, the source and amount of CO₂ captured and utilized must be measured.

Published data

Sources for published EFs or additional information to support the PCF calculations are described under section [5.2 Data as the basis – LCI](#).

10.3 An example PCF for CCU MeOH (0:100)

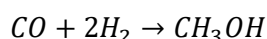
The following section provides an example for the application of the CFC CCU methodology to the production of MeOH from CCU CO₂. This example is based on the assumption, that the CO₂ benefit of the CO₂ capturing effort is claimed by CO₂ user (0:100 approach).

10.3.1 Introduction

Methanol (MeOH) is a high-volume commodity chemical. It is a precursor to several important industrial chemicals such as formaldehyde, acetic acid, methyl tertiary-butyl ether (MTBE) and dimethyl ether (DME). Global installed MeOH production capacity has been growing since 2009 with an average annual rate of about 10%, while the production has been also growing at a slightly smaller rate, around 7%, reaching 58 Mt in 2012, according to the IEA or 60.6 Mt according to the MeOH Market Services Asia (MMSA).

MeOH is typically produced from pressurized synthesis gas (or syngas, a mixture of mainly hydrogen (H₂), CO and CO₂), which reacts in the presence of a catalyst, according to:

Formula 8: Reaction equation of methanol



The reaction is highly exothermic, and a major challenge is the removal of excess heat, in order to shift the equilibrium towards the products and avoid side reactions and catalyst sintering. Syngas can be produced either by steam reforming in the case of light hydrocarbons, such as natural gas or light naphtha, or by partial oxidation, in the case of heavy oils or solid carbonaceous materials.

CCU represents a new economy for CO₂, since captured CO₂ can be used as raw material for other processes. This includes the synthesis of chemicals and materials (such as MeOH, formic acid, polyols for polyurethanes, carbonates), fuels (like CH₄ or kerosene) and direct use in applications based on CO₂ physicochemical properties (for example in supercritical state). To produce hydrocarbons from CO₂ the carbon atom of CO₂ needs to be reduced, which requires energy – again leading to another output of CO₂ and other GHGs. The consumption of energy in CCU processes is hence important and must be considered to compare the CCU process with the conventional production of the respective product, regarding emitted CO_{2e} and needed energy. Therefore, in this certification approach requirements will be described to calculate a cradle-to-gate (resource extraction until company gate) PCF for CCU MeOH.

During the conventional MeOH production, CO₂ is formed in the syngas production process. This CO₂ being part of the syngas during a conventional production process of MeOH cannot be considered as an eligible CO₂ source under this certification approach. Hence the respective part of a conventional MeOH production originating from this CO₂ being part of the conventional syngas cannot be considered as CCU MeOH under this approach.

10.3.2 Eligible H₂ sources

The used H₂ in this certification approach can originate from fossil sources (e.g. natural gas) but needs to be produced together with other products from the used fossil source (e.g. excess H₂ as part of a flue gas stream from the production of conventional MeOH, H₂ from syngas production with co-product CO). Dedicated production processes, which produce H₂ from fossil sources as the only product with all the carbon of the fossil feedstock being released as CO₂ to the atmosphere are not eligible under this approach (e.g. H₂ from natural gas or coal with all carbon of the fossil feedstock being vented as CO₂). So called “blue hydrogen” with all carbon emissions originating from the fossil feedstock during the H₂ production being stored permanently via CCS is an eligible H₂ source under this certification approach (e.g. H₂ with certified net-zero PCF under the CCS certification approach of the ISCC Carbon Footprint Module²⁷). ISCC is aware that H₂ as a by-product may have different EFs than the general databases. If possible, a primary data basis should therefore be used for H₂ as a by-product or literature/database values that correspond to the actual production process.

10.3.3 Methodology for the PCF calculation of CCU MeOH

This chapter defines specifications in the calculation of the PCF of CCU MeOH as well as the necessary verification of PCF calculations for CCU MeOH under ISCC CFC. For the case of CCU MeOH in this chapter, we assume that a

²⁷ ISO 14067 compliant assignment of CO₂ credits required, see documentation of CCS certification approach.

0:100 approach has been selected, assigning the benefit of the CCU activity to the CCU MeOH production.

The calculation of GHG emissions for CCU MeOH production shall consider the direct emissions of the MeOH production process, the upstream emissions associated with the production and the supply of process inputs such as electric energy, feedstock input to the process (e.g. syngas with its specific composition), process heat, captured CO₂, used as a process input, other process chemicals as well as potential co-products of the process. The GHG calculation needs to be performed on a yearly basis (preferred 12 months prior to certification) and shall be updated prior to recertification. The PCF calculated is valid for the validity period of the certificate (1 year) if no major changes for the PCF are expected e.g. by significant process changes.

Figure 16 shows a simplified process flow figure with the relevant parameters for the calculation.

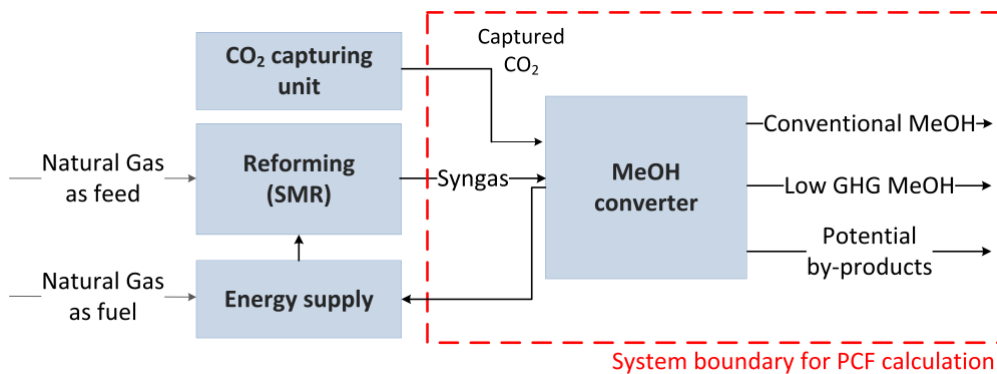


Figure 16 Main parameters for the PCF calculation of MeOH Production

PCF calculation for CCU MeOH

The calculation of the CCU MeOH PCF follows the methodology defined in [10.2 Methodology for the calculation of the CF of products](#).

At first, the total amount of CCU credit is calculated according to [Formula 9](#).

Formula 9: CCU credit of CCU methanol

$$CCU\ credit = -CO_2\ captured + E_{CCU\ CO_2\ upstream\ emissions}$$

<i>CO₂ captured</i>	<i>Amount of captured of CO₂, directly related to the production of the CCU MeOH product [t CO₂e] This term represents a credit for the avoided emissions from capturing the CO₂. The credit is limited to the amount of captured CO₂, which is introduced into the process for the CCU product.</i>
<i>E_{CCU CO₂upstream emissions}</i>	<i>Emissions from capturing and supply of the CCU CO₂ to the CCU MeOH PU [t CO₂e] This includes emissions from the use of energy for CO₂ capturing, compressing, the production and use of</i>

	process chemicals for purification/ concentration of the CO ₂ as well as the transport of CCU CO ₂ .
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In the second step, the CCU credit, assigned to the CCU utilizing unit is determined. As defined before, the 0:100 has been selected. Therefore, the allocation factor is set 0 and [Formula 4](#) is applied.

With this, the PCF of CCU MeOH can be calculated in a third step. [Formula 10](#) shows the application of [Formula 6](#) on the example of CCU methanol.

Formula 10: Emissions from the production of CCU methanol (incl. CCU credit)

$$PCF_{CCU\ MeOH} = \text{Incorporated CCU credit} + E_{CCU\ MeOH}$$

$PCF_{CCU\ MeOH}$	Product carbon footprint (PCF) of CCU methanol [t CO ₂ e/ t of MeOH]
Incorporated CCU credit	Incorporated CCU credit [t CO ₂ e/ t of MeOH] comprises the amount of incorporated CO ₂ in the specific MeOH. Furthermore, the total amount of incorporated CCU credit cannot exceed (1 – A) * CCU credit.
$E_{CCU\ MeOH}$	Emissions from the production of the CCU MeOH, including processing and feedstock emissions, without any credit accounting [t CO ₂ e/ t of MeOH]

Emissions from the production of CCU MeOH ($E_{CCU\ MeOH}$) are to be calculated as follows. The following calculation is referring to [Formula 7](#), but, giving more insights on the details of $E_{Feedstock}$ and E_p :

Formula 11: Emissions, related to the production of CCU MeOH

$$E_{CCU\ MeOH} = M_n * EF_n + W_{el} * EF_{el} + W_{th} * EF_{th} + m_{H_2} * EF_{H_2} + E_{de} + W_t * E_{Wt}$$

$E_{CCU\ MeOH}$	Emissions, related to the production of CCU MeOH [t CO ₂ e/ t of MeOH]
M_n	Quantity of process input (including feedstock, process chemicals, energy carriers, etc.) [t/ t of MeOH]
EF_n	EF for the production and transport of the process input to the processing unit [t CO ₂ e/ t]
W_{el}	Quantity of electricity (electrical work) input [kWh/ t of MeOH]
EF_{el}	EF for the production and supply of electricity (electrical work) to the processing unit [t CO ₂ e/ kWh]
W_{th}	Quantity of process heat (thermal work) input [kWh / t of MeOH]
EF_{th}	EF for the production and supply of process heat (thermal work) to the processing unit [t CO ₂ e/ kWh]

m_{H_2}	Net quantity of H ₂ used as feedstock for CCU MeOH production [t/ t of MeOH] Excess H ₂ , leaving the process unconverted shall be subtracted from this term. It is preferred to determine the net quantity of H ₂ input to produce the CCU MeOH via measurement of H ₂ introduction and measurement of H ₂ purge leaving the process unconverted. If this is not possible, the net quantity can also be determined via the chemical reactions of the process.
EF_{H_2}	EF for the production and supply of H ₂ to the MeOH process [t CO ₂ e/ t]
E_{de}	Direct process emissions [t CO ₂ e/ t of MeOH] This term shall consider direct GHG emissions of the MeOH process
W_t	Quantity of waste materials or residues for disposal or waste treatment [t/ t of MeOH]
E_{Wt}	EF for the treatment of process waste [t CO ₂ e/ t]

Emission factor of H₂ and allocation

Besides CCU CO₂, H₂ is an essential input to produce CCU MeOH. Thus, the PCF calculation shall include the respective environmental burdens associated with the production of the H₂ used for MeOH production.

The EF for the production and supply of the H₂ used to produce CCU MeOH must be calculated based on actual process data. Furthermore, the calculation of the EF for H₂ shall be made available to the auditor in the auditing process. For potential production processes to produce eligible H₂ under this certification approach, see [4.2.2 ISCC CFC certificate](#). The EF of H₂ must consider the input of energy sources (e.g. electricity or a gaseous energy carrier) and direct GHG emissions of the H₂ production process as well as emissions from the distribution of the H₂. Since the H₂ for the CCU MeOH production results from a multi-output process, the EF of the H₂ shall be determined based on an energy-based allocation, following the formula below.

Formula 12: Allocation factor for H₂ production/ supply

$$AF_{H_2 \text{ upstream emissions}} = \frac{M_{H_2} * LHV_{H_2}}{(M_{H_2} * LHV_{H_2}) + (M_{co-product} * LHV_{co-product})}$$

$AF_{H_2 \text{ upstream emissions}}$	Allocation factor for H ₂ production/ supply [-]
M_{H_2}	Net quantity of H ₂ [kg]
LHV_{H_2}	Lower heating value of H ₂ [MJ / kg]
$M_{co-product}$	Net quantity of co-product [kg]
$LHV_{co-product}$	lower heating value co-product [MJ / kg]

Allocation of products from CCU MeOH production

In case the CCU MeOH is produced from a multi-output process, the GHG emissions calculated with the approach described under [Formula 4](#) shall be allocated between the MP, the CCU MeOH and co-products such as heat or conventional MeOH. A prerequisite for the consideration of heat as a product is that the heat is utilized in other processes. Emissions from downstream processing or transport and distribution emissions of CCU MeOH cannot be

added prior to allocation, as those emissions are not related to the co-products. The allocation of GHG emissions to any products that are considered waste or residue is not permitted²⁸. Additionally, the attribution of the CCU credit to conventional MeOH as a potential product is not permitted.

Specific rules for the allocation of BPs are defined in [5.1.6 Allocation](#).

Calculating a PCF for conventional MeOH production

When assessing integrated production systems, in which CCU MeOH is produced together with conventional MeOH, the defined methodology can also be used to calculate a PCF of the conventional MeOH. Unlike the CCU MeOH, no CCU CO₂ and related CO₂ credits can be applied during the PCF calculation for conventional MeOH. Furthermore, the sources of CO₂ and H₂ might differ from the eligible sources for CCU MeOH defined in this document. In addition, the two PCF approach, as defined [10.1.3.3 CO₂ mass balance system and two-PCF-approach for CO₂ capturing unit](#) in shall be considered to calculate a baseline PCF for the MeOH production without CCU CO₂.

Data basis

Chapter [5.2 Data as the basis – LCI](#) defines the requirements for the data to be collected and used as an input for the PCF calculation of CCU MeOH.

The following data for the calculation of GHG emissions from the MeOH production process must be gathered on-site. All input values must be gathered for the same reference time period (identical start and end date). In the example below the period of 1 year is used.

- Amounts of CO, CO₂ and H₂ introduced into the process (e.g. per t of MeOH per year) as well as their specific source (e.g. syngas process, “recycled” excess H₂).
- The input and output data of the syngas process, including the use of feed, electricity, as well as the process output (e.g. syngas, heat) and process emissions.
- Source and amount of electricity used for the operations (e.g. MWh per year).
- Source and amount of process heat used for the operations (e.g. MWh per year).
- Source and amount of CO₂, captured from external processes.
- Type and amount of additional process inputs (e.g. t per year).
- Amount of MeOH produced (e.g. t per year).
- Amount of BPs produced (e.g. t excess H₂ per year).

²⁸ For the classification of waste and residues, please refer to ISCC 202-5.
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- Amount of process wastes (e.g. t per year). Waste streams might be clustered in case the EF for their treatment processes is the same.
- Amount and composition of flue gas and other direct process emissions, especially in relation to climate relevant emissions (e.g. CO₂, CH₄, N₂O, etc. in t per year). If these emissions cannot be measured directly, they shall be calculated based on the process inputs and outputs.
- Process data for the H₂ production and/ or detailed information about the EF calculation for H₂.

11 Combining ISCC PLUS & ISCC CFC

A further aim of ISCC CFC – in addition to the transparent, comprehensible and standardized PCF calculation and methodology – is the combination of different ISCC schemes. In particular, ISCC aims to combine ISCC PLUS and ISCC CFC.

ISCC PLUS is a voluntary certification applicable for the bioeconomy and circular economy. It covers supply chains for all kinds of biomass (including agricultural and forest biomass), biogenic and fossil waste and residues (bio-circular and circular feedstocks) and non-biological renewable materials. It ensures the traceability of certified materials throughout the supply chain. Companies can use ISCC PLUS for credibly communicating about products from alternative feedstocks²⁹.

Under ISCC PLUS, the raw material category “bio” refers to the materials that are obtained from renewable raw materials such as plants, algae or other organic sources. They replace fossil raw materials and can be used in various applications such as plastics, chemicals or packaging. ISCC PLUS certifies bio-based materials by ensuring that the biomass used is sustainably produced (in compliance with strict requirements for ecological and social practices on Farm/Plantation and Forest Sourcing Area level) and traceable throughout the entire supply chain.

Raw material category “bio-circular” refers to waste and residues of biological origin from agriculture, forestry and related industries, including fisheries and aquaculture, as well as the biodegradable fraction of industrial and municipal waste (e.g. UCO, tall oil, food waste, etc.)

Raw material category “circular” (incl. technical-circular) refers to materials that are derived from the mechanical and/or chemical processing of recyclable materials of nonbiological origin (fossil-based).

A distinction can be made between the physical segregation and the mass balance (MB) approach: Physically segregated biomass is where the bio-based resource is clearly separated from the fossil material throughout the entire supply chain (transport, processing and storage). On the other hand, MB allows a certain proportion of certified biomass to be mathematically included in the end-product, even if it is physically mixed with fossil or non-certified raw materials.

ISCC CFC enables the combination of MB and LCA or PCF in such a way that ISCC PLUS and ISCC CFC can be combined. The aim here is to show two PCFs per product system. Whereby one PCF has biogenic, circular, certified properties and the second PCF has the non-certified properties.

Currently, a combined CFC-PLUS certification is only possible for the ISCC PLUS raw material category “bio”. The requirements on the MB and the PCF

²⁹ <https://www.iscc-system.org/certification/iscc-certification-schemes/iscc-plus/>
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calculation for this raw material category are described in this chapter. Requirements for all other ISCC PLUS raw materials are currently under development.

11.1 Mass balance basics

Mass balance is a central concept in industrial production and engineering. Mass balance is based on the law of conservation of mass, which states that mass can neither be created nor destroyed in a closed system. The mass that enters a system must therefore either remain in the system or leave the system again. It is used to analyse, control, and optimize the flow of materials (mass flows) in a production process. In an industrial operation, mass balances are used to:

- Monitor processes
 - Ensure that production processes run as planned
 - Ensure that no unexpected losses or accumulations occur
- Optimize resources
 - Make efficient use of raw materials
 - Minimize waste
- Comply with environmental regulations
 - Monitor and control emissions and waste to comply with environmental regulations

This principle of balancing inputs and outputs based on mass also forms the conceptual foundation for certification and traceability systems in supply chains. The mass balance approach represents one type of Chain of Custody (CoC) model to account for certified and non-certified materials throughout production processes and value chains. CoC models often represent administrative or accounting systems for certified materials. In those CoC MB accounting systems losses will reduce the amount of certified material. Since the materials behind those losses may no longer be traced in CoC MB accounting systems, these systems may not necessarily strictly reflect the laws of mass conservation.

An LCA is also based on the principle of mass balance. All the data used (e.g. inputs, emissions) are broken down into individual production steps, outputs or products so that the mass balance principle is followed.

The mass balance approach as a chain-of-custody (MB-CoC) model allows for the simultaneous processing of inputs with and without certified characteristics. The associated material flows are recorded in such a way that the characteristics within the same system boundary are traceable. Certified characteristics of inputs are assigned to a portion of the outputs. The basis for

this is provided by ISO 22095, which, in addition to the MB, also provides other approaches for tracking certain characteristics.

[How does the mass balance approach work?](#)

The mass balance approach, as applied under ISCC PLUS, is a CoC option that tracks certified input materials within a product value chain when they are mixed with non-certified materials. Although the resulting products are not physically composed solely of certified material, defined quantities of certified input can be attributed to specific output batches. This attribution is permitted because certified and fossil materials are functionally equivalent in the production process, differing only in their sustainability attributes (e.g. bio, circular vs. fossil).

There are two implementation methods: the rolling average percentage method and the credit method. The rolling average method is the stricter approach of a MB, and the amount of certified input over a specific time period must be known and may only be credited to the corresponding output. The rolling average percentage method is based on the use of a fluctuating proportion of input with specified characteristics over a defined claim period, allowing a claim of an average percentage of the input with specified characteristics attributed to the output over the claim period. The conversion factor of the process(es) shall be considered when calculating the percentage of the amount and certified share of outputs. The attribution of specified characteristics to outputs shall be technically feasible. The organization shall calculate and disclose: the weighted average of the mass of the inputs and outputs of a defined category for each material or product; or the total mass of the material or product with specified characteristic divided by the total mass of input or output. The attribution of specified characteristics from inputs to outputs does not guarantee that those characteristics are physically present in all of the outputs. For the credit method of the mass balance, specified characteristics are represented as credits. Credits cannot be transferred between organizations separately from physical material or product but can be transferred within the mass balance system boundary.

Under ISCC PLUS both mass balance implementation methods (rolling average percentage method and the credit method) can be applied at the bookkeeping level. For the credit-based method certified characteristics can be attributed to physical products at the point of sale, provided that over a defined accounting period (e.g. three months), input and output quantities remain equivalent. Surpluses can be carried forward under ISCC PLUS rules, and third-party verification is required annually. In such cases, MB operates as a bookkeeping mechanism. At the point of sale, it is not necessary for the physical product to contain the exact quantity of certified material matching the MB claim. Instead, over a mass balance period (e.g. three months), the quantity of certified products sold must not exceed the amount of certified input materials introduced into the system. At the end of the accounting period, the MB must be reconciled. Any surplus of certified input (or unclaimed output) may be carried over to the next period, along with its associated emission

characteristics, in accordance with ISCC PLUS rules. This is possible regardless of the amount of material in stock (certified and non-certified) at the end of the MB period. It should be ensured that a company is continuously certified, i.e. that no time gaps between certification periods occur. An external audit is required annually to verify proper attribution and allocation.

Take home message of chain of custody mass balance approach: model in which materials or products with a set of certified characteristics are mixed according to defined criteria with materials or products without that set of characteristics. The physical proportion of input characteristics will typically vary across different outputs. CoC MB allows the attribution of a set of certified input characteristics to a dedicated output batch provided that over a defined accounting period input and output quantities remain equivalent.

Why is the mass balance approach used?

A complete physical separation of certified raw materials would often be inefficient or technologically unfeasible. “Sustainable” certified input materials can be integrated into existing production systems and companies can report certified shares even if 100% physical separation is not achieved. ISCC PLUS uses this approach to integrate certified input materials in areas such as chemicals, plastics and packaging into supply chains in a traceable manner and thus also create incentives to increase the use of certified input materials.

MB-CoC enables the input streams in the product to be verified on an accounting basis. With many outputs from complex production processes, it is of little use if each by-product only receives a 2% sustainability claim, for example. This is where MB-CoC can be useful.

Challenges in combining MB-CoC and PCF/ LCA

To enable the combination of ISCC PLUS and ISCC CFC, the characteristics of the input material must be provided with emissions (emission factors, PCFs), so that in addition to the share of MB-certified input, the emissions of these raw materials are also considered. It is important to note, that a biogenic raw material has not necessarily a lower emission factor/ PCF.

Combining MB-CoC and LCA, and therefore also PCFs, is challenging because the two methodologies have different system boundaries, assumptions and objectives. The biggest challenges to be considered when combining ISCC PLUS (mass balance approach) and ISCC CFC (PCF) can be summarized as follows:

- Different system logics

The MB-CoC is an accounting approach that enables attributing certified raw material characteristics to specific products based on a book-keeping level through value chains, even if the attributed amount

is theoretically not in the product. The LCA, on the other hand, analyses the actual physical material flows and environmental impacts along the (entire) life cycle of a product. The LCA is therefore based on real material flows and physical relationships. As a result, LCAs based on MB-CoC do not necessarily reflect the physical reality.

- Distribution of environmental burdens in the MB

As MB-CoC enables attribution of certified raw material characteristics across different products, the question arises how the associated environmental benefits or sustainability characteristics (e.g. lower CO₂ emissions or reduced resource consumption) are assigned to individual products. It must be clarified whether the environmental benefits linked to a certified input are fully attributed to a single product or proportionally distributed among multiple products within the system. This raises the fundamental question of whether an attribution based on MB-CoC corresponds to the allocation of environmental impacts, thereby directly relating to the system logic mismatch described above. If such allocation rules and attribution based on MB-CoC are arbitrary or insufficient transparent, this may result in greenwashing or create the impression of unjustified environmental benefits.

- LCA requires clear physical inputs

An LCA requires precise input data (Life Cycle Inventory) to correctly calculate environmental impacts (Life Cycle Impact Assessment). However, when the MB-CoC is involved, the end-product may in “worst case” physically consist of 100% fossil material, even though it is bookkept to be 50% bio-attributed, for example. The LCA model would then have to decide whether to apply the environmental benefit to the entire production or only to products of interest. The uncertainty in the physical composition makes precise, standardized and comprehensible PCF calculations challenging.

- Methodological incompatibilities with existing standards:

ISO 14040/ 44 (LCA norms) require objective, verifiable data – as does ISCC CFC, which follows the mentioned norms. ISO 22095 (CoC) allows an attribution on a bookkeeping basis of certified raw materials. Compliance with the LCA standards could be compromised if the MB-CoC deviates from causal relationships between inputs and outputs.

Consequently, clear rules are needed on how mass balance approach-based inventories may be integrated into LCA/ PCF, which are set out below. After selecting the mass balance approach, the next step is to choose the correct emission factors for the corresponding certified input materials. Further details and guidance on the selection of emission factors of bio and circular raw materials are given in the next sections.

11.2 Methodological approach – Mass balance regulations for combining ISCC PLUS and ISCC CFC

To illustrate different MB attribution scenarios, consider a fictional company producing a product composed of various raw materials (certified striped squares) and non-certified (grey squares and grey triangles) (see [Figure 17](#)). Raw materials are shown in [Figure 17](#) as squares and triangles, resulting in the product – shown as a combination of squares and triangles, drawn as a ‘house’.

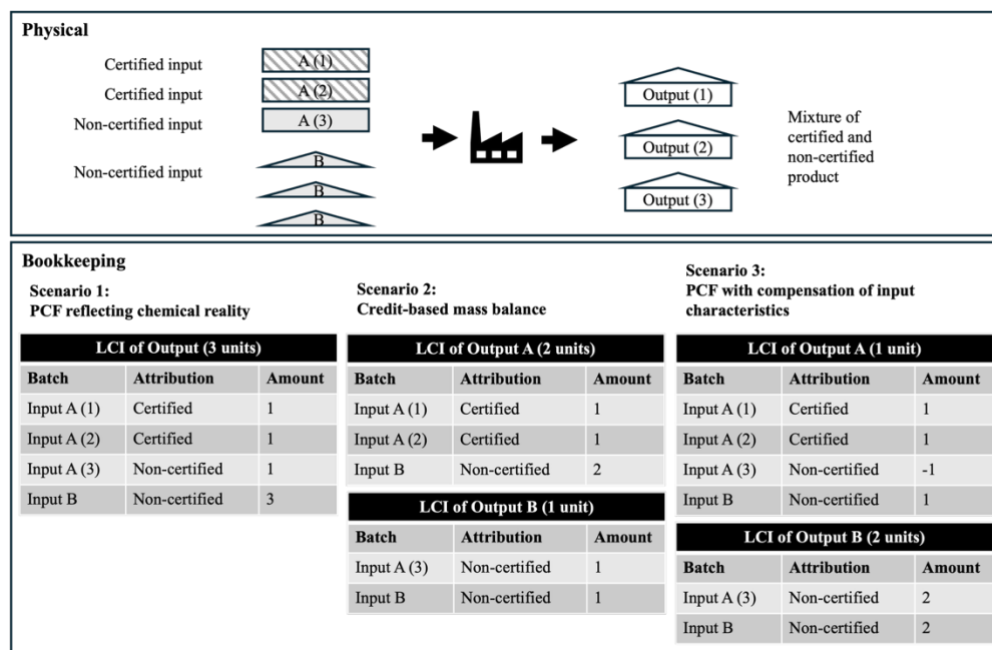


Figure 17: Life cycle inventory considering MB-CoC

Under MB-CoC rules, many plausible product compositions are possible, even with identical input amounts. This flexibility, while practical for certification, poses methodological issues for LCA, which depends on physically traceable flows and consistent system boundaries. The following subsections explore these scenarios and their implications for aligning MB-CoC with PCF and LCA methodologies.

All three scenarios include the substitution of a non-certified material (e.g. fossil-based feedstock) with a chemically identical but certified alternative (e.g. bio-based feedstock). Although the material function remains unchanged, the certified attributes - and thus the PCF or carbon intensity - differ. A real-world analogue would be the replacement of fossil-based natural gas with biogas. This substitution modifies the sustainability profile of the feedstock without changing its functional role, which typically results in a different PCF due to the different carbon intensity of the bio-based input.

[Chemical reality](#)

Scenario 1 (see [Figure 17](#)) illustrates the calculation of the PCF based on the actual physical configuration of the production system, which aligns with both the principles of MB-CoC and LCA. The PCF of the product is derived from

the weighted integration of all input components. In systems applying MB-CoC, the chemical reality scenario reflects the above-mentioned rolling average percentage method, leading to an average certified share and an average PCF of the evaluated product during the considered production period. In systems applying physical segregation, the chemical reality scenario allows the PCFs directly to reflect the separation of certified and non-certified inputs. This permits the assignment of distinct PCFs to each physically separated production stream.

Take home message: Under ISCC CFC, the chemical reality is accepted and can be used by system users and verified by auditors.

Credit-based mass balance

The second example (see *Figure 17*, scenario 2) introduces a virtual separation into two product batches: One product batch containing output 1 and 2 with certified input A and the other product batch containing output 3 with non-certified input A. This is done on a credit-based mass balance basis.

While ISO 14040, 14044, and 14067 do not comment on CoC-MB, they allow the use of modelling approaches for the allocation and attribution of material and emission flows within clearly defined system boundaries and reporting periods. In line with these principles, and consistent with the general mass balance concepts described in ISO 22095, the credit-based mass balance model needs to be implemented in a manner intended to ensure balanced, transparent, and period-consistent input-output accounting.

Side note: Across organizational boundaries

Another considered credit-based mass balance scenario might enable mass and emission attribution across organizational boundaries which is not accepted under ISCC CFC. Here, a company may accept input materials or sustainability claims from upstream suppliers without detailed knowledge of their production processes or LCA/ PCF methodologies. Suppliers may offer emission-optimized PCFs, possibly reflecting internal offsetting mechanisms, without a transparent link to physical material flows. This level of abstraction exceeds clearly defined system boundaries, both in the context of LCA and within certification systems such as ISCC, which require physical traceability at the site level. Consequently, ISCC CFC does not allow credit-based mass balance across organizational boundaries.

Take home message: Under ISCC CFC, a credit-based mass balance is accepted with the following requirements: The credit-based mass balance must occur within the same physical site, necessitating a site-specific approach and physical linkage to the production process. Accordingly, no multi-site credit transfer as described under ISCC PLUS is applicable under ISCC CFC. The mass balance of fossil and certified material needs to be carefully tracked and shown in detail to the auditor.

Compensation of input characteristics

The last option shown in *Figure 17* (scenario 3) is referred to as compensation of input characteristics. It covers scenarios in which the certified properties of an input material are attributed to one or more outputs to an extent that exceeds the actual proportion of this input. In this case, the proportions of other components in the product are compensated for. This increases the apparent certified share of the final product in a non-proportional manner. Such an approach is permissible under a certified mass balance like ISCC PLUS that allows to attribute certified characteristics from one out of multiple inputs to the combined output. Such a focus solely on material amounts, that have a certain characteristic like “bio” lacks functional equivalence. Extending this substitution to emission attribution is challenging under the methodological approach of LCA, as it somehow decouples environmental impacts from actual or even possible material functions and flows.

Take home message: Under ISCC CFC, compensation of input characteristics is not accepted. This means that the attribution of certified input material to CFC certified outputs must reflect the output material composition. The share of certified input material in the CFC certified output is limited to that part of the output, which is derived from the specific certified input material. Furthermore, the use of mass-balanced input materials certified with “compensation of input characteristics” cannot be taken into account under ISCC CFC.

Based on these reflections on potential MB-CoC scenarios from an LCA and PCF methodology perspective, the given take-home messages apply for mass balancing under ISCC CFC. For rolling average percentage and credit-based mass balance methods, the requirements and guardrails of mass balance as described under ISCC PLUS apply. Next to the general compliance with ISCC PLUS mass balance regulations, credit-based mass balances under CFC need to ensure full reflection of input characteristics (no compensation of input characteristics allowed).

11.3 Biogenic carbon uptake in the PCF calculation

Reflecting biogenic carbon uptake under ISCC CFC In the context of climate change mitigation and carbon accounting, the role of biogenic carbon in LCA and PCF has gained increasing prominence. Biogenic carbon refers to carbon that is temporarily sequestered from the atmosphere by biomass through

photosynthesis and subsequently incorporated into biobased products. In contrast to fossil carbon, which introduces additional carbon into the active carbon cycle, biogenic carbon flows are part of the short-term carbon cycle and are thus treated differently in LCA/ PCF methodologies.

Accurately accounting for biogenic carbon uptake is essential to reflect the potential climate change benefits associated with the temporary storage of atmospheric carbon in products derived from renewable resources. Furthermore, consistent biogenic carbon accounting enables comparability between fossil-based and biobased systems and supports decision-making in the context of decarbonization strategies, certified material selection, and circular economy assessments.

Standardized frameworks such as EN 15804 incorporate biogenic carbon uptake into the GWP indicator suite to ensure a harmonized and transparent representation of carbon flows across the product life cycle. However, the treatment of biogenic carbon remains a technically complex but necessary element of LCA/ PCF practice when evaluating products derived from biomass.

Excursus on EN 15804

The European standard EN 15804, which provides core rules for the Environmental Product Declarations (EPDs) of construction products – even though this is not yet focus of ISCC CFC -, includes explicit guidance on the accounting of biogenic carbon flows. This is particularly relevant for materials of biological origin, such as timber, which can act as temporary carbon sinks during their life cycle. ISCC CFC – even though not being primarily focused on the construction sector – considers the EN 15804-biogenic-uptake approach as relevant.

EN 15804:2012+A2:2019 mandates the inclusion of biogenic carbon flows in the GWP indicators, distinguishing between different GWP categories: GWP-fossil (GWP-fossil), GWP-biogenic (GWP-biogenic), GWP-land use and land use change (GWP-luluc). Biogenic carbon uptake is reported in GWP-biogenic. This category accounts for the net removals and emissions of carbon dioxide (CO₂) of biogenic origin over the product system's life cycle.

As already mentioned, biogenic carbon uptake occurs during the growth phase of biomass and is typically accounted for as a negative CO₂ emission (i.e., removal) in the production stage. The uptake is calculated based on the carbon content of the biomass incorporated into the product. The standard assumes a default carbon content of 50% of the dry mass of wood-based materials unless product-specific data is available. The corresponding release of biogenic carbon is modelled in the EoL stages – not yet being defined for ISCC CFC, as the focus for now is on cradle-to-gate. Nevertheless, the timing and mechanism of release depend on the EoL treatment (e.g. incineration, landfill, composting) and should be reported accordingly.

EN 15804 does not apply a temporary storage crediting. Instead, it follows a "carbon neutrality over the life cycle" principle: if the full life cycle is modelled, the net biogenic CO₂ balance ideally sums to zero, assuming full release at EoL. Deviations from this occur if carbon is stored beyond the reference study period (100 years), in which case a net removal may be claimed, subject to additional justification.

11.3.1 Biogenic carbon uptake for products with attributed biogenic carbon content under ISCC CFC

A central feature of EN 15804's treatment of biogenic carbon is the so-called "–1 / +1 approach", which provides a simplified and transparent accounting framework for temporary carbon storage and release within a product's life cycle: A biogenic carbon uptake is recorded as a negative emission (–1) in the product stage, reflecting the removal of atmospheric CO₂ during the growth of biomass used in the product. A corresponding biogenic carbon release is reported as a positive emission (+1) in the EoL stage, representing the return of this carbon to the atmosphere via degradation or combustion.

This approach ensures that, over the full life cycle, biogenic carbon flows net to zero if the carbon is fully released at EoL. The method follows a static carbon accounting convention and does not credit temporary storage unless it exceeds the standard 100-year time horizon.

Side note: Usage of the term "content" in the context of PLUS-CFC combination

In the interest of readability and ease of use of this guidance, the very common term "biogenic carbon content" is used in combination with the term "attributed" throughout this guidance to reflect the application of a mass-balance approach. Please be aware that the attributed biogenic carbon content reflects the biogenic carbon content on a mass-balance basis and that actual physical biogenic carbon contents of specific products may deviate from the attributed biogenic carbon content. The usage of this term in this document is for technical guidance and doesn't constitute a valid claim. The term "content" may not be used in claims for PLUS/CFC products unless the term is specified in the applicable regulations or standards. For further details and guidance on claims, see chapter [8 Logos and Claims](#).

Where ISCC PLUS certified bio-attributed material contributes to the LCI of a product subject to ISCC CFC certification, the corresponding attributed carbon content shall be considered biogenic. This biogenic carbon content shall therefore result in a recognized biogenic uptake of CO₂ at the level of the CFC certified product, reflecting the temporary storage of biogenic carbon in the product. The accounting of biogenic carbon uptake follows the approach by EN 15804. The biogenic carbon uptake is calculated based on the attributed biogenic carbon content of the product and the molar masses of CO₂ (44 g/

mol) and carbon (12 g/ mol). The attribution of bio-attributed input material to the product, and thus the determination of the attributed biogenic carbon content, shall follow the outlined mass balance regulations in chapter [11.2 Methodological approach – Mass balance regulations for combining ISCC PLUS and ISCC CFC](#).

Formula 13: Biogenic carbon uptake, given in kg CO₂e/ kg product

$$\text{Biogenic carbon uptake} = -\text{attributed biogenic carbon content} * \frac{M_{CO_2}}{M_C}$$

For instance, in case of 100% (attributed/ mass balanced) biogenic carbon content in polyethylene, which has a carbon content of 86%, the biogenic carbon uptake would be $-0.86 * 44 / 12 = -3.15$ kg CO₂e/ kg (having a positive effect on the cradle-to-gate PCF, as these 3.15 kg CO₂e/ kg would be stated as negative (-3.15 kg CO₂e/ kg) and the biogenic release would be stated as positive (+3.15 kg CO₂e/ kg) in the EoL PCF).

In general, the attributed biogenic carbon content cannot exceed the carbon content of a product. Based on the mass balance regulations outlined in chapter [11.2 Methodological approach – Mass balance regulations for combining ISCC PLUS and ISCC CFC](#) respective additional limitations for the maximum attributed biogenic carbon content occur in dependence of the setup and the input characteristics. Examples for those limitations are given in [Figure 18](#).

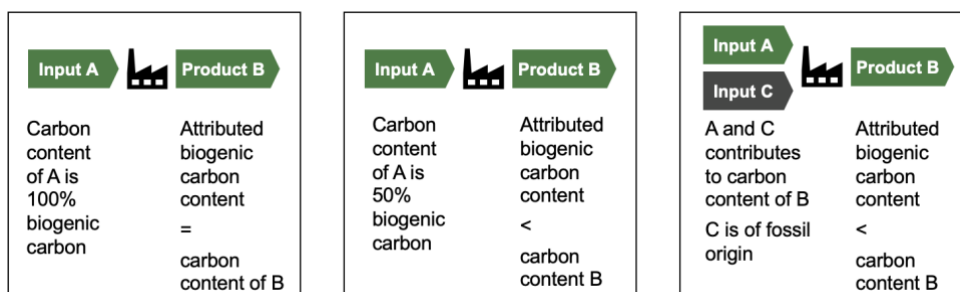


Figure 18: Examples for limitations of the attributed biogenic carbon content in dependence of setup and input characteristics

11.3.2 Practical calculation of PCF and biogenic carbon uptake

The following practical guidance can be applied to calculate PCFs and biogenic carbon uptakes in credit-based MB systems for products with and without attributed biogenic carbon content.

1. Calculation of two distinct PCFs for products with and without attributed biogenic carbon content according to respective norms and standards (e.g. ISO 14067, TfS) - both excluding biogenic carbon uptake. Emission factors for certified and non-certified input materials need to be chosen according to chosen attribution for evaluated product with or without attributed biogenic carbon content. Emission factors for certified bio-attributed input materials shall not include the biogenic carbon uptake to exclude double counting in step (2).

- Separate calculation of biogenic carbon uptake for product with attributed biogenic carbon content according to *Formula 13* under consideration of MB regulations given in *11.2 Methodological approach – Mass balance regulations for combining ISCC PLUS and ISCC CFC* and limitations for the attributed biogenic carbon content (see *Figure 18*).

Illustrative example

Based on the allowed approaches in *Figure 17* (chemical reality and credit-based mass balance), the following numerical, fictive examples in *Figure 19* with provided emission intensities and carbon content show, which PCFs and biogenic uptakes would be obtained:

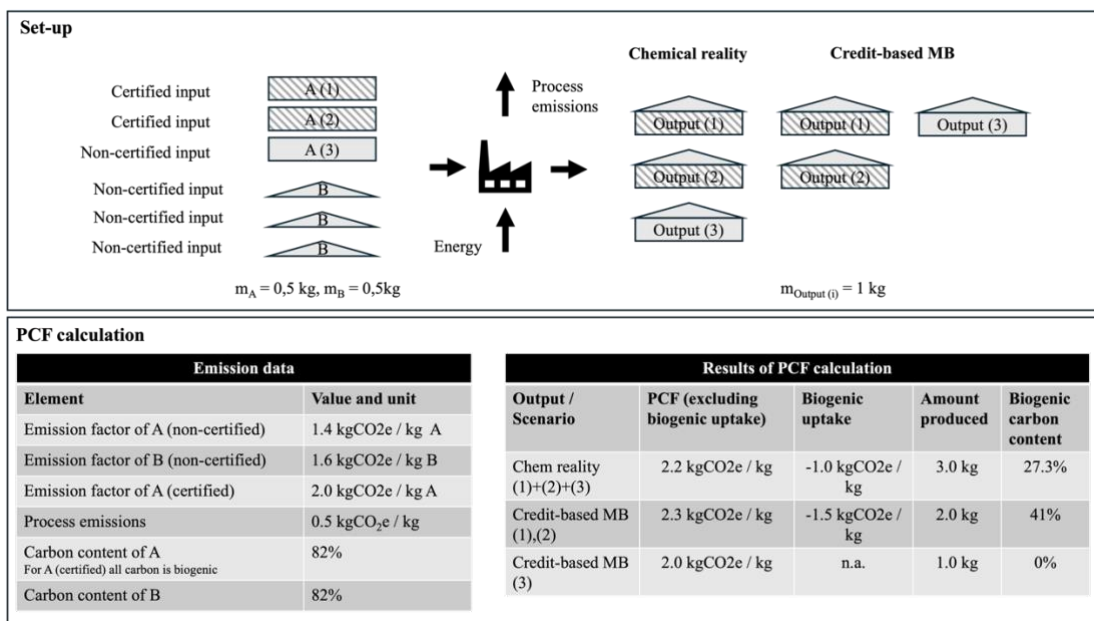


Figure 19: Biogenic carbon uptake – Life cycle inventory considering MB-CoC

Scenario 1: Chemical reality

Given:

- $Output_{(1)+(2)+(3)} = 2 A_{\text{certified}} + 1 A_{\text{non-certified}} + 3 B_{\text{non-certified}}$
- $Mass_{Output,(1)+(2)+(3)} = 3 \text{ kg}$

PCF (excluding biogenic carbon uptake) of output₍₁₎₊₍₂₎₊₍₃₎

$$PCF_{(1),(2),(3)} = (2 * m_A * EF_{A,\text{certified}} + 1 * m_A * EF_{A,\text{non-certified}} + 3 * m_B * EF_B + E_{P,3kg}) / m_{(1),(2),(3)}$$

$$PCF_{(1),(2),(3)} = \left(2 * 0.5 \text{ kg} * 2.0 \frac{\text{kg CO}_2\text{e}}{\text{kg}} + 1 * 0.5 \text{ kg} * 1.4 \frac{\text{kg CO}_2\text{e}}{\text{kg}} + 3 * 0.5 \text{ kg} * 1.6 \frac{\text{kg CO}_2\text{e}}{\text{kg}} + 3 \text{ kg} * 0.5 \frac{\text{kg CO}_2\text{e}}{\text{kg}} \right) / 3 \text{ kg}$$

$$= 2.2 \text{ kg CO}_2\text{e/kg}$$

Biogenic carbon uptake of output (1)+(2)+(3)Mass biogenic carbon

$$m_{bioC} = 2 * m_A * x_{bioC} = 2 * 0.5 \text{ kg} * 0.82 = 0.82 \text{ kg}$$

Conversion C → CO₂

$$\begin{aligned} \text{Biogenic carbon uptake} &= -(m_{bioC} * \frac{44}{12}) / m_{(1),(2),(3)} = -(0.82 * \frac{44}{12}) / 3 \text{ kg} \\ &= -1.0 \text{ kg CO}_2\text{e / kg} \end{aligned}$$

Biogenic carbon content of output (1)+(2)+(3)

$$X_{bioC} = 0.82 \text{ kg} / 3 \text{ kg} = 27.3\%$$

→ PCF with included biogenic carbon uptake would be 1.2 kg CO₂e / kg

Scenario 2: Credit-based mass balanceOutput (1)+(2)

Given:

- Output₍₁₎₊₍₂₎ = 2 A_{certified} + 2 B_{non-certified}
- Mass_{Output,(1)+(2)} = 2kg

PCF (excluding biogenic carbon uptake) of output (1)+(2)

$$\begin{aligned} PCF_{(1),(2)} &= (2 * m_A * EF_{A,certified} + 2 * m_B * EF_B + E_{P,2kg}) / m_{(1),(2)} \\ &= (2 * 0.5 \text{ kg} * 2.0 \frac{\text{kg CO}_2\text{e}}{\text{kg}} + 2 * 0.5 \text{ kg} * 1.6 \frac{\text{kg CO}_2\text{e}}{\text{kg}} + 2 \text{ kg} \\ &\quad * 0.5 \frac{\text{kg CO}_2\text{e}}{\text{kg}}) / 2 \text{ kg} \\ &= 2.3 \text{ kg CO}_2\text{e / kg} \end{aligned}$$

Biogenic carbon uptake of output (1)+(2)Mass biogenic carbon

$$m_{bioC} = 2 * m_A * x_{bioC} = 2 * 0.5 \text{ kg} * 0.82 = 0.82 \text{ kg}$$

Conversion C → CO₂

$$\begin{aligned} \text{Biogenic carbon uptake} &= -(m_{bioC} * \frac{44}{12}) / m_{(1),(2)} = -(0.82 * \frac{44}{12}) / 2 \text{ kg} \\ &= -1.5 \text{ kg CO}_2\text{e / kg} \end{aligned}$$

Biogenic carbon content of output (1)+(2)

$$X_{bioC} = 0.82 \text{ kg} / 2 \text{ kg} = 41\%$$

→ PCF with included biogenic carbon uptake would be 0.8 kg CO₂e / kg

Output (3)

Given:

- Output(3) = 1 A_{non-certified} + 1 B_{non-certified}
- Mass_{Output,(3)} = 1kg

PCF of output (3)

$$\begin{aligned} PCF_{(3)} &= (1 * m_A * EF_{A,conv} + 1 * m_B * EF_B + E_{P,1kg}) / m_{(3)} \\ &= (1 * 0.5 \text{ kg} * 1.4 \text{ kg} \frac{\text{CO}_2\text{e}}{\text{kg}} + 1 * 0.5 \text{ kg} * 1.6 \frac{\text{kg CO}_2\text{e}}{\text{kg}} + 1 \text{ kg} \\ &\quad * 0.5 \frac{\text{kg CO}_2\text{e}}{\text{kg}}) / 1 \text{ kg} \\ &= \underline{2.0 \text{ kg CO}_2\text{e} / \text{kg}} \end{aligned}$$

Biogenic carbon uptake of output (3)Mass biogenic carbon

$$m_{bioC} = 0 \text{ kg}$$

Biogenic carbon content of output (3)

$$X_{bioC} = 0\%$$

It is worth noting that overall emissions and biogenic uptake in scenarios chemical reality and credit-based mass balance are the same:

$$PCF: 3.0 \text{ kg} * 2.2 \frac{\text{kgCO}_2\text{e}}{\text{kg}} = 2.0 \text{ kg} * 2.3 \frac{\text{kgCO}_2\text{e}}{\text{kg}} + 1.0 \text{ kg} * 2.0 \frac{\text{kgCO}_2\text{e}}{\text{kg}}$$

$$\text{Biogenic carbon uptake: } 3.0 \text{ kg} * \left(-1.0 \frac{\text{kgCO}_2\text{e}}{\text{kg}}\right) = 2.0 \text{ kg} * \left(-1.5 \frac{\text{kgCO}_2\text{e}}{\text{kg}}\right).$$

11.3.3 Communication of biogenic carbon uptake: Requirements for PCF declarations

To communicate biogenic carbon uptake in the PCF declaration, the following accounting variants should be reported

- the PCF result including biogenic carbon uptake,

- the PCF result excluding biogenic carbon uptake, and
- the biogenic carbon uptake separately.

In addition to the separate quantification of the biogenic carbon uptake, also

- the attributed biogenic carbon content (kg attributed bio C/ kg product), and
- the carbon content (kg C/ kg product)

shall be disclosed in the PCF declaration for products in combined CFC-PLUS certifications (raw material category bio).

Take home message: ISCC CFC, following EN 15804, applied the -1 / +1 approach to biogenic carbon, whereby inclusion of the biogenic carbon uptake into the PCF calculation is allowed. For transparency the biogenic carbon uptake must always be quantified, and it must be declared whether the biogenic carbon uptake is included in the PCF calculation.

12 Renewable Energies

The use of renewable energy is a key component in the global strategy to combat climate change. Renewable energies, such as solar, wind, hydropower and biomass, offer a sustainable alternative to fossil fuels due to their lower GHG intensities. By combining renewable energy with accurate PCF accounting, companies can prove significant reductions in their environmental footprint and make an important contribution to achieving global climate targets.

This chapter refers to the use of renewable energy for utilities (e.g. furnaces, pumps, machinery at production). The consideration of renewable energy for an integral part of the reaction (e.g. redox reactions, electrolysis)³⁰ is subject to future development.

The selection of the EFs for renewable/ conventional energy input is explained in the following paragraphs.

12.1 System boundaries of EFs for energy

In alignment with ISO 14067, the EFs for energy shall cover:

- Upstream emissions (e.g. resource extraction and transport)
- Emission during generation (incl. losses during transmission and distribution)³¹, and
- Downstream emissions (e.g. waste treatment).

Take home message: The EFs for energy shall include upstream emissions, emissions during generation and downstream emissions.

In case (supplier-specific) life cycle EFs are not available, we recommend choosing best suitable life cycle EFs from databases such as ecoinvent and Sphera.

Selecting the accounting method is crucial for choosing EFs for energy input. According to the GHG protocol, there are two accounting methods for energy: (1) the market-based and (2) the location-based approach. ISCC CFC follows (1) the market-based approach, in line with ISO 14067 and TfS (see [Table 4](#)). According to the definition of GHG protocol, the market-based GHG calculation quantifies the emissions by using contractual instruments. This

³⁰ This application refers to so called so-called renewable-energy derived materials under ISCC PLUS or RFNBOs under ISCC EU. These combinations of certificates are not yet developed.

³¹ For further guidance on the inclusion of transmission and distribution, e.g. the guidance from the GHG protocol can be followed (<https://ghgprotocol.org/sites/default/files/2022-12/Chapter3.pdf>).

chapter includes the requirements that need to be met for the ISCC CFC certification, to ensure an exclusive use of the renewable energy.

Informative background information (not eligible under ISCC CFC)

The second method being used under the GHG protocol, the location-based approach, quantifies the emissions based on the average energy generation EF for defined geographical areas at the corresponding time frame. Location-based EFs reflect the GHG intensity of grids, regardless of any market type.

Standard	Location-based	Market-based
ISCC CFC		✓
GHG protocol corporate	✓	✓
GHG protocol product		✓
ISO 14040/ 44	No information	
ISO 14067		✓
TfS PCF guideline		✓

Table 4: Accounting methods for energy in different GHG accounting frameworks, according to Holzapfel et al.³², 2023 and TfS³³

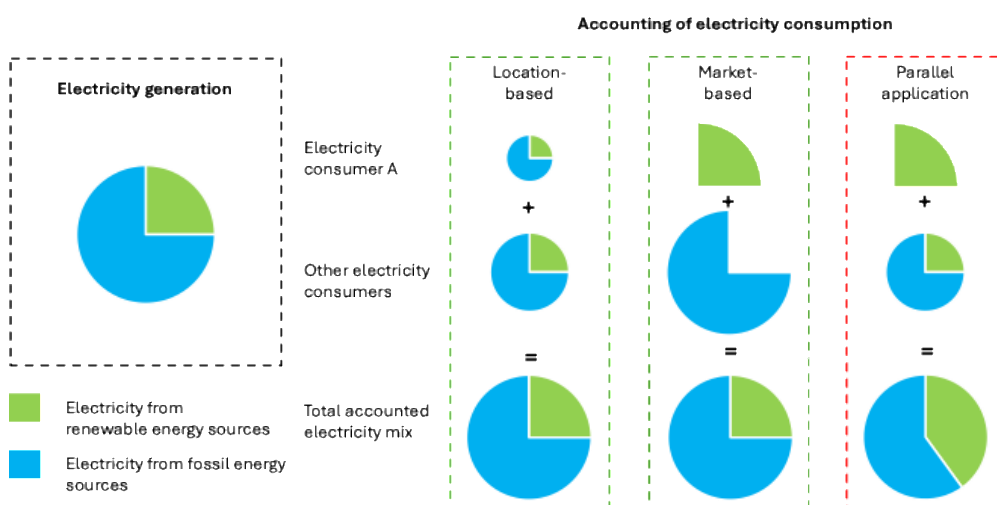


Figure 20: Challenges of double counting. Simplified example of electricity accounting in a hypothetical region, where consumer A purchases electricity from renewable sources. Illustration is based on Holzapfel et al., 2023.³⁴

The proof of renewability must ensure that double counting of renewable energy is avoided. [Figure 20](#) illustrates the challenges of double counting. The figure shows a simplified example of a specific region, where renewable electricity is purchased by consumer A. When applying the market-based

³² Holzapfel, P., Bach, V. & Finkbeiner, M. Electricity accounting in life cycle assessment: the challenge of double counting. *Int J Life Cycle Assess* 28, 771–787 (2023). <https://doi.org/10.1007/s11367-023-02158-w>.

³³ Together for sustainability (2024).

³⁴ Holzapfel, P., Bach, V. & Finkbeiner, M. Electricity accounting in life cycle assessment: the challenge of double counting. *Int J Life Cycle Assess* 28, 771–787 (2023). <https://doi.org/10.1007/s11367-023-02158-w>.

approach for consumer A and the location-based approach for all other consumer (other electricity consumers in *Figure 20*), the total accounted electricity mix is resulting in a higher share of renewables (see red-dotted line on the right side of *Figure 20: Parallel application*) than the actual electricity generation mix³⁵.

Take home message: ISCC CFC follows the market-based approach.

It is therefore crucial to not apply both methods in parallel and to set rules for the correct selection of EFs, as ISCC CFC is doing. The following paragraphs provide guidelines on choosing EFs for electricity and thermal energy.

12.2 Selection of EFs for electricity

The following *Figure 21* shows, how to choose the EF for the consumed electricity.

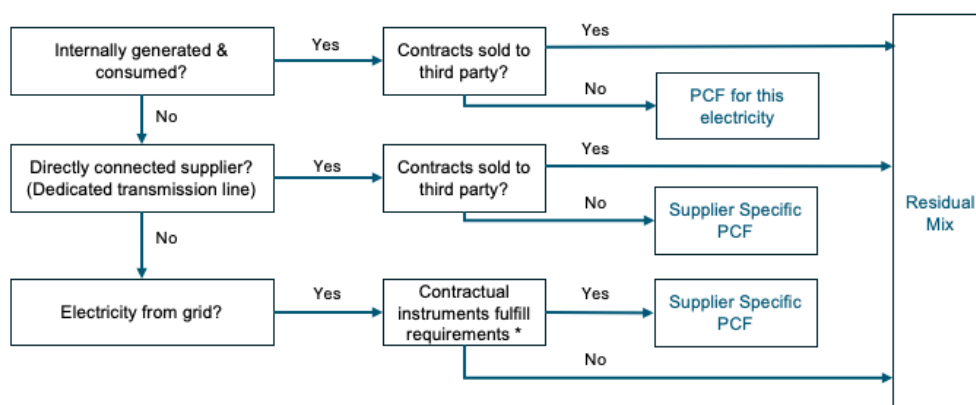


Figure 21: Selection of EFs for electricity (based on ISO 14067)

In case the consumed electricity is internally generated, and no contracts are sold to third party, the EF for this specific electricity shall be used. Referred here as “PCF of this electricity”, the EF shall include emissions covering upstream, during transmission/ distribution and downstream of the energy (see chapter *12.1 System boundaries of EFs for energy*). This is valid for example for electricity generated by on-site photovoltaic panels (first line, *Figure 21*). Respective proof of electricity generation and usage must be verified by the auditor. By including the entire life cycle of the energy, the PCF can never be zero. In case of the use of renewable energy, a value close to zero is expected – as it still covers parts of upstream and distribution emissions.

If there is a dedicated transmission line between the organization and the electricity generation plant and no contracts are sold to third party, the supplier

³⁵ Holzapfel, P., Bach, V. & Finkbeiner, M. Electricity accounting in life cycle assessment: the challenge of double counting. *Int J Life Cycle Assess* 28, 771–787 (2023). <https://doi.org/10.1007/s11367-023-02158-w>.

specific EF shall be applied (second line, *Figure 21*). The supplier specific PCF shall reflect the corresponding electricity source, and the source of the EF shall be according to the list of accepted EF sources under ISCC CFC (ref. chapter *5.2.1 Data categories*).

In case electricity is supplied by the grid, there are two options. Option 1 is the supplier specific EF. The supplier-specific EF shall be chosen, if the following information are part of the documentation (referring to “*” in *Figure 21*):

- The energy source from which the energy carrier was produced and the start and end dates of production;
- The type of energy or energy carrier (e.g. electricity);
- The identity, location, type and capacity of the installation where the energy or energy carrier was produced;
- The date on which the installation became operational (i.e., starting point of first electricity supply into grid);
- The date and country of issue and a unique identification number of the REC/ GoO. (In other words, a proof of no double counting need is required.)
- Therefore, the renewability of electricity can be proven via:
 - Energy Attribute Certificates (EACs) (e.g. Guarantees of Origin (GoO) in the EU, RECs in the U.S., or I-RECs in Mexico),
 - Renewable PPAs combined with EACs,
 - Renewable PPAs combined with comparable proof of no double counting,
 - Via a direct connection/ link of the PU with the respective unit producing renewable electricity.

Background information: Energy Attribute Certificates

	Applicability	Renewable Electricity
GoO	Europe	✓
REC	US and Canada	✓
I-REC	Latin America and the Caribbean, Africa, Asia	✓

Table 5: EACs applicability

The EACs can be sourced bundled (combined with PPAs) or unbundled, however the following requirements need to be met:

EACs shall only be accepted if they are issued, transferred and cancelled in an electronic registry operated by an institution that has been formally mandated or recognised by a competent national authority in accordance with applicable legislation and if they are acquired and used in compliance with national regulatory requirements. This requirement reflects the situation for GoOs and other EACs in Europe. However, EAC systems from other world regions can also be eligible, provided they are organised in a comparable way and listed in [Table 5](#).

Thereby, it needs to be guaranteed that: each certificate is only used once, and the auditor can verify the correct issuance and retirement of the EACs. EACs must originate from the same region (Europe, Asia, America, etc.) as the production site to which the corresponding EACs are attributed to, and from a system of EAC (GoO, REC, I-REC) applicable at the location of the production site (please consult [Table 5](#) to choose the applicable EAC). The specific validity period of the EACs may be subject of national legislations, e.g. 18 months after the production of the energy unit.

System users shall assign EACs to a specific product within the aforementioned validity period. Once EACs are assigned to a specific product for the purpose of PCF calculation, the EACs are bounded to it. Subsequent expiration of the EACs shall have no impact on the validity of the corresponding PCF value. Further details on the attribution of renewable energy can be found in section [12.6 Chain of Custody mass balance system for renewable energy](#). Any double counting or reselling of EACs is not allowed.

- The proof of renewability must ensure that double counting of the renewable electricity is avoided. A respective proof of the unit using the renewable energy must be provided during the audit.
- When applying the supplier specific EF, it must be ensured that beside emissions during generation, also upstream and downstream emissions are included. In other words, the applied PCF cannot be zero (see also explanation above). It must be ensured that the entire life cycle is included, if the supplier specific EF does not capture the entire life cycle, further emissions arising upstream and downstream need to be added. Therefore, the EF is referred to supplier specific

PCF in *Figure 21*, to ensure that the PCF has been reviewed and certified.

If those requirements are not fulfilled, or, in case the supplier specific EF is not available, or contracts are sold to third party, the residual mix (right side, *Figure 21*) should be selected, which is the EF for the relevant grid, excluding the previously claimed attributed electricity. According to the GHG protocol, the residual mix is the remaining energy source mix after the traceable energy consumption is subtracted. Energy consumption can be tracked using contractual instruments (GoO, PPA, etc.). For calculating emissions using the market-based method, the residual mix EF can be used if the origin of the purchased energy is unknown³⁶. The residual mix is considered to avoid double counting (see *Figure 21*).

The residual electricity mix by region³⁷ is available in several databases as ecoinvent, publicly available³⁸ or can also be self-calculated³⁹.

12.3 Selection of EFs for thermal energy

There are two options when selecting EFs for thermal energy. Option 1 is in case the thermal energy is self-generated. When calculating the emissions for self-generated energy, primary data shall be used to calculate emissions. In this case, it is important to consider: the PCF of the energy carrier, direct process emissions and the process efficiency as well as any by-products produced (e.g. electricity).

In case the thermal energy is purchased (option 2), supplier-specific EFs shall be used, following the market-based approach from the GHG protocol.

12.4 Biogas and biomethane as fuel

In cases where process energy is generated from biogas and/ or biomethane, the EF of the respective energy carrier is a key input parameter for the PCF calculation.

Considering the potential risks that unsustainable production and sourcing of biomass feedstocks may have on the PCF of biogas and biomethane, ISCC CFC currently allows only biogas and biomethane products that are certified under the Renewable Energy Directive (RED) framework⁴⁰.

³⁶ According to GHG protocol

³⁷ A region hereby can be a country or a state, as e.g. in <https://app.electricitymaps.com/map/72h/hourly>.

³⁸ The residual mix is e.g. for the European countries available at <https://www.aib-net.org/facts/european-residual-mix/2023>.

³⁹ A guidance on self-calculation of residual mixes can be e.g. found in https://www.trackingstandard.org/wp-content/uploads/NORSUS_Country-cases_Residual-Mix_Open_OR16.23.pdf.

⁴⁰ Further legislations and market instruments for the consideration of biogas and biomethane will be subject to upcoming methodological developments.

The EF for respective biogas/ biomethane products shall be determined as follows:

- As the biogas or biomethane is produced in a facility already certified under the RED framework, the EF defined during the certification process shall be applied. The respective proof of sustainability, provided by a certification scheme recognized by the EU Commission under the RED framework shall be used as evidence.
- The EFs for biogas/ biomethane have to be sourced from the documentation of an EU RED certification, while emission savings from the use of manure (included under E_{sca}) shall be set to zero.

The environmental attributes associated with biogas or biomethane (e.g. proof of sustainability) shall be uniquely assigned to the reported energy use. Double counting of environmental attributes is not permitted. Where unbundled instruments are used, their use shall follow the same principles as defined for renewable electricity in this standard.

Bundled vs. unbundled attributes

Evidence used to substantiate the EF (e.g. proof of sustainability, certification documents or contractual instruments) shall be valid for the reporting period of the PCF. The temporal alignment between energy production, attribute validity and energy use shall be demonstrated.

Temporal validity

12.5 Emission factors for electricity and heat from combined heat and power systems

If heat and electricity are supplied by a combined heat and power system (CHP), two EFs exist, one for the produced heat and the other for the produced electricity.

One can either use the EFs provided by the supplier of the heat or the electricity or calculate the respective EFs by considering the amount of fuel consumed, the respective EF of the fuel as well as the efficiency of the CHP process and the amounts of produced heat and electricity. The allocation factor (AF) is used to allocate the emissions between the heat and the electricity in the CHP.

The respective emission factors shall be calculated as:

Formula 14: Emission factor for heat from CHP

$$EF_{Heat\ from\ CHP} \left[\frac{kg\ CO_2e}{kWh} \right] = \frac{Fuel\ consumption \left[\frac{kg\ or\ l}{yr} \right] * EF_{Fuel} \left[\frac{kg\ CO_2e}{kg\ or\ l} \right]}{Amount\ of\ useful\ heat\ produced \left[\frac{kWh}{yr} \right]} * AF_{Heat}$$

The EF for electricity produced from CHP units shall be calculated according analogously, following the same methodology. For the allocation between electricity and heat, only useful heat shall be considered. The allocation shall

be done according to the guidelines for by-product allocation, provided in section [5.1.6 Allocation](#).

12.6 Chain of Custody mass balance system for renewable energy

Under ISCC CFC, it is possible to balance and certify transparent, traceable, and reproducible PCFs. This also includes the approach of integrating renewable energy, which further specifies the general ISO 14067 approach as follows:

According to ISO 14040/ 44/ 67, all emissions from raw material extraction over the entire life cycle result in a singular final PCF, with or without the use of renewable energy. ISCC CFC on the other hand, aims to report the share of renewable energy in a separately allocated PCF and with that established a CoC mass balance system for renewable energy, analogous to credit-based mass balance in [11.2 Methodological approach – Mass balance regulations for combining ISCC PLUS and ISCC CFC](#).

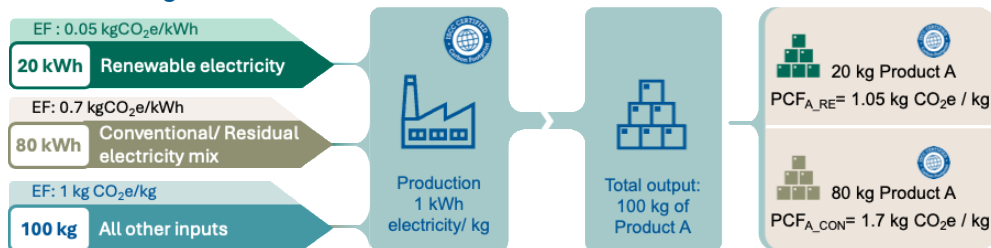


Figure 22: Example of PCF attribution based on percentage values of renewable and conventional electricity input

Under ISCC CFC, renewable energy can be attributed to product batches, following a CoC mass balance approach (see [Figure 22](#)), comparable to a credit-based mass balance of certified feedstock under ISCC PLUS. The example shown in [Figure 22](#) has two different electricity sources: renewable and conventional. 20% of the total electricity is sourced from renewable sources and the remaining 80% comes from conventional sources. Each of these inputs has a specific EF.

To calculate the total emissions of producing 1 kg of product A the formulas 15 and 16 are applied:

Without any mass balancing of the renewable energy input, the calculation would be as followed (simplified example).

Formula 15: PCF calculation without mass balancing of RE

$$PCF_{Product A} = Emissions_{All\ other\ inputs} + Emissions_{Electricity}$$

with

Formula 16: Emissions from electricity

$$Emissions_{Electricity} = EF_{Electricity\ Source} * Amount\ of\ electricity\ needed$$

When now attributing the renewable energy to specific product batches, the share of the renewable electricity input (20%) is the same share of the total production to which the emissions from renewable electricity can be allocated:

- Share of product attributed to the emissions from renewable electricity input:
- 100 kg of Product A * 20% = 20 kg of Product A with PCF_{A_RE}
- Share of product attributed to the emissions from conventional electricity input:
- 100 kg of Product A * 80% = 80 kg of Product A with PCF_{A_CON}

In this simplified example, the emissions for with PCF_{A_RE} and with PCF_{A_CON} are calculated as followed:

$$\begin{aligned} PCF_{A_RE} \left(\frac{kgCO_2e}{kg} \right) &= Emissions_{All\ other\ inputs} + Emissions_{Electricity} \\ &= 1 \left(\frac{kgCO_2e}{kg} \right) + \left(0.05 \left(\frac{kgCO_2e}{kWh} \right) * 1 \left(\frac{kWh}{kg} \right) \right) = 1.05 \left(\frac{kgCO_2e}{kg} \right) \end{aligned}$$

And

$$\begin{aligned} PCF_{A_CON} \left(\frac{kgCO_2e}{kg} \right) &= Emissions_{All\ other\ inputs} + Emissions_{Electricity} \\ &= 1 \left(\frac{kgCO_2e}{kg} \right) + \left(0.7 \left(\frac{kgCO_2e}{kWh} \right) * 1 \left(\frac{kWh}{kg} \right) \right) = 1.7 \left(\frac{kgCO_2e}{kg} \right) \end{aligned}$$

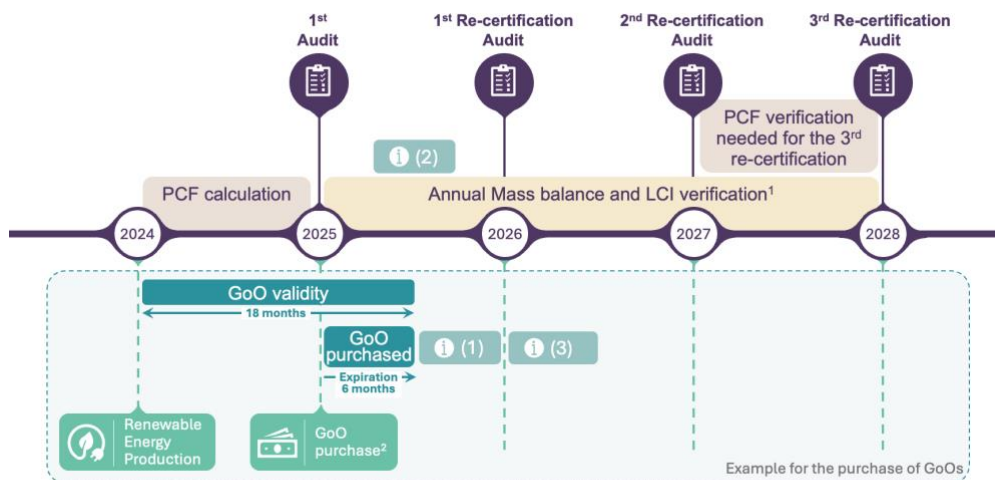
During the audit it must be verified that the renewable energy is only accounted once. In other words (with the simplified example), the sum of $PCF_{A_RE} * 20kg + PCF_{A_CON} * 80kg$ cannot be lower than $PCF_A * 100kg$.

In case of a multi-output process, where emissions are allocated to different products, the mass balancing of the renewable energy can be applied in a selective manner. To do so, the energy demand of the process can be allocated to the outputs according to common allocation principles (e.g. by a physical relationship of the outputs like mass). The energy supply for this “allocated energy demand” may be sourced from renewable energy, which means that the EF of the renewable energy can be used selectively in the PCF calculation of one product in a multi-output process.

When applying the mass balance, the following rules have to be followed:

- It is not allowed to split up the residual electricity mix (e.g. from the national grid) into a “renewable PCF” and a “conventional PCF”.
- The PCF, considering renewable energy input, can be accounted for from first day of certification.

- Renewable energy can only be accounted to site-specific energy inputs in processes.
- Any mass balancing between different types of energy is limited to the type of energy and the specific installation (e.g. the purchase of renewable electricity cannot be allocated to consumed thermal energy).



1. This applies, in case the PCF value has no changes of +/- 10%. Otherwise, a PCF verification would be needed additionally during the 1st and/or 2nd re-certification audit.
 2. GoOs can be assigned to the PCF as long as they are still valid, e.g., within those 6 months.

Figure 23: Illustration of an example on validity periods of GoOs.

- Accepted time frames:
 - In general, the attribution of renewable energy to product batches must be completed within the validity periods of the contracts. The assignment of EACs to a product for the purpose of the PCF calculation, may only take place as long as the certificate is valid at the time of cancellation. A respective proof of the unit using the renewable energy must be provided during the audit⁴¹. For details on validity periods and requirements on EACs please consult chapter [12.2 Selection of EFs for electricity](#).
 - In case additional EACs (such as GoOs) are required (due to the required amount or due to expiration periods), additional EACs can be purchased during the certification period. The important requirement thereby is that the EF/ PCF of the additional accepted market-based instrument remains the same. In [Figure 23](#), this would be the case for the time period, indicated with the info point (1).
 - In case the contract for the purchase of renewable energy gets cancelled during the certification period, the system user no longer fulfils the requirements, and it is his responsibility to inform the CB. Consequently, the system user cannot claim the PCF of the ISCC CFC certified material with attributed renewable energy any longer.

⁴¹ ISCC PLUS: https://www.iscc-system.org/wp-content/uploads/2023/03/ISCC-PLUS-System-Documents_V3.4.pdf

This may be for example in the time period indicated with the info point (2) in *Figure 23*.

- In case EACs are purchased within for example 2025, and not attributed to a specific batch, they can be transferred to the next certification period (for example 2026) and attributed to product batches as long as they are still valid. This may apply for example for the time period indicated with the info point (3) in *Figure 23*.
- The amount of produced material with attributed renewable energy input (as defined in the introduction) shall be treated on mass balance base with a mass balance period of three months. It is possible to go into deficit within a mass balance period (to go short), i.e. to sell more material with attributed renewable energy than available. This, however, is only possible under the condition that at the end of the mass balance period the amount of material with the attributed renewable energy is balanced to the amount of purchased renewable energy (e.g. via RECs). If there are remaining RECs at the end of a mass balance period, the surplus in the bookkeeping can be transferred into the next mass balance period under the condition that the EACs are still valid. At the end of a mass balance period the quantity bookkeeping either must be balanced or have a surplus in bookkeeping that can be carried forward. After attributing the renewable energy to dedicated product volumes during the validity period of the EAC, surpluses of the products with attributed renewable energy can be transferred in the bookkeeping as long as a valid certificate is in place. If there is a gap between two certification periods, any surpluses vanish. A negative mass balance is not permitted under ISCC CFC and treated as a non-conformity. If a negative mass balance occurs at the end of a mass balance period, the certified company must inform the CB immediately and without being requested.

12.7 Further requirements

Furthermore, the following requirements need to be met:

- The energy flows must be allocated to the end products by mass or calorific value of the end products (kWh/ kg product or kWh/ MJ product).
- The source of the renewable energy must be known and traceable.
- The EFs for both renewable and conventional energy must be provided by the producer (supplier specific) or justified by an external third-party verified source - in justified cases, these can also be EFs from peer-reviewed databases such as ecoinvent or peer-reviewed scientific publications.
- The mass-energy-balance is verified annually by a third-party (auditor/ CB) during the ISCC CFC audit:

- Amount of renewable energy purchased or generated
- Amount of sold product with “renewable” PCF
- Electricity needed to produce respective amount of sold product with “renewable” PCF

12.8 Remark

The ISCC CFC scheme is currently under further development. The following topics are subject to further methodological developments:

- Energy storage
- Renewable energy-derived materials under ISCC PLUS or RFNBOs under EU
- Hydrogen as fuel

13 Silicon metal produced with renewable energies

13.1 Introduction

Silicon is an important pre-product for many applications in different industrial sectors. Besides its use in the electrical, semi-conductor, photovoltaic and chemical industry, silicon is also used as an alloying element for the steel and aluminium production.

The various fields of application require different qualities, which results in different process treatments of the silicon. However, the first step always is the production of raw silicon in forms of ferrosilicon or silicon metal.

On an industrial level, the production of silicon is usually done with an electric arc furnace (EAF) which reduces quartzes and quartzites (hereinafter referred to as “Quartz/ite”), which are both mainly composed of silica (silicon dioxide (SiO_2)) with carbon as a reducing agent in an energy intense process. Besides silicon metal and silica fume, this process results in different off-gas components.

Depending on the specific process set-up as well as the type of reducing agents (e.g. the use of fossil or biogenic carbon) or electricity sources used, the PCF of the silicon product can vary significantly. Thus, the approach described in this chapter shall provide a basis to calculate, verify and communicate GHG emissions and emission reductions in the production of silicon metal compared to business-as-usual scenarios or a benchmark for the industry average.

This section describes the general approach for the calculation of GHG emissions for silicon metal production under the ISCC CFC module and provides guidelines for the certification of the corresponding PCFs. Specific requirements related to the collection of input data and the verification of the calculation are subject to the subsequent chapters. The PCF of silicon metal is mandatory to be published on the ISCC CFC certificate.

13.2 Scope and normative references

The scope of this chapter is the PCF calculation for Silicon metal within a cradle-to-gate approach. The general approaches for GHG emission calculations of various products will be, to the extent possible, widely harmonized under the ISCC CFC module. The methodology defined in this document follows the general approach defined in ISO 14067:2018, with further specifications to produce silicon metal.

13.3 Methodology for the calculation of PCFs for silicon metal products

The system document *ISCC EU 205 Greenhouse Gas Emissions* explains the options of stating GHG emissions along the supply chain and provides the

methodology, rules and guidelines for calculating and verifying GHG emissions and emission reduction.

This chapter defines specifications in the calculation of the PCF for silicon metal as well as the necessary verification of PCF calculations for silicon metal under ISCC CFC.

The calculation of GHG emissions from the production of silicon metal shall consider the direct emissions of the silicon metal production process, the upstream emissions associated with the production and the supply of process inputs such as electric energy, other process inputs and reducing agents, as well as potential co/ by-products of the process (e.g. silica fume). The certification approach for silicon metal under ISCC CFC hence aims for the calculation of a cradle-to-gate PCF for silicon metal considering all emissions happening prior to the gate of the silicon metal selling company, which can be forwarded to the downstream customer.

Figure 24 shows a simplified process flow with the relevant parameters for the calculation.

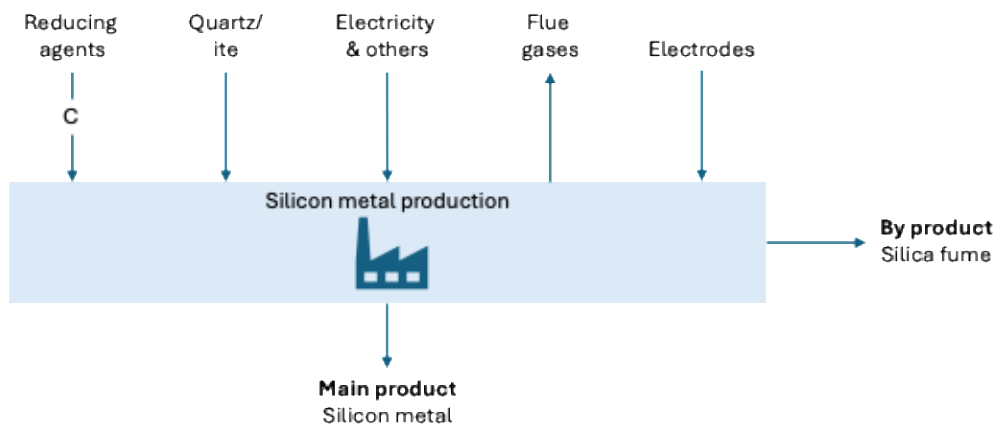


Figure 24: Main parameters for the PCF calculation of silicon metal

Typical set ups for the production of silicon metal⁴² consider the use of SiO₂-based raw materials (Quartz/ite) as the material feedstock, different kinds of carbon sources as reducing agents (e.g. coal, wood, charcoal), the input of electric energy for the operation of the EAF, the use of consumable electrodes and potential other process inputs (e.g. limestone, oxygen, nitrogen, fuels).

⁴² As for example defined by Schei, Anders & Tuset, Johan & Tveit, Halvard. Production of High Silicon Alloys. Trondheim (1998): TAPIR, ISBN: 8251913179
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Thus, the GHG emissions of the silicon metal production shall be calculated as:

Formula 17: Emissions from the production of silicon metal

$$E_{sm} = (m_{ra} * EF_{ra} + m_{Quartz/ite} * EF_{Quartz/ite} + W_{el} * EF_{el} + m_n * EF_n + E_{flue\ gas}) * A_{sm}$$

E_{sm}	Emissions from the production of silicon metal [kg CO ₂ e/ t of silicon metal]
m_{ra}	Quantity of reducing agent [kg/ t of silicon metal]
EF_{ra}	EF for the production and transport of the reducing agent to the PU [kg CO ₂ e/ kg] The EF shall consider all process steps until the provision of the process input to the silicon metal production unit, including production, storage and transport steps.
$m_{Quartz/ite}$	Quantity of Quartz/ ite inputs [kg/ t of silicon metal]
$EF_{Quartz/ite}$	EF for the production and transport of Quartz/ ite to the PU [kg CO ₂ e / kg] The EF shall consider all process steps until the provision of the Quartz/ite to the silicon metal production unit, including production, storage and transport steps.
W_{el}	Quantity of electricity (electrical work) input [kWh/ t of silicon metal]
EF_{el}	EF for the production and supply of electricity (electrical work) to the PU [kg CO ₂ e/ kWh] The EF shall consider all process steps until the provision of the process input to the silicon metal production unit.
m_n	Quantity of additional process input [kg/ t of silicon metal]
EF_n	EF for the production and transport of the additional process input to the PU [kg CO ₂ e/ kg] The EF shall consider all process steps until the provision of the process input to the silicon metal production unit, including production, storage and transport steps.
$E_{flue\ gas}$	Direct process emissions [kg CO ₂ e] The climate impact of the flue gas emissions shall be considered according to the characterization factors of the different GHG components. CO ₂ emissions from the combustion of biogenic carbon sources (e.g. when sustainably sourced charcoal is being used as a reducing agent) shall be taken to be zero.
A_{sm}	Allocation factor for silicon metal [-]. Please see next section.

13.4 Allocation factors for silicon metal and BPs

Emissions calculated according to the above defined approach shall be allocated between silicon metal and any additional products occurring from the silicon metal production process. The allocation of GHG emissions to any products that are considered a waste is not permitted. (For the classification of waste and residues, please refer to *ISCC EU 202-5 Wastes and Residues*).

The allocation of emissions shall be based on the mass flows of the products. Consequently, the allocation factor AF of the silicon metal, shall be calculated as:

Formula 18: Allocation factor of silicon metal

$$A_{sm} = \frac{m_{sm}}{m_{sm} + m_{co-product}}$$

A_{sm}	Allocation Factor of silicon metal [-]
m_{sm}	Quantity of silicon metal [kg]
$m_{co-product}$	Quantity of co-/ by-product [kg]

13.5 Benchmarking and claiming

Under the ISCC CFC approach for silicon metal, the absolute value of the PCF calculated via the here described methodology (E_{sm} , see [Formula 17](#)) needs to be published together with the certification. In addition to the absolute PCF value to be given, potential emission reductions can be claimed in comparison to respective benchmarks. Once the benchmark value is selected, the emissions reductions can be calculated as:

Formula 19: Emission reduction of considered silicon metal vs. benchmark

$$\text{Emissions reduction} = \frac{E_{Benchmark} - E_{sm}}{E_{Benchmark}}$$

<i>Emissions reduction</i>	<i>Emission reduction of considered silicon metal compared to benchmark silicon metal [%]</i>
$E_{Benchmark}$	<i>Emissions from the production of silicon metal, benchmark value [kg CO₂e/ t of silicon metal]</i>
E_{sm}	<i>Emissions from the production of silicon metal [kg CO₂e/ t of silicon metal]</i>

For claiming emission reductions, the selected benchmark needs to be clearly referenced. Two possibilities apply for the benchmark value:

Reference global value

In this case, the benchmark value will be a reference value for emissions related to silicon metal production on a global level. ISCC has selected a value from the ecoinvent data base of 10.9 kg CO₂e/ kg-silicon metal. This value is based on the “market for silicon, metallurgical grade, GLO” activity from ecoinvent, version 3.9.1, impact category GWP100 IPCC 2021. The value will be updated by ISCC once more recent data are available. When the calculation of silicon metal emissions according to the here outlined methodological requirements (including identical system boundaries, identical FU/ reference flow) results in lower emissions than a defined threshold of the reference global value, an additional claim on “low-carbon silicon metal production” is possible. For the certified silicon metal PCFs under ISCC CFC this threshold is set to 40% reduction compared to the global reference value to qualify for a low carbon product claim (PCF lower than 10.9 *(1-0.4) = 6.5 kg CO₂e/ kg-silicon metal).

Reference to system user's silicon metal production prior to emission reduction measures

In this case, the benchmark value for the silicon metal production emissions is the emission value calculated for the system user, before a new emission reduction measure was in place. This means the system user shall identify what were the original emissions for silicon metal production on its own production plant. The emissions from prior to the added emission reduction measure shall be calculated following the same methodology as laid out in this document. The systems user's reference production PCF value cannot be older than three years prior to the certification year and the year of comparison need to be stated in the claim. Independent of the achieved emission reduction compared to the system user's reference production this comparison does not qualify for the additional "low carbon silicon metal production" claim. The low carbon product claim is only possible when achieving the threshold of 40% reduction compared to the reference global value (see *Reference global value*).

It shall be highlighted that, while the calculation and claiming of emission reductions is optional, the communication of the calculated absolute PCF value is mandatory under ISCC CFC.

13.6 Data basis

The PCF calculation is based on actual data gathered from the individual (to be) certified company and, if needed, data sourced from databases and literature.

Data gathering during the audit is relevant for the process inputs defined in the PCF calculation in *Formula 17* including e.g. energy consumption, other process inputs and for output data like process emissions, wastes, products and BPs. Relevant parameters, which cannot be measured (e.g. process flue gas emissions) shall be calculated based on the input and output flows of the process and the corresponding chemical conversion.

Actual data measured and gathered at the system user's site must be documented and provided to the auditor for the verification. This can include production reports, production information systems, delivery notes, weighbridge protocols, contracts, invoices and others. The calculation period should cover a full twelve-month period.

It must be as up to date as possible. As an alternative, it must cover the previous calendar or financial year. In cases of exceptional maintenance measures and unstable production conditions a shorter period (for inputs and respective outputs) may be considered if it better reflects the relevant timeframe. The respective period for data gathering and thus for the calculation of GHG emissions must be transparently displayed in the calculation.

13.6.1 On-site data gathering

The following data for the calculation of GHG emissions from the silicon metal production process must be gathered on-site. They will form the basis for the

calculation of GHG emissions. All input values must be gathered for the same reference time period. In the example below the time period of 1 year is used:

- Type and amount of reducing agent (e.g. t coal or charcoal per year),
- Amount of Quartz/ ite (e.g. t Quartz/ ite per year),
- Source and amount of electricity used for the operations (e.g. MWh per year),
- Type and amount of additional process inputs (e.g. t per year),
- Amount of silicon metal produced (e.g. t per year),
- Amount of BPs produced (e.g. t silica fume per year),
- Amount of process waste (e.g. t per year); waste streams might be clustered in case the EF for their treatment processes is the same,
- Amount and composition of flue gas and other direct process emissions, especially in relation to climate relevant emissions (e.g. CO₂, CH₄, N₂O, etc. in t per year): If these emissions are not measured directly, they shall be calculated based on the process inputs, outputs and corresponding chemical conversion (e.g. the amount of CO₂ based on the amounts of used carbon reducing agent inputs and the assumptions of a chemical conversion to CO₂). If the amount of a climate active flue gas cannot be measured, the company must show during the audit that these flue gases are only produced in neglectable amounts (e.g. by literature process description of the applied process).

13.6.2 Published data

The following types of data for the calculation of GHG emissions can be gathered from reviewed databases and literature as well as from official statistics:

- EFs for the production and transport of the used reducing agents,
- EFs for the production and transport of the Quartz/ ite used in the process,
- EFs for the production and supply of additional process inputs,
- EFs for electricity and other energy sources in kg CO₂e per unit of energy used,

- EFs for the treatment of wastes and residues.

13.6.3 Requirements for the EF of used electricity

If electricity is sourced from the grid, the EF for electricity from the regional electricity mix shall be used.

If electricity from renewable energies or other sources is directly consumed, an adapted EF for the type of renewable electricity may be used. This is possible under two conditions: a) if that plant is not connected to the electricity grid; or b) there is a direct connection between the PU and the individual electricity production plant, being possible to validate the amount of electricity used with a suitable meter. (Adapted EFs by the use of Power Purchase Agreements (PPAs) are currently being evaluated by ISCC and may be added in revisions of this document).

13.7 Specific verification guidance for PCF calculation and used EFs

Existing publications on the GHG emission of silicon production indicate important drivers and influencing factors for the overall PCF of silicon. These can include:

- The source and GHG intensity of the electricity used in the silicon production process.
- The amount and specific composition of the flue gas emissions from the silicon production process.
- The source of the reducing agent (carbon) and the emissions associated with its production.

Verification of PCF calculations for silicon under ISCC CFC should recognize the importance of these parameters and verify individual calculations or EFs for these elements.

In case biogenic carbon (e.g. from charcoal or wood chips) is used as a reducing agent, the following aspects need to be verified for the choice of an appropriate EF:

- The EF for the reducing agent shall include the complete supply chain from the cultivation and sourcing of the biogenic feedstock, the transport of the feedstock, to the processing and final transport to the silicon production. Respective PCF calculations and EFs of the used charcoal shall be checked regarding the completeness of system boundaries, covering the complete value chain from the production and supply of the biogenic feedstock, the conversion to a reducing agent as well as the distribution process to the silicon metal production.

- Direct emissions from the processing of the biogenic feedstock (e.g. in a pyrolysis process to produce charcoal as reducing agent) have to be considered, following the methodology defined in the *ISCC EU 205 Greenhouse Gas Emissions* document:
 - Evidence of appropriate measures for the recording of emissions from the processing of the biogenic feedstock shall be provided when requested.
 - Records of emissions from the processing of the biogenic feedstock shall be provided when requested.
 - Records for energy consumption of the processing of the biogenic feedstock shall be provided when requested.
 - The verification of those primary data from the suppliers of the reducing agent processing biogenic feedstock may need a direct communication between the auditor and the supplier. The system user is to facilitate that direct communication. If requested, the auditor may also decide to verify specific parts of the EF calculation of the reducing agent on-site at the supplier (e.g. the handling of pyrolysis gases from pyrolysis process).
 - The calculation of emissions of co-products produced during the production of reducing agents from biogenic feedstock need to follow the methodology defined in the *ISCC EU 205 Greenhouse Gas Emissions* document (see defined allocation procedures, e.g. no system expansion).
- It shall be verified that the biogenic feedstock is sourced from sustainably managed areas and forests. Biomass and biofuels used as a process input (e.g. as a reducing agent) produced from forest biomass shall meet the following land-use, land-use change and forestry (LULUCF) criteria:
 - The country or region of origin of the forest biomass:
 - Is a Party to the Paris Agreement;
 - Has submitted a nationally determined contribution (NDC) to the United Nations Framework Convention on Climate Change (UNFCCC), covering emissions and removals from agriculture, forestry and land use which ensures that changes in carbon stock associated with biomass harvest are accounted towards the country's commitment to reduce or limit GHG emissions as specified in the NDC; or
 - Has national or sub-national laws in place, in accordance with Article 5 of the Paris Agreement, applicable in the area of harvest, to conserve and enhance carbon stocks and sinks, and providing

evidence that reported LULUCF-sector emissions do not exceed removals.

- Where evidence regarding these points is not available, verification of the sustainable sourcing of biomass can be done in two alternative approaches:
 - Sourcing biomass from an ISCC certified forest/ forest management unit.
 - Certification against the requirements of a certification scheme recognized by ISCC, or of compliance with appropriate ISCC recognized local regulation (EU forestry strategy⁴³). recognized
- Records of the shipment of materials from forest to PUs, and from PUs to secondary PUs (etc.) shall be provided when requested.

⁴³ Forests: in: Environment.
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