EUROPEAN COMMISSION
DIRECTORATE-GENERAL
TAXATION AND CUSTOMS UNION
Indirect Taxation and Tax Administration
CBAM, Energy and Green Taxation

Brussels, 14 August 2026

GUIDANCE DOCUMENT NO. 1: INTRODUCTION TO CBAM CONCEPTS

Disclaimer: This guidance document is not legally binding and it is of an explanatory nature. Legal provisions of Union law take precedence over the contents of this document and should always be consulted. The authentic texts of the EU legal instruments are those published in the Official Journal of the European Union. This guidance was prepared by Commission services and does not represent an official position of the Commission. Only the Court of Justice of the European Union is competent to authoritatively interpret Union law.

VERSION HISTORY

Date	Version notes
14.08.2026	First Publication of this document for the definitive period.

CONTENTS

1. PREFACE

1.1. Structure and content of the guidance documents

This series of documents has been written to support stakeholders by explaining the requirements of the CBAM Regulation in a non-legislative language. This series of guidance documents should benefit a variety of stakeholders. A specific focus has been put on clarifying the **requirements for operators of installations producing CBAM goods outside of the EU for the definitive period.**

- **Guidance 1** provides an overview of the main changes to the CBAM methodology between the definitive period and the concluded transitional period. It also introduces the CBAM and an overview of the compliance cycle, roles and responsibilities, as well as milestones and deadlines for operators of installations outside the EU during the definitive period and explains the general exemptions from the CBAM.

- **Guidance 2** provides a quick guidance for the intended reader of this document, the operator of an installation producing CBAM goods. It provides a roadmap of the most important concepts of CBAM emissions monitoring and where to find more information in this series of documents.

- **Guidance 3** sets out the monitoring and reporting obligations and recommendations which are potentially applicable to any affected producer of CBAM goods.

- **Guidance 4** provides an overview of how the adjustment for free allocation is to be determined and what information is needed.

- **Guidance documents 5a, 5b, 5c, 5d, 5e and 5f** present an overview per sector of the production processes and value chains for goods that are included in the scope of the CBAM, as well as sector-specific monitoring and reporting considerations for each CBAM good where this is relevant. These sections are supplemented by examples for each sector.

The series of guidance documents is accompanied by an electronic template for information that should be used by installation operators to communicate information to the authorised CBAM declarants and CBAM Registry.

Presentation of numbers in EU documents

To align with EU legal documents, this guidance document uses the following convention when presenting numbers.

The decimal separator used to separate the integral part of a number from its fractional part is a comma, e.g.: 0,890

Thousands, and powers of 10^{3n} thereafter, are separated by a space, e.g.:

- fifteen thousand is written as 15 000
- fifteen million is written as 15 000 000

1.2. Reference regulations and legal acts

Several regulations and legal acts are referred to throughout this series of guidance documents. For ease of reading and to avoid ambiguity, simplified references are used when citing these acts.

- **CBAM Regulation**: Regulation (EU) 2023/956 and Regulation (EU) 2025/2083 amending Regulation (EU) 2023/956. Notably, where article numbers are given in this document without further specification, they always refer to the CBAM Regulation.

  It can be accessed at the following link (consolidated version): **http://data.europa.eu/eli/reg/2023/956/2025-10-20**

- **Methodology Act:** Commission Implementing Regulation (EU) 2025/2547, in legal texts referred to as "Implementing act pursuant to Article 7(7) of the CBAM Regulation".

  It can be accessed at the following link: **http://data.europa.eu/eli/reg_impl/2025/2547/oj**

- **Default Values Act**: Commission Implementing Regulation (EU) 2025/2621, in legal texts referred to as "Implementing act pursuant to Article 7(7) of the CBAM Regulation", also referred to as "default values determined in accordance with Annex IV to the CBAM Regulation".

  It can be accessed at the following link: **http://data.europa.eu/eli/reg_impl/2025/2621/oj**

- **Verification Principles Act**: Commission Implementing Regulation (EU) 2025/2546, in legal texts referred to as "Implementing act pursuant to Article 8(3) of the CBAM Regulation".

  It can be accessed at the following link: **http://data.europa.eu/eli/reg_impl/2025/2546/oj**

- **Accreditation & Verification Requirements Act**: Commission Delegated Regulation (EU) 2025/2551, in legal texts referred to as "Delegated act pursuant to Article 18(3) of the CBAM Regulation".

  It can be accessed at the following link: **http://data.europa.eu/eli/reg_del/2025/2551/oj**

- **Free Allocation Adjustment Act**: Commission Implementing Regulation (EU) 2025/2620, in legal texts referred to as "Implementing act pursuant to Article 31(2) of the CBAM Regulation".

  It can be accessed at the following link: **http://data.europa.eu/eli/reg_impl/2025/2620/oj**

For acronyms and definitions used in this document, please see Annex B and Annex A.

2. CBAM GENERAL CONCEPTS

2.1. Introduction to the CBAM: policy objectives and phases of implementation

The Carbon Border Adjustment Mechanism (CBAM) is an environmental policy instrument designed to support the EU climate ambitions of achieving a net reduction of greenhouse gas (GHG) emissions of at least 55% by 2030 and of reaching climate neutrality by 2050 at the latest.

The CBAM complements the EU Emission Trading System (EU ETS). Under the EU ETS, operators of installations producing emission-intensive goods surrender emission allowances for each tonne of CO_2e emissions released. Since an (increasing) amount of these allowances are purchased in auctions or on the secondary market, these operators are subject to a 'carbon price'[1] on their GHG emissions. However, most operators in non-EU countries do not have such an obligation, and this competitive advantage puts European production at risk of carbon leakage i.e. relocation outside the EU.

The CBAM seeks to address the risk of carbon leakage by ensuring that products, irrespective of whether they are imported or produced in the Union, are subject to an equivalent carbon price. Prior to the introduction of the CBAM, the relevant industry sectors have been receiving a part of their allowances free of charge ("free allocation") under the EU ETS. With the introduction of the CBAM, free allocation is gradually being phased out as the CBAM is gradually phased in. Instead of alleviating the carbon costs for EU operators, the CBAM ensures that importers of goods from non-EU countries bear similar carbon costs for the "embedded emissions" of the imported goods.

The CBAM does not target countries but the embedded greenhouse gas emissions of products imported into the EU for specific sectors – those that are the most at risk of carbon leakage – that are within the scope of the EU ETS. These sectors consist in: cement, iron and steel, aluminium, fertilisers, hydrogen and electricity. The CBAM also includes some precursors and some downstream products of the aforementioned sectors (hereinafter referred to as "CBAM goods"). The complete list of CBAM goods is provided in Annex I to the CBAM Regulation.[2]

The CBAM has been introduced in two phases as follows:

- **Transitional period** (1 October 2023 to 31 December 2025):
  This period was designed as a "learning phase", during which CBAM importers were required to report a set of data, including emissions embedded in their imported goods, *without paying a financial adjustment* for the embedded emissions. Verification of data was optional. However, penalties could be imposed, for example, for failing to submit the required *quarterly CBAM reports*. This period has now concluded.
- **Definitive period** (starting on 1 January 2026):
  - Embedded emissions are to be reported on the basis of either default values or actual verified emissions, by way of an annual CBAM declaration –

[1] More precisely, a price for the CO_2 or other equivalent greenhouse gas emissions.

[2] A detailed overview per sector is given in Guidance documents 5a, 5b, 5c, 5d and 5e respectively.

except where they are imported in such little amounts that they fall below the annual single-mass based threshold of 50 tonnes.

  - From 2026 to 2033, the embedded emissions for imported CBAM goods will gradually be covered by the CBAM obligation, as free allocation under the EU ETS is gradually phased out.
  - From 2034, 100% of emissions embedded in the CBAM goods will be covered by CBAM certificates and no free allocation will be given under the EU ETS for these goods.

The CBAM in the definitive period is designed to mirror the emission cost under the EU ETS:

- EU operators will pay the carbon price of their emissions and surrender allowances (EUAs) under the EU ETS; whereas
- EU importers of CBAM goods will purchase and surrender CBAM certificates that closely reflect the situation of the EU ETS, both in terms of MRV rules and of the price of the certificates.

The CBAM is designed in compliance with World Trade Organization (WTO) rules and other international obligations of the EU and is applied equally to imports from all countries outside the EU.[3]

This document only deals with the requirements of the CBAM definitive period (from 1 January 2026 onwards), building on the experience of the transitional period.

The transitional phase was meant for learning and for setting up the relevant MRV approaches outside the EU, and the institutions and information technology systems within the EU. It provided the basis for the definitive-period arrangements described in this guidance.

2.2. Definitions and scope of emissions covered in the CBAM

The textbox below signposts the key sections in the Methodology Act defining terms used for the CBAM.

Legislative references:

The CBAM Regulation, Article 3 Definitions and Annex IV Definitions

Methodology Act Article 1 (Definitions) and Annex I, Section 1 Definitions.

A list of definitions and abbreviations used are also provided in Annex B and Annex A respectively in the back of this guidance document.

---

[3] The only exception are goods from countries that either apply the EU ETS (currently Iceland, Norway and Liechtenstein) or have an ETS fully linked with the EU ETS (currently Switzerland). Producers in these countries therefore face the same carbon price as in the EU.

The following terms are frequently used in this guidance document:

- **'tonne of CO_2e'** means one metric tonne of carbon dioxide ('CO_2'), or an amount of any other greenhouse gas listed in Annex I to the CBAM Regulation adjusted to the equivalent global warming potential of CO_2.
- **'Direct emissions'** means emissions from the production processes of goods, including emissions from the production of heating and cooling consumed during the production processes, regardless of the location of the production of the heating and cooling.
- **'Indirect emissions'** means emissions from the production of electricity, which is consumed during the production processes of goods, regardless of the location of the production of the consumed electricity.
- **'Embedded emissions'** means emissions released during the production of goods, including the embedded emissions of precursor materials consumed in the production process.
- **'Precursor'** *means any input material into a production process included in the list of goods set out in Annex I to the CBAM Regulation*. I.e. precursors are materials (simple or complex goods) which themselves have embedded emissions not equal to zero and which are identified for monitoring purposes as being within the system boundaries for the calculation of embedded emissions of a complex good.
- **'Simple goods'** means goods produced in a production process requiring exclusively input materials and fuels having zero embedded emissions.
- **'Complex goods'** means goods other than simple goods.
- **'Specific embedded emissions'** means the embedded emissions of one tonne of goods, expressed as tonnes of CO_2e emissions per tonne of goods.
- '**Production process'** means the parts of an installation in which chemical or physical processes are carried out to produce goods under an aggregated goods category defined in Table 1 of section 2 of Annex I to the Methodology Act, and its specified system boundaries regarding inputs, outputs and corresponding emissions.
- '**Aggregated goods category**' is *implicitly* defined in the Methodology Act by listing the relevant aggregated goods categories and all the goods identified by their CN codes in Table 1 of section 2 of Annex I to the Methodology.
- **'Production route'** means a specific technology used in a production process to produce goods under an aggregated goods category. One production process usually relates to one group of CBAM goods produced (the 'aggregated goods categories'). However, in some case more than one production route exists for producing these goods.
- **'Verifier'** means a legal person [i.e. a company] carrying out verification activities and who is accredited by a national [EU] accreditation body for the purpose of the CBAM Regulation.
- **'Functional unit'** means the reference unit [usually tonnes, but not always] used for the calculation of embedded emissions in goods.

- ‘**System boundary**’ means the group of chemical or physical processes included in the calculation of [direct and where relevant indirect] embedded emissions of goods [including the embedded emissions of any precursor goods consumed] under the same aggregated goods category.

2.3. Transitional period (concluded): key elements

A summary of key elements of the transitional period, which has concluded, is presented in Table 2-1.

Table 2-1: Transitional period (concluded) – key points

Duration	1 October 2023 to 31 December 2025.
MRV rules	Implementing Regulation (EU) 2023/1773.
Reporting of indirect emissions	Was required for all CBAM goods.
Default values for reporting of embedded emissions	Global values (except electricity). Were able to be used for precursors of complex goods contributing up to 20% of the total for the complex good during the transitional period. Were used for imports of electricity and for indirect emissions during the transitional period, unless certain criteria were met.
Flexibility regarding MRV rules	The use of rules from other (non-EU) carbon pricing or monitoring, reporting and verification schemes were only allowed for operators of installations until the end of 2024, providing they covered the same emissions and provided similar accuracy. Importers were allowed to use other (estimation) methods until 31 July 2024.
Frequency of reporting	Quarterly (for importers) during the transitional period.
Verification of reported data	Was not required in the transitional period. Operators and importers reported as accurately and completely as possible. If verification was undertaken this was noted in the submission.
Surrender of CBAM certificates	Was not required in the transitional period.

These transitional-period rules and experiences provided the basis for the definitive-period arrangements described in the following sections of this guidance.

2.4. Definitive period

A summary of key elements of the definitive period is presented in Table 2-2.

Table 2-2: Definitive period – key points

Duration	From 1 January 2026 onwards. Between 2026 and 2033 the CBAM obligation is phased in in parallel with the phase-out of free allocation under the EU ETS. From 2034, embedded emissions of CBAM goods are fully covered by CBAM certificates, with no free allocation for those goods.
MRV rules	The CBAM Regulation, together with the Methodology Act, which lays down detailed methods for the calculation of embedded emissions and the use of default values for the definitive period, and other CBAM implementing and delegated acts that specify further MRV requirements. Operators shall design and implement a monitoring plan and submit it in English. Monitoring records and supporting documentation shall be kept for at least six years after the reporting period. The reporting period corresponds to the calendar year during which the good was produced; for imported goods the reporting period is by default the calendar year of import unless sufficient evidence identifies the actual time of production.
Reporting of indirect emissions	Indirect emissions are taken into account in the CBAM declaration only for those CBAM goods and, where applicable, precursors for which indirect emissions are in scope under the CBAM Regulation and its implementing acts (i.e. goods listed in Annex I to the CBAM Regulation and not listed in Annex II to that Regulation). For other CBAM goods, only direct emissions are covered.
Default values for reporting of embedded emissions	Default values for embedded emissions of certain goods and for electricity/indirect emissions are laid down in accordance with Annex IV to the CBAM Regulation, as further specified in implementing acts adopted under the CBAM Regulation for the definitive period.
Flexibility regarding MRV rules	In the definitive period, operators must apply the monitoring, calculation and attribution rules laid down in the CBAM Regulation and in the related implementing and delegated acts. Where it is technically feasible to apply more accurate monitoring methods without incurring unreasonable costs, such methods must be applied; the benefit of improvements is determined using a reference price of EUR 80 per tonne of CO_2e and measures are not deemed to incur unreasonable costs up to an accumulated amount of EUR 4 000 per year.

	Data originating from other (non-EU) carbon pricing or emissions-monitoring schemes may only be used where they are consistent with CBAM system boundaries and quality requirements and are integrated into a CBAM-compliant monitoring methodology.
Frequency of reporting	Authorised CBAM declarants submit an annual CBAM declaration for the preceding calendar year, in accordance with the CBAM Regulation, covering quantities of imported CBAM goods, their embedded emissions and any eligible carbon price effectively paid in third countries .
Verification of reported data	Verification requirements for embedded emissions used in the CBAM declaration are laid down in the CBAM Regulation and in the delegated and implementing acts on accreditation and verification. In the definitive period, embedded emissions must be verified in accordance with these rules before being used in the CBAM declaration.
Further reporting requirements	Not only embedded emissions, but also the corresponding adjustment for free allocation under the EU ETS ("specific embedded free allocation") needs to be reported. These data are included in the verification mentioned above. Where an operator already pays a carbon price in its own jurisdiction, this can further reduce the number of CBAM certificates that need to be surrendered by importers. For this purpose, relevant data on the carbon price paid in that third country needs to be compiled, too. This "carbon price report" has to be certified by an independent person, which may be the above-mentioned verifier.
Surrender of CBAM certificates	Authorised CBAM declarants must purchase CBAM certificates, at a price linked to the EU ETS allowance price, and surrender them annually for the embedded emissions of their imported CBAM goods, in accordance with the CBAM Regulation. The number of certificates to be surrendered takes account of the applicable phase-in of the CBAM, the phase-out of free allocation under the EU ETS, and any eligible carbon price effectively paid in third countries where the goods (or precursors) were produced.

2.4.1. Key reporting roles and responsibilities

The **“authorised CBAM declarant”**[4] is the entity responsible for the reporting of embedded emissions of imported goods as part of the annual CBAM declaration and for fulfilling the related CBAM obligations in the definitive period, notably on the purchase and surrendering of CBAM certificates. The authorised CBAM declarant is the person lodging the customs declaration, which is usually the “**Importer**” or in some cases the indirect customs representative. Where different actors are involved in the importation process, it is important to remember that every tonne of imported good is the *responsibility of exactly one authorised CBAM declarant*, i.e. that it is neither reported twice nor omitted from reporting.

Starting in 2027 for the emissions embedded in goods imported in 2026, the authorised CBAM declarant must submit an annual ‘**CBAM declaration**’[5], via the CBAM Registry, by 30 September of each year (starting in 2027), and covering the emissions embedded in goods imported in during the previous calendar year (starting in 2026). This declaration covers the information required under Articles 6, 7, 8 and 9 of the CBAM Regulation and the relevant implementing acts for the goods imported into the EU during that year. This includes information on the quantity of imported goods and their origin, their embedded emissions, any accompanying verification reports, the deduction of the free allocation adjustment, and any carbon price effectively paid in the third-country. Note the specific requirements, including on the date of importation, in case of the so-called “inward processing” customs procedure. The CBAM declaration may be subject to a review from the Commission and/or the National Competent Authority (NCA).

The **operator of an installation** producing CBAM goods outside the EU is another important actor. **Operators established outside the EU are not obliged to carry out any activities under the CBAM.** Importers may continue importing CBAM goods from operators that are not interested to monitor, calculate and verify embedded emissions in line with the CBAM Regulation. If authorised CBAM declarants do not receive actual verified data on the embedded emissions of the imported goods from the operators producing the goods, they always have the possibility to use default values provided by the European Commission for the calculation of the embedded emissions and the submission of the CBAM declaration.

Installation operators are the persons who have direct access to information on the emissions of their installations. They are therefore responsible for **monitoring and reporting the embedded emissions of CBAM goods** which they have produced and for communicating this information to the authorised CBAM declarant. This means that operators are required to design and implement a monitoring plan, prepare an operator’s emissions report, and, where the embedded emissions of electricity are calculated based on actual emissions, also a declarant-specific addendum. Operators shall keep monitoring records and supporting documentation for at least six years.

Third-party verifiers also play an important role. Where embedded emissions are determined on the basis of actual emissions, verification by an accredited verifier is required before those values can be used in the CBAM declaration, in line with Articles 8

[4] The CBAM Regulation uses the term “authorised CBAM declarant” to cover situations where the importer or, where applicable, an indirect customs representative is responsible for CBAM obligations (see in particular Articles 5, 6 and 14 of the CBAM Regulation).

[5] Article 6 of the CBAM Regulation, as amended.

and 18 of the CBAM Regulation and the accompanying accreditation and verification rules adopted pursuant to that Regulation. Where actual data is provided for precursors produced outside the installation that is producing the complex good, that actual data must be taken from a verification report issued by an accredited verifier covering the reporting period during which the precursor was produced. Another important task of the verifier is to assess the operator's monitoring plan for compliance with the Methodology Regulation's requirements.

Carbon price certifiers ("Independent persons"[6]): Third-country installations producing CBAM goods may be subject to a mandatory carbon pricing mechanism in their local jurisdiction. In such case, the operator may calculate and report the carbon price effectively paid (i.e. after the deduction of rebates and other forms of compensation) per tonne of CBAM good. Such carbon price must be certified by an independent person in accordance with Article 9 of the CBAM Regulation and the accompanying implementing act adopted pursuant to that Regulation. The authorised CBAM declarant will then be able to use this information to claim a corresponding reduction of the number of CBAM certificates to be surrendered. A separate guidance document is available for details on this certification.

Furthermore, the **competent authority in the EU Member State** where the authorised CBAM declarant is established plays an important role. It is responsible for enforcing certain provisions of the CBAM Regulation, such as reviewing the CBAM declarations to ensure that authorised CBAM declarants submit, complete, and correct CBAM declarations and comply with other CBAM obligations, and to impose penalties in line with the CBAM Regulation if necessary.

The European Commission (in this document also "**the Commission**") is responsible for the review of CBAM declarations alongside NCAs, as well as for managing the CBAM Registry[7], assessing the overall implementation of the CBAM and further developing the CBAM legislation where appropriate. Furthermore, the European Commission provides a dedicated website for the CBAM[8], with further guidance documents, templates for reporting, training material, and the portal to the CBAM Registry.

2.4.2. How is the CBAM obligation calculated?

In order to make the costs for GHG emissions embedded in goods comparable in the CBAM to those faced by an EU ETS installation, the '**CBAM obligation**', i.e. the number of CBAM certificates to be surrendered by the authorised declarant, is calculated using three elements:

- The embedded emissions of the imported goods, expressed in tonnes of CO_2 equivalent (t CO_2e) per tonne of product (per MWh in case of imported electricity);
- Reduced by an adjustment reflecting the **free allocation** that would be granted if the good had been produced by an installation covered by the EU ETS (except for electricity which is not covered by free allocation). This adjustment is based on the relevant CBAM benchmark and a time-dependent CBAM factor. It decreases over time

[6] The draft implementing act uses the term "independent person", defined as "*the person referred to in Article 9(2) of Regulation (EU) 2023/956 that is certifying the carbon price report*".

[7] Article 14 of the CBAM Regulation

[8] Carbon Border Adjustment Mechanism - Taxation and Customs Union.

to reflect the gradual phase-out of free allocation and expected improvements in emissions performance; and

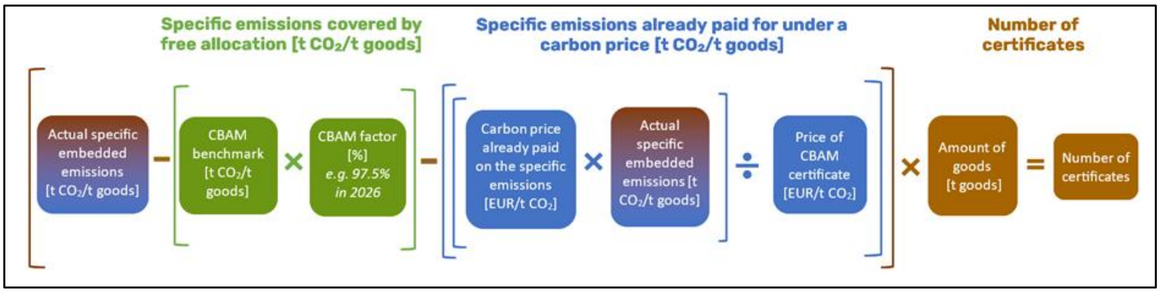
- If applicable, further reduced by the **effective carbon price paid** in the third country of production. This correction reflects the carbon cost borne abroad, expressed relative to the embedded emissions and the price of CBAM certificates. Being an *effective* carbon price, it is reduced by any rebate or other compensation received in that third country.

If this calculation gives a negative number, the CBAM obligation is zero. In practice, this means that where the embedded emissions are lower than the applicable free allocation adjustment or where the carbon price effectively paid in third countries is equal to or higher than the CBAM price, or where both effects jointly are higher than the embedded emissions, no CBAM certificates need to be surrendered.

The consequence of this calculation is that operators have to provide the relevant input data not only for the embedded emissions, but also for the free allocation adjustment, and, if applicable, for the carbon price already paid in their jurisdiction (as explained in a separate guidance document).

For verifiers, it means that they need to fully understand all the rules relating to the monitoring and reporting methodology of the CBAM, including rules for determining the free allocation adjustment, i.e. they need to know the content of the guidance document for operators in addition to this current guidance document. Independent person certifying the carbon price effectively paid (including verifiers, if they carry out this activity), need to know the rules for the deduction of this carbon price, including the content of the separate guidance on carbon price paid, and the rules of the carbon pricing mechanism applicable in the installation's jurisdiction.

Figure 2-1: Illustration of the calculation formula for the CBAM obligation (for a simple good using actual data).



As illustrated by Figure 2-1, for calculating the total number of CBAM certificates to be surrendered by the authorised declarant for each imported good *g* in line with point (c) of Article 6(2) of the CBAM Regulation, the following formula can be used, combining the elements of Articles 7, 9 and 31 of the CBAM Regulation:

$$CBAM\ Obligation_g = \max\left[0\ ;(SEE_g - SEFA_g - \frac{SECPP_g}{RP_{CBAM}})\right] \times M_g$$

Where:

- SEE_g is the specific embedded emissions of good *g* determined in line with Article 7 of the CBAM Regulation,
- $SEFA_g$ is the specific embedded free allocation (Article 31 of the CBAM Regulation),
- $SECPP_g$ is the specific embedded carbon price paid for good *g* (Article 9 of the CBAM Regulation [9], which contains elements "emissions covered" and "carbon price per tonne CO_2e" as well as "rebate or compensation subtracted"),
- RP_{CBAM} is the reference price of a CBAM certificate, determined by the Commission as the yearly average of the prices determined pursuant to Article 21 of the CBAM Regulation[10], and
- M_g is the mass[11] of the imported good.

The term "*Max(0; ...)*" ensures that any result of the formula which is below zero would become zero.

In this calculation, SEE_g values must be expressed per tonne (or per MWh if electricity is imported), while the value per functional unit (where different from tonnes of good) is to be transformed in value per tonne of good applying the formulas for specific compositions in Annex III of the Methodology Act.

2.4.3. What needs to be monitored by operators

The first element is the monitoring of **direct emissions** of the installation. However, monitoring of an installation's emissions is only the initial part of determining embedded emissions of a product. Whenever an installation produces several different products, the emissions must also be **appropriately attributed to the individual products** in accordance with the applicable functional unit and the attribution rules laid down in the Methodology Act, including, where applicable, averaging across production routes used within the installation for goods to which the same functional unit applies. Due to the specific rules for attributing emissions to goods, there is also a need to determine certain flows of heat (steam, hot water, etc.) to and from the installation, and between relevant production processes. The same applies to so-called "waste gases" (e.g. blast furnace gas in the steel industry). Both heat and waste gases contribute to the direct emissions.

You must also monitor and report to the authorised CBAM declarant(s) the quantities of specific input materials which themselves have embedded emissions (the so-called "precursor materials", which are themselves CBAM goods) used in the manufacturing process, and determine the **embedded emissions of these precursor materials**. Where you purchase precursors to produce other CBAM goods, you need to obtain data on the embedded emissions from the supplier of these precursors and, where applicable, apply the default weighted-average rules across suppliers and reporting periods for the same

[9] A draft of the implementing act is available here: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/14830-Carbon-border-adjustment-mechanism-CBAM-carbon-price-paid-in-a-third-country_en

[10] Further specified in Implementing Regulation (EU) 2025/2548

[11] The only exception is imported electricity, where the quantity imported is to be given in MWh.

precursor CN code, unless you can provide sufficient evidence for more granular attribution.

Indirect emissions released from the generation of the electricity consumed during the production of CBAM goods must be monitored for the purposes of the CBAM where indirect emissions are in scope for those goods under the CBAM Regulation[12]. These indirect emissions are attributed to the goods produced in line with the CBAM calculation rules. Again, emissions embedded in precursors must be included where required by the CBAM rules (including, for iron and steel goods, where the embedded indirect emissions of precursors are required to be included). Where actual data is provided for precursors produced outside the installation producing the complex good, that actual data must be taken from a verification report issued by an accredited verifier covering the reporting period during which the precursor was produced.

Note that only direct emissions are relevant for electricity imported into the EU as a good in its own right.

As a new element in the definitive period of the CBAM, you as an operator must also determine the **level of free allocation** which you would receive for your production process, if your installation were situated in the EU. This level of free allocation is deducted from the embedded emissions to determine the amount of CBAM certificates which the authorised declarant has to surrender upon the import of your goods ("the CBAM obligation"). This is necessary to make the CBAM obligation comparable to the carbon costs faced by EU ETS operators. The rules to determine the "embedded free allocation" of CBAM goods are significantly simpler than those used in the EU ETS and well aligned with the monitoring needs you already have for the embedded emissions. Like for embedded emissions, either default values ("default CBAM benchmarks") can be used or values that take into account actual data from your installation. Because the free allocation in the EU ETS is phased out while the CBAM is gradually introduced, the production year of the goods produced and of the precursors used are important parameters.

Finally, you must communicate to the authorised CBAM declarant(s) the carbon price paid in the production of the good within its own jurisdiction, if any. This includes the carbon price per tonne CO_2e and the amount of free allocation or any other financial support, compensation or rebate received per tonne of the product relevant for the CBAM in line with Article 9 ("Carbon price paid in a third country") of the CBAM Regulation, as amended. Notably, in the case of complex goods, the carbon costs due by the producers of precursor materials must also be taken into account where those precursors and their embedded emissions are within the scope of the CBAM and have not already been subject to the EU ETS or to a carbon pricing system that is fully linked with the EU ETS.

[12] During the transitional period, indirect emissions of *all* CBAM goods were to be monitored and reported, including the embedded indirect emissions of precursors. However, in the definitive period, indirect emissions are taken into account only for those CBAM goods for which indirect emissions are in scope under the CBAM Regulation, that is CBAM goods listed in Annex I to Regulation (EU) 2023/956 other than those listed in Annex II ("Goods for which only direct emissions are taken into account).

2.4.4. *Third-party verification*

If you provide your emissions data and free allocation data to the authorised declarant for use in the CBAM declaration, or to other operators who use your products as precursors for other CBAM goods, these "**actual data**" are eligible to be used instead of default values only if they are verified by an accredited verifier. For this purpose, **you as operator of the installation must contract a verifier**.

The verifier must have an accreditation from a national accreditation body located in the EU and valid at the time it issues the final verification report. The accreditation must cover the industrial sector of your installation.

National accreditation bodies are processing applications for accreditation on a rolling basis. To ensure that the verifier that you have contracted is duly accredited for CBAM, you should check the verifier's accreditation certificate, awarded by an EU Member State's national accreditation body. The European cooperation for Accreditation (EA) maintains a list of accreditation bodies that provide accreditation services for CBAM[13], and each national accreditation body must publish the accreditation certificates on their website. To help you find a verifier, it will be possible to search for a verifier directly in the CBAM registry. In addition, DG TAXUD will publish and regularly update a list of accredited CBAM verifiers on their webpage.

In order to avoid bottlenecks in the verifier's capacity near the end of the reporting period, you should find and contract a verifier early during the reporting period. This helps because many verification activities can be performed already throughout the reporting period, e.g. assessment of the monitoring plan. The verifier will guide you through the process. This usually means that the verifier will request all documents and data from you which are relevant to verification, will schedule at least one site visit, etc.

After the end of the reporting period, you as the operator of the installation must compile all the emissions data of the installation, broken down by production process and for each good (each 8-digit CN code) in an "operator's emissions report". When you use the Commission's Excel template, this will also automatically generate the "summary emissions report" required. That report will also contain the data on free allocation adjustment. The report must be uploaded in the CBAM Registry for this purpose. When this report is ready, the last phase of the verification starts.

The verifier will follow a verification plan that it has set up during the first phases of the verification (called "strategic analysis" and "risk analysis"). This plan includes the details of what needs to be checked on-site, questions to the operator's staff dealing with the monitoring and reporting processes. It will also contain a plan for selecting samples of data for detailed checking, commensurate with identified risks. For this purpose, the verifier takes into account the operator's control system. The operator can reduce the risk of errors and thereby reduce the verifier's efforts (and its' costs) by establishing an effective control system.

When the verifier detects "misstatements" (i.e. mistakes) in the data or "non-conformities" in the monitoring methodology, the verifier will ask you, the operator, to make corrections as appropriate, and to take corrective action to avoid similar problems in the future. However, detecting misstatements in the data may also require the verifier to review the

---

13 https://european-accreditation.org/national-accreditation-bodies-that-intend-to-offer-accreditation-of-verifiers-for-eu-cbam/

original risk analysis, to intensify the verification activities (e.g. increase the size of the samples taken for intensive checks). This is the reason why international standards do not allow the verifier to accept lump sum contracts for a verification: When more work is required, it must also be remunerated. Otherwise, there would be the risk of a breach of the impartiality and independence of the verifier, which is against accreditation rules.

After all identified misstatements (if applicable) have been corrected by the operator, the verifier prepares a verification report. The key message therein is called the "verification statement". A positive verification statement is required so that your data may be used by other actors in the CBAM. The report may also include more detailed findings (e.g. "non-material misstatements") and recommendations for improvement. You should take those into account for improving your monitoring methodology in the future. Note that the verifier is not allowed to give detailed instructions on how you should make those improvements, as performing consulting work would jeopardize the verifier's impartiality and independence, which can lead to losing its accreditation.

The verifier must create the verification report in the CBAM Registry. This will guarantee the authenticity of the verification report and prevent the use of verification reports that were not originally issued in the CBAM Registry. If you as an operator are registered in the CBAM Registry, you can directly allow declarants to access and use actual verified emissions via the CBAM Registry. A downloaded version thereof will also be provided, so you can provide it to other operators who use your goods as precursors for other CBAM goods. If you are not registered in the CBAM Registry, you will need to ask the verifier to provide you with a downloadable PDF version of the verification report and share this document, along with your full emissions report– to be prepared outside the CBAM Registry using the Commission's Excel template – to authorised CBAM declarants. The authorised CBAM declarant will then need to manually upload the documents in the CBAM Registry when preparing the CBAM declaration. Therefore, if you as an operator are not registered in the CBAM Registry, you will have to disclose the complete emissions report data to the authorised CBAM declarant.

More detailed guidance on accreditation and verification can be found in a dedicated guidance document provided by the Commission.

2.4.5. Reporting periods for operators and importers

The **reporting period** is the reference period for determining embedded emissions. In the definitive period, the reporting period corresponds to the calendar year during which the good was produced. Specific rules apply for identifying the reporting period for goods and precursors under the CBAM Regulation and the Methodology Act.

Installation operators

For you (as an operator), the CBAM reporting period corresponds to the calendar year of the production of your goods, to allow you to collect representative data that reflects an installation's annual operations and to align with the definition of "reporting period" in Article 1(5) and the rules in Articles 7 and 13 of the Methodology Act. For precursors, the default reporting period is also the year of production of the complex goods, unless there is sufficient evidence to identify the actual time of production of the precursor.

A full calendar year is considered representative as this reflects seasonal variations in an installation's operations, as well as any periods of disruption to the process resulting from planned annual shutdowns (e.g. for maintenance) and start-ups. A full year also helps to mitigate any data gaps e.g. by using meter reads taken on either side of any missing periodic data points.

In all the above cases, the direct and indirect embedded emissions of goods must be calculated as the **average of the reporting period** applicable under the CBAM rules.

In the definitive period, you should ensure that embedded emissions for each calendar year are determined and compiled in time to be communicated to authorised CBAM declarants so that they can prepare and submit their annual CBAM declarations by the deadline laid down in Article 6(1) of the CBAM Regulation, as amended.

Importers

In the definitive period, by 30 September, each authorised CBAM declarant must submit an annual CBAM declaration covering the goods imported during the preceding calendar year, in accordance with Article 6(1) of the CBAM Regulation, as amended by Regulation (EU) 2025/2083.

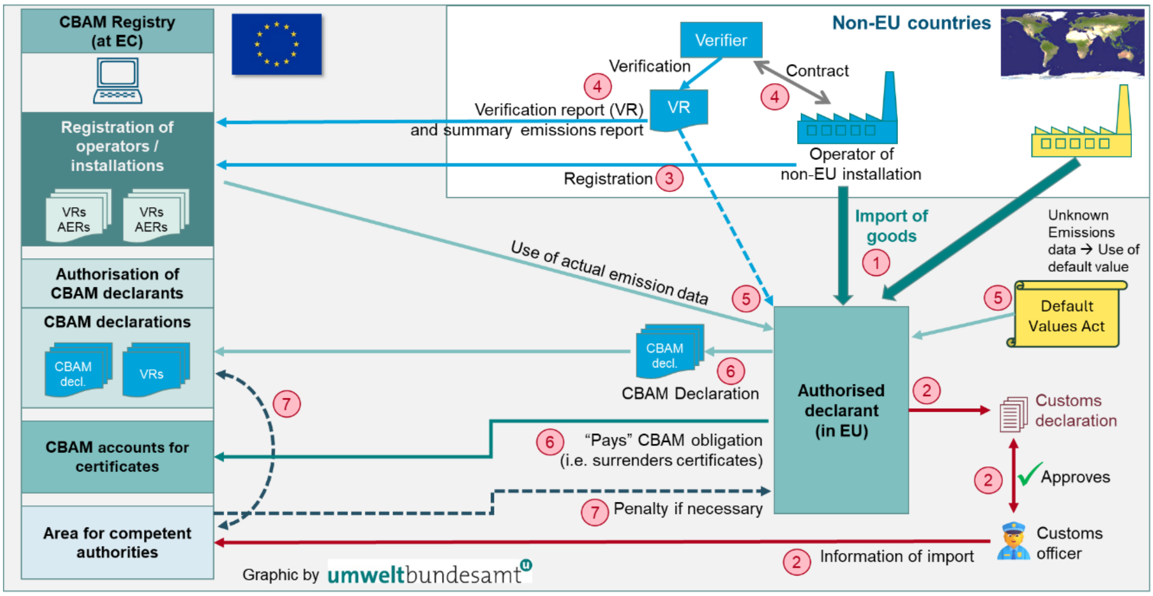
The annual CBAM declaration summarises the total embedded emissions in goods imported during the preceding calendar year, splitting out direct and indirect emissions where these are in scope for the CBAM goods concerned, the level of free allocation to be used for reducing the CBAM obligation, as well as any carbon price paid outside the EU in accordance with Articles 6, 7, 9 and 31 of the CBAM Regulation. For determining the reporting period for an imported good, the date of release for free circulation in the customs territory of the Union is relevant. By default, the reporting period is the calendar year during which the good was imported; however, if there is sufficient evidence to identify the actual time of production, the reporting period is the period during which the good was produced. By way of derogation, for electricity imported into the customs territory of the Union, the reporting period is the year of import. This is important in particular for goods put under the "**inward processing**" procedure.

In practice, authorised CBAM declarants have an incentive to use the latest available embedded emissions data communicated by installation operators for the relevant reporting period when preparing their annual CBAM declarations.

Under the definitive CBAM regime, any corrections to CBAM declarations that authorised CBAM declarants may want to make are governed by the CBAM Regulation and the implementing acts adopted under Article 6(6) of that Regulation, which specify the format and submission arrangements for the CBAM declaration.

2.4.6. *Governance of the CBAM*

Figure 2-2: Overview of the roles and data flows in the definitive period of the CBAM. For explanation of the figure numbers (relating to the workflow), please see main text below.



As shown schematically in Figure 2-2, the governance system and workflows of the CBAM follow the steps below (paragraph numbering follows the red numbers in the figure):

1. The authorised CBAM declarant receives CBAM goods from various installations, possibly from different countries outside the EU. There are two situations: Either the installation is known and provides actual verified data to the declarant, or the declarant will have to use default values.

2. For each import, the customs declaration includes the CBAM account number of the authorised CBAM declarant and respective TARIC document code(s). The customs authority of the relevant EU Member State checks and clears the import, as usual. The customs authority (or the IT system used) shares the information of this import with the European Commission. This information is ultimately gathered in the CBAM Registry, where it is used to check the completeness and accuracy of the annual CBAM declaration and related CBAM obligations.

3. The operator may request registration in the CBAM Registry. Such registration is recommended, as it strongly facilitates the communication between operators and declarants, and helps safeguard confidential data. The documentation of the verification process takes place in any case inside the Registry.

4. Where the operator intends to provide actual data on the installation's CBAM goods to the authorised CBAM declarant, verification of those data is required. For this purpose, the operator has to contract a CBAM accredited verifier. The CBAM Registry will help operators to select a verifier competent for the required verification scope, and the verifier will provide the verification report by means of the Registry.

5. The authorised CBAM declarant requests the relevant data on specific embedded emissions of the imported CBAM goods from the operators (in practice, this may involve intermediary traders, who would have to forward the request to the operator of the installation which produced the CBAM goods). The operators can provide their data to the authorised CBAM declarants by sending the requested data (dashed arrow in the figure), i.e. the operator's emissions report and verification report, and a summary thereof (and, where the embedded emissions of electricity are calculated based on actual emissions, a declarant-specific addendum). If the operator has registered in the Registry, it is simpler to 'disclose' the relevant data (non-confidential part only) to the declarant directly in the CBAM Registry (solid arrow). Where actual emissions are used, the embedded emissions must be determined and verified in accordance with the CBAM Regulation and the applicable accreditation and verification rules before being used in the CBAM declaration. Where actual data is provided for precursors produced outside the installation producing the complex good, that actual data must be taken from a verification report issued by an accredited verifier covering the reporting period during which the precursor was produced.
   However, where no actual data is provided, the authorised CBAM declarant has to use default values from the relevant legislation (indicated by the 'Default Values Act' in the figure).
6. The authorised CBAM declarant is then able to compile and submit the annual CBAM declaration via the CBAM Registry and to surrender the corresponding CBAM certificates, in accordance with the CBAM Regulation and the implementing acts adopted under it. The CBAM declaration is submitted for imports of the preceding calendar year and reflects the reporting period rules applicable to imported goods (by default, the year of import unless sufficient evidence identifies the actual time of production).
7. The Commission and national competent authorities may perform reviews regarding the correctness of CBAM declarations. An information exchange between the Commission and the competent authorities in the EU Member States, as well as with national accreditation bodies, takes place. The Commission is informed (based on the customs data) about which authorised CBAM declarants are expected to submit CBAM declarations and to surrender CBAM certificates. Furthermore, the Commission can perform spot checks of actual CBAM declarations and check their completeness with regards to the customs data. Where irregularities are identified, the Commission informs the competent authority of this. The competent authority will then follow up with the authorised CBAM declarant and it can ultimately impose a (financial) penalty in line with Article 26 of the CBAM Regulation and the applicable national provisions.
8. (Not shown in the figure and not required by legislation, but in the own interest of the authorised CBAM declarant): To avoid similar problems in the future, the importer who received a penalty should inform the operator of the problem(s) identified by the Commission or the competent authority in order to address the issue(s) for future submissions. The Commission or the competent authority may also inform the operator.
9. (Not shown in the figure, but important for verifiers): National competent authorities regularly exchange information with national accreditation bodies and vice-versa. If issues in verification reports are identified as part of the review of the CBAM declaration, national competent authorities can request the accreditation body to follow up on the issue with verifiers, e.g. during their surveillance activities

on verifiers. Similarly, national accreditation bodies will inform the national competent authorities of any issue which they have identified during their surveillance activities regarding a verifier.

2.4.7. Inward processing

The Union Customs Code defines several special procedures. "Inward processing"[14] means that a good is imported into the EU for processing with suspension of import duties and VAT. After the processing operations, the processed products or the original imported goods can then be re-exported or released for free circulation in the EU. The latter would imply the obligation to pay import duty and taxes, as well as the application of commercial policy measures.

This principle is extended to the CBAM, i.e. the CBAM applies only where goods (or processed products from those goods) are released for free circulation or otherwise brought into the customs territory of the Union in accordance with Article 2(1) and (2) of the CBAM Regulation. In the case of re-export, no CBAM obligation arises for goods placed under inward processing. However, if a CBAM good placed under inward processing leaves that procedure to be released for free circulation in the EU, either as the original good or as a processed product, a CBAM obligation arises. This also applies even if the processed products are not CBAM goods.

For CBAM goods, or processed products obtained therefrom, released for free circulation after having been placed under inward processing, the calendar year for which they must be included in the CBAM declaration is determined by the date of release for free circulation within the EU. By default, the reporting period for such goods is the calendar year during which they are released for free circulation, unless there is sufficient evidence to identify the actual time of production. This means that goods placed under inward processing before the start of the definitive period may still need to be included in a CBAM declaration when they are eventually released for free circulation.

The CBAM Regulation, in particular Article 2(1) and (2) on the scope of the CBAM and Article 6 on the CBAM declaration, sets out the rules applicable to goods released for free circulation after inward processing. In line with those provisions, and for the purposes of this guidance, the following principles apply:

- If the good was not processed during the inward processing, the quantities of the CBAM good released and the embedded emissions of those quantities are to be reported; the values are the same as for the good placed under inward processing. The CBAM declaration shall also include the country of origin and the installations where the goods were produced, if those are known;
- If the good was processed, and the product of the inward processing no longer qualifies as a CBAM good, then the quantities of the original good and embedded emissions of those original quantities are still to be reported. The report shall also include the country of origin and the installations where the goods were produced, if those are known;

[14] See: https://taxation-customs.ec.europa.eu/customs-4/customs-procedures-import-and-export-0/what-importation/inward-processing_en

- If the good was processed, and the product of the inward processing is a CBAM good, then the quantities and the embedded emissions of the original good are to be reported. The CBAM declaration shall also include the country of origin and the installations where the goods were produced, if those are known;
- Where the origin of the good used for inward processing cannot be defined, the embedded emissions shall be calculated on the basis of the weighted average embedded emissions of the totality of the goods placed under the inward processing procedure for the same aggregated good category in a manner consistent with the CBAM Regulation and the applicable CBAM calculation rules.

2.5.Exemptions from the CBAM

During the definitive period certain general exemptions apply, which are listed below.

The CBAM Regulation references:

- The CBAM Regulation, Section I, Article 2a De minimis exemption. Annex VII, The single mass-based threshold.
- The CBAM Regulation, Section I, Article 2 Scope, paragraphs 3, 4 and 7; Annex III Third countries and territories outside the scope of this Regulation for the purpose of Article 2.

De minimis exemption

Importers, including any importer with the status of an authorised CBAM declarant, are exempt from CBAM obligations if the net mass of imported goods in a given calendar year does not cumulatively exceed the single mass-based threshold laid down in point 1 of Annex VII to the CBAM Regulation. The current threshold is set at 50 tonnes of net mass. The threshold applies to the aggregate net mass of all goods, across all CN codes, imported by the same importer within the same calendar year. Where this exemption applies, the importer (including an authorised CBAM declarant) must indicate the exemption in the relevant customs declaration.

If, during a calendar year, the importer exceeds the single mass-based threshold, the importer or the authorised CBAM declarant becomes subject to all CBAM obligations for that calendar year, covering the emissions embedded in all goods imported during that year, including those imported before the threshold was exceeded.

The Commission assesses import data on a yearly basis to ensure that the single mass-based threshold ensures that the exemption applies to no more than 1% of the emissions embedded in the imported goods and processed products. Where this condition is not satisfied, the commission will amend the single mass-based threshold.

The “de minimis exemption” does not apply to imports of electricity or hydrogen.

Military use exemption[15]

An exemption applies to any goods imported to be used by the military authorities of Member States, or under agreement with those of a non-EU country, under the EU's Common Security and Defence Policy, or under NATO.

Electricity and hydrogen exemption

The CBAM Regulation does not apply to electricity generated on the continental shelf or within the exclusive economic zone of a Member State, or of a country or territory listed in points 1 and 2 of Annex III of the CBAM Regulation. It also does not apply to hydrogen originating on the continental shelf or within the exclusive economic zone of a Member State, or of a country or territory listed in point 1 of Annex III of the CBAM Regulation.

EFTA exemption

Goods originating in countries which apply the EU ETS (Norway, Iceland, Liechtenstein), or which have an ETS fully linked to the EU ETS (Switzerland), are exempted from the CBAM (see section 1 of Annex III to the CBAM Regulation).

Limited exemption for electricity imports

Imports of electricity from non-EU countries are covered by the CBAM, unless the non-EU country's electricity market is integrated with the EU internal market through market coupling, and there is no technical solution for the application of the CBAM to the importation of electricity into the customs territory of the Union from that third country or territory. This exemption only applies if all the conditions outlined in Article 2 paragraph 7 of the CBAM Regulation have been fulfilled. Third countries that qualify for this exemption are listed in Annex III point 2 of the CBAM Regulation. No third country qualifies for this exemption at the time of completion of this guidance.

15 Commission Delegated Regulation (EU) 2015/2446 of 28 July 2015 supplementing Regulation (EU) No 952/2013 of the European Parliament and of the Council as regards detailed rules concerning certain provisions of the Union Customs Code.

Annex A List of definitions

Term	Definition
'Accuracy'	means the closeness of the agreement between the result of a measurement and the true value of the particular quantity or a reference value determined empirically using internationally accepted and traceable calibration materials and standard methods, taking into account both random and systematic factors
'Activity data'	means the amount of fuels or materials consumed or produced by a process relevant for the calculation-based methodology, expressed in terajoules (TJ), mass in tonnes or (for gases) volume in normal cubic metres, as appropriate
'Actual emissions'	means the emissions calculated based on primary data from the production processes of goods and from the production of electricity consumed during those processes as determined in accordance with the methods set out in Annex IV [to the Methodology Act]
'Activity level'	means the quantity of goods to which the same functional unit applies that are produced within the system boundaries of a production process during a reporting period
'Aggregated goods categories'	means aggregated goods categories pursuant to Table 1 of point 2 of Annex I. A group of CBAM goods with their CN codes, used for the purpose of defining system boundaries of production processes.
'Agricultural, aquaculture, fisheries and forestry residues'	means residues that are directly generated by agriculture, aquaculture, fisheries and forestry and that do not include residues from related industries or processing
'Authorised CBAM declarant'	means a person authorised by the competent authority in accordance with Article 17 [of the CBAM Regulation]. The 'authorised CBAM declarant' [which replaces the term 'reporting declarant' from the transitional period] may be importers of CBAM goods, or their indirect customs representatives, who have applied for and been granted the status of authorised CBAM declarant.
'Batch'	means an amount of fuel or material representatively sampled and characterised, and transferred as one shipment or continuously over a specific period of time
'Biomass'	means biomass as defined in Article 2, point (24) of the Renewable Energy Directive (RED II)[16]; it includes bioliquids and biofuels as defined in Article 2, point (32) and (33), biomass fuels as defined in Article 2, point (27) and biogas as defined in Article 2 point (28) of the RED II;

[16] Directive (EU) 2018/2001

Term	Definition
'Biomass fraction'	means the ratio of carbon stemming from biomass to the total carbon content of a fuel or material, expressed as a fraction
'Calculation factors'	means net calorific value, emission factor, preliminary emission factor, oxidation factor, conversion factor, carbon content or biomass fraction
'Calibration'	means the set of operations, which establishes, under specified conditions, the relations between values indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material and the corresponding values of a quantity realised by a reference standard
'Carbon price'	means the monetary amount paid in a third country, under a carbon emissions reduction scheme, in the form of a tax, levy or fee or in the form of emission allowances under a greenhouse gas emissions trading system, calculated on greenhouse gases covered by such a measure, and released during the production of goods
'CBAM certificate'	means a certificate in electronic format corresponding to one tonne of CO_2e of embedded emissions in goods
'CO_2 emission factor'	means the weighted average of the CO_2 intensity of electricity produced from fossil fuels within a geographic area. The CO_2 emission factor is the result of the division of the CO_2 emission data of the electricity sector by the gross electricity generation based on fossil fuels in the relevant geographic area. It is expressed in tonnes of CO_2 per megawatt-hour
'Combined nomenclature' (CN)	means the classification of goods, designed to meet the needs of: i) the Common customs tariff, setting import duties for products imported into the European Union (EU), as well as the Integrated tariff of the European Communities (Taric), incorporating all EU and trade measures applied to goods imported into and exported out of the EU; ii) the international trade statistics of the EU. The CN provides the means of collecting, exchanging and publishing data on EU international trade statistics. It is also used for the collection and publication of international trade statistics in intra-EU trade.[17]
'Combustion emissions'	means greenhouse gas emissions occurring during the exothermic reaction of a fuel with oxygen
'Competent authority'	means the authority designated by each Member State in accordance with Article 11 [of the CBAM Regulation]

[17] For definition see: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Combined_nomenclature_(CN)

Term	Definition
'Continuous emission measurement' (CEM)	means a set of operations having the objective of determining the value of a quantity by means of periodic measurements, applying either measurements in the stack or extractive procedures with a measuring instrument located close to the stack, whilst excluding measurement methodologies based on the collection of individual samples from the stack
'Control system'	means the operator's risk assessment and entire set of control activities, including the continuous management thereof, that an operator has established, documented, implemented and maintained pursuant to point A.2. of Annex II
'Complex goods'	means goods other than simple goods
'Conservative'	means that a set of assumptions is defined in order to ensure that no under-estimation of reported emissions or over-estimation of production of heat, electricity or goods occurs
'Conversion factor'	means the ratio of carbon emitted as CO_2 to the total carbon contained in the source stream before the emitting process takes place, expressed as a fraction, considering CO emitted to the atmosphere as the molar equivalent amount of CO_2
'Co-product'	means any of two or more products resulting from the same production process
'Customs declarant'	means a declarant as defined in Article 5, point (15) of Regulation (EU) No 952/2013 lodging a customs declaration for release for free circulation of goods in its own name or the person in whose name such a declaration is lodged
'CCUS system'	means a group of economic operators with technically connected installations and transport equipment for CO_2 capture, transport, use in production of goods, or geological storage
'Data flow activities'	mean activities related to the acquisition, processing and handling of data that are needed to draft an emissions report from primary source data
'Data set'	means one type of data, either at installation level or production process level as relevant in the circumstances, as any of the following: (a) the amount of fuels or materials consumed or produced by a production process as relevant for the calculation-based methodology, expressed in terajoules, mass in tonnes, or for gases as volume in normal cubic metres, as appropriate, including for waste gases; (b) a calculation factor;

Term	Definition
	(c) net quantity of measurable heat, and the relevant parameters required for determining this quantity, in particular: i) mass flow of heat transfer medium; and ii) enthalpy of transmitted and returned heat transfer medium, as specified by composition, temperature, pressure and saturation; (d) quantities of non-measurable heat, specified by the relevant quantities of fuels used for producing the heat, and the net calorific value (NCV) of the fuel mix; (e) quantities of electricity; (f) quantities of CO_2 transferred between installations; (g) quantities of precursors received from outside the production process, and their relevant parameters, such as country of origin, used production route, specific direct and indirect emissions;
'Default value'	means a value, which is calculated or drawn from secondary data, which represents the embedded emissions in goods
'Direct emissions'	means emissions from the production processes of goods including emissions from the production of heating and cooling that is consumed during the production processes, irrespective of the location of the production of the heating or cooling
'Embedded emissions'	means direct emissions released during the production of goods and indirect emissions from the production of electricity that is consumed during the production processes, calculated in accordance with the methods set out in Annex IV and further specified in the implementing acts adopted pursuant to Article 7(7)
'Emissions'	mean the release of greenhouse gases into the atmosphere from the production of goods
'Emission factor'	means the average emission rate of a greenhouse gas relative to the activity data of a source stream assuming complete oxidation for combustion and complete conversion for all other chemical reactions
'Emission factor' for electricity	means the default value, expressed in CO_2e, representing the emission intensity of electricity consumed in production of goods.
'Emission source'	means a separately identifiable part of an installation or a process within an installation, from which relevant greenhouse gases are emitted
EU ETS	means the system for greenhouse gas emissions allowance trading within the Union in respect of activities listed in Annex I to Directive 2003/87/EC other than aviation activities

Term	Definition
'EU ETS allowance'	means an allowance as defined in Article 3, point (a), of Directive 2003/87/EC in respect of activities listed in Annex I to that Directive other than aviation activities
'Fossil carbon'	means inorganic and organic carbon that is not biomass
'Fossil fraction'	means the ratio of fossil carbon to the total carbon content of a fuel or material, expressed as a fraction
'Fugitive emissions'	means irregular or unintended emissions from sources that are not localised, or too diverse or too small to be monitored individually
'Functional unit'	means the reference unit used for the calculation of embedded emissions in goods
'Goods'	means goods listed in Annex I [to the CBAM the CBAM Regulation]
'Greenhouse gases'	mean greenhouse gases as specified in Annex I [to the CBAM the CBAM Regulation] in relation to each of the goods listed in that Annex
'Heat meter'	means a thermal energy meter or any other device to measure and record the amount of thermal energy produced based upon flow volumes and temperatures
'Importer'	means either the person lodging a customs declaration for release for free circulation of goods or a bill of discharge in accordance with Article 175(5) of Delegated Regulation (EU) 2015/2446 in its own name and on its own behalf or, where the customs declaration is lodged by an indirect customs representative in accordance with Article 18 of Regulation (EU) No 952/2013, the person on whose behalf such a declaration is lodged
'Importation'	means release for free circulation as provided for in Article 201 of Regulation (EU) No 952/2013
'Indirect customs Representative'	A customs representative appointed by an importer established in a Member State. If the importer appoints an indirect customs representative and they agree, they can act as an authorised CBAM declarant and submit the application for an authorisation on behalf of the importer. The indirect customs representative is liable for all operations made for the importers it represents
'Indirect emissions'	means emissions from the production of electricity which is consumed during the production processes of goods, irrespective of the location of the production of the consumed electricity
'Inherent CO_2'	means CO_2 which is part of a source stream.
'Installation'	means a stationary technical unit where a production process is carried out

Term	Definition
'Legal metrological control'	means the control exercised by a public authority or regulator of the measurement tasks intended for the field of application of a measuring instrument, for reasons of public interest, public health, public safety, public order, protection of the environment, the levying of taxes and duties, the protection of consumers and fair trading
'Measurable heat'	means a net heat flow transported through identifiable pipelines or ducts using a heat transfer medium, such as, in particular, steam, hot air, water, oil, liquid metals and salts, for which a heat meter is or could be installed
'Measurement point'	means the emission source for which continuous emission measurement systems (CEMS) are used for emission measurement, or the cross-section of a pipeline system for which the CO_2 flow is determined using continuous measurement systems
'Measurement system'	means a complete set of measuring instruments and other equipment used to determine variables for the monitoring and calculation of emissions
'Minimum requirements'	means monitoring methods using the minimum efforts allowed for determining data in order to result in emission data acceptable for the purpose of the CBAM Regulation.
'Mixed fuel'	means a fuel which contains both biomass and fossil carbon
'Mixed material'	means a material which contains both biomass and fossil carbon
'Multifunctional process'	means a process that delivers multiple outputs or whose outputs feed into several production processes
'Net calorific value' (NCV)	means the specific amount of energy released as heat when a fuel or material undergoes complete combustion with oxygen under standard conditions, less the heat of vaporisation of any water formed
'Non-CBAM good'	means any good produced in the installation that is not included in Annex I to the CBAM Regulation
'Non-measurable heat'	means all heat other than measurable heat
'Operator'	means any person who operates or controls an installation in a third country, including a parent company that controls an installation in a third country
'Oxidation factor'	means the ratio of carbon oxidised to CO_2 as a consequence of combustion to the total carbon contained in the fuel, expressed as a fraction, considering carbon monoxide (CO) emitted to the atmosphere as the molar equivalent amount of carbon dioxide (CO_2)
'Power purchase agreement'	means a contract under which a person agrees to purchase electricity directly from an electricity producer

Term	Definition
'Precursor'	means any input material into a production process included in the list of goods set out in Annex I to the CBAM Regulation;
'Preliminary emission factor'	means the assumed total emission factor of a fuel or material based on the carbon content of its biomass fraction and its fossil fraction before multiplying it by the fossil fraction to produce the emission factor
'Production process'	means the chemical and physical processes carried out to produce goods in an installation
'Production route' [18]	means a specific technology used in a production process to produce goods
'Process emissions'	means greenhouse gas emissions other than combustion emissions occurring as a result of intentional and unintentional reactions between substances or their transformation, for a primary purpose other than the generation of heat, including from the following processes: (a) the chemical, electrolytic or pyrometallurgical reduction of metal compounds in ores, concentrates and secondary materials; (b) the removal of impurities from metals and metal compounds; (c) the decomposition of carbonates, including those used for flue gas cleaning; (d) chemical syntheses of products and intermediate products where the carbon bearing material participates in the reaction; (e) the use of carbon containing additives or raw materials; (f) the chemical or electrolytic reduction of metalloid oxides or non-metal oxides such as silicon oxides and phosphates.
'Proxy data'	means annual values which are empirically substantiated or derived from accepted sources and which an operator uses to substitute a data set[19] for the purpose of ensuring complete reporting
'Rebate'	means any amount that reduces the amount due or paid by a person liable for the payment of a carbon price, before its payment or after, in a monetary form or in any other form.
'Recommended improvements'	means monitoring methods which are proven means to ensure that data are more accurate or less prone to mistakes than by mere application of minimum requirements
'Related emissions'	means: – the direct emissions caused by the source stream or emission source concerned; – emissions attributed to a quantity of measurable heat; – the indirect emissions related to the quantity of electricity concerned; – embedded emissions of a material produced or of a precursor consumed.

[18] Note that different production routes can fall within the same production process.

[19] Refers to the activity data or the calculation factors.

Term	Definition
'Reporting period'	means the period corresponding to the calendar year during which the good was produced and used by the authorised CBAM declarant as reference for the determination of embedded emissions
'Residue'	means a substance that is not the end product that a production process directly seeks to produce; it is not a primary aim of the production process and the process has not been deliberately modified to produce it
'Simple goods'	means goods produced in a production process requiring exclusively input materials (precursors) and fuels having zero embedded emissions
'Source stream'	means either of the following: (a) a specific fuel type, raw material or product giving rise to emissions of relevant greenhouse gases at one or more emission sources as a result of its consumption or production; (b) a specific fuel type, raw material or product containing carbon and included in the calculation of greenhouse gas emissions using a mass-balance method
'Specific embedded emissions'	means the embedded emissions of one tonne of goods, expressed as tonnes of CO_2e emissions per tonne of goods
'Standard conditions'	means temperature of 273,15 K and pressure conditions of 101 325 Pa defining normal cubic metres (Nm^3)
'System boundary'	means the group of chemical or physical processes included in the calculation of embedded emissions of goods under the same aggregated goods category. The system boundaries shall cover direct emissions, indirect emissions for goods not listed in Annex II to the CBAM Regulation, and the embedded emissions of any precursor.
'Third country'	means a country or territory outside the customs territory of the [European] Union
'Tonne of $CO_{2(e)}$'	means one metric tonne of carbon dioxide ('CO_2'), or an amount of any other greenhouse gas listed in Annex I [to the CBAM Regulation] with an equivalent global warming potential ['CO_2e']
'Transmission system operator'	means an operator as defined in Article 2, point (35) of Directive (EU) 2019/944 of the European Parliament and of the Council ([20]).

[20] Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity and amending Directive 2012/27/EU (OJ L 158, 14.6.2019, p. 125).

Term	Definition
‘Uncertainty’	means a parameter, associated with the result of the determination of a quantity, that characterises the dispersion of the values that could reasonably be attributed to the particular quantity, including the effects of systematic as well as of random factors, expressed in percent, and describes a confidence interval around the mean value comprising 95% of inferred values taking into account any asymmetry of the distribution of values
‘Waste’	means any substance or object which the holder discards or intends or is required to discard, excluding substances that have been intentionally modified or contaminated in order to meet this definition
‘Waste gas’	means a gas containing incompletely oxidised carbon in a gaseous state under standard conditions which is a result of any of the processes listed under ‘process emissions’

Annex B List of abbreviations

Abbreviation	Full term
AD	Activity Data
AEM	Anode Effect Minutes
AEO	Anode Effect Overvoltage
AL	Activity Level
AOD	Argon Oxygen Decarburisation.
BAT	Best Available Techniques
BF	Biomass Fraction
BFG	Blast Furnace Gas
BM	Benchmark
BOF	Basic Oxygen Furnace
BOFG	Basic Oxygen Furnace Gas
BREFs	Best Available Techniques Reference documents
CA	Competent Authority
CBAM	Carbon Border Adjustment Mechanism, the
CCR	Clinker to Cement Ratio
CCS	Carbon Capture and Storage
CCU(S)	Carbon Capture and Utilisation (and Storage)
CEMS	Continuous Emission Measurement Systems
CF	Conversion Factor
CFP	Carbon footprint of products
CHP	Combined Heat and Power
CKD	Cement Kiln Dust
CN	Combined nomenclature
COG	Coke Oven Gas
DRI	Direct Reduced Iron
EAF	Electric Arc Furnace
EEA	European Economic Area (EU-27, Iceland, Norway, Liechtenstein)
EF	Emission Factor
EFTA	European Free Trade Area
EORI	Economic Operator Registration and Identification
ETS	Emissions Trading System
EU ETS	EU Emissions Trading System
EUA	EU Allowances (used in the EU ETS)
EUR	Euro (currency)

Abbreviation	Full term
FAR	Free Allocation Rules (Regulation 2019/331)[21]
FIFO	First-In-First-Out principle
GHG	Greenhouse Gas
GWP	Global Warming Potential
HBI	Hot Briquetted Iron
HS	Harmonised System (for international trade)
IEA	International Energy Agency
ISO	International Organization for Standardization
LULUCF	Land-use, land change and forestry (criteria)
MP	Monitoring Plan
MRR	Monitoring and Reporting Regulation (Regulation 2018/2066)[22]
MRV	Monitoring, Reporting and Verification
MS	Member State(s)
MWh	Megawatt-hour
NCV	Net Calorific Value
NPI	Nickel pig iron
OF	Oxidation Factor
PCI	Pulverised Coal Injection
PEMS	Predictive Emission Monitoring System
PFC	Perfluoro-carbon
PoS	Proofs of Sustainability
RED II	Renewable Energy Directive, re-cast
SEE	Specific embedded emissions
SEFA	Specific embedded free allocation
TARIC	Integrated Tariff of the European Union database
TJ	Terajoules
TSO	Transmission System Operator
UCC	Union Custom Code
UN/LOCODE	United Nations Code for Trade and Transport Location

[21] Free Allocation Rules (Commission Delegated Regulation (EU) 2019/331 of 19 December 2018 determining transitional Union-wide rules for harmonised free allocation of emission allowances pursuant to Article 10a of Directive 2003/87/EC of the European Parliament and of the Council)

[22] Monitoring and Reporting Regulation (Commission Implementing Regulation (EU) 2018/2066 of 19 December 2018 on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council and amending Commission Regulation (EU) No 601/2012

EUROPEAN COMMISSION
DIRECTORATE-GENERAL
TAXATION AND CUSTOMS UNION
Indirect Taxation and Tax Administration
CBAM, Energy and Green Taxation

Brussels, 14 August 2026

GUIDANCE DOCUMENT 2: QUICK GUIDE FOR NON-EU OPERATORS ON CBAM IMPLEMENTATION

Disclaimer: This guidance document is not legally binding and it is of an explanatory nature. Legal provisions of Union law take precedence over the contents of this document and should always be consulted. The authentic texts of the EU legal instruments are those published in the Official Journal of the European Union. This guidance was prepared by Commission services and does not represent an official position of the Commission. Only the Court of Justice of the European Union is competent to authoritatively interpret Union law.

VERSION HISTORY

Date	Version notes
14.08.2026	First Publication of this document for the definitive period.

CONTENTS

1 PREFACE: STRUCTURE AND CONTENT OF THE GUIDANCE DOCUMENTS

This series of documents has been written to support stakeholders by explaining the requirements of the CBAM Regulation in a non-legislative language. This series of guidance documents should benefit a variety of stakeholders. A specific focus has been put on clarifying the **requirements for operators of installations producing CBAM goods outside of the EU for the definitive period.**

- **Guidance 1** provides an overview of the main changes to the CBAM methodology between the definitive period and the concluded transitional period. It also introduces the CBAM and an overview of the compliance cycle, roles and responsibilities, as well as milestones and deadlines for operators of installations outside the EU during the definitive period and explains the **general** exemptions from the CBAM.

- **Guidance 2** provides a quick guidance for the intended reader of this document, the operator of an installation producing CBAM goods. It provides a roadmap of the most important concepts of CBAM emissions monitoring and where to find more information in this series of documents.

- **Guidance 3** sets out the monitoring and reporting obligations and recommendations which are potentially applicable to any affected producer of CBAM goods.

- **Guidance 4** provides an overview of how the adjustment for free allocation is to be determined and what information is needed.

- **Guidance documents 5a, 5b, 5c, 5d, 5e and 5f** present an overview per sector of the production processes and value chains for goods that are included in the scope of the CBAM, as well as sector-specific monitoring and reporting considerations for each CBAM good where this is relevant. These sections are supplemented by examples for each sector.

The series of guidance documents is accompanied by an electronic template for information that should be used by installation operators to communicate information to the authorised CBAM declarants and CBAM Registry.

In this document we provide a step-by-step overview of important concepts, rules and obligations under the definitive period. This builds on the experience gained during the transitional period (1 October 2023 to 31 December 2025).

2 Understanding the CBAM: main roles and concepts

Are you an operator of an installation producing "CBAM goods"?

CBAM goods are goods from the cement, iron and steel, aluminium and some chemical industries (fertilisers and hydrogen), and electricity included in Annex I of the CBAM Regulation. To answer this question, you must compare the CN codes[1] of your products against the list of goods given in Annex I to the CBAM Regulation.

If you do not produce such goods, you do not have to read this document. However, it is written to be of help also to all other kinds of interested audiences (academia, CBAM importers, GHG verifiers, competent authorities, consultants, etc.).

Are you exporting your goods to customers in EU Member States?

The CBAM affects you if this is the case.

P**lease note** that your products are also subject to CBAM if they are purchased by clients who themselves manufacture CBAM goods. In that case, your products serve as "precursor" for their CBAM goods, which then may be exported to EU countries. Also, if you sell your products to traders who then sell them to EU customers, your goods fall under the CBAM.

In all those cases where CBAM goods end up being imported into the EU, at some point the importer will contact you to gather information on the "embedded emissions" of these CBAM goods. Alternatively, the operator using your goods as precursor for producing other CBAM goods will ask for the embedded emissions. **Therefore, you must be prepared to provide these data** and as soon as possible start to develop a monitoring methodology at your installation, as described in this guidance document.

How to communicate your data?

At this time, two different routes are available:

- The recommended, but currently voluntary method is that you, as the operator, obtain a ***registration* in the CBAM Registry**, i.e. the IT system run by the European Commission for managing inter alia the CBAM Declarations by the authorised declarants, their purchases and surrenders of CBAM certificates, and the verification process. If you choose this approach, you need to upload your emissions data for each installation *only once*, and after verification, you will be able to share the relevant data with *all declarants* who import your goods into the EU. In 2027, the CBAM Registry will be extended so that you can also share emissions data with other operators who use your goods as precursors for their own CBAM goods. You are strongly advised to register and share emissions data through the CBAM Registry, since this will greatly facilitate the declaration of emissions by authorised CBAM declarants. Furthermore, using the CBAM registry helps you protect potentially confidential parts of the emissions reports by limiting the information seen by the declarant to a summary of the emissions report.

- Alternatively, without such a registration, you will have to organise the data communication with authorised CBAM declarants and other operators using your own

[1] CN (Common Nomenclature) codes are the EU version of the HS (Harmonised System) codes for international trade. CN codes consist of 8 digits (the first 6 digits are identical to the HS code). Where Annex I to the CBAM Regulation contains fewer digits, it means that all CN codes starting with those digits are covered.

tools, but using the same emissions report template as used by registered operators. With this approach you would have to communicate with all concerned parties separately, which you may find inconvenient. It is recommended to use email only for non-confidential communication, unless you and your recipient have the ability to use encrypted emails. In this context you should note that authorised declarants are obliged to request complete verification reports and emissions reports from you, in order to make them available in case of review by the competent authorities, whereas with registration, declarants and other operators gain access only to necessary summary data for you.

For registering in the "O3CI" Module[2] of the CBAM Registry, please see the Commission's CBAM Website:
https://taxation-customs.ec.europa.eu/carbon-border-adjustmentmechanism/cbam-registry-and-reporting_en#module-for-non-eu-installation-operators-o3ci

At that site, you will find respective guidance documents and video tutorials for the registration process.

What are embedded emissions?

The concept has been developed to reflect as much as possible the way in which emissions are covered by the EU ETS if the CBAM goods were produced in the EU. The EU ETS requires operators to pay a price for their own ("direct") emissions. However, if they consume electricity, they also incur the CO_2 costs included in the price of electricity they purchase[3] (carbon costs associated with "indirect emissions"). The same applies to the input materials needed for their production process, and which may be supplied by an EU ETS installation. These so-called precursors therefore contribute to the carbon costs the EU ETS installation faces. The "embedded emissions" are defined in parallel to the emissions causing carbon costs in the EU ETS: they take into account the direct and indirect[4] emissions of the production process as well as the embedded emissions of precursors, subject to the sector-specific rule on whether indirect emissions are in scope for the good and (where relevant) for its precursors. Embedded emissions are similar in concept to a carbon footprint of the goods. The scope of the CBAM is principally related to the rules of the EU ETS and therefore has differences to other methods for calculating product carbon footprints such as the "GHG Protocol" or ISO14067.

3 PLANNING THE MONITORING PLAN

What do you need to monitor?

To answer this question, you need to perform the following steps to develop your monitoring methodology and document it in writing as a 'monitoring plan' (**MP**), i.e. the

2 O3CI = Operators of 3rd country Installations

3 If the EU installation produces its own electricity, it experiences the CO_2 costs directly.

4 In the definitive period, indirect emissions are taken into account only for those CBAM goods for which indirect emissions are required under the CBAM Regulation (i.e. CBAM goods listed in Annex I to Regulation (EU) 2023/956, other than those listed in Annex II, for which only direct emissions are taken into account).

handbook you and your personnel use as a basis for performing monitoring tasks in a consistent way during the coming years. This monitoring plan will be of crucial support also during the verification process. The presented steps will ensure that all the data which you need to calculate embedded emissions are covered.

- Step 1: Define the **installation's boundaries**, production processes and production routes. Production process means the system boundaries which are needed to attribute emissions to specific goods produced, to which the same 'functional unit' applies[5]. A production process shall be identified for goods to which the same functional unit applies and shall, where relevant, encompass all production routes used within the installation for producing those goods.

  Since the functional unit focusses on CN codes for defining the boundaries of each production process, there could be a high number of production processes which require separate monitoring. To avoid this situation, i.e. to aggregate several CN codes into production processes that are more manageable from a monitoring point of view, the Methodology Act provides for rules on how to aggregate goods into larger production processes.

- Step 2: Define the **reporting period** you are going to use. For your own installation's emission monitoring, in the definitive period, the reporting period corresponds always to the calendar year[6] during which the goods are produced. When the authorised CBAM declarant imports the goods this information serves as reference for the determination of embedded emissions. Where there is sufficient evidence to identify the actual time of production, the reporting period shall be the period during which the good was produced (but not before 2026); otherwise, for goods imported in 2026 the reporting period shall be 2026 and for goods imported in subsequent years the reporting period shall by default be the calendar year during which the good was imported. For electricity imported into the customs territory of the Union, the reporting period shall be the year of import.

- Step 3: Identify all the **parameters you need to monitor**:
  - **Direct emissions** of the installation: you have two options available:
    a) The "calculation-based" approach, where you need to determine the **quantities of all fuels and relevant materials[7]** consumed, and corresponding "calculation factors" (in particular the so-called "**emission factor**" based on the carbon content of the fuel or material);
    b) The "measurement-based" approach, where you need to measure in real-time the **concentration of the greenhouse gases** as well as the **flow of the flue gas** for each "emission source" (stack).

    In the definitive period, you must apply the monitoring and calculation methods laid down in the Monitoring Regulation. For PFC[8] emissions from primary aluminium production a special methodology based on overvoltage measurements must be applied. For N_2O emissions from nitric acid production, the measurement-

[5] If you are familiar with the EU ETS, it may help you to understand the concept of "production process" that it is very similar to the "sub-installations" used for benchmarking.

[6] Gregorian calendar, i.e. from 1 January to 31 December.

[7] The term "source stream" is used to cover both, fuels and other input or output materials that have an influence on emissions.

[8] Perfluorocarbons.

based method is compulsory. In all other cases, you may choose which method best fits to the situation of your installation.

Additionally, if your installation has more than one production process, there may be a need to monitor fuel or material streams between the production processes in order to enable correct attribution of emissions to production processes[9].

- **(Direct) emissions related to heat flows**[10]: Heat consumption (of both heat produced in the installation or received from a separate installation) needs to be attributed to each production process, and emissions related to heat exported from production processes need to be deducted from the attributed emissions of each production process from where the heat is produced or recovered. Therefore, rules for monitoring heat flows are found in section C of Annex II and section A.2.2 of Annex III to the Methodology Act. There are also rules on determining the **emission factor of heat**.
- **Indirect emissions**: For goods listed in Annex I to the CBAM Regulation and not listed in Annex II to that Regulation, indirect emissions must be included. These are emissions occurring during the production of the electricity your installation consumes for its production processes, irrespective of whether this electricity was produced within the installation or imported from outside. If you produce such goods, you need to monitor the quantities of **electricity consumed** in each relevant production process and multiply it by the relevant emission factor of electricity. For the emissions factor, the following options exist:
  - i. If the electricity comes from the grid, you use the emission factor made available in Annex II to the Default Values Act (which were determined in accordance with Annex IV to the CBAM Regulation).
  - ii. If you produce electricity yourself in your installation (i.e. you are an "auto-producer"), you need to monitor the emissions of the power plant or CHP plant[11] in the same way as you monitor other direct emissions of your installation, and **use specific rules to calculate the emission factor from the fuel mix** and taking into account CHP heat production, if applicable. The relevant rules are found in points D.4.1 and D.4.2 of Annex II to the Methodology Act.
  - iii. If you receive electricity from a specific installation other than your own one, you may want to use that installation's actual emissions data. For this purpose,

---

9 For example, if a blast furnace produces pig iron, a part of the waste gases is usually used as fuel in other parts of the installation (e.g. a power plant or a hot-rolling mill). In such a case, the quantity and calculation factors need to be determined also for this waste gas, although they are not necessary to calculate the total emissions of the installation.

10 Note 1: this is only about "**measurable heat**", i.e. heat that is transported via a heat medium such as steam, hot water, liquid salts, etc. and where its flow rate can be measured in a pipe, duct, etc. Where heat is produced in a burner and directly used e.g. in a kiln or dryer there is no need to monitor the heat flow, instead the emissions are determined from the fuel consumption. On the other hand, measurable heat is often produced centrally or at several points in the installation, which do not directly correspond to the system boundaries of production processes. It is therefore useful to determine the emissions of the heat production separately, and to attribute the emissions to production processes via the heat consumed in each production process.

Note 2: In the context of carbon footprints, emissions from (imported) heat is often considered "scope 2 emissions" and therefore termed "indirect emissions". Please be aware that in the CBAM legislation as well as in this document, the expression "indirect emissions" refers only to electricity, not heat.

11 CHP means combined heat and power, also known as "cogeneration".

you need to provide evidence either for the fact that the specific installation (supplying power) is directly connected to your own one, or that you have a valid "power purchase agreement". Furthermore, that power plant must monitor its emissions in line with the same rules as applicable for auto-produced electricity, have it verified and communicate that information to you appropriately. If these criteria are fulfilled, you may use the resulting emission factor for this electricity. Additional evidence and documentation requirements apply where actual emissions are used for imported electricity, as set out in point D.2.4 of Annex II to the Methodology Act.

Where an installation receives electricity from multiple sources during a reporting period, the embedded indirect emissions shall by default be determined as the average of the emission factors of each electricity source, weighted by the share of total electricity consumed that the electricity received from each source represents; however, where sufficient evidence is provided that for a given production process, only electricity from one single source, or from a subset of sources, was used, the embedded indirect emissions for goods produced through that production process shall be determined accordingly.

- **Precursors**: The concept of embedded emissions includes the addition[12] of embedded emissions of certain materials used in the production process, the so-called precursors. **Which precursors are relevant** to each production process is determined by the definition of "precursor" in Article 1 of the Methodology Act, which refers to all CBAM goods (i.e. the goods listed in Annex I to the CBAM Regulation) if they are used in a production process. There is no threshold defined for omitting minimal amounts of precursors. However, the Methodology Act clarifies that "*the purchase and maintenance of infrastructure and equipment*" are excluded[13]. In addition, cross-sectoral rules clarify how precursor embedded emissions are accounted for (including where precursors are produced on-site or acquired). The following parameters need to be monitored for each precursor material:

  a) **If the precursor is produced within your installation**, all relevant monitoring is already done in line with the above points. You only need to take the precursor's embedded emissions into account when calculating the embedded emissions of the goods which use the precursor in the production process.

  b) **If you purchase the precursor** from other installations, and if you want to use actual data instead of default values, you need to request data from the relevant producers in the same way as you are asked for data when your goods are imported into the EU. This means, a valid, positive verification report from the installation producing the good, covering the relevant year of production, needs to be provided, and you have to keep it in your records. The relevant information to be used then in your calculation of embedded emissions includes the following, for each precursor, by precursor CN code (and, where

[12] Note the difference between precursors and normal input materials: For the determination of direct emissions it is taken into account that the carbon atoms contained in a material may be oxidised to CO_2 and emitted. However, for *precursors*, additionally the emissions which took place already earlier (during their own production), i.e. the precursor's embedded emissions, need to be added.

[13] E.g. materials purchased by the installation for maintaining its existing infrastructure or creating new infrastructure (such as steel or cement used for construction) are excluded from the installation's system boundaries.

relevant, by reporting period and installation of production), as needed to apply the default weighted-average rules:

- Identification of the installation(s) where it was produced and the applicable reporting period(s);
- The specific[14] direct and indirect embedded emissions of the precursor;
- The production route, and additional parameters that the importer needs to report when the final good is imported to the EU under the CBAM. These additional parameters are listed in point 2 of Annex IV to the Methodology Act.
- The reporting period applied by the producer of the precursor (noting that, by default, the reporting period of a precursor is the year of production of the complex good, unless sufficient evidence identifies the actual time of production).
- Where actual data is provided for precursors produced outside the installation producing the complex good, the relevant verification report issued by an accredited verifier covering the reporting period during which the precursor was produced.
- The specific embedded free allocation of the precursor.
- If applicable, information on a carbon price paid in the relevant jurisdiction production of the precursor.
- Where a precursor originates in the Union or in exempted countries/territories, the precursor's specific embedded emissions (direct and, if applicable, indirect) are counted as zero for the complex good calculation. However, the information to identify the precursor and the quantities used must still be monitored and reported.

c) In both cases, i.e. for purchased or self-produced precursors, you need to monitor the **quantity of each precursor you used** during the reporting period for each of your production processes.

Where indirect emissions are included in embedded emissions for a complex good, note that: (i) if the complex good is listed in Annex II to the CBAM Regulation and includes precursors not listed in Annex II, the precursor's indirect emissions are included; (ii) if the complex good is not listed in Annex II and includes precursors listed in Annex II, indirect embedded emissions from that precursor are not included.

The rules for monitoring precursor-related data are found in point E of Annex II to the Methodology Act.

- Finally, there are some **additional qualifying parameters** that the EU importer needs to report under the CBAM. These depend on the goods produced. For example, for cements imported, the total clinker content needs to be reported, for mixed fertilisers the contents of the different forms of nitrogen, etc. The relevant parameters are listed in point 2 of Annex IV to the Methodology Act. You need to ensure that you collect all the parameters necessary for your CBAM goods and communicate them to the importers of your goods or downstream producers of other CBAM goods.

[14] Specific (embedded) emissions means emissions related to one tonne of the material under discussion.

- Step 4: **Determine the methodology to monitor each parameter** you have identified:
  - For **quantities of fuels and materials** (including precursors) used, you may either have measurement instruments available which tell you how much has been consumed during the reporting period (e.g. weighing belts, flow meters, heat meters, etc.) or you may determine the used amounts from purchase records and stock measurements at the end of each period.
  - For the so-called **calculation factors** (e.g. the carbon content of the fuel or material) you can either choose a "standard value" from applicable literature (in particular national GHG inventories submitted under the UNFCCC/ Paris Agreement) or from point G of Annex II to the Methodology Act, or you can determine them based on laboratory analyses, for which the Methodology Act provides further rules in point B.5.4 of Annex II.
  - For continuous emission measurements, heat flow and electricity measurements you also need to define the **instruments to use**, and applicable calibration and maintenance measures.
  - In some cases, it may be necessary to define **estimation methods**, or **indirect methods** based on known correlations of measurement parameters.
  - As the very last resort, if you have no other methods available for monitoring your goods' embedded emissions, and in particular if the producer of your precursors used does not provide the required data, you may use the **default values for embedded emissions** of CBAM goods (which include precursors) laid down in accordance with Annex IV to the CBAM Regulation, as referred to in Article 11 of the Methodology Act.

  Note that sometimes you may have the choice of different monitoring approaches (e.g. you may have more than one measurement instrument, or you need to choose between continual metering and use of batch-wise delivery records, or choose between calculation-based and measurement-based methods, etc.) The Methodology Act contains provisions in section A.3 of Annex II on how to select the best available (i.e. most accurate) data source.

- Step 5: **Determine data needs for the free allocation adjustment:**

  What is required to determine the free allocation? As a new element in the definitive period of the CBAM, you as an operator must also determine the **level of free allocation** which you would receive for your production process if your installation were situated in the EU. This level of free allocation is deducted from the embedded emissions to determine the amount of CBAM certificates which the authorised declarant has to surrender upon the import of your goods ("the CBAM obligation"). This is necessary to make the CBAM obligation comparable to the carbon costs faced by EU ETS operators. The rules to determine the "embedded free allocation" of CBAM goods are well aligned with the monitoring needs you already have for the embedded emissions. Like for embedded emissions, either default values ("default CBAM benchmarks") can be used or values that take into account actual data from your installation. Because the free allocation in the EU ETS is phased out while the CBAM is gradually introduced, the production year of the goods produced and of the precursors used are important parameters.

- Step 6: **Determine data needs if you pay a carbon price in your own jurisdiction:**

  Do you pay a carbon price in your own jurisdiction? To ensure similar treatment between installations in the EU ETS and in other countries, an effective carbon price paid in the country where a CBAM good is produced allows for a reduction in the CBAM obligation in the definitive period from 2026 onwards. This is a reporting requirement under the CBAM Regulation, because EU authorised declarants need this information to calculate any related reduction of CBAM certificates. You need to ensure that you include information on carbon pricing in your monitoring methodology, so you can convey the relevant information to the importer of your CBAM goods.

  If your installation is subject to a carbon price, you will have to collect information on the carbon price paid, in such a way that you can attribute it to production processes and CBAM goods categories, in a similar way as you attribute embedded emissions to the goods. The *effective* carbon price is to be considered, i.e. taking into account any applicable rebates (in case of an ETS, any free allocation is considered a rebate).

  Note that you need to collect **information for each precursor purchased** if a carbon price applies in its country of origin. If the producer of the precursor does not provide the required information, you can use default carbon price values for the precursor, when they will be published by the Commission.

  The total effective carbon price needs to be attributed to the CBAM goods in a similar way as the specific embedded emissions, i.e. it needs **to be expressed as euros per tonne of CBAM good** (or euros per MWh in case of imported electricity).

  The reporting rules of information regarding the carbon price paid are to be found in the Implementing Act pursuant to Article 9 to the CBAM Regulation. A separate guidance document on topics related to the carbon price paid in third countries will be provided on the Commission's website.

- Step 7: **Set up data flow and control procedures**:

  In order to minimise the risk of misstatements ([15]), the operator shall define data flow procedures and set up a control system accompanying the monitoring plan. The better the control system functions, the simpler will be the verification. While the rules for such control system are not spelled out in detail in the Methodology Act, CBAM guidance document No. 3 on methodology in its section 4.5.6 provides guidance. In the Monitoring and Reporting Regulation (MRR) for the EU ETS there are more detailed requirements, which may serve as guidance for CBAM operators, too. They are explained in detail in the Commission's MRR guidance document No.6 ("Data flow activities and control system") ([16]). For the CBAM, the following step-by-step recommendation can be given:

---

[15] 'misstatement' means an omission, misrepresentation or error in the operator's reported data, not considering the uncertainty permissible for measurements.

[16] It can be found in the MRR guidance section of https://climate.ec.europa.eu/eu-action/carbon-markets/eu-emissions-trading-system-eu-ets/monitoring-reporting-and-verification_en?prefLang=de#documentation

- Step 7a: Perform a (simplified, if appropriate) risk assessment on the data flows. This has to take into account the probability of an error to happen, and its impact (e.g. inaccurate data, complete loss of data, size of the data gap resulting). Identify areas of high and medium risk which require control activities.
- Step 7b: Define the control measures (e.g. corroboration of data with a second data source, regularly performing independent reviews ("4-eyes principle"), installing redundant measurement instruments, define maintenance and calibration cycles for instruments, etc.).
- Step 7c: Repeat the risk assessment including the control measures defined. If there are still remaining high or medium risk issues, go back to step 7b.

It is to be noted that a control system is a "living system", i.e. the control measures should be evaluated for their effectiveness regularly, and where relevant, e.g. because new data flows are introduced, the risk assessment may have to be repeated or at least updated. Therefore, the above steps have to be understood as being performed at the time the monitoring plan is developed.

4 DEVELOPING THE MONITORING PLAN

Compile the monitoring plan (MP) for the installation: At this point you have listed all the monitoring methods for all the materials or emission sources you need to monitor throughout the year. You must then compile this information together into one written document (the "monitoring plan" of your installation) so that the selected monitoring methods and information that comprises your monitoring methodology can be consistently used over the coming years. This should be done in a systematic way (e.g. by listing all measurement instruments, all reading intervals, all data sources for standard values). An outline template containing the minimum required elements for the installation monitoring plan is provided in section A.5 of Annex II to the Methodology Act.

The guiding principle for setting up this monitoring plan is that it must be sufficiently clear and transparent so that independent persons, who have some knowledge of GHG monitoring, are enabled to understand the monitoring methodology. It needs to be detailed enough to serve as instructions to the installation's personnel to perform all necessary tasks for determining the embedded emissions of goods. It must therefore also contain the applicable calculation steps, and all calculation factors which are not determined by analyses. The monitoring methodology that is documented in the monitoring plan should only be subsequently changed where this can be objectively justified; for example, relevant reasons could be changes to the configuration of the installation in terms of technology used, input materials or fuels used, or goods produced; or the introduction of new data sources or monitoring methods; or changes to data collection e.g. improvements to the data control system.

For laying down the monitoring methodology for all relevant parameters, and for respective data flows and calculation steps, operators shall design and implement a monitoring plan containing at least the elements outlined in section A.5 of Annex II to the Methodology Act. The monitoring plan shall be made available (in particular to the verifier) in English. However, as it needs to serve as a "recipe book" to the installation's personnel, you should also have a version in your local language available. It may also be helpful to check the monitoring methodology against the templates for the operator's emissions report and the summary thereof, as set out in points 1.1. and 1.2. of Annex IV to the Methodology Act. You may want to use the data requirements of that template for checking the completeness of the MP.

Furthermore, the MP needs to contain control measures in the data flow from primary data to final specific embedded emissions. These measures must be commensurate with the risks for errors. Measures should include frequent checking by an independent person, and comparing data from different sources, consistency checking of time series, etc.

5 PERFORM MONITORING AND PREPARE THE EMISSIONS REPORT

Perform monitoring throughout the reporting period: While all the steps above are necessary only once to prepare your installation and its staff for the monitoring tasks, this and the following point are to be performed continuously throughout all the following years.

You have to perform the monitoring tasks defined in the MP. You have to regularly read fuel meters, take stock of materials consumed or produced, take samples of fuels or materials to be analysed, carry out maintenance, control and calibration of measuring instruments, etc. You need to collect the relevant data, perform calculation of emissions, and perform all relevant quality control and assurance measures defined in the MP.

Furthermore, at least once per reporting period, you must review the MP and check if it is still accurate and appropriate. For instance, does it still reflect the technologies used in your installation, is the list of produced goods still up to date? Have new fuels or materials become relevant? Can you use better (more accurate) monitoring methods and can you reduce the risk for errors in the data flow? All changes and improvements must be documented in the MP, and you must ensure that only the latest version of the MP is used.

Finally, you must **communicate the embedded emissions data of your CBAM goods to the EU importer(s)** who bear(s) the reporting obligation under the CBAM Regulation. As you may sell your goods to a multitude of clients, there may be a large number of EU importers who must request this information from you. In order to perform this communication as efficiently as possible, where the embedded emissions are calculated based on actual emissions, operators shall prepare an annual emissions report ("operator's emissions report") and a summary thereof, and, where the embedded emissions of electricity are calculated based on actual emissions, operators shall, in addition, prepare a declarant-specific addendum to the operator's emissions report.

The use of this **'operator's emissions report'** template is mandatory in accordance with Article 10 of the Methodology Act. The use of such **a common template greatly simplifies the communication** on both ends. Your customers may be established in different EU Member States, may speak different languages, and may themselves purchase CBAM goods from many suppliers in different countries. The common **operator's emissions report** template ensures a common reporting format in English, so that the same type of information can always be found in the same field in the template.

After the end of a calendar year, you must **compile the monitored data of the whole reporting period**, determine the attributed emissions of each production process, and divide them by the corresponding "activity level" (i.e. the total tonnes of goods or other functional unit under the related CBAM category produced within the reporting period) in order to get the **specific embedded emissions of this good**. This is the main parameter the EU importer is interested in. Until you finalise the data compilation of the following reporting period, you should use these embedded emissions data (using the template you have filled for this reporting period) and provide it to all your customers who need them for CBAM purposes.

The **operator's emissions report** template is intended to facilitate the communication of embedded emissions data from operators of installations to authorised CBAM declarants..

6 VERIFICATION: KEY CONCEPTS

If you provide your emissions data and free allocation data to the authorised declarant for use in the CBAM declaration, or to other operators who use your products as precursors for other CBAM goods, these "actual data" are eligible to be used instead of default values only if they are verified by an accredited verifier. For this purpose, **you as operator of the installation must contract a verifier**.

The verifier must have an accreditation from a National Accreditation Body situated in the EU, valid at the time it issues the final verification report. The accreditation must cover the industrial sector of your installation. In order to avoid capacity bottlenecks near the end of the reporting period, you should seek for a verifier already early during the reporting period. The verifier will then guide you through the process. This usually means that the verifier will request all documents and data from you which are relevant to verification, will agree the time of a site visit, etc.

Certification

In case of the **carbon price paid** in third countries, the Article 9 of the CBAM Regulation requires data to be "***certified** by a person that is independent from the authorised CBAM declarant and from the authorities of the third country.*" The implementing act on carbon price provides further competence requirements for such certifiers. Accredited verifiers (see above) may also meet these requirements. A separate guidance document on topics related to the carbon price paid in third countries will be provided on the Commission's website.

EUROPEAN COMMISSION
DIRECTORATE-GENERAL
TAXATION AND CUSTOMS UNION
Indirect Taxation and Tax Administration
CBAM, Energy and Green Taxation

Brussels, 14 August 2026

GUIDANCE DOCUMENT 3: CBAM METHODS FOR THE CALCULATION OF EMISSIONS EMBEDDED IN GOODS

Commission européenne/Europese Commissie, 1049 Bruxelles/Brussel, BELGIQUE/BELGIË – Tel. +32 22991111

VERSION HISTORY

Date	Version notes
14.08.2026	First Publication of this document for the definitive period.

CONTENTS

1 PREFACE

1.1 Structure and content of the guidance documents

This series of documents has been written to support stakeholders by explaining the requirements of the CBAM Regulation in a non-legislative language. This series of guidance documents should benefit a variety of stakeholders. A specific focus has been put on clarifying the **requirements for operators of installations producing CBAM goods outside of the EU for the definitive period.**

- **Guidance 1** provides an overview of the main changes to the CBAM methodology between the definitive period and the concluded transitional period. It also introduces the CBAM and an overview of the compliance cycle, roles and responsibilities, as well as milestones and deadlines for operators of installations outside the EU during the definitive period and explains the general exemptions from the CBAM.

- **Guidance 2** provides a quick guidance for the intended reader of this document, the operator of an installation producing CBAM goods. It provides a roadmap of the most important concepts of CBAM emissions monitoring and where to find more information in this series of documents.

- **Guidance 3** sets out the monitoring and reporting obligations and recommendations which are potentially applicable to any affected producer of CBAM goods.

- **Guidance 4** provides an overview of how the adjustment for free allocation is to be determined and what information is needed.

- **Guidance documents 5a, 5b, 5c, 5d and 5e** present an overview per sector of the production processes and value chains for goods that are included in the scope of the CBAM, as well as sector-specific monitoring and reporting considerations for each CBAM good where this is relevant. These sections are supplemented by examples for each sector.

The series of guidance documents is accompanied by an electronic template for information that should be used by installation operators to communicate information to the authorised CBAM declarants and CBAM Registry.

Presentation of numbers in EU documents

To align with EU legal documents, this guidance document uses the following convention when presenting numbers.

The decimal separator used to separate the integral part of a number from its fractional part is a comma, e.g.: 0,890

Thousands, and powers of 10^{3n} thereafter, are separated by a space, e.g.:

- fifteen thousand is written as 15 000
- fifteen million is written as 15 000 000

1.2 Reference regulations and legal acts

Several regulations and legal acts are referred to throughout this series of guidance documents. For ease of reading and to avoid ambiguity, simplified references are used when citing these acts.

- **CBAM Regulation**: Regulation (EU) 2023/956 and Regulation (EU) 2025/2083 amending Regulation (EU) 2023/956. Notably, where article numbers are given in this document without further specification, they always refer to the CBAM Regulation.

  It can be accessed at the following link (consolidated version): **http://data.europa.eu/eli/reg/2023/956/2025-10-20**

- **Methodology Act:** Commission Implementing Regulation (EU) 2025/2547, in legal texts referred to as "Implementing act pursuant to Article 7(7) of the CBAM Regulation".

  It can be accessed at the following link: **http://data.europa.eu/eli/reg_impl/2025/2547/oj**

- **Default Values Act**: Commission Implementing Regulation (EU) 2025/2621, in legal texts referred to as "Implementing act pursuant to Article 7(7) of the CBAM Regulation", also referred to as "default values determined in accordance with Annex IV to the CBAM Regulation".

  It can be accessed at the following link: **http://data.europa.eu/eli/reg_impl/2025/2621/oj**

- **Verification Principles Act**: Commission Implementing Regulation (EU) 2025/2546, in legal texts referred to as "Implementing act pursuant to Article 8(3) of the CBAM Regulation".

  It can be accessed at the following link: **http://data.europa.eu/eli/reg_impl/2025/2546/oj**

- **Accreditation & Verification Requirements Act**: Commission Delegated Regulation (EU) 2025/2551, in legal texts referred to as "Delegated act pursuant to Article 18(3) of the CBAM Regulation".

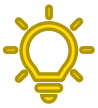
  It can be accessed at the following link: **http://data.europa.eu/eli/reg_del/2025/2551/oj**

- **Free Allocation Adjustment Act**: Commission Implementing Regulation (EU) 2025/2620, in legal texts referred to as "Implementing act pursuant to Article 31(2) of the CBAM Regulation".

  It can be accessed at the following link: **http://data.europa.eu/eli/reg_impl/2025/2620/oj**

For acronyms and definitions used in this document, please see Annex A and Annex B.

A series of icons are used throughout to help guide the reader:

Icon	Description of use
	Points to information of particular importance for operators of installations producing CBAM goods.
Simplified!	Highlights simplified approaches of the general requirements of the CBAM.
	Used where recommended improvements are presented.
	Used where other documents, templates or electronic tools are available from other sources.
	Points to examples given for the topics discussed in the surrounding text.

2 MAIN CHANGES IN THE CBAM METHODOLOGY ACT FOR THE DEFINITIVE PERIOD AND IMPLICATIONS FOR NON-EU OPERATORS

The implementing act on calculation methods applicable in the CBAM definitive period (from 1 January 2026 onwards) builds on, and in several areas refines, the rules that applied during the CBAM transitional period (1 October 2023 to 31 December 2025). The main objective of these changes is to move from a learning and data-collection phase to a fully operational regime in which embedded emissions determine the financial obligations of EU authorised declarants through the purchase and surrender of CBAM certificates.

Table 2-1 below provides an overview of the main changes in the implementing act and its annexes compared with the rules that applied in the transitional period, together with a brief explanation and the corresponding legal references. The changes are grouped into the following thematic areas:

- **Scope, timing and costs:** including the duration of application, the definition of the reporting period, the default production period for imported goods, data retention requirements and the cost threshold for monitoring improvements;
- **Calculation methodology and standardisation:** including revised functional units for certain goods such as cement and fertilisers, new composition-based calculation formulas, the treatment of different production routes and updated production process definitions;
- **Treatment of precursors:** including default production periods for precursors, rules on averaging across suppliers and periods, more granular attribution where appropriate, and strengthened requirements for the validity of precursor data;
- **Documentation and reporting:** including language requirements for operator documentation, the use of standardised reporting documents and templates, and references to the treatment of CO_2 permanently bound in products under the EU ETS framework; and
- **Indirect emissions and electricity:** including the general rule for the inclusion of indirect emissions for specific goods, the treatment of indirect emissions in iron and steel precursors, how to deal with the case of multiple electricity sources, evidentiary requirements for actual emissions from imported electricity, and exclusions or specific rules for certain goods.

For operators, these changes have several practical implications. In particular, they:

- Introduce more prescriptive and standardised calculation rules, improving the comparability of embedded emissions across installations and goods;
- Clarify and, in some cases, tighten the requirements on the treatment, documentation and evidence for precursors and indirect emissions;
- Strengthen data quality, retention and documentation obligations, reflecting the fact that CBAM declarations in the definitive period give rise to financial obligations; and
- Provide more detailed rules on functional units and production routes, limiting discretion in how product boundaries are defined and emissions are allocated.

Table 2-1: Key changes to the methodology between transitional and definitive periods

Area of Change	Explanation of Change	Reference in the transitional IA	Reference in the definitive IA
I. Scope, Timing, and Costs			
Duration of Application	Signals the shift from the temporary data reporting phase (2023–2025) [called the 'transitional period'] to the mandatory calculation and declaration regime [called the 'definitive period'] beginning in 2026.	Article 1	Preamble (3)
Definition of Reporting Period	Standardises the baseline calculation period to the **calendar year** of production for the definitive period, removing the operator's choice (e.g., fiscal year) allowed during the transition.	Annex II, Section 1(2)	Article 1(5)
Default Production Period (Imported Goods)	Creates a **legal presumption** that imported goods were produced in the year of import (post-2026), moving from quarterly reporting to an annual model, with the option to rebut the presumption with evidence of actual production time.	Article 3(1)	Article 7(2)
Data Retention Period	Increases the mandatory retention period for all monitoring records by **50% (from 4 to 6 years)**, ensuring data is available for extended audit cycles.	Annex III, Section A.2(3)	Annex II, Section A.2(4)
Cost Threshold for Monitoring Improvement	Significantly increases the incentive for investment in accurate monitoring by **quadrupling the reference price of carbon** used to determine the benefit of improvements (from EUR 20 to EUR 80) and **doubling the annual non-unreasonable cost limit** (from EUR 2,000 to EUR 4,000).	Annex III, Section A.3(8)	Annex II, Section A.3(8)
II. Calculation Methodology and Standardization			
Functional unit	Sets the maximum level of disaggregation or product category in terms of functionality or performance of the CBAM goods		Definition: Point (1) of Article 1, Use: Article 4
Functional Unit (Cement)	Refines the measurement unit for cement calculation from simple mass (tonnes) to **tonnes of clinker**	Annex II, Section 1(1)	Article 4(5)

Area of Change	Explanation of Change	Reference in the transitional IA	Reference in the definitive IA
	content, reflecting that clinker is the primary source of process emissions.		
Functional Unit (Fertilisers)	Refines the measurement unit for key fertilisers to **kilograms of nitrogen content** or **supplementary units** (where applicable), as the nitrogen content is the compositional driver of emissions for these goods.	Annex II, Section 1(1)	Article 4(4)
Calculation based on Composition (New Formulas)	Mandates new, detailed calculation procedures requiring emissions to be averaged across **composition ranges (no larger than 10%)** for goods based on clinker or nitrogen content.	Annex III, Section G	Annex III, Section B, Equations 64, 65, 66.
Treatment of Production Routes (Averaging)	**Mandates emissions averaging** when producing goods with the same functional unit but via different production routes within one installation. This is in line with the maximum level of disaggregation set by the functional unit, which would not be respected if the production process were split in production routes.	Annex II, Section 3.1	Article 4(6)
Production Process Definition (Mandatory grouping of CN codes)	Shifts process definition away from simple CN code categories toward **installation-level, common production routes**. Mandates grouping of multiple CN codes (e.g., steel products of different shapes) if they share the same precursors and production steps, enabling pragmatic disaggregation below the aggregated goods category level.	Annex III, Section A.4(a), (b)	Annex II, Section A.4
Deletion of 5% Mass/Alloying Threshold	Removes the previous explicit rule requiring materials above a 5% mass threshold to be accounted for, simplifying the system boundaries by relying instead on the functional unit and precursor definitions.	Annex II, Section 3.16.1	Annex I, Section 3.16.2
III. Treatment of Precursors			

Area of Change	Explanation of Change	Reference in the transitional IA	Reference in the definitive IA
Default Precursor Production Period	Establishes a **legal presumption** that the precursor was produced in the same calendar year as the complex good, simplifying the administrative tracking of raw material production timelines, though the operator may still rebut this presumption.	Annex III, Section E(2)(e)	Article 13
Precursor Averaging (Multiple Periods)	Mandates the calculation of a **weighted average** when precursors received from an external supplier cover different reporting periods, simplifying the use of external data that spans multiple years.	Annex III, Section E(2)(e)	Article 14(1)
Precursor Averaging (Multiple Suppliers)	Changes the default rule from requiring separate tracking per supplier installation to requiring a **weighted average** across all suppliers of the same precursor type (CN code).	Annex III, Section G	Article 14(2)
Granular/Specific Precursor Attribution	Explicitly allows deviation from the default weighted average only where the operator can provide **sufficient evidence** that the precursor was used in a production process.	Annex III, Section G	Article 14(3)
Required Precursor Data Validity	Imposes new quality controls: actual data obtained for third-country precursors must be taken from a **verification report issued by an accredited verifier** and that report **must cover the reporting period during which the precursor was produced**.	Annex III, Section E(2)(e)	Annex II, Section A.1(5)
Including precursor indirect emissions only for certain goods	If i) a complex good listed in the CBAM Regulation Annex II (iron or steel, aluminium, chemicals) includes precursors not listed in that Annex, then indirect emissions from the precursor are included in the embedded emissions of the complex good; if ii) a complex good not listed in Annex II includes precursors listed in that Annex, indirect embedded emissions from the precursor are not included.		Annex I, section 3.1 Cross sectoral Rules

Area of Change	Explanation of Change	Reference in the transitional IA	Reference in the definitive IA
Precursors no longer listed under aggregated goods categories as 'relevant precursors'.	No longer refers to 'relevant precursor' in text of the implementing act or Annexes. Any CBAM good can be a precursor of another CBAM production process	Annex II, sections 3.2-3.19	
Zero-rating of precursors produced within the EU for embedded emissions, where these go on to be used to produce complex goods imported into the EU	Precursors produced within the EU or listed territories, that subsequently go on to be used outside of the EU to produce complex goods imported into the EU, are zero rated for direct and indirect embedded emissions. However, the quantity used must be reported.		Annex III, Section B, p.72,
IV. Documentation and Reporting			
Operator Documentation Language	Introduces a mandatory requirement for the **monitoring plan to be submitted in English**, streamlining the verification and review process for EU authorities.	Annex III, Section A.2(2)	Article 5(5), (6)
Operator Documentation	Requirement for an operator **Monitoring Plan (MP)** with a template given in the Annexes.	Annex III, A.2. para 2	Annex II, A.2., para 2, p.20; A.5., p.24, Annex IV, para 2 p.78
Operator Reporting Documents	Replaces the optional single electronic template with a mandatory structure of three documents: a full annual **Emissions Report**, a public-facing **Summary** (for declarants), and a confidential **Declarant-Specific Addendum** (for electricity data).	Article 3(5)	Article 10(1)
CO_2 Permanent Chemical Binding (Regulatory Reference)	Updates the cross-reference for defining permanent CO_2 chemical binding for emissions deduction, shifting from a specific future regulation reference to the generic enabling **EU ETS legal framework**.	Annex II, Section B.8.2(2)	Annex II, Section B.8.2(2)
V. Indirect Emissions			
General Rule for Indirect Emissions Inclusion	Clarifies that indirect emissions are only included for goods **not listed in Annex II** of the main CBAM Regulation (i.e., Cement, Fertilisers, agglomerated iron ores).	Annex III, Section A.1(c), (d)	Article 3(2)
Indirect Emissions for Iron and Steel	Confirms the calculation rule that precursors'	Annex III, Section A.1(d)	Annex I section 3.1

Area of Change	Explanation of Change	Reference in the transitional IA	Reference in the definitive IA
Precursors (see also above)	indirect emissions must still be included for Iron and Steel goods (i.e. indirect emissions from agglomerated iron ores to be included for iron and steel goods), **even though steel itself has no indirect emissions listed in Annex II** (it is implicitly covered by the Annex II rule).		
Indirect Emissions Exclusion (Hydrogen / Ammonia)	Clarifies a specific legal distinction: the indirect emissions of a precursor listed in Annex II (e.g. hydrogen) may be disregarded where the final complex product is not listed in Annex II (e.g. ammonia), therefore is already subject to indirect emissions rules.	Annex II, Section 3.6	Annex I, Section 3.1 ('Cross-sectoral rules')
Indirect Emissions Aggregation (Multiple Sources)	Introduces a default rule that if an installation receives electricity from **multiple sources** (e.g., grid, PPA), the indirect emissions calculation must use the **weighted average** of all sources for the goods produced.	Annex III, Section D	Article 9(1)
Actual Emissions Evidence for Indirect Emissions	Mandates detailed documentary evidence proving either a direct technical link with the electricity source or a PPA with an electricity producer, for the use of actual data for the emission factor.	Annex III, Section D.4	Annex II, Section D.4.3
VI. Electricity			
Actual Emissions Evidence (Electricity Imported into the EU)	Mandates detailed documentary evidence (PPA, capacity nomination, smart metering data) specifically as pre-condition for the use of actual emissions for imported electricity, formalizing requirements that were less explicit in the transitional phase.	Annex III, Section D.2(d)	Annex II, Section D.2.4
VII. Other			
Installation maintenance activities	Clarifies system boundaries exclude purchase and maintenance of infrastructure and equipment.	Annex II, section 3.1 Cross-sectoral rules	Annex I, Section 3.1. Cross sectoral Rules

3 CBAM GOODS AND PRODUCTION ROUTES

This section provides guidance on industry-sector-specific rules that apply for the definitive period (from 2026 onwards), for the cement, hydrogen, fertilisers, iron and steel and aluminium sectors. It deals with the specification of products covered by the CBAM and the relevant production routes.

3.1 Identifying CBAM goods

This section explains how goods covered by the CBAM are defined and identified in the Regulation. The textbox below signposts the key sections for the definition and reporting of CBAM goods, relevant for the CBAM transitional period.

Methodology Act references:

- **Annex I,** point 2 Table 1 “Mapping of CN codes to aggregated goods categories”
- **Annex III** “Rules for attributing emissions to goods”.

3.1.1 Product specifications

The Combined Nomenclature (CN)[1,2] classification system defines the essential characteristics of goods and is used to identify those sector goods in scope for the CBAM.

The CN ‘product specification’ classification system comprises two parts, firstly a numerical 4, 6 or 8-digit numbering system, reflecting different levels of product disaggregation, and secondly a short text description of each product category giving its essential characteristics. The first 6 digits are identical to the Harmonised System (HS) classification used in international trade and the remaining 2 digits are EU-specific additions.

Both parts of the goods’ product specification are given in Annex I to the CBAM Regulation, but elsewhere in the text this may also be abridged to the numerical code only, for ease of reference.

In this Guidance document, as in the CBAM Regulation, reference may be made to CN codes indicated with fewer than 8 digits (i.e. 4 or 6 digits). In such cases, this refers to all 8-digit CN codes that share the same initial 4 or 6 digits.

[1] Council Regulation (EEC) No 2658/87 of 23 July 1987 on the tariff and statistical nomenclature and on the Common Customs Tariff (OJ L 256, 7.9.1987, p. 1). http://data.europa.eu/eli/reg/1987/2658/2026-01-01 This list is regularly updated. When consulting this website, please make sure to check whether it indicates “in force”, or whether a more recent version exists.

[2] For further information on the CN definitions for goods see the Eurostat ShowVoc database for 2026 at: https://showvoc.op.europa.eu/#/datasets/ESTAT_Combined_Nomenclature,_2026_%28CN_2026%29/downloads

3.1.2 Identifying goods in scope for the CBAM Regulation

You (as an operator) must first establish which goods produced by your installation fall under the scope of the CBAM. To this end, you should:

- Draw up a list of all goods and precursors at your installation, both produced at your installation and precursors obtained from outside the installation.

Note that it is possible for the same goods category to be applicable to both the good produced and for the precursor used to produce that good. This is relevant for iron and steel, aluminium and fertiliser sector goods.

- Check and compare the full range of goods produced against the product specifications given in Annex I to the CBAM Regulation.

- From this comparison, establish which of the listed goods produced by the installation are within the scope of the CBAM.

4 MONITORING AND REPORTING OBLIGATIONS

This section contains all rules necessary for monitoring and calculating embedded emissions during the definitive period. It is structured as follows:

- Section 4.1 contains **definitions** and principles.
- Section 4.2 explains the **concept of embedded emissions** (section 4.2.1), before it provides the **calculation rules** (section 4.2.2) in three steps:
  - **Installation-level** monitoring (section 4.2.2.1).
  - **Attributing the emissions data to production processes** within the installation (section 4.2.2.2).
  - **Calculation of specific embedded emissions** from the attributed emissions of the processes, the embedded emissions of the precursor, and the activity level of the production process.
- **How to define the production processes** of the installation and their **system boundaries** is the topic of section 4.4. This topic is linked to the definition of a '**functional unit**' to express the activity levels of the processes.
- Section 4.5 deals with the planning of the monitoring methodology. This includes setting up the '**Monitoring Plan'** (MP), how to select the **best available data sources** and the possibilities to **limit monitoring costs**. The section also provides advice on setting up a **control system** for ensuring correct data.
- Section 4.6 is a central part of this guidance. It gives guidance on the **eligible monitoring approaches** to monitor direct emissions at installation level, with the following sub-structure, reflecting the "building-block" character of allowed approaches:
  - Section 4.6.1: **Calculation-based methodology**
    - Calculation formulae and parameters are explained in sections 4.6.1.1 (standard method) and 4.6.1.2 (mass balance).
    - Rules for determining **activity data** (i.e. quantities of fuels and materials used) are given in section 4.6.1.3.
    - The rules for determining '**calculation factors**' (i.e. information on properties and composition of the fuels and materials used) are subject of section 4.6.1.4. These methods include the selection of appropriate standard values, or the use of **laboratory analyses**, for which basic requirements are discussed.
  - In section 4.6.2, the measurement-based methodology is described, i.e. how to use CEMS (**continuous emissions monitoring systems**). This is in particular necessary for **N_2O emissions**.
  - Requirements for **accounting for biomass** emissions as zero in all the above methods are outlined in section 4.6.3, which is supplemented by additional information in Annex C.
  - The monitoring of **PFCs** (perfluorocarbon emissions) is explained in section 4.6.4.

  - As the last element of installation-level monitoring, section 4.6.5 outlines basic elements of 'transferred CO_2' monitoring, which is the link to **CCS and CCU rules**.

  Note that in some cases, these cross-sectoral rules are supplemented by sector-specific rules.

- **Indirect emissions** of an installation and their monitoring requirements are explained in section 4.7.
- The rules for **attributing emissions to production processes** are the subject of section 4.8 containing the following detailed rules:
  - General rules for monitoring: section 4.8.1,
  - **Flows of (measurable) heat** and the related emissions: section 4.8.2,
  - **Electricity** and respective emissions: section 4.8.3,
  - Rules for the combined production of heat and electricity (**cogeneration, CHP**) to supplement the two previous sections are explained in section 4.8.4.
  - **Waste gases** and their emission attribution rules: see section 4.8.5,
- **Calculation of embedded emissions from attributed emissions**: Relevant guidance is found in section 4.9 with the following sub-sections:
  - **Rules on goods produced** (quality and activity levels) are found in section 4.9.1.
  - The rules for monitoring quality and quantity of **precursor materials** are discussed in section 4.9.2.
- The monitoring rules are concluded by explaining in which cases the default values should be used (section 4.10):
  - **Use of default values** of specific **embedded emissions** is discussed in section 4.10.1.
  - For indirect emissions, where the electricity is received from the grid, **alternative default values for the emission factor of electricity** may be developed, as described in section 4.10.2.
  - Guidance on **closing of minor data gaps** in everyday monitoring activities is given in section 4.10.3.
- Collecting data on a **carbon price** paid in the country of origin (as possible rebate from the CBAM obligation) is the topic of a separate guidance document.

4.1 Definitions and scope of emissions covered in the CBAM

In order to complete the relevant calculations, it is important to understand the precise meanings of terms are used in these calculations. This section presents additional terms used in the following sections of this guide.

4.1.1 *Installation, production process, production routes and functional unit*

The following hierarchical approach of definitions applies:

- **'Installation'** means a stationary technical unit where a production process is carried out.
- '**Production process'** means the chemical and physical processes carried out to produce goods in an installation. The production process system boundaries are defined per aggregated goods categories in Section 3 of Annex I.
- **'Production route'** means a specific technology used in a production process to produce goods under an aggregated goods category.
- '**Aggregated goods category**' is *implicitly* defined in the Methodology Act by listing the relevant aggregated goods categories and all the goods identified by their CN codes in Table 1 of Section 2 of Annex I.
- **'Functional unit'** means the reference unit used for the calculation of embedded emissions in goods. The quantities of goods produced in tonnes classified under the same (8-digit) CN code shall constitute the functional unit, except for: i) cement, which has as a functional unit the tonnes of clinker contained in the good, as embedded emissions are dependent on the clinker content; ii) fertilisers, which have a functional unit of kg of nitrogen[3], as emissions are dependent on nitrogen content in the good (or supplementary units – which are also kg of nitrogen); and iii) electricity as a good, which has a functional unit of 'kWh'.

From these definitions it can be deduced that an installation may consist of one or more production processes. For the purpose of the CBAM, only those production processes that are listed in Annex I Section 3 of the Methodology Act 'Functional Unit and System Boundaries' are relevant. If your installation carries out other production processes, it is your choice to include them in your monitoring plan or not. In both cases the rules for attributing the emissions to the CBAM-relevant processes will work, but inclusion of the non-CBAM processes leads to improved transparency and verifiability.

One production process usually relates to one group of CBAM goods which are produced under the same CN code listed in Annex I to the CBAM Regulation and share the same functional unit. As a general rule, the functional unit is the tonnes of goods under the same CN code. In some cases more than one production route exists for producing these same goods. If more than one production route co-exists at your installation for producing goods which share the same functional unit, then a single production process shall be defined, so that the different production routes are jointly monitored using a single production process and its respective system boundaries.

There are **further rules** in the Methodology Act which allow you to aggregate several CN codes into a production process in order to reduce the administrative burden of the monitoring and verification processes. These rules are described in section 4.3. Simplified

From the above, the short summary is: An installation can consist of more than one production process, and production processes can consist of more than one production

[3] Note that for mixed fertilisers, all chemical states of nitrogen are covered under one single functional unit, i.e. ammoniacal N (NH_4^+), nitrate (NO_3^-) and Urea-N. However, as system boundaries of production processes are determined at the level of CN codes, functional units reflect the chemical form of nitrogen in the case of the production of the precursors Ammonia, nitric acid and urea.

route. CBAM goods that are produced under the same CN code and therefore that share the same functional unit are grouped together into one production process. Sometimes a higher aggregation is possible. The "attributed emissions" are always calculated at the production process level. Note that some further rules exist for defining production processes and their system boundaries, as discussed in section 4.4.

4.1.2 Activity level, quantity of goods produced

In a given reporting period, the **'activity level'** is the total quantity of goods, produced within the system boundaries of a production process under the same CN code and measured in functional units and tonnes of goods (or MWh for electricity). For the purpose of determining the activity level of a production process, the quantity of all goods under the same CN code are added up.

The activity level for an installation or production process must only take into account **saleable product,** i.e. goods which can be sold or used directly as **precursor** in **another production process** for producing other products.

In order to **avoid any double counting** of production, e.g. where precursors are produced and used within the same installation to produce a complex good, you as the operator should only consider the final products leaving the system boundaries of the production process. Product that is returned to the same production process, as well as any waste or scrap must be excluded from the total.

In reporting the activity level for goods, you must also take into account any special provisions given in Annex I, Section 3 of the Methodology Act regarding the system boundaries for specific production processes or production routes.

4.1.3 Direct and indirect embedded emissions

During the definitive period you need to account for both 'direct emissions'[4] and, where relevant, 'indirect emissions'[5], in reporting the embedded emissions of the goods produced at your installations.

<u>Indirect emissions are relevant only for certain goods</u>

The indirect emissions are *relevant* for all goods that are listed in Annex I *but not in Annex II* to the CBAM Regulation. That means that indirect emissions are relevant for:

- **Goods from the cement sector;**
- **Goods from the fertiliser sector;**

!

[4] 'Direct emissions' mean emissions from the production processes of goods including emissions from the production of heating and cooling consumed during the production processes, regardless of the location of the production of the heating and cooling;

[5] 'Indirect emissions' mean emissions from the production of electricity, which is consumed during the production processes of goods, regardless of the location of the production of the consumed electricity.

- **Agglomerated iron ores and concentrates** (also referred to in this guidance document as **'sintered ore').**

Also, since the **indirect emissions of precursors have to be added** to the total embedded emissions of the complex goods in which they are used (pursuant to Point 3.1 of Annex I to the Act), **even where no indirect emissions are relevant for the complex good**, the indirect emissions of sintered ore will have to be found in all goods from the iron and steel sector, too.

Terms applicable in this context:

- **Direct emissions** include combustion and process emissions for your installation, but also emissions produced during the production of heat or cooling consumed in your installation; for example, in case the installation receives heat from adjacent installations or from a district heating network.
- **Direct attributed emissions** are the emissions attributed to the relevant production process producing goods at your installation, based on your installation's direct emissions, emissions from relevant heat flows, material flows, waste gases (if relevant).
- **Direct embedded emissions** of the goods produced are calculated from the direct attributed emissions of the production process by adding the embedded emissions of any precursor materials used in this production process.
- **Specific direct embedded emissions**: These are the direct embedded emissions of the goods produced, divided by the activity level of the production process. The result is expressed as tonne CO_2e per tonne of goods. Where the functional unit is not the tonne of product, i.e. in cement products and fertilisers products, the specific embedded emissions must be reported as tonne CO_2e per functional unit (tonnes of clinker and kg of nitrogen respectively).
- **Indirect emissions** include emissions related to the **electricity consumed** at your installation and are only relevant for certain goods (see text box see above). Note that if your installation **produces** electricity itself, the fuels consumed in the electricity production count as *direct* emissions of the installation. But electricity production is considered a separate production process, i.e. those direct emissions are *not attributed* to direct attributed emissions of any goods produced in this installation except the electricity itself.
- **Indirect attributed emissions** are the indirect emissions attributed to the relevant production process producing goods at your installation.
- **Indirect embedded emissions** of the goods produced are calculated from the indirect attributed emissions of the production process by adding the indirect embedded emissions from any precursors used in the production process.
- **Specific indirect embedded emissions**: These are the indirect embedded emissions of the goods produced, divided by the activity level of the production process. The result is expressed as tonne CO_2e per tonne of goods. Furthermore, where the functional unit is not the tonne of product, the specific indirect embedded emissions must also be reported as tonne CO_2e per functional unit.

- **(Specific) total embedded emissions**: The sum of (specific) direct and indirect embedded emissions. The result is expressed as tonne CO_2e per tonne of goods, and where relevant, per functional unit.

Your approach used to monitor direct and indirect emissions must reflect the range of 'emission sources' and 'source streams' (for definition see section 4.2.2.1) that need to be covered for your individual installation and its production processes.

Embedded emissions in precursor goods

You must include the embedded emissions in precursor goods (both direct and if relevant indirect emissions, as above) in the calculation of total embedded emissions for every final good which is a 'complex good'. The embedded emissions of the precursor goods[6] are added to attributed emissions of the complex good.

There are particular rules on whether or not indirect embedded emissions of precursors are included in the embedded emissions of a complex good, whereby:

- If the complex good is listed in Annex II to the CBAM Regulation (i.e. goods in the iron and steel, aluminium, or chemicals sectors), i.e. if indirect emissions are not relevant for the complex good, but is produced using precursors *not* listed in that Annex, then the indirect embedded emissions of the precursor are still to be included in the embedded emissions of the complex good; whereas,
- If the complex good is not listed in Annex II (i.e. indirect emissions *are* relevant), but is produced from precursors listed in that Annex, then the indirect embedded emissions from the precursor are *not* to be included in the embedded emissions of the complex good.

The inclusion of the embedded emissions of precursor goods in the corresponding complex goods is necessary to ensure the comparability of carbon costs under the EU ETS and the CBAM. Therefore, zero embedded emissions are to be added for precursors that have been produced in the EU or in countries or territories excluded[7] from the CBAM. The relevant greenhouses gas emissions correspond to those greenhouse gas[8] emissions covered also by Annex I to the EU ETS Directive[9], namely carbon dioxide (CO_2) for all sectors, and additionally nitrous oxide (N_2O) for fertilisers and perfluorocarbons (PFCs) for aluminium.

Embedded emissions outside of the operator's control

Where you (as an operator) are receiving electricity, heat or precursor goods from outside the installation, for use in your installation's production processes, you have the choice to use either *default values* or *actual values*, i.e. the data available from your supplier for the reporting period during which the goods or electricity were produced, for the purpose of

6 Where a precursor is itself a complex good, this process is repeated recursively until no more precursors are relevant.

7 These countries and territories can be found in Annex III of the CBAM Regulation. Currently, the following countries are excluded: Iceland, Liechtenstein, Norway, Switzerland; and the following territories: Büsingen, Heligoland, Livigno, Ceuta, Melilla. For the import of electricity into the EU, currently no other country has been excluded from the CBAM.

8 'Greenhouse gases' mean greenhouse gases as specified in Annex I to the CBAM Regulation in relation to each of the goods listed in that Annex.

9 Directive 2003/87/EC

determining the embedded emissions of your CBAM goods. Such emissions-related data include:

- The emissions factor for indirect emissions from imported grid electricity (if relevant), see sections 4.8.3 and 4.10.2;
- Emissions factors for electricity and heat imported from other installations. Rules for heat are discussed in section 4.8.2, and on cogeneration (CHP, combined heat and power) in section 4.8.4.
- Direct and indirect embedded emissions of precursors received from other installations: actual data for precursor goods shall only be used if: i) it is taken from a verification report from an accredited verifier; and ii) the verification report covers the reporting period during which the precursor was produced. Otherwise, you, as the operator, must use the relevant default values for the precursor, as listed in the Default Values Act (explained in section 4.10.1).

4.1.4 Units for reporting embedded emissions

The unit used for reporting embedded greenhouse gas is 'tonne of CO_2e[10]', which means one metric tonne of carbon dioxide ('CO_2'), or an amount of any other greenhouse gas listed in Annex I to the CBAM Regulation with an equivalent ('e') global warming potential[11]; i.e. where relevant, N_2O and PFCs emissions must be converted to their 't CO_2e' value.

For reporting purposes, embedded emissions data over the reporting period must be rounded to full (whole) tonnes CO_2e. Parameters used to calculate the reported embedded emissions should be rounded to include all significant digits, and specific direct and indirect embedded emissions data shall be expressed to a maximum of 5 decimal places (if significant). The level of rounding required for parameters used in such calculations will depend on the accuracy and precision of the measurement equipment used.

4.2 How to determine embedded emissions

4.2.1 The concept

The concept of embedded emissions is, for the purposes of the CBAM, based on **but** not fully aligned with the principles and requirements for a carbon footprint of products (CFP). A CFP is usually understood as an amount of GHG emissions (expressed as kg or t CO_2e) per *declared unit*, (e.g. a tonne of good) based on a life-cycle perspective covering, all significant emissions from upstream and downstream processes (called life-cycle stages), from mining and production to transport, use and end-of-life.

The difference from the CFP scope is because the CBAM is intended to cover the same emissions as would be covered by the EU ETS if the production were situated in the EU.

---

10 'tonne of CO_2e' means one metric tonne of carbon dioxide ('CO_2'), or an amount of any other greenhouse gas listed in Annex I to the CBAM Regulation with an equivalent global warming potential

11 In line with the EU ETS legislation, the 100-year GWP values of the 5th IPCC Assessment Report (AR5) are used.

The system boundaries of emissions covered by the EU ETS, and therefore the CBAM, are **narrower than those in a CFP**. Downstream emissions (emissions from the use and end-of-life) of the products are outside the scope of the EU ETS and the CBAM. Emissions from transport of materials between sites and from processes further upstream are not included either. *Figure 4-1* summarizes this situation graphically. Furthermore, Table 4-1 compares the CBAM scope of emissions to the scope of the EU ETS and other common GHG reporting schemes for carbon footprints.

For the purpose of determining CBAM embedded emissions at a product level, the starting point are emissions of an installation. The installation's emissions are split ('attributed') to emissions of its production processes. Then any relevant embedded emissions of precursor materials are added, and the result is divided by the activity level of each production process, for products under the same CN code and to which the same functional unit applies, thereby resulting in 'specific embedded emissions' (SEE) of the goods from the production process. These considerations are reflected in the definitions of direct and indirect emissions, as set out in the CBAM Regulation, and in its Annex IV 'Methods for calculating embedded emissions for the purpose of Article 7' which lays down the basic calculation approach, which in particular requires taking into account precursor materials. The details of this approach are elaborated in the Methodology Act on the CBAM methodology, in particular Annex II 'Rules for determining data set of production processes at installation level' and Annex III 'Rules of attributing emissions to goods' and explained in this document.

Figure 4-1: Comparison of product environmental footprint, product carbon footprint, and the specific partial carbon footprint that is to be used for determining embedded emissions in the CBAM.

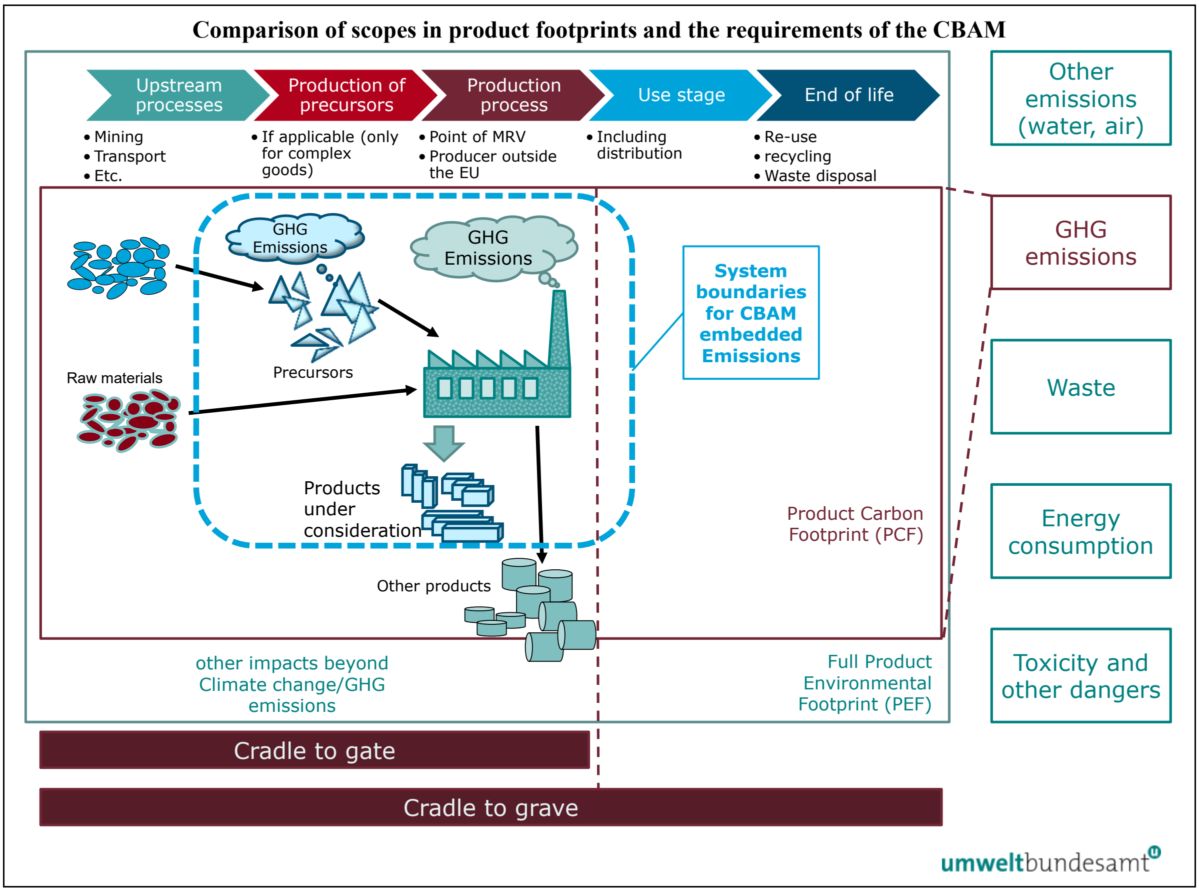


Table 4-1: Comparison of the GHG emission scope of the CBAM, the EU ETS, and the definitions contained in widely used standards (ISO 14064-1 and the 'GHG Protocol')

Parameter	**ISO 14064-1 (Annex B)**	**GHG protocol**	**EU ETS**	**CBAM**
"Direct emissions" (stationary)	Category 1	Scope 1	Subject to system boundaries of each EU ETS installation	Direct emissions are defined as "*Emissions from the production processes of goods including emissions from the production of heating and cooling consumed during the production processes,* irrespective *of the location of the production of the heating and cooling*"
"Direct emissions" (mobile, e.g. forklift, cars)			Outside the scope	Outside the scope
"Indirect emissions" (upstream)				
of heating/cooling imported	Category 2	Scope 2	Covered if produced in an EU ETS installation	Included under "direct emissions"
of electricity imported			Covered if produced in an EU ETS installation	Where relevant for the sector good, indirect emissions are defined as *"Emissions from the production of electricity, which is consumed during the production processes of goods, irrespective of the location of the production of the consumed electricity"*
of fuels imported	Category 3	Scope 3	Outside the scope	Outside the scope
Transport			Outside the scope	Outside the scope
of (precursor) materials imported	Category 4		Covered if produced in an EU ETS installation	To the extent precursors are defined as relevant in the implementing act
"Indirect emissions" (downstream and other, e.g. use of product, end-of-life emissions)	Category 5		Outside the scope	Outside the scope

4.2.2 *From installation's emissions to goods' embedded emissions*

This section outlines the steps to follow to determine the embedded emissions of a good; first explaining the concept, then the attribution of emissions and finally the calculation of the embedded emissions.

The textbox below signposts the key sections in the Methodology Act for this purpose, relevant for the CBAM definitive period.

Methodology Act references:

Annex I, Section 3 Functional unit and system boundaries

Annex II, Section A Principles and general requirements, and in particular, sub-sections A.4. Specific provisions of division of installations into production processes

Annex III, Section A Principles for attributing data to production processes

---

To aid understanding of the monitoring rules contained in Annex II to the Methodology Act, this section explains some terms and concepts. If you are experienced with emissions monitoring, you may skip this section. This might be the case for example if your installation is located in a jurisdiction where a carbon pricing system (e.g. an emissions trading system) or a mandatory monitoring rule for GHGs applies, or if your installation performs GHG reduction projects under an internationally accepted certification scheme with verification.

The approach of the CBAM is "top-down" as follows:

- First the emissions of the installation are determined (details in section 4.6).
- Then the installation is split into 'production processes' which produce the groups of goods under the same CN code and functional unit for which the embedded emissions should be determined. The installation's total emissions are 'attributed' to these production processes using the concepts described in section 4.2.2.2. The rules for defining system boundaries of production processes are found in section 4.4.
- The attribution of emissions to production processes is a relatively complex task, because the rules had to be designed in a way that different installation designs are treated as equally as possible. Such different situations involve e.g.:
    - The different ways of heat supply: Heat can be produced directly within the process from fuels or electricity, it can be received from other parts of the installation (e.g. from a central boiler, a CHP unit, a steam network or grid with various heat sources, from exothermal chemical reactions) or from outside the installation (from a known boiler house or CHP unit, or from a district heating network). A certain amount of emissions must be attributed to any such heat. Therefore, attribution of emissions to production processes requires the monitoring of relevant heat streams (for rules see section 4.8.2).
    - Differences in electricity supply: It requires the monitoring of electricity quantities (rules see section 4.8.3) exported from production processes (the import is relevant for the determination of indirect emissions, if relevant).

For every type of electricity there are common elements (such as the emission factor).

    - Finally, so-called ‘waste gases’ have to be taken into account, i.e. gases that have some heating value due to incompletely oxidised fuels and which occur as result of some production processes (e.g. the blast furnace of a steel plant) are treated with some special rules which evolved during the development of EU ETS benchmarks (see section 4.8.5).

- The next step is the addition of embedded emissions of precursor materials. The ‘attributed emissions’ of the production process only give the emissions of the CBAM good as if it were a ‘simple good’. However, if other CBAM goods are used as inputs (precursors) to the production process to produce the final good, i.e. the final good is a ‘complex good’, then the precursor’s own embedded emissions need to be added. Only thereafter it is correct to use the term ‘embedded emissions’ of the final goods produced.
  The concept is further described in section 4.2.2.3, and rules for monitoring of precursor-related data are given in section 4.9.2.

- Finally, the embedded emissions as determined under the previous step still relate to the total production process and the total quantity of goods produced therein, over the whole ‘reporting period’ of a calendar year. However, the importers need to report the embedded direct and where relevant indirect emissions *per tonne and functional unit of product*, which are the so-called ‘specific (direct or indirect) embedded emissions’ of the good. Those specific embedded emissions are determined by dividing the process-level embedded emissions by the ‘activity level’ of the production process during the reporting period, i.e. the total quantity of the goods produced, measured in functional units and in tonnes of goods. Rules for determining the activity level are discussed in section 4.1.2.

Note: The Commission’s ‘annual emissions report' template for the communication between operators and importers is designed to perform most of the relevant calculations automatically when the necessary data is input. It is, therefore, a valuable tool for you as an operator to provide all the data that importers are obliged to report, as it will help you to avoid incomplete data and to reduce calculation errors to a large extent.

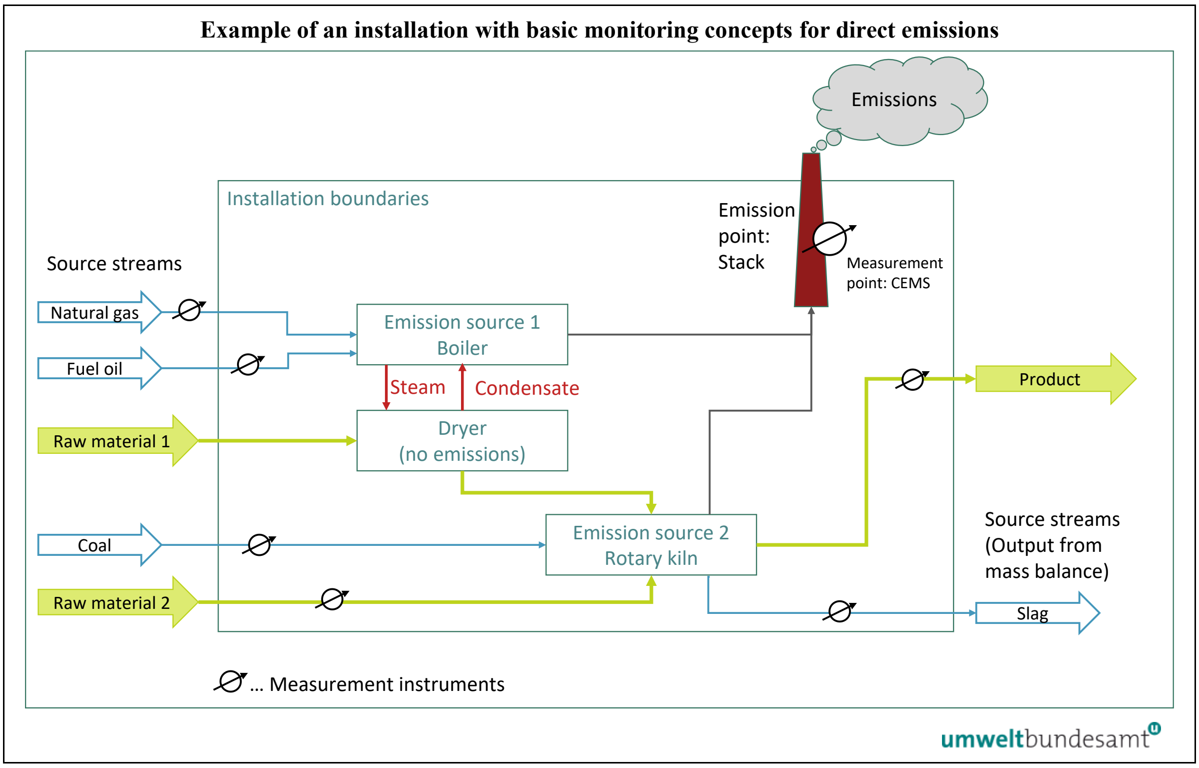
4.2.2.1 Concepts of installation-level GHG monitoring

Annex II Section B, to the Methodology Act provides several monitoring methodologies like a building block system, so that operators can choose for their installation the best possible monitoring approach, where “best” includes elements such as accuracy, but also cost efficiency. For the latter purpose, it is often beneficial to choose monitoring methods which are already available at the installation, e.g. measuring instruments that are used for process control, or for confirming quantities of materials and fuels received or sold.

Here we use Figure 4-2 to introduce some of the main concepts and terms which are then used when discussing the Methodology Act’s detailed monitoring rules in section 4.6 of this document.

The fictitious example installation consists of a dryer in which raw material 1 is dried using steam from a boiler. This material is considered not to contribute to the emissions. Another raw material (e.g. limestone) is calcined in a rotary kiln, where CO_2 is set free from a carbonate. A mixture of the calcined materials is considered the only product of this installation, which consequently has only one production process. The following elements can be shown using *Figure 4-2*.

Figure 4-2: Example of a simple installation for explaining basic monitoring concepts (please see main text for more information).



Definitions:

- '**Source stream**'[12]: The fuels or materials containing carbon that can be released by combustion or other chemical processes are summarised by the term 'source stream'. In case that outputs such as products, by-products or wastes contain significant amounts of carbon, they would also qualify as 'source streams', and the 'mass balance' approach would take these into account by subtracting their carbon amounts from the emissions. In the *Figure 4-2*, input source streams are the fuels natural gas, fuels oil and coal, furthermore the material "raw material 2", and potentially the products and the slag, if they contain relevant amounts of carbon.
- '**Emission source**'[13]: Single process units, such as the boiler and the kiln are termed 'emission sources'. Note that also the stack could be considered an emission source.

[12] Definition in the Implementing Regulation: *'source stream' means either of the following: (a) a specific fuel type, raw material or product giving rise to emissions of relevant greenhouse gases at one or more emission sources as a result of its consumption or production;*
(b) a specific fuel type, raw material or product containing carbon and included in the calculation of greenhouse gas emissions using a mass balance method;

[13] Definition in the Implementing Regulation: *'emission source' means a separately identifiable part of an installation or a process within an installation, from which relevant greenhouse gases are emitted.*

It is, however, more consistent to term that an '**emission point**', which is a place where a Continuous Emissions Measurement System (CEMS) can be installed at a 'measurement point' (which is the location of the CEMS).

Monitoring approaches:

Annex II to the CBAM Methodology Act allows the following monitoring approaches at installation level:

- **Calculation-based approach** in two variants (more details are given in section 4.6.1.1):
  - **Standard method**: This requires the quantity ('**activity data**') of all the fuels and input materials to be determined, as well as some qualitative information on these fuels and materials, in particular the '**emission factor**'. Should some carbon not be emitted (e.g. if some carbon remains in the ash of coal), then this is taken into account by the '**oxidation factor**'. Other incomplete processes are taken into account by a '**conversion factor**'. In the example of *Figure 4-2* the measurement instruments indicate where quantities of the source streams are determined for this purpose.
  - **Mass balance**: In this case, the carbon quantities of all fuels, input materials as well as output materials are determined, again by determining their quantities as well as their **carbon contents**.
  - What is not shown in *Figure 4-2*: If a source stream contains biomass, the respective CO_2 emissions may be zero-rated under certain conditions. This is achieved by multiplying the '**preliminary emission factor**' by a term "1 – **biomass fraction**", so that in case of pure fossil fuel, the resulting emission factor is identical to the preliminary emission factor, while it is zero for pure biomass. However, only biomass complying with certain **sustainability criteria** (see section 4.6.3) is eligible for such "zero-rating".
- **Measurement-based approach** (more details are given in section 4.6.2): Instead of monitoring separately all the source streams, it may sometimes be desirable to perform monitoring by a single operation. In *Figure 4-2:* the stack receives all emissions from all emission sources (and consequently from all source streams. If a CEMS is installed here, it can be used to monitor the whole installation's emissions.
- Note that for avoiding double counting, there is **a choice to be made** between calculation-based and measurement-based approach. Both can co-exist at an installation for different parts of the installation, or for mutual corroboration of the same emissions data. However, you, as the operator, have to make a choice which of the methods to use in a way that neither gaps nor double counting in your monitoring occur. For making this choice, section 4.5.4 gives further advice.

Measurement instruments and analyses:

Figure 4-2 indicates symbolic measurement instruments. Some further clarification is justified:

- Measurements for determining quantities of fuels and materials can be carried out basically in two ways: **Continual** metering (such as using a gas meter or a liquid flow meter for oil), which requires only reading of the incremental amounts consumed, e.g. monthly. On the other hand, **batch-wise** metering is applied e.g.

where every truck load, or train or ship loads are weighted separately. Such quantities are usually stored at the installation before use. Therefore, **stocks** need to be taken into account at the beginning and end of the reporting period.
In the figure, it can be assumed that natural gas is metered continually, while fuel oil, coal and the raw materials are metered batch-wise.

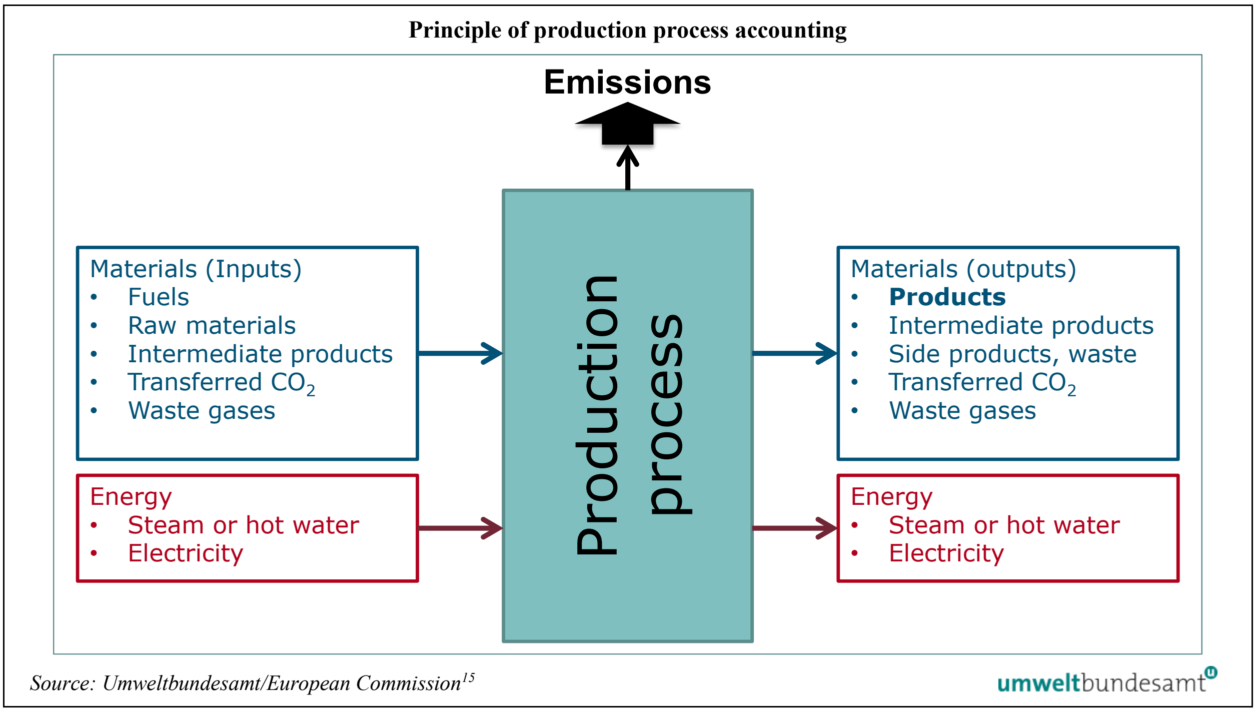
- For selecting a monitoring approach, it is relevant whether an instrument or sampling point is **under the operator's control** or under somebody else's control. In the example of *Figure 4-2*, the meter for natural gas is indicated to be outside the installation boundaries. This happens often, that the metering is done by the fuel supplier. Therefore, official **information such as invoices** may be used for determining the quantity of fuels and materials (more details are given in section 4.6).
- Regarding the qualitative information on source streams (the '**calculation factors**'), in principle two options exist (more details are given in section 4.6.1.4):
    - Fixed values are used for the emission factor etc.: These can be (internationally accepted) **standard values** from the IPCC guidelines as presented in Section G of Annex II to the Methodology Act (and copied in **Annex D** of this guidance), or more suitable national values, literature values etc.
    - Values determined by **laboratory analyses**: This approach is appropriate for larger amounts of fuels and materials, or where the quality of the fuel or material is strongly variable. The Methodology Act provides rules on sampling and analyses. In particular, sampling must be carried out in a representative way (the sampling point might correlate with the measuring points for quantity, but this is not always appropriate), and analyses are to be carried out according to accepted standards in laboratories that are competent for the task (ideally demonstrated by accreditation according to ISO/IEC 17025).

Further cases not shown in this picture on which the Methodology Act contains rules:

- Special methods for the determination of non-CO_2 greenhouse gases: PFC (perfluorocarbons) in the production of aluminium (section 4.6.4), and N_2O in the production of nitric acid and fertilisers.
- Rules on 'transferred CO_2' relating to CCU and CCS[14] (more details are given in section 4.6.5.2).

[14] Carbon Capture and Utilisation, and Carbon Capture and (long-term geological) Storage

Figure 4-3: Schematic description of system boundaries relevant for the attribution of emissions to a production process (please see main text for more information).



4.2.2.2 Attribution of emissions to production processes

As has been said above in section 4.2.2, the attribution of emissions is a complex task. This is because a production process's system boundaries in principle form an energy and mass balance, from which the result are the attributed emissions, as sketched in *Figure 4-3*.

Attributed direct emissions

For calculating attributed direct emissions of a production process, the relevant formula is given in section A.3 of Annex III to the Methodology Act. It is applied using total figures over the whole reporting period for the parameters given in the Equation 55[16] as follows:

$$\boxed{AttrEm_{Dir} = DirEm^{*} + Em_{H,imp} - Em_{H,exp} + WG_{corr,imp} - WG_{corr,exp} - Em_{el,prod}}$$

Where $\mathrm{AttrEm_{Dir}}$ is calculated to have a negative value, it shall be set to zero.

This formula provides a guideline for which parameters need to be monitored whenever an installation consists of more than one production process, or where heat supply is separated, or where waste gases or electricity production are found in an installation. Note that details will be given in sections 4.8.2 (heat), 4.8.3 (electricity) and 4.8.5 (waste gases).

15 Guidance document No. 5 on monitoring for free allocation in the EU ETS: https://climate.ec.europa.eu/system/files/2019-02/p4_gd5_mr_guidance_en.pdf

16 Note the Equation reference numbers given in this guidance document refer to those given in the Methodology Act.

Parameter explanations are as follows:

$\boldsymbol{AttrEm_{Dir}}$	are the attributed direct emission of the production process over the whole reporting period, expressed in t CO_2e;
$DirEm^*$	are the directly attributable emissions from the production process, determined for the reporting period using the rules provided in Section B of Annex II and Section A of Annex III to the Methodology Act, and the following rules: Measurable heat: Where fuels are consumed for the production of measurable heat which is consumed outside the production process under consideration, or which is used in more than one production process (which includes situations with imports from and exports to other installations), the fuels' emissions are not included in the directly attributable emissions of the production process, but added under the parameter $Em_{H,import}$ in order to avoid double counting. Waste gases: The emissions caused by waste gases produced and fully consumed within the same production process are included in $DirEm*$. The emissions from the combustion of waste gases exported from the production process are fully included in $DirEm*$ irrespective of where they are consumed. However, for exports of waste gases the term $WG_{corr,export}$ shall be calculated. Emissions from the combustion of waste gases imported from other production processes are not taken into account in DirEm*. Instead the term $WG_{corr,import}$ shall be calculated;
$Em_{H,imp}$	are the emissions equivalent to the quantity of measurable heat imported to the production process, determined for the reporting period using the rules provided in Section A.2 of Annex III to the Act, and the following rules: Emissions related to measurable heat imported to the production process include imports from other installations, other production processes within the same installation, as well as heat received from a technical unit (e.g. a central power house at the installation, or a more complex steam network with several heat producing units) that supplies heat to more than one production process. Emissions from measurable heat shall be calculated using the following formula: $Em_{H,imp} = Q_{imp} \cdot EF_{heat}$ Where:

	EF_{heat} is the emission factor for the production of measurable heat determined in accordance with Section A.2 of Annex III to the Act, expressed in t CO_2/TJ and Q_{imp} is the net heat imported to and consumed in the production process expressed in TJ;
$Em_{H,exp}$	are the emissions equivalent to the quantity of measurable heat exported from the production process, determined for the reporting period using the rules provided in Section A.2 of Annex III to the Act. For the exported heat either the emissions of the actually known fuel mix in accordance with Section A.2 of that Annex shall be used, or – if the actual fuel mix is unknown – the standard emission factor of fuel most commonly used in the country and industrial sector, assuming a boiler efficiency of 90% (see section 4.8.2). Heat recovered from electricity-driven processes and from nitric acid production shall not be accounted;
$WG_{corr,imp}$	are the attributed direct emissions of a production process consuming waste gases imported from other production processes, corrected for the reporting period, using the following formula: $WG_{corr,imp} = V_{WG} \cdot NCV_{WG} \cdot EF_{NG}$ (Equation 53) Where: V_{WG} is the volume of the waste gas imported; NCV_{WG} is the net calorific value of the waste gas imported, and EF_{NG} is the standard emission factor of natural gas as given in Point G of Annex II to the Act;
$WG_{corr,exp}$	are the emissions equivalent to the quantity of waste gases exported from the production process, determined for the reporting period using the rules provided in Section B of Annex II to the Methodology Act, and the following formula: $WG_{corr,exp} = V_{WG,exp} \cdot NCV_{WG} \cdot EF_{NG} \cdot Corr_{\eta}$ (Equation 54) Where: $V_{WG,exported}$ is the volume of waste gas exported from the production process; NCV_{WG} is the net calorific value of the waste gas; EF_{NG} is the standard emission factor of natural gas as given in Point G of Annex II to the Act, and

	$Corr_\eta$ is the factor that accounts for the difference in efficiencies between the use of waste gas and the use of the reference fuel natural gas. The standard value is $Corr_\eta = 0{,}667$;
$Em_{el,prod}$	are the emissions equivalent to the quantity of electricity produced within the boundaries of the production process, determined for the reporting period using the rules provided in Section D of Annex II to the Methodology Act;

Attributed indirect emissions

$$AttrEm_{indir} = Em_{el,cons} \qquad \text{(Equation 56)}$$

Where:

$\boldsymbol{AttrEm_{indir}}$	are the attributed indirect emission of the production process over the whole reporting period, expressed in t CO_2e;
$\boldsymbol{Em_{el,cons}}$	are the emissions equivalent to the quantity of electricity consumed within the boundaries of the production process, determined for the reporting period using the rules provided in Section D of Annex II to the Methodology Act.

4.2.2.3 Calculation of embedded emissions of a good

Adding precursors' embedded emissions

As has been said above in section 4.2.2, the last step for the determination of embedded emissions is – where applicable, i.e. only for 'complex goods' – to add the embedded emissions of any precursors used in a production process to the attributed emissions of the process. However, if you produce precursors yourself in the same installation, and if you can use the 'bubble approach' (see section 4.4), the attributed emissions of this 'bubble' production process already include the emissions occurring during the production of the precursor. Therefore, **users of the bubble approach need to perform the following calculation only with regard to any precursors produced outside this "bubble"[17]** in addition to the self-produced ones.

The following equations apply:

$$EE_{Proc,dir} = AttrEm_{Proc,dir} + \sum_{i=1}^{n} M_i \cdot SEE_{i,dir}$$

$$EE_{Proc,indir} = AttrEm_{Proc,indir} + \sum_{i=1}^{n} M_i \cdot SEE_{i,indir}$$

[17] I.e. precursors received from other installations (purchased or free of charge) or produced by separate production processes.

Where

$EE_{Proc,dir}$ are the embedded direct emissions at the level of the production process over the whole reporting period;

$EE_{Proc,indir}$ are the embedded indirect emissions at the level of the production process over the whole reporting period;

$AttrEm_{Proc,dir}$ are the attributed direct emissions of the production process as determined in line with section 4.2.2.2 for the whole reporting period;

$AttrEm_{Proc,indir}$ are the attributed indirect emissions of the production process as determined in line with section 4.2.2.2 for the whole reporting period;

M_i is the mass of precursor *i* consumed in the production process during the reporting period, expressed in functional units of precursor *i*; However, where a default value is used for SEE_i (taken from the Default Values Act, see section 4.10 , which is expressed as t CO_2e / t of good, also M_i must be expressed as tonnes of precursor for consistency;

$SEE_{i,dir}$ are the specific direct embedded emissions of precursor *i*, expressed in t CO_2e per functional unit of precursor *i*; However, where a default value is used, it is expressed as t CO_2e / t of good;

$SEE_{i,indir}$ are the specific indirect embedded emissions of precursor *i*, expressed in t CO_2e per functional unit of precursor *i*; However, where a default value is used, it is expressed as t CO_2e / t of good;

Note on the parameter M_i:

Throughout the CBAM methodology, the relevant parameter for "emissions from precursors to be added" are based on the mass of the precursor *consumed* in the production process, not the amount of precursor "contained" in the complex good. This takes into account e.g. the stoichiometry of chemical reactions, but also losses of material throughout production processes. Point C of Annex III to the Act explicitly clarifies that "*It* [=M_i] *also includes quantities of the precursor which do not end up in the complex goods but may be spilt, cut off, combusted, chemically modified, etc. in the production process and leave the process as by-products, scrap, residues, wastes, or emissions.*"

If the precursor was produced within the same installation, you, as the operator, should determine SEE_i values using the rules of the Methodology Act yourself. In case you receive the precursors from other installations, you must request the relevant information from the operator of the installation where the precursor was produced. In order to be allowed to use that producer's actual data instead of default values, a valid verification report from that operator is required. This builds on the same emissions report template provided by the European Commission as for communication between operators and importers[18].

[18] Note that you will not only need the information on the specific embedded emissions of the precursor, but also – if applicable – information on a carbon price paid (see separate guidance document).

If a precursor material is received from different installations or production years, it may have different SEE_i values. Even where default values are used, SEE_i values are year-dependent due to the phase-in of the mark-up over the period 2026-28. Therefore, separate tracking of M_i and SEE_i values per supplier installation and production year is to be used in the calculation, as if it were different precursor materials. This will be necessary to fulfil the rule that operators must use weighted averages for SEE_i values calculated across all suppliers and production years of the same precursor type used during the whole production period (see section 4.9.2). More guidance on the tracking of precursors from different suppliers/production years is given in section 4.9.2.

Note that operators may only use data different to the default weighted average SEE_i values where you as the operator can provide sufficient evidence that the precursor was used in a specific production process or came from a single/subset of installations.

Specific embedded emissions (normalising to 1 functional unit)[19,20]

Having performed all the above calculations, the embedded emissions at process level only need to be divided by the 'activity level' of the process in order to arrive at the specific embedded emissions of the produced goods:

$$SEE_{g,dir} = \frac{EE_{Proc,dir}}{AL_g}$$

$$SEE_{g,indir} = \frac{EE_{Proc,Indir}}{AL_g}$$

Where

$SEE_{g,dir}$ are the specific direct embedded emissions of the goods g expressed in t CO_2e per functional unit, valid for the reporting period;

$SEE_{g,indir}$ are the specific indirect embedded emissions of the goods g expressed in t CO_2e per functional unit, valid for the reporting period;

AL_g is the activity level of the production process producing goods g for the reporting period, determined in accordance with point F of Annex II, expressed in functional units.

Note that these formulae seem to deviate from the formulae given in the CBAM Regulation Annex IV, and in Annex III to the Methodology Act. However, they are mathematically equivalent. The difference is only that in this guidance we assume it to be easier to first determine the process-level data before dividing by the activity level. This method is also applied in the Commission's **'operator's emissions report'** template. However, the legislation gives formulae which do the addition of precursor's embedded emissions in one single step with the normalisation to one tonne. For complex goods this reads as follows:

$$SEE_g = \frac{AttrEm_g + EE_{InpMat}}{AL_g} \qquad \text{(Equation 59)}$$

[19] In most cases, this is a normalisation to one tonne of product. In case of cement it is a normalisation to one tonne of clinker, and in case of fertilisers to one kg of nitrogen.

[20] See also Equation 57 for the calculation of specific embedded direct emissions and Equation 58 for the calculation of specific embedded indirect emissions in Annex III to the Methodology Act.

$$EE_{InpMat} = \sum_{i=1}^{n} M_i \cdot SEE_i \qquad \text{(Equation 60)}$$

Where

EE_{InpMat} are the embedded direct or indirect emissions of all precursors consumed during the reporting period, expressed in t CO_2e;

M_i is the mass of precursor i used in the production process yielding g during the reporting period, expressed in functional units of precursor i; However, where a default value is used for SEE_i; which is expressed as t CO_2e / t of good, also M_i must be expressed as tonnes of precursor for consistency.

SEE_i are the specific direct or indirect embedded emissions of precursor i expressed in t CO_2e per functional unit of precursor i, or as t CO_2e/t of good in case of default values.

Note that in the case of simple goods, EE_{inpMat} is simply equal to zero.

The Methodology Act gives further formulae for a general approach of first normalising the attributed emissions before calculating *SEE* as follows:

The specific mass consumption m_i for each precursor i: $m_i = M_i / AL_g$ (Equation 61)

Where: m_i is the specific mass consumption of precursor i used in the production process yielding one functional unit of goods g, expressed in functional unit of precursor i per functional unit of goods g (i.e., dimensionless).

Thereby the specific embedded emissions of complex goods g may be expressed as:

$$SEE_g = \mathrm{ae_g} + \sum_{i=1}^{n} (m_i \cdot SEE_i) \qquad \text{(Equation 62)}$$

Where: ae_g are the specific attributed direct or indirect emissions of the production process yielding goods g, expressed in t CO_2e per functional unit, being equivalent to specific embedded emissions without precursors' embedded emissions:

$$ae_g = AttrEm_g / AL_g \qquad \text{(Equation 63)}$$

Note that Equation 62 only works if all pairs of m_i and SEE_i values are expressed using functional units. Alternatively, the equation works with all variables expressed using tonnes of complex good, but not with a mixture of both approaches.

In principle it is left to you, as the operator, to decide on the calculation path you choose, if you can demonstrate that the calculation gives the same results as above for *SEE*. However, **if you use the Commission's template for communicating your products' embedded emissions to importers (or to other operators who use your goods as precursor), you can assume that the calculation is performed correctly**.

For SEE_i you, as the operator of the installation, should use the value of emissions resulting from the installation where the input material was produced in your calculations of weighted average values, provided that that installation's data are provided in a valid verification report. During the definitive period, default values for the embedded emissions, as provided in the Default Values Act, must be used where no verified actual data for the precursor are available. More information on selecting the appropriate default value is given in section 4.10.

4.3 Dividing installations into production processes

The textbox below signposts the key sections in the Methodology Act for this purpose, relevant for the CBAM definitive period.

Act references:

Articles 3 and 4

Annex II, sub-section A.4. Specific provisions of division of installations into production processes

---

A key element of the CBAM-related monitoring of embedded emissions of goods is the definition of the boundaries of production processes. After determining the emissions of the whole production process, it is a relatively simple task to calculate the specific embedded emissions of the goods produced in that process, basically by dividing those emissions by the relevant quantity of the goods produced. However, splitting the installation's emissions appropriately into emissions of production processes can be more demanding than the installation-level monitoring. This is because there may be exchanges of fuels, materials (including waste gases), heat and electricity between production processes. For each such exchange, an additional element in the monitoring methodology is required, such as flow meters and other measurements and/or calculations.

Therefore, it is in the operator's interest to define as few production processes as possible. On the other hand, sufficient transparency and accuracy of embedded emissions are required. To strike the right balance between these two targets, the Methodology Act provides a set of rules for defining production processes. If you, as the operator of an installation, have already monitored your goods' embedded emissions, this can mean that you may have to make some changes in your monitoring methodology when defining the monitoring plan for the definitive period.

4.3.1 Definitive Period rules for production processes

1. The starting point for defining the production processes is a **list of all CN codes** of the goods your installation produces. This list will usually be longer than the list of 'aggregated goods categories' (AGCs) used as the starting point in the transitional phase. However, several rules in the Methodology Act allow an aggregation to reduce the monitoring needs.
2. For each CN code, you need to define the **functional unit**. As given by Article 4 of the Methodology Act, the following functional units apply:
    - For cement products except aluminous cement, the functional unit is "tonnes of clinker" without distinction of grey or white clinker;

- For fertilisers, the nitrogen content (kg N) serves as functional unit for the different CN codes;
- For electricity, if imported into the EU, the functional unit is kWh;
- For all other goods (iron and steel sector, aluminium sector and hydrogen), the functional unit is the tonnes of good classified under the same CN code.

3. Next, you will require to align those CN codes with the **system boundaries** of the AGCs given in Annex I to the Methodology Act. These system boundaries will also help you to define your value chains, i.e. the sequence in which your goods are produced. In particular, you should list all the precursors used in your installation for each CN code. Table 4-2 will help you in this task.

   Note that Table 4-2 provides for different production routes in some cases. However, in line with Article 4(6) of the Methodology Act, no distinction of production routes must be made. This means that whenever your installation produces goods of a CN code using different production routes, you have to make sure that there is only one production process covering all the production routes.

4. Where a CN code requires other precursors than the other CN codes in your list, in particular because it is in a different position of your value chain, this is an indication that this CN code will have to be linked to an own production process.

5. **Recommendations for the possible aggregation** of CN codes:

   - Aggregation rule 1 (Article 4(8)): Where goods under different CN codes are produced using the same (group of) physical processes, they can be considered to form one "**multifunctional process**". This is not a requirement, but a recommendation to help operators in accurately representing their installation and simplifying monitoring when different functional units are produced via shared processes. For example, many CN codes in the steel industry are formed by subsequent hot rolling and cold rolling, i.e. the same physical processes. Therefore, all these CN codes can be considered "co-products" of the same (multifunctional) process. Using their respective functional units (tonnes of steel per CN code), the total output (the activity level) of this multifunctional process can be split on a pro rata basis to the goods of each CN code covered (see attribution rules in section A.2 of Annex III to the Methodology Act).

     To help interpreting this provision for iron and steel products, the following level of grouping are recommended:

     - First level of grouping: production processes of goods whose CN codes share the **same range in composition of ferroalloys** covered by CBAM.
       Example: in an installation carrying out hot-rolling of semi-finished stainless steel products, all CN codes of semi-finished hot-rolled stainless steel with a nickel content below 2.5% can be grouped in a multifunctional production process: CN codes 7219 12 90, 7219 13 90, 7219 14 90, 7219 21 90, …
     - Second level of grouping: production processes whose CN codes are made of the **same material** (non alloy steel, stainless steel)
       For instance, in an installation that carries out finishing processes of stainless semi-finished steel products, all CN codes of Chapter 73 of the Harmonized System could be grouped in a multifunctional process: CN codes 7304 11 00, 7304 22 00, 7304 24 00, 7304 41 00, …

- Third level of grouping: production processes **whose processes have emissions with limited contribution in the** embedded emissions of the final complex good.

  For instance, where an installation uses as precursors semi-finished stainless steel products, and carries out on one side hot-rolling and on another side finishing processes (without hot-rolling): the resulting goods can be grouped under a multifunctional processes (CN codes 7219 12 90, 7219 13 90, 7219 14 90, 7219 21 90, … and CN codes 7304 11 00, 7304 22 00, 7304 24 00, 7304 41 00, …). This is because goods under these CN codes share the same precursors and embedded emissions of that precursor is contributing to most of the embedded emissions of the final complex goods. In this case, while the hot-rolling and finishing processes might differ in emissions, semi-finished and finished products would be grouped and attributed emissions equally. This will simplify monitoring and calculation with minimal loss of accuracy.

- Aggregation rule 2 (Annex II section A.4) – **mandatory multifunctional processes** in the **metal industries**: For each of the following aggregated goods categories, the aggregation of CN codes is **mandatory** under certain conditions:
  - Crude steel[21];
  - Iron and steel products;
  - Unwrought aluminium;
  - Aluminium products.

  The **conditions** for applying the mandatory aggregation are:
  - The different functional units (i.e. CN codes) **differ only in size or shape**: to fulfil this criterion, the descriptions of CN codes must only differ in size or shape – e.g. CN codes referring to different widths or thicknesses of a specific type of product (cast, extruded, rolled or forged products etc.).
  - The different functional units are **produced with the same precursors in types**: to fulfil this criterion, the functional units must be produced with the same precursors in terms of CN codes.
  - The different functional units are **produced with the same precursors in quantities and proportions**: to fulfil this criterion, the functional units have to contain these precursors in the same ranges – e.g. if ferro-nickel is a precursor to the different functional units, the functional units of the goods produced have to contain the same ranges of nickel content.
- Aggregation rule 3 (Annex II section A.4) – **mandatory multifunctional processes** in the **fertiliser** industries: The criteria are laid down as "*where different functional units are produced with the same precursors in types, quantities and proportions or are composed by the same substance, and only differ in concentrations*". This implies that the following aggregations are possible:

[21] In principle, also pig iron can be grouped in one production process, where relevant, as the CN codes under heading 7201 only differ in elements that are likely to be influenced by the composition of the iron ore used. If iron (other than steel) is cast in ingots under CN codes of heading 7206, they might be grouped here, too. However, this would be a non-mandatory grouping.

- Ammonia (CN 28141000 and 28142000) builds one production process;
- Nitric acid (CN 28080000) builds one production process;
- Urea (CN 31021012, 31021015, 31021019, 31021090) builds one production process;
- Ammonium nitrate and its mixtures (CN 31023010, 31023090, 31024010, 31024090) build one production process;
- Ammonia salts (CN 31022100, 31053000, 31054000) build one production process;
- Nitrates (CN 28342100, 31025000) build one production process;
- Other CN codes of the aggregated goods category “mixed fertilisers” can be considered a joint production process.

6. For simplifying the monitoring methodology in case of vertically integrated installations, the so-called “**bubble approach**” is provided by Article 4(9) of the Methodology Act. In principle this remains unchanged from the transitional phase, although “precursors” now must be understood at the level of CN codes (including the above aggregation possibilities), while the bubble approach focussed on aggregated goods categories in the transitional phase.

   The bubble approach means that precursors and their downstream complex goods can be monitored by means of a single overall production process. The condition is that the said precursors do not leave the “bubble” process. If this is the case, no separate determination of the precursors’ embedded emissions is necessary. All the emissions of this “bubble” are directly attributed to the final good, as if it were a simple good. This is conceptually different from a multifunctional process, where the aim is to attribute emissions to several goods produced in parallel.

Table 4-2: Aggregated goods categories and their typical precursors – note that this table does not exclude the relevance of other precursors.

#	CBAM Goods Category *Production route*	Typical precursors
1	Calcined clay	
2	Cement clinker	
3	Cement	Calcined clay, Cement clinker
4	Aluminous cement	
5	Hydrogen *Steam reforming and partial oxidation* *Steam cracking* *Electrolysis of water and Chlor-Alkali electrolysis*	
6	Ammonia *Steam reforming* *Gasification of coal etc.*	Hydrogen
7	Nitric acid	Ammonia
8	Urea	Ammonia

#	CBAM Goods Category *Production route*	Typical precursors
9	Mixed fertilisers	Ammonia, Nitric acid, Urea, other (mixed) fertilisers
10	Sintered Ore	
11	Ferro alloys (FeMn, FeCr, FeNi)	Sintered Ore
12	Pig Iron *Blast furnace route* *Smelting reduction*	Hydrogen, Sintered Ore, Ferro alloys, Pig Iron, DRI
13	DRI (Direct Reduced Iron)	Hydrogen, Sintered Ore, Ferro alloys, Pig Iron, DRI
14	Crude steel *Basic oxygen steelmaking* *Electric arc furnace*	Ferro alloys, Pig Iron, DRI, (Crude Steel)
15	Iron or steel products	Ferro alloys, Pig Iron, DRI, Crude Steel, other iron or steel products
16	Unwrought aluminium *Primary (electrolytic) smelting* *Secondary melting (recycling)*	(unwrought aluminium)
17	Aluminium products	unwrought aluminium, other aluminium products
18	Electricity	

4.3.2 Handling of multifunctional processes

A multifunctional process is a production process that has several different goods as product simultaneously, like the electrolysis of water which inevitably leads to the simultaneous production of oxygen and hydrogen. For chemicals (and in particular for hydrogen), the Methodology Act provides a specific rule in section A.2.1 of Annex III, i.e. that the attribution of emissions to the co-products has to be done using molar ratios. The formula to be applied is:

$$Em_i = Em_{total}\left(\frac{\frac{m_{i,prod}}{M_i}}{\sum_{i=1}^{n}\frac{m_{i,prod}}{M_i}}\right) \text{ (Equation 43)}$$

Where:

Em_i … Either direct or indirect emissions attributed to each co-product *i* produced over the reporting period, expressed in tonnes of CO_2

Em_{total} … Either direct or indirect emissions of the whole (multifunctional) production process over the reporting period, expressed in tonnes of CO_2

$m_{i,prod}$ …Mass of each co-product *j* produced in the installation over the reporting period, expressed in tonnes

M_i … Molar mass of each co-product *i*

Only where the molar masses of at least one of co-products is unknown, the attribution is done based on mass of product. In that case, the attribution will follow two steps:

1) First the emission will be attributed based on mass to the fractions whose molar masses are unknown. The formula would be as follows:

$$Em_j = Em_{total}\left(\frac{m_{j,prod}}{\text{total mass of co} - \text{products}}\right)$$

Where

Em_j … Either direct or indirect emissions attributed to each co-product j whose molar mass is unknown produced over the reporting period, expressed in tonnes of CO_2

$m_{j,prod}$ …Mass of each co-product j whose molar mass is unknown produced in the installation over the reporting period, expressed in tonnes

2) Second, the rest of emissions will be attributed based on molar ratios to the fractions with known molar masses. The formula would be as follows:

$$Em_i = \left(Em_{total} - \sum_{j=1}^{n} Em_j\right)\left(\frac{\frac{m_{i,prod}}{M_i}}{\sum_{i=1}^{n}\frac{m_{i,prod}}{M_i}}\right)$$

Where

Em_i … Either direct or indirect emissions attributed to each co-product i whose molar mass is known produced over the reporting period, expressed in tonnes of CO_2

The more general rule in Section (second paragraph of section A.2 of Annex III) specifies that outputs of multifunctional processes is done based on the functional unit of the produced goods. (i.e. the unit of *m* would change, but the formula would be the same).

4.3.3 Examples

Cement: Installation produces white and grey clinker (nothing separately sold), and white and grey cement. Therefore, a bubble approach is possible. As white and grey cements of different grades are produced, the bubble is at the same time a multifunctional process. The different products get the specific embedded emissions assigned by using their functional unit, i.e. by tonnes of clinker.

Assumptions: Total direct emissions of the installation: 125 000 t CO_2

Products:

- Grey Portland cement (composition: 95% clinker): 50 000 t
- White cement (composition: 98% clinker): 40 000 t
- Mixed special cement (composition: 80% white clinker, 17% grey clinker): 60 000 t

Result:

Total functional units produced =
= 50 000 × 0,95 + 40 000 × 0,98 + (0,80 + 0,17) × 60 000 = 144 900 t clinker

Specific direct embedded emissions = 125 000 / 144 900 = 0,863 t CO_2/t clinker

Attribution to goods:

Produced good	**AttrEm (t CO_2 / yr)**	**SEE (t CO_2 / t cement)**
Grey Portland cement	40 976,5	0,820
White cement	33 816,4	0,845
Mixed special cement	50 207,0	0,837

Fertilisers: The processes at the installation are:

- (Phosphoric acid – non CBAM)
- Ammonia;
- Urea – Two products: AUS 32 (AdBlue) solutions, solid Urea sold separately;
- MAP (Monoammonium phosphate, CN 31054000) and DAP (Diammonium phosphate, CN 31053000)
- NPK of many different grades, containing Urea and NH_3 in various mixtures

In this example, no bubble approach is possible, since ammonia and urea are sold separately.

Result: The following production processes have to be defined: (1) Ammonia), (2) Urea, (3) MAP+DAP[22], and (4) all other mixed fertilisers.

Iron and Steel

Example 1: Integrated plant, – Assumption that only carbon steel is produced:

- Production process 1: Sintered Ore (CN 26011200)
- Production process 2: Pig iron (CN 7201nnnn)
- Production process 3: Crude steel (can include all different shapes of semi-finished goods covered by CN 7207nnnn)
- Production process 4: Diverse final products as listed in example 1 for iron & steel, including 7208nnnn and 7212nnnn "Flat rolled products" of different sizes, 7213nnnn "Bars and rods" of various dimensions, 730210nn "Rails of iron or steel, for railway or tramway track"

All the above fit into one production process under the "bubble approach" (Article 4(9) of the Methodology Act). Hence, it is possible to have only one multifunctional process with the following system boundaries:

- The quantities of sintered ore, pig iron and crude steel produced do not have to be monitored separately, and neither is it required to monitor any energy or material

22 Because only ammonia is precursor, while in process (4), ammonia *and* urea are used.

flows between processes 1 to 4. Only the total fuels and materials entering this bubble production process, and the waste gases leaving this bubble (for use in the power plant) need to be monitored.

- Embedded emissions of any precursors coming from other installations entering the bubble process at any point (e.g. iron ore pellets, additional crude steel, etc.) have to be added to the attributed emissions of the overall bubble process.
- Co-products are all goods listed above under process 4. They all have a functional unit of tonnes of steel products. Therefore, the total attributed emissions including those of additional precursors need to be divided only by the total tonnes produced in order to give the specific embedded emissions of the final products (complex goods) of this installation.

Example 2:

In this example, a wide range of carbon and stainless steels are produced using the EAF (electric arc furnace) route. First, the installation produces a range of crude steel semi-finished goods, some of which are sold on the market (i.e. no bubble approach possible). Thereafter, many final goods are produced from these semis (but the example is limited to few CN codes for illustration only, see Table 4-3).

The amounts of precursors (FeNi, FeCr, FeMn and (non-alloyed) crude steel) as well as steel scrap (not a precursor) need to be monitored separately for each production process which is identified in the table. In those cases where several CN codes fall under the same production process, these processes are formally "multifunctional processes", and their emissions need to be attributed to each good using the functional unit. However, as the functional unit is "tonne of steel product" in these cases, a simple mass-based attribution is very simple to perform.

Table 4-3: Products and production processes for steel example 2.

Proc. no.	CN code	Product	steel type
1	72071114	Semi-finished products, of iron or non-alloy steel, containing by weight < 0,25% carbon, of square or rectangular cross-section, the width < twice the thickness of <= 130 mm, rolled or obtained by continuous casting (excl. free-cutting steel)	Crude steel / carbon steel
1	72071116	Semi-finished products, of iron or non-alloy steel, containing by weight < 0,25% carbon, of square or rectangular cross-section, the width < twice the thickness of > 130 mm, rolled or obtained by continuous casting (excl. free-cutting steel)	Crude steel / carbon steel
2	72189911	Semi-finished products of stainless steel, of square cross-section, rolled or obtained by continuous casting	Crude steel / stainless steel
4	72149931	Bars and rods of iron or non-alloy steel, only hot-rolled, hot-drawn or hot-extruded, containing < 0,25% of carbon, of circular cross-section, of a maximum diameter of >= 80 mm (other than of free-cutting steel, smooth bars and rods, for reinforced concrete, or bars and rods containing indentations, ribs, grooves or other deformations produced during the rolling process, or wound after rolling)	Iron & steel products / carbon steel

Proc. no.	CN code	Product	steel type
4	72149939	Bars and rods of iron or non-alloy steel, only hot-rolled, hot-drawn or hot-extruded, containing < 0,25% of carbon, of circular cross-section of a maximum diameter of < 80 mm (other than of free-cutting steel, smooth bars and rods, for reinforced concrete, or bars and rods containing indentations, ribs, grooves or other deformations produced during the rolling process, or wound after rolling)	Iron & steel products / carbon steel
4	721610nn	U, I or H sections of iron or non-alloy steel, not further worked than hot-rolled, hot-drawn or extruded, of a height of < 80 mm	Iron & steel products / carbon steel
5	72221181	Bars and rods of stainless steel, not further worked than hot-rolled, hot-drawn or extruded, of circular cross-section measuring < 80 mm and containing by weight >= 2,5% nickel	Iron & steel products / stainless steel
5	722240nn	Angles, shapes and sections of stainless steel, n.e.s.	Iron & steel products / stainless steel

Within one aggregated goods category (crude steel), all relevant goods are produced using the same technology (electric arc furnace with subsequent continuous casting). The relevant CN codes imply that the same sizes and shapes of different steel qualities are produced (rectangular shapes from continuous casting, width < twice the thickness). However, it is impossible to produce those three groups of CN codes using the same types and proportions of precursors. Therefore, the grouping by carbon steel and stainless is not only determined by the distinct CN codes, but by the rule pursuant to Annex II section A.4. As shown for carbon steel (CN codes 72071114, 72071116), further sizes and shapes could be included in these production processes.

Overall, four production processes need to be defined in this example. However, in practice such installation might be equipped with two physically separate production lines, e.g. because for the non-carbon steel products an additional production step (AOD/VOD[23]) is necessary. In such hypothetical two-line installation, it might happen that the operator does not sell any intermediate product (the crude steel from continuous casting) from the carbon steel production line to other users, while semis of stainless and other alloy steel are sold. In this specific situation, the operator may decide to cover the complete carbon steel production by a bubble approach, i.e. to put production processes 1 and 4 (as determined in accordance with Table 4-3) into one joint production process for the purpose of monitoring the emissions, while the other processes would have to remain separate.

4.4 Defining production process system boundaries

This section outlines the monitoring approaches available to you, as an operator, for the CBAM definitive period. The section outlines how you align the physical reality of your installation with the production processes determined in line with the CBAM rules outlined in section 4.3 above. The textbox below signposts the key sections in the Methodology Act for the division of installations into production processes.

[23] Argon Oxygen Decarburization / Vacuum Oxygen Decarburization

Methodology Act references:

Annex I, Section 3 Functional unit and system boundaries

Annex II, Section A Principles and general requirements

In order to determine the embedded emissions of the goods produced in the (possibly aggregated) production processes covered by the CBAM and determined in line with section 4.3, you (as an operator) need to define the (physical) system boundary for the production of each good's production process. This involves identifying:

- All of the relevant production processes or equipment used during production of the CBAM good;
- All of the fuel, energy (electricity[24], heat or waste gases[25]) and material flows into and out of these production processes; and
- The sources of GHGs emitted directly from these production processes and, if relevant, during the production of the energy and precursor materials consumed.

Step 1: List all goods, physical units, inputs, outputs and emissions for the installation

Firstly, for your installation, list all production process physical units, process inputs (e.g. raw materials, fuel, heat, and electricity inputs required for making the products) and outputs (produced goods, co-products, by-products and waste, heat, electricity, waste gases and emissions).

Using a schematic diagram of your installation can be a helpful way to visually identify the system boundaries. It is also important to identify units such as boilers, CHP units and steam pipework networks (or grids) which may be used jointly by different production processes. The emissions of such units must be monitored separately and attributed to the production processes according to the amount of heat consumed in the different production processes.

In order to satisfy the CBAM Regulation's definition of "direct emissions", heat imported must be taken into account (i.e. added to the installation's total emissions). And if relevant, the "indirect emissions" from electricity consumed in producing the good must also be accounted for.

Step 2: Establish correlation between production processes and physical installation parts

In this step you establish a correlation between the physical parts of the installation (from step 1) with list of all the goods with their CN codes which your installation produces, and the production processes you have them assigned to following section 4.3. In defining the system boundaries of a production process, **key criteria** are:

[24] Note that electricity generation is defined as a separate production process. See Section 5.8.3.

[25] For definition of 'waste gases' please see section 4.8.5.

- The system boundaries should enclose the physical production units[26] performing the sequential process steps to produce the good;
- Any other (100%) dedicated units that support the production process and allows it to reach and maintain its full production capacity should be included in the system boundary – for example CHP units (input activity) or flue gas scrubbing (output activity).
- Physical units used by more than one production process (e.g. boilers supplying steam to several processes, or air compressors providing compressed air) need to be virtually split (by treating their emissions separately in accordance with the formulae provided in section 4.2.2.2);
- Only stationary units are included in the system boundary – emissions from vehicles (forklifts, trucks, bulldozers etc.) are not included in the system boundary of a production process.

Overall, the **relevant emissions of an installation must be 100% covered between CBAM goods and any non-CBAM goods**, whereby:

- For an installation with a single production process, all (100%) relevant emissions from the installation must be attributed to the CBAM good production process.
- For an installation with several relevant production processes, you, as an operator, should where necessary attribute shared equipment, 'source streams' and emission sources between the different production processes identified.

Therefore, all inputs, outputs and corresponding emissions in your installation must be attributed to a production process, unless they relate to any non-CBAM good.

You should take particular care to ensure that production processes do not overlap, i.e. inputs, outputs and corresponding emissions must not be covered by more than one production process so that there is no double counting of relevant emissions.

You should also note that, for transparency purposes, the rationale for any production processes defined needs to be provided to the verifier, and, if applicable, the authority who checks the CBAM declarations. This is in particular achieved by making sure that the monitoring plan (see section 4.5) is complete and written in a way that persons with appropriate technical understanding can understand the functioning of the installation as well as the relevant split into production processes, and the necessary monitoring methodology for attributing emissions to production processes.

Recommended improvement:

List all emission sources and source streams of the total installation, in order to perform completeness checks, as well as to control the energy and emissions efficiency of the installation as a whole.

<u>Step 3: Determine monitoring needs on installation level</u>

Once you have identified all the CBAM-relevant production processes and the related emission sources and source streams (i.e. fuels and materials contributing to emissions),

[26] "Units" means industrial equipment such as kilns, furnaces, boilers, reactors, distillation columns, dryers, flue gas cleaning, etc.

you need to decide on the monitoring approaches. At installation level ‘calculation-based’ and ‘measurement-based’ approaches are available. More details on the applicable methods are presented in section 4.6.

In some cases, additional material or energy flows which take place between production processes need to be monitored, even if not necessary for installation-level emission monitoring. For example, a waste gas resulting from the production of pig iron, which is consumed in the production of iron or steel products downstream, would not have to be separately monitored at installation level. For attribution to different production processes and subsequently to goods, such monitoring is necessary and needs to be identified for the next step. However, a simplification is possible where the Methodology Act allows either the definition of a single multifunctional process or the ‘bubble approach’ (see section 4.3) for covering a wider range of CBAM goods production. In those cases, the monitoring of energy and material flow between the separate processes can be avoided.

Step 4: Assign emissions to production processes

Once the methods for determining total emissions of an installation have been determined, you must ensure you have all data for splitting the emissions according to the production processes defined and the goods produced.

In this step, this is done without considering the embedded emissions of precursor materials used. Instead, each good is considered a “simple good”, i.e. only the direct and if applicable indirect emissions from each production process are taken into account. If an installation also produces some precursor materials, they are to be considered separately as individual goods themselves.

At this stage the aim is to attribute 100% of the installation’s emissions to goods, without gaps and double counting. Note that in this context “electricity” and “heat” produced for use outside of the production process are also “goods” (they have an economic value and can be traded). Also, goods which are not covered by the CBAM have to be considered in order to reach this 100% target.

4.5 Planning your monitoring

This section outlines the monitoring approaches available to you, as an operator. The textbox below signposts the key sections in the Methodology Act for monitoring, relevant for the CBAM definitive period.

Methodology Act references:

Annex II, Section A Principles and general requirements, in particular, sub-sections: - A.1. Overall approach; - A.2. Monitoring principles; - A.3. Methods representing the best available data source; - A.4. Specific provisions of division of installations into production process; - A.5. Monitoring plan.

Annex II, Section B Monitoring of direct emissions at installation level, in particular, sub-sections: - B.1. Completeness of source stream and emissions sources; - B.2. Choice of monitoring methodology; - B.3. Formulae and parameters[27] - B.4. Requirements for activity data; - B.5. Requirements for calculation factors for CO_2.

Annex II, Section E Monitoring of precursors.

Annex II, Section F Monitoring of activity levels

Annex III, Rules for attributing emissions to goods.

4.5.1 What documentation is needed to plan your monitoring

As an operator, you must document the monitoring methodologies used to determine the CBAM emissions and production data for your installation and production processes. These methodologies must be documented in the CBAM installation's **Monitoring Plan** (MP). It defines the system boundaries of your installation and each of your production processes, in line with the specific requirements for each industry sector. The Monitoring Plan must also identify which source streams use a calculation-based standard or mass balance method, and for which emission sources a measurement-based approach is used. It must also contain all other relevant monitoring approaches, such as for the qualities and quantities of CBAM goods produced, heat, electricity and waste gas flows, as applicable. A systematic, transparent and complete monitoring plan does not only help you as the operator to instruct you personnel on monitoring activities and to ensure consistent results over the years. It is pre-condition for the annual verification of the operator's emissions report.

A good document management system is advisable from the outset. To help with this the Monitoring Plan should ideally be collated into a single document, that is comparable to the 'Monitoring Plan' in the EU ETS. The template given in Section A.5. of Annex II to the Methodology Act sets out the minimum necessary elements for the CBAM Monitoring Plan. The table below also provides this template, which you as the operator may adapt to your installation providing the minimum elements are retained. (At this time a standardised 'off-the-shelf' Monitoring Plan template in electronic form, for use by all, is not available).

Table 4-4: Template for the Monitoring Plan for documenting the monitoring methodology used

Minimum elements to include in the installation Monitoring Plan (MP)
1. Date and version number of the MP;
2. Description of the installation and production processes carried out by the installation;
3. A list of all relevant goods produced by CN code and functional unit, and where applicable the specific compositions in terms of clinker content and nitrogen content, including precursors not covered by separate production processes in accordance with Article 4;
4. A list of all CBAM production processes and routes carried out at the installation and list of goods delivered per production processes;
5. If relevant, a list of non-CBAM goods produced per production process and the quantity produced;
6. A list of the relevant CBAM benchmarks to be used for the determination of the free allocation adjustment for all relevant goods produced;
7. The methods for monitoring data per each production process including:

[27] Note specifically section B.3.3 to Methodology Act on zero-rating criteria for biomass emissions.

a) a detailed description of the calculation-based methodology when applied, including a list of input data and calculation formulae;

b) a description of the measurement systems used, and exact location of the measuring instruments to be used for each of the source streams to be monitored;

8. The methods for determining calculation factors and sampling plan for each source stream, if applicable;

9. A list of source streams and emission sources and their description for each production process;

10. A list of source streams for which the calculation-based standard method or the mass balance method is used, including the detailed description of the determination of each relevant parameter provided in Annex II point B.3.4;

11. A list of emission sources for which a measurement-based methodology is used, including the description of all relevant elements provided in Annex II point B.6;

12. A description of the monitoring methodology for PFCs from primary aluminium production;

13. A suitable diagram and process description of the installation including the system boundaries of the installation and different production processes, providing evidence that there is neither double counting nor data gaps in the emissions of the installation;

14. The precursors used in each production process and if produced in other installation, name and country of origin of their suppliers;

15. Whether any zero-rated fuels are used and how the applicability of zero-rating of the fuels is demonstrated;

16. Whether measurable heat is imported from or exported to other installations, and an identification of those installations, a detailed description of the methods to determine the emissions attributed to the heat flows for each production process;

17. For indirect emissions, whether electricity is produced inside the installation; and if so, whether electricity is:

a) produced by co-generation;

b) produced by separate generation;

c) produced from fossil or renewable sources;

d) exported from the system boundaries of a production process;

18. Where the indirect emissions are determined on the basis of actual emissions, the information needed to provide the relevant parts of the elements of evidence laid down in Annex II point D.4.3;

19. Where the embedded emissions of electricity imported into the customs territory of the Union are determined on the basis of actual emissions, the information needed to provide the elements of evidence laid down in Annex II point D.2.4, including, where this information is not directly available to the operator, how the operator plans to receive it;

20. Whether waste gases are produced and used in the installation, or imported from or exported to other installations, and an identification of those installations;

21. Whether CO_2 capture, storage and/or use in accordance with Annex II point B.8.2. apply, the identity and contact data of a responsible person of the receiving installations or transport infrastructure or entities to which it is transferred, and the monitoring methodology in accordance with Annex II point B.8.3; and

22. A control system to ensure the data quality which shall include, where applicable:

e) quality assurance of the relevant measurement equipment ensuring that all relevant measuring equipment is calibrated, adjusted, and checked at regular intervals including prior to use, and checked against measurement standards traceable to international measurement standards, where available, and proportionate to the relevance of the measurement equipment;

f) risk assessment where sources of risks of errors in the data flow from primary data to final data are identified

g) quality assurance of information technology systems ensuring that the relevant systems are designed, documented, tested, implemented, controlled and maintained in a way that ensures processing reliable, accurate and timely data in accordance with the risks identified in the risk assessment;

h) segregation of duties in the data flow activities and control activities, as well as management of necessary competencies;

i) internal reviews and validation of data;

j) corrections and corrective action;

k) control of out-sourced processes;

l) keeping records and documentation including the management of document versions.

Note also that the operator's annual emissions report now includes a summary of the installation's Monitoring Plan, as per point 2 Annex IV to the Methodology Act.

4.5.2 Monitoring methodology principles and procedures

As an operator, you are required to document a monitoring methodology to ensure that all the monitoring and reporting activities are carried out **consistently** and are **comparable** from one year to the next. In this regard, the Monitoring Plan serves as a "rule book" for all your installation staff, as well as for training of new staff involved in the monitoring. During verification, the verifier will furthermore use it to confirm whether your monitoring methodology is in compliance with the Monitoring Regulation.

Guiding principles for planning your monitoring:

- **As simple** monitoring methodology **as possible**, which takes into account existing systems in place at your CBAM installation and is based on using the **most reliable data sources**, robust metering instruments, short data flows, and **effective control procedures**.
- **Full transparency** and traceability of how data is compiled, for the purposes of verification of your CBAM data, **stating any calculations or assumptions** made and what controls are in place to ensure data accuracy.

  In particular, complete monitoring records of all data relevant for the determination of embedded emissions of goods produced and supporting documentation shall be kept for at least **six years** after the reporting period.

As installations undergo technical changes over the years, the Monitoring Plan should be considered as a living document that you, as the operator, must **regularly review**, at least annually and whenever the installation undergoes significant technical changes. Any changes made to the monitoring methodology must be recorded in your Monitoring Plan and should be objectively justifiable.

Typical elements of a monitoring methodology involve the following activities for you, as the operator (as applicable, depending on the installation's specificities):

- Data collection (metering data, invoices, production protocols, stock determination etc.).
- Sampling of materials and fuels.
- Laboratory analyses of fuels and materials.
- Maintenance and calibration of meters.
- Description of the calculations and formulae to be used.

- Documentation of standard values used and their sources.
- Control activities (e.g. four-eyes principle for data collection and calculations).
- Data archiving (including security to guard against manipulation).
- Regular identification of improvement possibilities (you should attempt to improve your monitoring systems wherever possible).

Recommended improvement: you should regularly check (at least once per year) whether new and more accurate data sources have become available, for the purpose of improving the monitoring methods. In the case that such new data sources are considered more accurate in accordance with the ranking presented under section A.3 point 1 of Annex II to the Methodology Act (see section4.5.4), they shall be laid down in the monitoring plan and be applied from the earliest date possible.

4.5.3 Supplementary written procedures

Written procedures supplement the monitoring plan by setting out roles and responsibilities and by providing clear instructions for activities implemented under the Monitoring Plan and locations of relevant data. The principle to split some procedures from the monitoring plan was introduced in the EU ETS, where updates of the monitoring plan require formal approval by the competent authority. To make it easier for operators to keep the monitoring plan constant, the written procedures are used to cover elements that may change more frequently. For CBAM purposes, the same approach seems useful to focus the verifier's activities.

Written procedures should be used to cover the following elements:

- Managing responsibilities and competency of personnel – description of roles and assignation of responsibilities to key members of staff.
- Data flow and control procedures.
- Quality assurance measures (checks to be carried out).
- Estimation method(s) for substituting data where data gaps are identified.
- Regular review of the monitoring methodology as documented in the Monitoring Plan for its appropriateness.
- A sampling plan and process for revision, if required.
- Procedures for methods of analyses, if applicable.
- Procedure for demonstrating evidence for equivalence to EN ISO/IEC 17025 accreditation of laboratories, if relevant.
- Procedures for use of measurement-based methodologies, including for corroborating calculations and for subtracting biomass emissions, if relevant.
- Procedure for regular review and update of the list of products and precursors produced and/or imported by an installation.

You, as the operator, should make sure that all versions of the monitoring plan and written procedures are clearly identifiable, and that the most recent versions are always being used by all staff involved. If you are using a formal quality management system or environmental management system (as, e.g., pursuant to ISO 14 001), it has proven useful to integrate the monitoring plan and written procedures into the documentation of those management systems, to help e.g. in ensuring awareness of staff or in the tracking of document versions.

4.5.4 Choosing best available data sources

Section A.3 of Annex II to the Methodology Act contains details about the general principle that "**best available data sources**" should be used for any kind of monitoring for the purpose of determining embedded emissions of goods falling under the CBAM. In this context:

- "**Best**" means primarily the **most accurate**[28] option to determine the required data. This implies e.g. that when you decide which of two measurement instruments for the same variable should be used, you should choose the one where the operator specifies the lowest "error in use" for the environment in which you use it. Furthermore, where there are instruments under "legal metrological control" (i.e. instruments officially verified under some legislation, e.g. for ensuring accepted measurements for trading of fuels), these should be preferred due to their defined characteristics.

  However, "best" includes also the element of data processing. Where personnel have to read a value every hour or every day, then write them down in a journal, which is then manually transferred into an electronic spreadsheet, and where that spreadsheet is not well protected against (unwanted) editing, there are significant risks in the 'data flow' which requires specific 'control procedures' (see section 4.5.6). A better data source would be one that delivers automatically data from e.g. a process control system to a data base which can be used for extracting data without danger of manipulation. Therefore, "best" involves those data sources with **lowest risk of errors on the data flow**.

- "**Available**" means in the first place that you as an operator have the data source already available, e.g. because the parameters measured are important for your process control or cost calculation etc. If this is not the case, a choice has to be made: Will you purchase an additional measurement system, will you establish a system for sampling materials and performing laboratory analyses, for the purpose of the CBAM? Or do you have the possibility to use other methods, including "indirect" ones (see below), or are there literature sources that provide reasonable and credible standard values for the parameter you require for monitoring (e.g. a standard value for the emission factor of a fuel)?

  The legislation provides significant flexibility for answering the above questions. Although "best" sources should be used, the legislation acknowledges that **administrative burden and costs should be limited**. To this end, the concepts of "**technical feasibility**" and "**unreasonable costs**" (see section 4.5.5) are introduced. These allow you to go for "2nd best" (or even 3rd best") data sources, if the best one would not be feasible or involve unreasonable costs.

  Furthermore, the legislation allows you to use **measurements "not under the operator's control"**, if necessary. This means that e.g. if your fuel supplier already determines the net calorific value and emission factor of your fuel, or if the supplier

[28] More precisely, the aim is to have **lowest uncertainty** of measurements, which includes both concepts, high *accuracy* (the closeness of the measured value to the "true value") and high *precision* (low variability of measurements).

owns the flow meter or weigh bridge used for determining the sold fuel quantity, these data may be used for the purpose of the CBAM, and you do not have to purchase your own equipment or analyses. Nevertheless, it is to be noted, that the use of monitoring under the operator's own control is preferred, where possible.

- "**Data sources**" means everything needed for determining all the parameters occurring in the monitoring at emissions level, at production process level and for determining embedded emissions of goods. On an abstract level, this involves in particular the determination of **quantities** of fuels, materials, energy flows etc. and of **quality** of these flows (carbon content of materials, temperature, pressure and saturation of steam, etc.). While more concrete details are given in the following sections, which deal with the different parameters, on this abstract level, the following methods are distinguished by the legislation:
    - **Direct determination**: This means e.g. the direct reading of a flow meter for natural gas, the weighing of a truck delivering coal, etc., and regarding quality it means applying directly a standard value for an emission factor, or performing laboratory analyses to determine the carbon content of a material directly. Where more than one parameter is required[29], it is considered 'direct determination' if all the parameters are actually measured.
    - **Indirect determination[30]**: This is also referred to often as 'estimation method'. Here you, as the operator, have to make several assumptions, and look for measurements which are somehow connected by a scientifically sound reasoning. For example, if you have a boiler for producing steam but you do not have heat meters, you may use the boiler producer's specified energy efficiency in order to calculate the heat amounts based on the fuel consumed. Method B for cement clinker process emissions is in principle also an indirect method: From the amount of CaO and MgO contained in the clinker, one calculates back to the amount of carbonates that are assumed to have been present in the raw meal (the scientific context here is stoichiometry and the likelihood that no other carbonates were present).

      It is to be noted that direct determination methods are preferred, but for limiting administrative costs, indirect methods are acceptable. Their main application, however, is the filling of data gaps during temporary failure of direct determination methods.
    - **Correlations**: These are an "improved indirect method", applicable in particular for quality parameters of fuels. Most prominently, coal emission factors can often be determined based on correlations between the ash content, the calorific value, and the emission factor to be determined. Some process gases can be characterised by using density or thermal conductivity correlating with the gas' composition (carbon content).

      Such correlations need to be regularly (annually) confirmed by laboratory analyses, and are therefore considered "better" than using standard

[29] In particular for determining net heat flows, where the flow of steam, the temperature, pressure and saturation, and the amount and temperature of returned condensate are required.

[30] Such indirect methods include: i) calculation based on design data e.g. the manufacturer's value for the energy efficiency of a specific technical unit; and ii) calculation based on a known chemical or physical processes using generally accepted values from related literature and appropriate calculation factors.

emission factors (which are fixed values), but not as "best" as actual laboratory analyses with representative sampling.

- For '**Calculation factors**' a specific ranking applies (actual analyses preferred over different types of standard values), as presented in section 4.6.1.4.

Where you, as the operator of an installation, find that you have more than one data source for the same parameter available, you should choose the "best" one available for monitoring, and put it into the Monitoring Plan as the "primary data source". All of the data sources that have been selected for determination of embedded emissions should be included in the Monitoring Plan. However, you should not discard all other data sources, but define them as a "corroborating data source", and use the values from those sources for checking regularly the consistency of the data with the "primary" data source. It thereby serves your 'control system' (see section 4.5.6). The corroborating data sources are also the most logical candidates for providing surrogate data where gaps occur in the primary data source.

Overall, there is no absolute "right" or "wrong" in selecting data sources. However, it is to be expected that over time you as operator will collect experience with your data sources and find confirmation whether the chosen sources are "best" indeed. Furthermore, new technologies may become available or less costly, and your installation may undergo changes. Therefore, the legislation foresees that regular (at least annual) review of the monitoring methodology should be performed.

4.5.5 Limiting monitoring-related costs

As indicated in section 4.5.4, the Methodology Act allows the operator to limit the costs caused by monitoring for the purpose of the CBAM, firstly by using existing methods and equipment, to the extent feasible, and secondly by allowing deviation from the preferred approaches, if a monitoring approach is either "**technically not feasible**", or if it incurs "**unreasonable costs**". These criteria are discussed in more detail in this section.

Determining whether costs are reasonable or not

Point 8 of section A.3 of Annex II to the Methodology Act explains that for a cost to be identified as "**unreasonable**", the **cost** of a 'specific determination methodology' (i.e. monitoring approach or improvement measure) must **exceed its benefit**.

As an operator, you should therefore carry out a **cost/benefit analysis**, for the specific determination methodology for the data set concerned, to determine whether costs are unreasonable or not. If you then decide that the costs are unreasonable, this calculation must be attached to the monitoring plan as a justification for not choosing a certain approach.

Benefit calculation: The methodology to use for the benefit calculation for the cost/benefit analysis is provided in section A.3 of Annex II to the Methodology Act, Point 8 (a) to (c). The **benefit (in euros)** resulting from the specific determination methodology is calculated as follows:

benefit = **'improvement factor'** × **CO_2e reference price**.

- Where the '**improvement factor'** (in tonnes CO_2e) is calculated by multiplying the expected percentage improvement in estimated uncertainty
- in a measurement, by the estimated **'related emissions'**[31] over the **reporting period**; or by **1%** of the related emissions where no improvement of measuring uncertainty is involved;
- The '**CO_2e reference price'** is **EUR 80** per tonne of CO_2e[32].

Cost calculation: In considering what costs to include in this calculation, you should only include those costs that are additional to the **existing reference system**, i.e. the incremental cost compared to either: existing equipment, or for a more expensive (but more accurate) item minus the cost of the equipment that would have been purchased without the CBAM. In this context, the types of costs that should be considered are:

- **Investment costs** – for new equipment, if applicable. The cost for the new equipment should be the cost per annum depreciated over its economic lifetime e.g. depreciated on a straight-line basis.
- **Operating and maintenance costs** – such as for annual calibration services.
- **Costs due to disrupted operations** – due to plant shutdowns to install new equipment (to mitigate this you, as the operator, may consider timing this to happen at the same time as the annual plant shut down for maintenance); and/or
- Any other **reasonable resulting costs**.

When you have calculated the above, and **if** the (annual) costs exceed the (annual) benefit, you are free to choose a less costly monitoring approach or equipment, because the costs are considered to be 'unreasonable'.

Please note that **minor costs** are **never** considered unreasonable. To this end, a threshold is defined of an accumulated amount of **EUR 4 000 per year.** Below this amount, costs are always considered to be **reasonable additional costs** for taking measures to improve an installation's monitoring approach, in line with the monitoring obligations of the CBAM.

Technically feasible

The second concept for avoiding more costly monitoring approaches is based on 'technical feasibility'. A measure is considered "**technically not feasible**", where the installation has not the technical resources for meeting the needs of a proposed data source or monitoring method so it can be implemented in the required time for the purposes of the CBAM. This can be the case e.g. if there is no space available to install a technical equipment, if there are safety concerns, or if the technology is not available in the country. Technical infeasibility is usually closely linked with unreasonable costs.

---

[31] 'Related emissions' are the direct emissions in tonnes CO_2e over the reporting period caused by the source stream or emission source concerned, which may be: the emissions attributed to a quantity of measurable heat; the indirect emissions (if applicable) related to the quantity of electricity concerned; or the embedded emissions of a material produced or of a precursor consumed.

[32] This CO_2 price aligns with the CO_2 reference price in the EU ETS legislation in order to give price certainty to help with the planning of monitoring costs.

If you decide that the measure is technically not feasible, an explanation of this must be attached to the monitoring plan as a justification for not choosing a certain approach.

Both decisions (either regarding unreasonable costs or technical feasibility) must be regularly reviewed, in the context of improving monitoring methods, and at least annually in line with the written procedure linked to your monitoring plan.

4.5.6 Control measures and quality management

It is commonly accepted best practice in carbon pricing and GHG monitoring systems that the operator ensures an effective **control system** for the data flows relevant for the emissions monitoring, as is required by the monitoring principles laid out in Section A.2. of Annex II to the Methodology Act. The more advanced the control system is, the less effort will be required by the independent verifier. The control system is therefore a key to an effective verification process. Therefore, the implementation of such control system is in the best own interest of the operator. Here we outline only briefly **how to set up a control system**.

<u>Step 1: Perform a (simple) risk assessment:</u>

Map out all the data flows from the first point where data occurs (e.g. the fuel invoices, the reading of an instrument in the installation), how it is written down or entered in an IT system, how it is used in calculations until it ends up in the final embedded emissions data which you communicate to authorised CBAM declarants under the CBAM.

Then you identify points with a high risk for errors (high risk means that either the likelihood of the error is high, or that the impact of the error on emissions is very high, or both factors are at least "medium").

<u>Step 2: Establish effective controls</u>

For the identified "high risk" points (and ideally also at least for the "medium risk" points) you need a control measure. If for example there is a high risk for a measurement instrument to fail, for copy & paste errors when data is transferred from a paper-based production journal to a spreadsheet, or where data on a computer is freely accessible to your whole staff, measures need to be taken. The same applies if there is a risk for incomplete data (e.g. because fuel suppliers are chronically late in sending invoices, etc.).

<u>Step 3: Regularly evaluate if the control measures are effective.</u>

You, as a CBAM operator, have to monitor the effectiveness of the control system, including by carrying out internal reviews and taking into account the findings of the verifier, if reported to you. When the control system is found ineffective or not commensurate with the risks identified, the control system shall be improved and the monitoring plan updated accordingly, including the underlying written procedures for data flow activities, risk assessments and control activities, as appropriate.

Control measures (non-exhaustive)

The control measures are to be laid down in written procedures. One simple measure with a very good cost/benefit ratio is the application of the "four-eyes" principle, i.e. that all data flows are controlled by a second person which is independent from the main person doing the data compilations[33].

Furthermore, the Methodology Act lists in the Monitoring Plan template, in Section A.5. Annex II to the Methodology Act, the following areas that may require attention:

- Quality assurance of the relevant measurement equipment (calibration and maintenance): It shall be ensured that all relevant measuring equipment is calibrated, adjusted, and checked at regular intervals including prior to use, and checked against measurement standards traceable to international measurement standards, where available, and proportionate to the risks identified.

  Where components of the measuring systems cannot be calibrated, those components shall be identified in the monitoring plan and alternative control activities shall be established.

  When the equipment is found not to comply with required performance, necessary corrective action shall be promptly taken.
- Quality assurance of information technology systems;
- Segregation of duties in the data flow activities and control activities;
- Management of necessary competence of staff;
- Internal reviews and validation of data: data resulting from the data flow activities shall be regularly reviewed and validated. Such review and validation of the data should include:
  - A check as to whether the data are complete;
  - Checks between the results of the primary data source and corroborating data source, where available;
  - A comparison of the data determined over the preceding reporting period and, in particular, consistency checks based on time series of greenhouse gas efficiency of the relevant production processes;
  - A comparison of data and values resulting from different operational data collection systems, in particular for production protocols, sales figures and stock figures of relevant goods;
  - Comparisons and completeness checks of data at the level of the installation and production process of relevant goods.
- Corrections and corrective action, where instruments or procedures fail, or where errors (e.g. double counting of fuel or material qualities) happen. In particular it shall be ensured that, where data flow activities or control activities are found not to function effectively, or not to respect the rules set in the documentation of

[33] Independence means e.g. if an accountant controls the head of environmental, safety & health department who is the main responsible for data collection. Note that regarding competence, both persons need to be trained in the basic concepts of GHG emissions monitoring for the CBAM.

procedures for those activities, corrective action is taken and affected data is corrected without undue delay.

- Control of out-sourced processes (e.g. where laboratories outside the installation are involved, or where instruments not under the operator's control are used): Where one or more data flow activities or control activities are outsourced from the installation, all of the following should be performed:
  - Checking the quality of the outsourced data flow activities and control activities in accordance with the needs of the Methodology Act;
  - Defining appropriate requirements for the outputs of the outsourced processes as well as the methods used in those processes;
  - Checking the quality of the outputs and methods referred to in the previous bullet point;
  - Ensuring that outsourced activities are carried out such that those are responsive to the inherent risks and control risks identified in the risk assessment.
- Keeping records and documentation including the management of document versions.

4.5.7 Updating the monitoring plan

Industrial installations tend to undergo modifications frequently for various reasons (technical improvements for debottlenecking, improving efficiency, expanding capacity, adjusting the product mix to market demand, adjusting to new raw materials, etc.). Some changes will not require a change of the monitoring plan, other changes will be of minor nature, and only fewer changes will be considered "significant". Point (g) of Article 3(1) of the Verification Principles Act contains a non-exhaustive list of changes that are considered 'significant'.

Where such significant changes take place, operators must update the monitoring plan without undue delay and apply it immediately. To be sure that the updated monitoring plan complies with the CBAM legislation, operators are recommended to seek the verifier's assessment of the changes as soon as possible. Otherwise, they risk applying inadmissible monitoring methodologies which could trigger material misstatements. However, operators are not obliged to meet specific deadlines. If their own risk assessment indicates that the monitoring plan update is in accordance with the Methodology Act, they may inform the verifier about the monitoring plan update during the next regular verification.

For minor MP updates, operators may collect the changes in a changes log and inform the verifier for the purpose of the next upcoming verification. However, even minor changes may lead to non-compliances under some circumstances, which may lead to misstatements in the data. Therefore, operators are recommended to make any monitoring plan changes only carefully, and in particular always strive for more accurate methodologies, for data flows that are less prone to errors, and to reduce the risk of data gaps.

To reduce administrative burden resulting from too frequent changes in the monitoring plan, and to avoid typical problems with monitoring plans, operators are advised to apply the following approach:

- Monitoring activities which are not crucial in every detail, and which by their nature tend to be frequently amended as found necessary, may be put into “written procedures”, which are mentioned and described briefly in the MP, but the detail of which are not considered part of the assessment of the MP. In particular, many activities require a clear assignment of the persons responsible. To avoid frequent updates, it is prudent to use generic names of the respective post (e.g. “shift master”, “environmental plant manager” etc. instead of indicating the name of the person currently filling the position).
- Measurement instruments should be clearly identified, e.g. using the position in the installation’s flow chart or process control system. It should be specified by its functional principle (e.g. “ultrasonic flow meter” and measurement range, and if possible its specified uncertainty). However, it is not necessary to specify the exact type or product name, or even serial number. Thereby, a simple exchange against very similar other measurement instruments (“like-for-like replacement”) does not need to trigger a monitoring plan change.

4.6 Determine installation’s direct emissions

The CBAM Regulation builds on the principle of applying a **top-down approach** to calculating embedded emissions, starting from the installation level, and splitting those emissions such that they are attributed to different production processes, and thereafter to products, with further embedded emissions added for precursor materials.[34] In this sub-section we provide guidance on how these calculations can be carried out.

The emissions at installation level can be monitored by different approaches, which can also be combined, provided that neither gaps nor double counting occur.

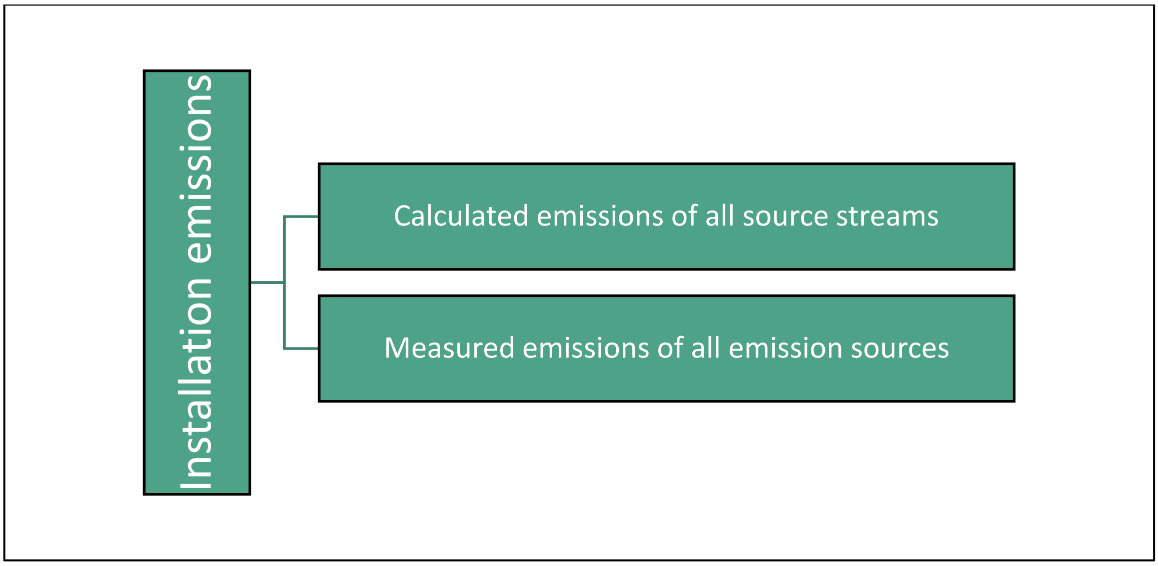
As an operator, you should select a **monitoring methodology** on the basis that it gives the most accurate and reliable results (see section 4.5.4), except where a particular method is required for sector-specific reasons. The monitoring methodologies allowed under the CBAM are:

- **Calculation-based approaches**, which entails determining emissions from source streams on the basis of activity data (such as fuel consumption data) and additional parameters from laboratory analyses or standard values, as necessary. Either the ‘standard methodology’ (which distinguishes combustion and process emissions) or ‘mass-balance methodology’ may be used.
- **Measurement-based approach**, which requires a continuous emissions monitoring system (CEMS) to directly measure emissions from emissions sources.

[34] Embedded emissions could theoretically also be calculated using a bottom-up approach. The starting point would be the product to be imported, which is traced through the value chain until all emissions from all previous production steps are added up. In practice, it is usually simpler to monitor the total emissions of a defined installation, since there is usually one main metering device for each fuel which is used in the whole installation, whereas there are less often sub-meters which allow the split of fuel quantity to individual production processes, so that is the method required by the Implementing Regulation for the CBAM.

You can also use a combination of the above approaches, provided that there is no double-counting or data gaps in the emissions reporting, which allows different parts of your installation to be monitored by either of the allowed approaches.

Figure 4-4: Overview of installation emissions



The above *Figure 4-4* illustrates how the installation's emissions are calculated according to the Methodology Act Annex II, which is in detail:

$$Em_{Inst} = \sum_{i=1}^{n} Em_{calc,i} + \sum_{j=1}^{m} Em_{meas,j} \qquad \text{(Equation 4)}$$

Where:

Em_{Inst} are the (direct) emissions of the installation expressed in tonnes CO_2e;

$Em_{calc,i}$ are the emissions from source stream *i* determined using a calculation-based methodology expressed in tonnes CO_2e;

$Em_{meas,j}$ are the emissions from emission source *j* determined using a measurement-based methodology expressed in tonnes CO_2e.

For the definition of the terms 'source stream' and 'emission source' please see section 4.2.2.1.

During the definitive period, **indirect emissions must be reported only for specific sectors**, as explained in section 4.1.3. This section is structured as follows:

- Everything regarding the **calculation-based method** will be summarised in section 4.6.1:
    - The **standard methodology** is discussed in section 4.6.1.1 (with separate sub-sections for combustion and process emissions);
    - The **mass balance** method is presented in section 4.6.1.2;

  - Rules for determining **activity data** are relevant for both, standard and mass balance method. The requirements are given in section 4.6.1.3;
  - Likewise, requirements for the **calculation factors** apply to both methods. The relevant rules (either choosing appropriate **standard values**, using correlations or performing **laboratory analyses** and the related sampling) are given in section 4.6.1.4;
- The **measurement-based method** (using Continuous Emission Measurement Systems, CEMS) is subject of section 4.6.2. It is of particular importance for monitoring of **nitrous oxide (N_2O)** emissions in the fertiliser sector (production of nitric acid).
- Since CO_2 emissions from **biomass** may be considered to be zero under certain conditions, section 4.6.3 gives guidance on the respective rules. These rules apply to all methods, i.e. calculation-based and measurement-based methods.
- The topic of **PFC (perfluorocarbon)** emissions is shortly touched in section 4.6.4.
- Finally, rules for **transfers of CO_2** between installations are mentioned in section 4.6.5.

The determination of indirect emissions of an installation is thereafter discussed in section 4.7. From section 4.8 onwards, the rules are described that are necessary for splitting ('attributing') the installation's direct and indirect emissions to production processes. A completely different type of data to be reported is any effective carbon price paid. Nevertheless, it should be on the operator's agenda and documented in the monitoring methodology.

Equally connected, but different, is the monitoring and reporting of "specific embedded free allocation" values, i.e. a value that is deducted from the embedded emissions to determine the CBAM obligation in order to reflect the gradual phasing-out of EU ETS free allocation (and related phase-in of the CBAM).

4.6.1 Calculation-based approach

4.6.1.1 Standard methodology

The standard approach is straightforward to apply in cases where a fuel or material is directly related to the emissions. It entails the calculation of emissions by means of **activity data** (e.g. amount of fuel or process input material consumed) multiplied by an **emission factor**; two other factors may be applied for correcting the emissions numbers in case of incomplete chemical reactions, based on laboratory analyses, namely the **oxidation factor** for combustion emissions, and the **conversion factor** for process emissions.

Key requirements for using the standard method are:

- **Combustion emissions** – Minimum requirements: Fuel quantity (t or m^3), Emission factor (t CO_2/t or t CO_2/m^3); ***Recommended improvement**: Fuel quantity (t or m^3), NCV (TJ/t or TJ/m^3), Emission factor (t CO_2/TJ), Oxidation factor, Biomass fraction*.

- **Process emissions** – Minimum requirements: Activity data (t or m^3), Emission factor (t CO_2/t or t CO_2/m^3); ***Recommended improvement****: Activity data (t or m^3), Emission factor (t CO_2/t or t CO_2/m^3), conversion factor.*

Standard method formulae for combustion and process emissions and parameters are given in the Methodology Act Annex II, section B.3.1, and are discussed in further detail below.

Combustion emissions[35]

Combustion emissions are calculated as

$$\boxed{Em_i = AD_i \cdot EF_i \cdot OF_i \quad \text{(Equation 5)}}$$

Where:

Em_i…Emissions [t CO_2] caused by fuel i

AD_i…Activity data [TJ] of fuel i, calculated as

$$\boxed{AD_i = FQ_i \cdot NCV_i \quad \text{(Equation 6)}}$$

EF_i…Emission factor [t CO_2/TJ, t CO_2/t or t CO_2/Nm^3] of fuel i

OF_i…Oxidation factor (dimensionless) of fuel i, calculated as

$$\boxed{OF = 1 - C_{ash}/C_{total} \quad \text{(Equation 7)}}$$

And:

FQ_i… Fuel quantity consumed [t or m^3] of fuel i

NCV_i… Net Calorific Value (lower heating value) [TJ/t or TJ/m^3] of fuel i

C_{ash}… Carbon contained in ash and flue gas cleaning dust (soot)

C_{total}… Total carbon contained in the fuel combusted

Factors with units in tonnes are usually to be used for solids and liquids. Nm^3 are usually used for gaseous fuels. In order to achieve numbers of similar magnitude, values are usually given in [1000 Nm^3] in practice.

The **oxidation factor** for combustion emissions is typically determined by laboratory analyses. The two C variables, above, are expressed as [tonnes C] i.e. the quantity of material or fuel times the concentration of carbon in it. Therefore, not only the carbon content of the ash has to be determined by analysis, but also the amount of ash must be determined for the period for which the oxidation factor is determined.

In order to reduce monitoring effort, you, as an operator, may always use the conservative assumption that ***OF = 1***. Simplified!

For combustion emissions, the emission factor is usually expressed in relation to the energy content (NCV) of the fuel rather than its mass or volume:

---

35 'Combustion emissions' are defined by the Implementing Regulation as *greenhouse gas emissions occurring during the exothermic reaction of a fuel with oxygen*.

- If the emission factor of a fuel is to be calculated from the analyses of carbon content and NCV, the following equation is used: $\boxed{EF_i = CC_i \cdot \frac{f}{NCV_i}}$ (Equation 8)
- If the emission factor of a material or fuel expressed as t CO_2/t is to be calculated from an analysed carbon content, the following Equation 9 is used: $\boxed{EF_i = CC_i \cdot f}$ Where f is the ratio of molar mass of CO_2 to C: $\boxed{f = 3{,}664 \text{ t } CO_2/\text{t C}}$

It is acceptable to modify the above approach, where you have evidence that higher accuracy can be achieved, as follows:

- Activity data is expressed as fuel quantity (i.e. in t or m^3), rather than using the above equation;
- EF is expressed as t CO_2/t fuel or t CO_2/m^3 fuel, as applicable; and
- NCV can be omitted from the calculation if an EF expressed as t CO_2/t fuel is used. However, a recommended improvement is to report NCV for allowing consistency checking and your own monitoring of the energy efficiency of **the whole production process.**

Where **biomass** is used as a fuel for combustion and it complies with the sustainability and GHG emissions saving criteria established by the 'Renewable Energy Directive' (RED II)[36], it may be zero-rated for emissions. This applies for accounting purposes only, while physically, still CO_2 is emitted from the installation. Details on these "RED II criteria" are given in section 4.6.3.

Where mixed fuels (i.e. fuels which contain both fossil and biomass components) are used, the emission factor must be determined from the preliminary emission factor and the (zero-rated) biomass fraction of the fuel according to the following equation:

$$\boxed{EF_i = EF_{pre,i} \cdot (1 - BF_i)} \quad \text{(Equation 10)}$$

Where:

EF_i…Emission factor of fuel i

$EF_{pre,i}$… preliminary emission factor of fuel i (i.e. emission factor assuming the total fuel is fossil)

BF_i… Biomass Fraction (dimensionless) of fuel i

For fossil fuels and where the biomass fraction is unknown, BF_i is set to the conservative value zero.

[36] Directive (EU) 2018/2001 (2018) on the promotion of the use of energy from renewable sources http://data.europa.eu/eli/dir/2018/2001/2024-07-16)

Process emissions[37]

Process emissions are calculated as

$$\boxed{EM_j = AD_j \cdot EF_j \cdot CF_j} \text{ (Equation 11)}$$

Where:

Em_j…Emissions [t CO_2] caused by material j

AD_j…Activity data [t of material] of material j

EF_j…Emission factor [t CO_2 / t] of material j

CF_j…Conversion factor (dimension-less) of material j

You may use the conservative assumption that the ***CF = 1*** in order to reduce monitoring effort. Simplified!

Activity data in the above equation may refer to either: an input material; or, to the resulting output from the process. For this purpose, two methods for calculating process emissions are possible Method A (input based) and Method B (output based).

Both methods are considered equivalent. However, Method B (output based) **may only be used where CO_2 process emissions are from carbonates**. For CO_2 process emissions other than from carbonates, only method A should be used. An important case of carbonate process emissions occur during **flue gas desulphurisation** which need to be included in the calculation of the emissions related to heat, electricity and CHP units (see sections 4.8.2 to 4.8.4)[38].

Carbonate materials process emissions

For calculating process emissions from the thermal decomposition of carbonate-based (inorganic) materials, either of two methods is possible:

- **Method A (input based):** The emission factor, conversion factor and activity data are related to the amount of material input (carbonates) into the process, for which the standard emission factors for carbonates in the Methodology Act, Annex II, Section G, Table 3 should be used (taking into account the composition of the material).
- **Method B (output based):** The emission factor, conversion factor and activity data are related to the amount of material output (metal oxides) from the process, for which standard emission factors for metal oxides in the Methodology Act, Annex

37 'Process emissions' are defined by the Implementing Regulation as *greenhouse gas emissions **other than combustion emissions** occurring as a result of intentional and unintentional reactions between substances or their transformation, for a **primary purpose other than the generation of heat**, including from the following processes:*
(a) the chemical, electrolytic or pyrometallurgical reduction of metal compounds in ores, concentrates and secondary materials;
(b) the removal of impurities from metals and metal compounds;
(c) the decomposition of carbonates, including those used for flue gas cleaning;
(d) chemical syntheses of products and intermediate products where the carbon bearing material participates in the reaction;
(e) the use of carbon containing additives or raw materials;
(f) the chemical or electrolytic reduction of metalloid oxides or non-metal oxides such as silicon oxides and phosphates.

38 A second type of process emissions for flue gas cleaning occurs where urea is used for removing NO_x.

II, Section G, Table 4 should be used (taking into account the composition of the material).

The standard factors mentioned can also be found in **Annex D** of this guidance document.

In choosing which method to use, the method giving the more accurate results **for each source stream** should be used, taking into account the available measurement systems for activity data, and that avoids unreasonable costs.

Mixed materials process emissions

In case of mixed process input materials, which contain inorganic as well as organic forms of carbon, you may choose to:

- Determine a total preliminary emission factor for the mixed material by analysing the total carbon content, and using a conversion factor and – if applicable – biomass fraction and net calorific value related to that total carbon content; or

- Determine the organic and inorganic contents separately and treat them as two separate source streams.

In both cases, Method A is to be applied. For the biomass fraction of mixed materials, the emission factor for biomass may be set to zero, provided the main purpose of the material's use is different from energy production (i.e. it needs to be clarified that it is really compliant with the definition of 'process emissions'[37]). If the main purpose is heat generation, the "RED II" criteria have to be met for allowing zero-rating of the emissions, as discussed under section 4.6.3 on 'Rules for biomass'.

4.6.1.2 Mass balance method

Like the standard approach, the mass balance approach is a calculation-based method for determining the emissions of an installation. It is used with complex installations, for example at an integrated steelworks, where it may be difficult to link the emissions directly to individual input materials, because the products (and wastes) contain significant amounts of carbon.

Using a mass balance approach, a complete balance of carbon entering and leaving the installation or a defined part thereof is used. The CO_2 quantities relevant for each source stream are calculated based on the carbon content in each material, without distinguishing fuels and process materials. Non-emitted carbon leaving the installation in products is taken into account by output source streams, which have therefore negative activity data.

Mass balance method formulae and parameters are set out in the Methodology Act Annex II, Section B.3.2.

Key requirements for using the mass balance approach method are: Minimum requirement: Material quantity (t), Carbon content (t C /t material); ***Recommended improvement****: Material quantity (t), Carbon content (t C /t material), NCV (TJ/t), biomass fraction, evidence for meeting the criteria of point B.3.3. of Annex II to the Methodology Act 'Criteria for zero-rating of biomass emissions'.*

The following remarks should be considered when setting up a monitoring approach using a mass balance:

- Emissions of carbon monoxide (CO) to the atmosphere are not counted as outgoing source stream in the mass balance, but are considered as the molar equivalent amount of CO_2 emissions. This is easily accomplished by just not listing the CO as outgoing material.
- It is important to comply with the principle of completeness of the monitoring data, i.e. all input materials and fuels must be taken into account, if not monitored by an approach outside the mass balance.

The mass balance is implemented by calculating emissions corresponding to each source stream as follows: $\boxed{Em_k = f \cdot AD_k \cdot CC_k}$ (Equation 12)

Where:

AD_k … activity data [t] of material k; for outputs, AD_k is negative;

f is the ratio of the molar masses of CO_2 and C: $f = 3.664$ t CO_2/t C, and

CC_k is the carbon content of material k (dimensionless and positive).

If the carbon content of a fuel k is calculated from an emission factor expressed in t CO_2/TJ, the following equation shall be used: $\boxed{CC_k = EF_k \cdot NCV_k / f}$ (Equation 13)

If the carbon content of a material or fuel k is calculated from an emission factor expressed in t CO_2/t, the following equation shall be used: $\boxed{CC_k = EF_k / f}$ (Equation 14)

Treatment of biomass in mass balances

Emissions from biomass may be zero-rated if the biomass complies with the “RED II criteria” (see section 4.6.3). Since those criteria apply only to energetic use of biomass, it must be established for such source streams if they are used primarily for energy purposes. For example, charcoal used as reducing agent in a blast furnace will qualify as primary non-energetic use.

For mixed fuels or materials containing biomass being included as inputs in a mass balance, the preliminary carbon content is to be adjusted for the fossil fraction only. Where the biomass fraction is not known, it must be taken as if there was no biomass used:

$$\boxed{CC_k = CC_{pre,k} \cdot (1 - BF_k)} \quad \text{(Equation 15)}$$

Where:

$CC_{pre,k}$ is the preliminary carbon content of fuel k (i.e. emission factor assuming the total fuel is fossil) and

BF_k is the Biomass Fraction of fuel k (dimensionless).

Where biomass is used as input material or fuel, and output materials contain carbon, the overall mass balance shall treat the biomass fraction conservatively, meaning that the fraction of biomass in total output carbon shall not exceed the total fraction of biomass contained in input materials and fuels, except if the operator provides evidence of a higher biomass fraction in the output materials by a “trace the atom” (stoichiometric) method or by ^{14}C analyses.

4.6.1.3 Rules for activity data

Section B.4 of Annex II to the Methodology Act provides the requirements for determining activity data. Two generic approaches are applicable:

- **Continual metering** at the process where the material is consumed or produced;
- **Batch-wise** determination: Quantities separately (batch-wise) delivered or produced are added up over the reporting year taking into account relevant stock changes. For this purpose, the following formulae shall apply:
    - $Cons = I - E + S_{start} - S_{end}$
    - $Prod = E - I - S_{start} + S_{end}$

Where *Cons* is the amount of fuel or material consumed during the reporting period, *I* is the amount of the fuel or material 'imported'[39] to the installation during the reporting period, *E* is the amount of the fuel or material 'exported'[40] from the installation during the reporting period, S_{start} is the stock at the start of the reporting period and S_{end} is the stock at the end of the reporting period.

Where you as an operator find that it would incur unreasonable costs (see section 4.5.5) to determine quantities in stock by direct measurement, those quantities may be estimated either based on data from previous years and correlated with appropriate activity levels for the reporting period, or based on documented procedures and respective data in audited financial statements for the reporting period. Furthermore, if using the exact date at the end of the reporting period leads to unreasonable costs, the next most appropriate day may be chosen to separate a reporting period from the following one. The deviations involved for each product, material or fuel are to be clearly recorded to form the basis of a value representative for the reporting period and to be considered consistently in relation to the next year.

According to the Methodology Act, it is preferred that you use measurements which are under your, the operator's control. However, if your installation does not have the relevant measurement instruments available, it is acceptable for limiting the monitoring costs to use other measurements, in particular instruments belonging to the supplier of fuels or materials, where a commercial transaction is involved, which requires a quality of instruments that enables mutual trust (these ore often instruments under 'legal metrological control'). Using such instruments outside the operator's control is furthermore recommended in case they lead to more accurate results than the operator's own instruments, or if there are other reasons that lead to a lower risk of errors in the data flow (see section 4.5.6 on control measures).

If you as operator make use of a measurement systems outside your own control, you may either use direct readings from that measurement system, if possible, or amounts taken from invoices issued by the trade partner.

---

[39] 'Import' to the installation includes purchases as well as amounts received without commercial transaction, e.g. materials received from the operator's own mining sites.

[40] 'Export' from the installation includes sales as well as amounts transferred out of the installation for other purposes, e.g. materials sent to an external waste treatment or scrap recycling plant.

Requirements for measurement systems

The key concept for judging the quality of a measuring instrument is the 'uncertainty' associated with the values read from the instrument. As an operator, you need a thorough understanding of that concept for making a choice on the "best" data source. See for this purpose also section 4.5.4 (Choosing best available data sources).

Recommended improvement: *you should aim to achieve a measurement uncertainty commensurate with the total emissions of the source stream or emission source, with the lowest uncertainty for the biggest parts of the emissions.*

In light of the above statement, the Methodology Act gives a range for orientation: For the biggest emissions (source streams leading to emissions of more than 500 000 t CO_2 per year), the uncertainty over the full reporting should be 1,5 % or better, while for the smallest sources (source streams leading to emissions below 10 000 t CO_2 per year), uncertainty lower than 7,5 % is considered acceptable. These values are understood to apply if they do not lead to unreasonable costs.

Where you have to replace a measuring instrument, e.g. because of malfunction or because calibration shows that the desired uncertainty is not met anymore, you should replace it by an instrument that ensures meeting the same or a better uncertainty level compared to the existing instrument. (i.e. you should always strive for improvement of the monitoring method, but at least keep the existing standard).

4.6.1.4 Rules for calculation factors

Calculation factors are all variables used in the calculation-based approaches except the activity data. This section covers rules for the emission factor (EF), net calorific value (NCV), oxidation factor (OF), conversion factor (CF), carbon content (CC) and biomass fraction (BF) for the formulae given in sections 4.6.1.1 (standard method) and 4.6.1.2 (mass balance).

In principle, calculation factors are the *qualitative information* on the source streams, which can be determined by laboratory analyses. However, as these involve significant efforts and require specialised competence, the calculation factors are often set to fixed values in the monitoring methodology. This is justified as – on average over a whole GHG reporting system – they provide sufficiently representative data.

The calculation factors need to be determined consistently with the state used for related activity data. For example, if the activity data relates to coal weighted as taken from a pile, which may contain significant moisture from rain or dust prevention, then also NCV and carbon content have to be determined with the same moisture level. If the laboratory analyses are carried out on dry material, the activity data must be adjusted accordingly for moisture, or vice versa.

The Methodology Act allows the following methods for setting calculation factors (with increasing data quality, i.e. the first ones are meant for rather small source streams, while for the largest emissions the best type of analyses is recommended):

1. **Fixed values** ("type I standard values");
2. Fixed Values ("type II standard values");

3. **Correlations** for determining proxy data;
4. **Laboratory analyses** carried out outside the operator's control, e.g. by the supplier of the fuel or material, contained in purchase documents, without further information on the methods applied;
5. Laboratory analyses in non-accredited laboratories, or in accredited laboratories, but with simplified sampling methods; and
6. Laboratory analyses in accredited laboratories, applying best practice regarding sampling.

Fixed values

As an operator, you can choose from a relatively large set of options to find the most appropriate value for each of the calculation factors of each source stream you need to monitor. For ensuring consistency over time and for preventing arbitrary changes in the data, you must lay down in the monitoring plan (MP) which values you are using. In some cases (e.g. national GHG inventories of the country where the installation is situated), these values may change over time. In such case you need to document and implement a procedure which allows regular updating of this value (in this example, the procedure would e.g. entail that a defined person is responsible for updating this value once a year before compiling all emissions data; to do this they would need to look up the latest national GHG inventory and determine the required factor from there).

The following are considered 'Type I standard values' (which are applicable only if no Type II standard value is available for the same parameter and material or fuel):

- Standard factors provided in point G of Annex II to the Methodology Act (attached to this guidance document as Annex D);
- Standard factors contained in the latest IPCC guidelines for GHG inventories[41];
- Values based on laboratory analyses carried out in the past, not older than 5 years and considered representative for the fuel or material.

The following are considered 'Type II standard values' (which are considered more accurate than 'Type I' values):

- Standard factors used by the country where the installation is located for its latest national inventory submission to the Secretariat of the United Nations Framework Convention on Climate Change (UNFCC);
- Values published by national research institutions, public authorities, standardisation bodies, statistical offices etc. for the purpose of more disaggregated emissions reporting than under the previous point[42];

[41] United Nations International Panel on Climate Change (IPCC): IPCC Guidelines for National Greenhouse Gas Inventories. Note that also the values in point G Annex II to Methodology Act are taken from this source, but the IPCC guidelines contain more data than that annex.

[42] For example, the national GHG inventory may use only one emission factor for coal in the country, but a research institute may have published different factors representative for different coal mines or mining regions. If you know the source of your coal, these factors will be more appropriate to use.

- Values specified and guaranteed by the supplier of a fuel or material where there is evidence that the carbon content exhibits a 95 % confidence interval of not more than 1 %[43];
- Stoichiometric values for the carbon content and related literature values for the net calorific value (NCV) of a pure substance;
- Values based on laboratory analyses carried out in the past not older than two years and considered representative for the fuel or material.

Note that in order to ensure consistency over time, the standard values used shall be laid down in the monitoring plan. If a new value is used because it is more adequate and representative for the fuel or material used than the previous one this must be evidenced.

If, however, the standard values change more frequently such as on an annual basis, the authoritative applicable source of that value shall be laid down in the monitoring plan instead of the value itself.

Correlations for determining proxy data

You may determine a proxy for the carbon content or emission factor from the following parameters:

- Density measurement of specific oils or gases, including those common to the refinery or steel industry;
- Net calorific value for specific coal types.

The pre-condition for using such correlation is that you can establish an empirical correlation at least once per year using laboratory analyses meeting the requirements given below. The difference to using directly analyses for determining the calculation factors lies in the fact that you need to carry out the analyses only once a year for establishing the correlations, and not for each batch of material. This reduces the overall costs of your monitoring.

Requirements for laboratory analyses

This section applies to all types of laboratory analyses required for determining properties of materials and for determining correlations (see above). Note that this is not limited to source streams and the calculation-based approaches, but may also relate to the goods produced and to all measurements used for measurement-based approaches.

For each batch of material or fuel subject to analyses, a representative sample is required. Analysis results shall only be used in calculations in respect of the batch from which the sample was taken.

Any analyses, sampling, calibrations and validations for the determination of calculation factors shall be carried out by applying methods based on corresponding ISO standards. Where such standards are not available, the methods shall be based on suitable (European) EN or national standards. Where no applicable published standards exist, suitable draft standards, industry best practice guidelines or other scientifically proven methodologies may be used, limiting sampling and measurement bias.

[43] If this variation level is not complied with, the value would be considered a ‘Type I’ value.

Analysis frequency

The number of analyses per fuel or material per year strongly impacts the overall costs for monitoring. It is therefore desirable not to carry out too many analyses. However, where materials are very heterogeneous, more analyses are required. Below we discuss the required or recommended analyses frequency. This must not be misunderstood as the frequency of taking samples, which is discussed thereafter.

The Methodology Act in Annex II Section B.5.4.2 contains a table with minimum frequencies of analyses for different material types. These build on experience in the EU ETS for being useful orders of magnitude. If you as an operator want to deviate from this table, you should consider the following:

- If the minimum frequency listed in would incur unreasonable cost;
- If the fuel or material is sufficiently homogenous (demonstrated based on data from recent reporting periods), you may apply lower analysis frequencies. This is the case if any variation in the analytical values for the respective fuel or material does not exceed 1/3 of the uncertainty that you apply in determining the activity data of the relevant fuel or material.

If the table does not contain an applicable minimum frequency, the best choice is to use this 1/3 rule, i.e. to chose to analyse as frequently as it leads to this 1/3 uncertainty over the whole reporting period.

Table 4-5: Minimum analyses frequencies in accordance with the Methodology Act

Fuel/material	**Minimum frequency of analyses**
Natural gas	At least weekly
Other gases, in particular synthesis gas and process gases such as refinery mixed gas, coke oven gas, blast-furnace gas, convertor gas, oilfield, and gas field gas	At least daily — using appropriate procedures at different parts of the day
Fuel oils (for example light, medium, heavy fuel oil, bitumen)	Every 20 000 tonnes of fuel and at least six times a year
Coal, coking coal, coke, petroleum coke, peat	Every 20 000 tonnes of fuel/material and at least six times a year
Other fuels	Every 10 000 tonnes of fuel and at least four times a year
Untreated solid waste (pure fossil or mixed biomass/fossil)	Every 5 000 tonnes of waste and at least four times a year
Liquid waste, pre-treated solid waste	Every 10 000 tonnes of waste and at least four times a year
Carbonate minerals (including limestone and dolomite)	Every 50 000 tonnes of material and at least four times a year
Clays and shales	Amounts of material corresponding to emissions of 50 000 tonnes of CO_2 and at least four times a year

Fuel/material	Minimum frequency of analyses
Other materials (primary, intermediate, and final product)	Depending on the type of material and the variation, amounts of material corresponding to emissions of 50 000 tonnes of CO_2 and at least four times a year

Note regarding "number of times a year" in Table 4-5 above: Where an installation operates for part of the year only, or where fuels or materials are delivered in batches that are consumed over more than one reporting period, a more appropriate schedule for analyses may be chosen, provided that it results in a comparable uncertainty as under the last point of the previous paragraph.

"Frequency of Sampling" versus "Frequency of Analyses"[44]

The Methodology Act refers to "Frequency of Analyses" in Annex II section B.5.4.2. Depending on the specific situation, the operator may note in the MP e.g. that the minimum frequency of analyses of the emission factor of a certain source stream is four times a year.

This term "Frequency of Analyses" must not be confused with the "Frequency of Sampling", i.e. the frequency of taking samples or increments from a batch or delivery of a fuel or material. In general, a lot more samples/increments than four have to be taken over the year to obtain representative results.

Example: A coal firing plant is burning 500 000 tonnes of coal a year. In accordance with Table 4-5, the operator is required as a minimum to analyse every 20 000 tonnes of coal. This will at least result in 25 different laboratory samples that are analysed each year. The main objective of the sampling plan, which also includes the frequency of sampling, is to prepare (at least) 25 laboratory samples that are representative for each of the 20 000 tonne batches. In order to have representative laboratory samples more than just one sample/increment will have to be taken from each 20 000 tonne batch.

Sampling

Samples shall be representative for the total batch or time period of deliveries for which they are taken. In order to ensure representativeness, the heterogeneity of the material has to be taken into account, as well as all other relevant aspects such as the available sampling equipment, possible segregation of phases or local distribution of particle sizes, stability of samples, etc. The sampling method shall be laid down in the monitoring plan.

It is **recommended improvement** to use a dedicated **sampling plan** for each relevant material or fuel, following applicable standards, containing the relevant information on methodologies for the preparation of samples, including information on responsibilities,

44 Text based on Guidance document No.5 on EU ETS Monitoring and Reporting ("Sampling and Analyses"), https://climate.ec.europa.eu/system/files/2021-10/policy_ets_monitoring_gd5_sampling_analysis_en.pdf

locations, frequencies and quantities, and methodologies for the storage and transport of samples. More detailed guidance on sampling plans (although from the perspective of the EU ETS instead of the CBAM) can be found in the Commission's EU ETS Guidance document No.5.

Recommendations for laboratories

Laboratories used to carry out analyses for the determination of calculation factors shall be accredited in accordance with ISO/IEC 17025, for the relevant analytical methods. Laboratories not accredited may be used for the determination of calculation factors only where there is evidence that access to accredited laboratories is technically not feasible or would incur unreasonable costs (see section 4.5.5), and that the non-accredited laboratory is sufficiently competent. A laboratory is considered sufficiently competent if it fulfils all of the following criteria:

- It is economically independent of the operator, or at least organisationally shielded from influence by the management of the installation;
- It applies the applicable standards for the analyses requested;
- It employs personnel competent for the specific tasks assigned;
- It appropriately manages the sampling and sample preparation, including control of sample integrity;
- It regularly carries out quality assurance on calibrations, sampling and analytical methods, by suitable methods, including regular participation in proficiency testing schemes, applying analytical methods to certified reference materials, or inter-comparison with an accredited laboratory; and
- It manages equipment appropriately, including by maintaining and implementing procedures for calibration, adjustment, maintenance and repair of equipment, and record keeping thereof.

Determining the biomass fraction

For the determination of the biomass fraction some additional rules are to be taken into account:

- The biomass fraction needs to be determined only for mixed materials which contain biomass and fossil fractions. For pure fossil fuels, the biomass fraction is zero. For pure biomass, it is one (100%).
- If the biomass fraction is hard to analyse or if as an operator you do not want to make use of zero-rating (e.g. because the biomass fraction is very small anyway), you may apply the conservative approach to assume the whole material to be fossil.
- Only biomass which complies with the "RED II criteria" (see section 4.6.3) may be counted as "biomass fraction". Any remaining other biomass is counted as part of the fossil fraction.

Additional guidance:

- If you want to determine the biomass fraction by laboratory analyses, the appropriate standard to use is ISO 21644:2021 (Solid recovered fuels – Methods for the determination of biomass content) or EN 15440 (Solid recovered fuels – Methods for the determination of biomass content). These standards offer three methods (selective dissolution method; manual sorting method; ^{14}C method). All three methods have advantages and disadvantages. Therefore, the method to be used must be carefully selected for the specific purpose of the source stream at hand, taking into account the limitations of each method as described in the standard.

- As industrial installations often use wastes from defined production processes from their own or from neighbouring installations, the composition of the wastes is often well-known. It is therefore an acceptable approach to determine the biomass fraction based on a kind of mass balance of the process producing the waste, where possible. For example, if wastes from a wood particle board producer are combusted, it may be possible to determine the biomass fraction (wood) and fossil fraction (resins) from the "recipe" of the boards.

4.6.2 Measurement-based Methodology – Continuous Emission Measurement Systems (CEMS)

In contrast to the calculation-based approaches, the greenhouse gases in the installation's off-gases in the stack may be measured. This is difficult in installations with many emission points (stacks) or indeed impossible where fugitive emissions have to be taken into account. On the other hand, the strength of the measurement-based methodologies is the independence of the number of different fuels and materials used (e.g. where many different waste types are combusted).

The application of CEMS (Continuous Emission Measurement Systems) always requires two elements:

- Measurement of the GHG concentration; and
- Measurement of the volumetric flow of the gas stream where the measurement takes place.

The Methodology Act requires the mandatory use of the measurement-based approach for the monitoring of N_2O emissions, where this is defined as a relevant greenhouse gas emission for the CBAM good (i.e. for nitric acid and fertiliser production).

The Methodology Act gives detailed requirements in Section B.6 of Annex II. The essential requirements are summarised here.

Calculating the emissions of a reporting period (annual emissions)

$$GHG\ EM_{total}[t] = \sum_{i=1}^{HoursOp}\left(GHG\ conc_{hourly,i} \cdot V_{hourly,i}\right) \cdot 10^{-6}[t/g] \quad \text{(Equation 16)}$$

Where:

$GHG\ Em_{total}$ are the total annual GHG emissions in tonnes; *$GHG\ conc_{hourly,\ i}$* are the hourly concentrations of GHG emissions in g/Nm^3 in the flue gas flow measured during operation for hour or shorter reference period *i*; *$V_{hourly,\ i}$* is the flue gas volume in Nm^3 for one hour *i,* determined by integrating the flow rate over the hour, and *HoursOp* = are the total number of hours for which the measurement-based methodology is applied, including the hours for

which data has been substituted in accordance with Section B.6.2.6 of Annex II. The index *i* refers to the individual operating hour (or reference periods).

Hourly values shall be averages over all individual measurements during that hour. Note that instead of full hours other reference periods (e.g. half-hours) may be used, if this fits better to the configuration of the measuring instrument or to requirements for measurements for other purposes carried out at the installation.

The concentration of the GHG under consideration is determined by direct measurement at a representative point, but in the case of high concentration in the flue gas may be calculated by indirect measurement, taking into account the measured concentration of all other components *i* of the gas stream using the following equation.

$$GHG\ conc\ [\%] = 100\% - \sum_i\ Conc_i\ [\%] \quad \text{(Equation 17)}$$

Recommended improvement: *for CEMS is to achieve an uncertainty of 2,5 % at least for emission sources emitting more than 100 000 tonnes of fossil CO_2e per reporting period.*

CO_2 emissions from biomass

Where relevant, any CO_2 amount stemming from biomass which complies with the "RED II criteria" (see section 4.6.3) may be subtracted from the total measured CO_2 emissions. For this purpose, one of the following methods must be used to determine the amount of biomass CO_2 emissions:

1. A calculation-based methodology, determining the biomass fractions of all used source streams separately;

2. Methodologies using analyses and sampling based on ISO 13833 (Stationary source emissions — Determination of the ratio of biomass (biogenic) and fossil-derived carbon dioxide — Radiocarbon sampling and determination);

3. The 'balance method' based on ISO 18466 (Stationary source emissions — Determination of the biogenic fraction in CO_2 in stack gas using the balance method);

4. Other methods based on relevant international standards.

Determination of flue gas flow

The measurement of the flue gas flow is difficult, as the measuring point(s) must be selected such that measurement is representative for the whole stack's cross section (see also "quality requirements" below). Therefore, as an alternative method, flow may be calculated using a suitable mass balance. This would have to take into account, for CO_2 emissions: all significant parameters on the input side, including at least input material loads, input airflow and process efficiency, and on the output side at least the product output and the concentration of oxygen (O_2), sulphur dioxide (SO_2) and nitrogen oxides (NO_X).

In the specific case of N_2O measurement in nitric acid production, if it is not technically feasible to use a mass balance, then flue gas flow may be determined using continuous emissions flow measurement. The flue gas flow shall be calculated in accordance with the following formula:

$$V_{flue\ gas\ flow}[Nm^3/h] = V_{air} \text{ x } (1 - O_{2,air})/(1 - O_{2,flue\ gas}) \text{ (Equation 29)}$$

Where: V_{air} is the total input air flow in Nm^3/h at standard conditions; $O_{2,air}$ is the volume fraction of O_2 in dry air (= 0,2095); and $O_{2,flue\ gas}$ is the volume fraction of O_2 in the flue gas. V_{air} shall be calculated as the sum of all air flows entering the nitric acid production unit, in particular primary and secondary input air, and seal input air, where applicable. All measurements shall be adjusted to a dry gas basis and reported consistently.

Treatment of measurement gaps

Where the continuous measurement equipment for a parameter is out of control, out of range or out of operation for part of the hour or reference period, the related hourly average shall be calculated pro rata to the remaining data points for that specific hour or shorter reference period, provided that at least 80 % of the maximum number of data points for a parameter are available. Where fewer than 80 % of the maximum number of data points for a parameter are available, the following calculation is used:

$$C^*_{subst} = \bar{C} + 2\ \sigma_c \text{ (Equation 19)}$$

Where: $\bar{C}$ is the arithmetic mean of the concentration of the specific parameter over the whole reporting period or, where specific circumstances applied when data loss occurred, an appropriate period reflecting the specific circumstances and σ_c is the best estimate of the standard deviation of the concentration of the specific parameter over the whole reporting or, where specific circumstances applied when data loss occurred, an appropriate period reflecting the specific circumstances.

Where the reporting period is not applicable for determining such substitution values due to significant technical changes at the installation, another sufficiently representative timeframe shall be chosen for determining the average and standard deviation, where possible with the duration of at least 6 months.

In the case of a parameter other than concentration, substitute values shall be determined through a suitable mass balance model or an energy balance of the process. This model shall be validated by using the remaining measured parameters of the measurement-based methodology and data at regular working conditions, considering a time period of the same duration as the data gap.

Quality requirements

All measurements shall be carried out applying methods based on international standards, such as:

- ISO 20181:2023 Stationary source emissions — Quality assurance of automated measuring systems;
- ISO 14164:1999 Stationary source emissions — Determination of the volume flowrate of gas streams in ducts — Automated method;

- other relevant ISO standards[45], in particular ISO 16911-2 (Stationary source emissions — Manual and automatic determination of velocity and volume flow rate in ducts).

Where no applicable published standards exist, suitable draft standards, industry best practice guidelines or other scientifically proven methodologies shall be used, limiting sampling and measurement bias.

All relevant aspects of the continuous measurement system shall be considered, including the location of the equipment, calibration, measurement, quality assurance and quality control. For competence requirement of the laboratory, see section 4.6.1.4.

Further requirements

CO_2 emissions determined by a measurement-based methodology shall be **corroborated by calculating** the annual emissions of each greenhouse gas in question for the same emission sources and source streams. For this purpose, the requirements for calculation-based approaches may be simplified as appropriate.

Where CO_2 is measured, any amounts of carbon monoxide (CO) emitted shall be taken into account as the molar equivalent of CO_2.

4.6.3 Treatment of biomass emissions

The textbox below signposts the key sections for biomass in the Methodology Act, relevant for the CBAM definitive period.

Methodology Act references:

Annex II, Section A.2. and Section B Monitoring of direct emissions, B.3.3 Criteria for zero-rating of biomass emissions and B.6.2.3 CO_2 emissions from biomass (CEMS).

Annex II, Standard factors used in the monitoring of direct emissions, section G, Table 2.

All biomass emissions must be treated like fossil emissions, unless evidence for meeting the criteria for zero rating in accordance with Section B.3.3 of Annex II to the Methodology Act is provided.

Criteria for zero rating

Under the rules for GHG inventories established by the IPCC and used under the Paris agreement, CO_2 emissions of biomass are accounted for at the point where the biomass is harvested (e.g. when a forest is felled). To avoid double counting it is therefore logical to **"zero-rate" these emissions**, i.e. to account for the CO_2 emissions as zero, where biomass is consumed as fuel or process material, despite the fact that CO_2 is physically emitted to the atmosphere at that point. EU climate policy has found that this type of accounting may lead to some unintended incentive to use biomass excessively with unfavourable

45 For example, the following could be considered: ISO 14385-1:2014 Stationary source emissions — Greenhouse gases — Part 1: Calibration of automated measuring systems; Part 2: Ongoing quality control of automated measuring systems.

environmental impacts (e.g. on biodiversity and soil quality). Therefore, the EU's legal instrument for encouraging the use of renewable energy, the "RED II" (re-cast Renewable Energy Directive[46]), introduced a set of "**sustainability and GHG savings criteria**"[47] (which are summarised as "**RED II criteria**" in this guidance document), which have to be met for zero-rating biomass emissions. These criteria shall apply irrespective of the geographical origin of the biomass. The monitoring rules under the EU ETS require that those criteria have to be met for zero-rating biomass emissions from combustion. Otherwise, the emissions are treated as if they were from fossil sources. **The Methodology Act requires the same criteria to be met** in order to achieve the goal to put a similar CO_2 price on goods produced outside the EU as to those produced in the EU and under the EU ETS.

Since the correct application of the "RED II criteria" is a relatively complex task, which is potentially only relevant for a relatively small number of installations, this section gives only a quick overview of the most relevant points. A more detailed explanation of the applicable RED II criteria is given in **Annex C** of this document.

It is recommended that you, as an operator, include a written procedure in your monitoring plan to attribute each batch of biomass used in the installation to either a 'RED II compliant biomass' source stream or to a 'non-RED II compliant biomass' source stream, depending on whether the applicable sustainability and/or greenhouse gas criteria are met, or not.

Note that RED II criteria apply only where **biomass is used as a fuel** ("for energy purposes"). Where **biomass is used as process input** (e.g. where charcoal is used as reducing agent in a blast furnace or where electrodes made from charcoal and tar pitch are used), such material may always be zero-rated without applying RED II criteria.

Demonstrating compliance with RED II criteria

There are several ways in which operators can demonstrate compliance with the RED II sustainability and GHG savings criteria:

- If the operator provides a 'proof of sustainability' (PoS) using a voluntary **certification scheme** (i.e. a confirmation of compliance with that scheme's rules) that complies with the requirements of the RED II and the relevant implementing regulation[48].

  Such certification schemes can operate world-wide. If you as an operator want to be certain whether the scheme complies with all the relevant regulations under the RED II, you must select a scheme that has been '**recognised**' (i.e. approved) by the European Commission under these rules.[49]

- If the operator provides evidence of the purchase of a quantity of biofuel, bioliquid or biogas connected to the cancellation of the respective quantity in the Union Database set up pursuant to Article 31a of the RED II. This method, however, is

[46] RED II: Directive (EU) 2018/2001, see footnote 36

[47] The sustainability and the greenhouse gas emissions saving criteria laid down in Article 29(2) to (7) and (10) of the RED II

[48] Commission Implementing Regulation (EU) 2022/996 on rules to verify sustainability and greenhouse gas emissions saving criteria […], http://data.europa.eu/eli/reg_impl/2022/996/2025-02-24

[49] A list of recognised biomass certification schemes is hosted on the Commission's website: https://energy.ec.europa.eu/topics/renewable-energy/bioenergy/voluntary-schemes_en

primarily used for transport fuels[50]. But as mobile machinery is excluded from the system boundaries of CBAM installations, this method will be rarely applicable.

- You can also **collect all relevant data and perform relevant calculations yourself**, as operator of the installation using the biomass. Annex C of this guidance document explains the principles for this approach. However, as this is a complex task, special experience is needed. CBAM verifiers may find it difficult to approve the operator's own calculations. Therefore, the first option above (making use of a recognised certification scheme) is the single preferred method.

Where you, as the operator of the installation using biomass, do not have the required evidence for compliance of a batch of biomass with the RED II criteria, where they apply, you have to treat that biomass as if it were a fossil fuel.

4.6.4 Determine PFC (perfluorocarbon) emissions

Section B.7 of Annex II to the Methodology Act describes the determination of PFC (Perfluorocarbon) emissions. PFC emissions are currently only covered by the CBAM for aluminium goods. The gases to be monitored are CF_4 and C_2F_6. Emissions from anode effects as well as fugitive emissions are to be included. The method is based on the guidance "Aluminium sector greenhouse gas protocol" published by the International Aluminium Institute (IAI)[51]. This uses a calculation-based approach which significantly deviates from the calculation-based approach outlined in section 4.6.1. Two different methods are allowed: The "slope method" and the "overvoltage method". Which method is to be applied depends on the installation's process control equipment.

While the Methodology Act describes the principal requirements and calculation formulae, other details on the applicable methods should be taken from the guidance mentioned above. Note that on top of the PFC emissions, CO_2 emissions from anode consumption in primary aluminium production are to be included in embedded emissions. Also, all fuel-related emissions from secondary aluminium production as well as from diverse forming steps downstream of aluminium melting need to be covered. For that purpose, the usual calculation-based methods apply.

4.6.5 Rules for transfers of CO_2 between installations

Specific rules apply for how emissions are attributed where CO_2 is transferred between installations, where either: i) pure or almost pure CO_2 is being transferred, for example, for use as a chemical feedstock for urea production; or ii) CO_2 that is already an inherent part of a waste gas or other gaseous source stream is transferred.

The text box below gives the references to the relevant Regulation sections.

Methodology Act references:

Annex II, Section B.8 Requirements for CO_2 transfers

[50] Hence, although the Union Database can have world-wide coverage, it will be used mostly by shipping companies and aircraft operators having to comply with the EU ETS, not CBAM operators.

[51] Available from https://ghgprotocol.org/sites/default/files/2023-03/aluminium_1.pdf

The following sections cover the attribution of direct emissions from CO_2 in these circumstances.

4.6.5.1 *Accounting for inherent CO_2 contained in waste gases and other gaseous source streams*

The term 'inherent CO_2' refers to CO_2 which is contained in a gas, such as natural gas, or in a waste gas source stream, which is then recovered as a fuel or is flared. In order to ensure consistent reporting and avoid double counting, the inherent CO_2 is either accounted for in the CBAM installation in which it originates, or in the CBAM installation to which it is transferred, whereby:

- Where a CBAM installation receives and uses a source stream containing inherent CO_2: The emission factor (or in case of mass balances, the carbon content) takes into account the inherent CO_2 (i.e. the CO_2 forms a part of the source stream just like any other carbon contained in fuels, and the inherent CO_2 counts as emitted by the installation which emits the CO_2).
- Where a CBAM installation transfers inherent CO_2 out of the installation, e.g. to another installation, the rules for transferred CO_2 (see 4.6.5.2) apply by analogy.

Regarding monitoring of CO_2 transfers, the same approach as for the transfer of waste gases is applicable (see section 4.6.5.3).

Note that the above rules apply to the direct emissions at installation level. For the purpose of calculating attributed emissions of a production process, in particular regarding use of waste gases, the formulae given in section 4.2.2.2 apply.

4.6.5.2 *Capture and transfers of CO_2 between installations for the purposes of long-term geological storage (CCS) or utilisation of captured CO_2 (CCU)*

Where pure or almost pure CO_2 emissions are captured at an installation and are either stored or used at that installation, or are transferred out via a transport infrastructure (such as a pipeline network, or by road tanker or other) to another installation, the CO_2 may be subtracted (or 'accounted for as not emitted') from the installation's emissions provided that the following criteria and conditions are met (see Methodology Act Annex II, point B.8.2):

- The purpose of the installations must be for CO_2 capture and long-term geological storage (CCS) or for CO_2 capture and utilisation (CCU) to produce products where the captured CO_2 is '***permanently chemically bound***'[52]. Only certain products are eligible are these are defined in a delegated regulation under the EU ETS Directive, the 'permanent CCU' Regulation[53], which also applies for the purpose of the CBAM.

---

[52] The Implementing Regulation is aligned here with the applicable EU ETS Directive Article 12(3b), which requires as a criterion for counting CO_2 as not emitted that it is used "*in such a way that they have become permanently chemically bound in a product so that they do not enter the atmosphere under normal use, including any normal activity taking place after the end of the life of the product*".

[53] Commission Delegated Regulation (EU) 2024/2620; http://data.europa.eu/eli/reg_del/2024/2620/oj

- The installation, or installations acting together (as in a chain) transferring CO_2 for the purposes of CCS or CCU, must monitor their emissions using the CBAM methodology;
- The CO_2 captured and transferred must originate from fossil carbon, from either combustion or process emissions (because emissions from biogenic origin may count as zero anyway, so there is nothing to deduct);
- Relevant emissions must be monitored using the methods specified by Methodology Act for CCS or CCU by reference to the MRR under the EU ETS (see section 4.6.5.3);
- Only the fraction of CO_2 actually stored or utilised (compared to the total amount of CO_2 transferred out of the originating installation) can be subtracted from each installation's total emissions; this fraction must be calculated and evidenced across the whole 'chain of custody' for CCS or for CCU;
- The chain of custody includes the transport network for transfers of CO_2 between installations, and extends from the originating installation to the geological storage site[54] for CCS, and to the installation using the CO_2 for CCU.

In all other cases, the CO_2 transferred out of the installation is to be accounted for in the emissions of the originating installation.

Note that the criterion in the first bullet point for CO_2 being permanently chemically bound applies also to situations where the CO_2 is used for this purpose within the same installation. **As at the start of the definitive period, no production process covered by the CBAM has been identified in the relevant legislation to allow captured CO_2 to be considered chemically permanently bound[55].** However, CO_2 originating from a CBAM production process may be counted as not emitted, if that CO_2 is used in an eligible CCU process (see text box below).

Further information on the delegated regulation for 'permanent CCU' in products

The textbox below summaries the relevant criteria given in the delegated regulation for considering CO_2 permanently chemically bound in a product, and the products currently considered eligible for deducting emissions.

Commission Delegated Regulation (EU) 2024/2620 defines the relevant criteria in Article 3 (both of the following criteria must be met):

- The chemical bond between the CO_2 and the product was achieved through an active and controlled utilisation process, which allows the determination of the exact amount of CO_2 equivalent bound in the product during and solely from the utilisation process, i.e. excluding carbon present in the material before or naturally absorbed from the atmosphere or other sources after the utilisation process; and

54 The geological storage site must also monitor emissions for the purposes of the chain of custody for CCS and must meet equivalent conditions to long-term geological storage sites in the EU, as laid out in Union law (CCS Directive 2009/31/EC, see: https://eur-lex.europa.eu/eli/dir/2009/31/oj).

55 In particular CO_2 bound in the production process of urea is not eligible, as permanence is not given in urea's main use, as a fertiliser.

- The CO_2 must remain bound to the product throughout its useful life and any normal activity taking place after the product's end of life, for at least several centuries, without being released to the atmosphere. This excludes products subjected to high temperature combustion (such as waste incineration) at any stage of their life cycle.

Based on these criteria the annex to the delegated regulation lists the following products considered to permanently chemically bind CO_2, for which emissions may be deducted:

- **Mineral carbonates used in the following construction products:** (a) carbonated aggregates used unbound or bound in mineral-based construction products; (b) carbonated constituents of cement, lime, or other hydraulic binders used in construction products; (c) carbonated concrete, including precast blocks, pavers or aerated concrete; (d) carbonated bricks, tiles, or other masonry units.

In all other cases, the CO_2 cannot be considered permanently chemically bound and therefore cannot be deducted from the emissions of an installation.

Note: The source alkaline materials for carbonation are not specified nor limited by the regulation. Examples include bauxite residues, ashes, burnt lime or clinker, etc.

The delegated regulation includes a review process to update the list of products considered to permanently chemically bind CO_2, with further advances in CCU knowledge and experience. Therefore, operators of installations performing capture of CO_2 with the purpose of using it in production processes must check the annex to the 'permanent CCU' Regulation as required to confirm if any change to the list of eligible products has been made.

4.6.5.3 Monitoring requirements

Regarding the monitoring of inherent CO_2, the same monitoring approach as for the transfer of waste gases above is applicable.

Transfers of CO_2 between installations

Where CO_2 capture processes are performed, where CO_2 is transported by means of pipeline networks or other transport infrastructure (which are treated like installations regarding their monitoring obligations), and where geological storage of CO_2 is performed, the monitoring rules from the EU ETS as laid down in points 21 to 23 of Annex IV to the MRR[56] shall be applied.

To monitor the quantity of CO_2 transferred from one installation to another, a measurement-based methodology should be used. The receiving and/or the transferring installation should monitor the incoming CO_2 stream using a CEMS and share and align the quantity transferred to ensure this is reported consistently between both installations.

[56] Monitoring and Reporting Regulation, Commission Implementing Regulation (EU) 2018/2066, http://data.europa.eu/eli/reg_impl/2018/2066/2025-05-27

This continuous monitoring can be omitted if the complete CO_2 mass stream of the installation, or of a clearly identifiable part thereof, are transferred. In such case the CO_2 quantity can be calculated from the input source streams of that installation.

Permanently chemically bound CO_2

For the amount of CO_2 permanently chemically bound in products, a calculation-based methodology should be used, based on a mass balance of the carbon (in the form of fuels or materials or transferred CO_2) entering and leaving the CO_2 binding process.

Monitoring plan requirements

For CO_2 transfers, the operator must provide details of the originating and receiving installations including contact details of the responsible persons at each installation.

Where CO_2 is permanently chemically bound, the monitoring plan must include a detailed description of the calculation methodology used to monitor the quantity of permanently chemically bound CO_2, including how the products meet the criteria; the chemical reactions applied; and all relevant stoichiometric factors.

4.7 Determine installation's indirect emissions

For the purpose of the definitive period of the CBAM, indirect embedded emissions have to be included in the embedded emissions only for goods that are listed in Annex I but not in Annex II of the CBAM Regulation (see section 4.1.3).

Indirect attributed emissions of a production process are equivalent to the emissions caused by the production of the electricity consumed in the production process of goods, respectively, multiplied with the applicable emission factor for electricity:

$$AttrEm_{indir} = Em_{el,cons} = E_{el} \cdot EF_{el} \quad \text{(Equations 56 and 35)}$$

Where:

$AttrEm_{indir}$ are the indirect attributed emissions of a production process expressed in t CO_2;

$Em_{el,cons}$ are the emissions related to electricity consumed, expressed in t CO_2;

E_{el} is the electricity consumed expressed in MWh; and

EF_{el} is the emission factor for electricity applied, expressed in t CO_2/MWh.

The general rule for the emission factor is that the operator shall use a default value provided by the European Commission for that purpose, in Annex II of the Default Value Act (see section 4.10.2). However, Section D.4.3 of Annex II to the Methodology Act defines conditions, and corresponding evidence required, under which the operator may use **actual data** for the emission factor. The two criteria are non-cumulative, i.e. either proof of a direct technical link or of a valid power purchase agreement suffice:

- There is a **direct technical link** between the installation in which the imported good is produced and the electricity generation source. The evidence required to demonstrate this is:
  - o Single line diagram that confirms the existence of a direct technical link between the electricity producer and the installation;
  - o Smart metering system data demonstrating that quantities of electricity generated and consumed can be reconciled within the same measurement periods (of one hour or less); and
  - o Where the direct technical link connects more than two installations, evidence for a contractual agreement between the two operators covering the delivery of at least the quantity of electricity consumed, which may be a contract where these are entirely separate legal entities; or an intra-company offtake agreement where the two operators are owned by the same legal entity.
- If the operator of that installation has concluded a **power purchase agreement**[57] with a producer of electricity for an amount of electricity that is equivalent to the amount for which the use of an actual emission factor value is claimed. The evidence required to demonstrate this is:
  - o Written documentation that confirms the existence of a physical grid connection between the electricity producer and the installation. This documentation should be from a public authority, transmission system operator or other reliable publicly available source;
  - o Data obtained from a smart metering system demonstrating that quantities of electricity generated and consumed can be reconciled within the same measurement periods (of one hour or less); and
  - o A single contractual agreement between all relevant parties (the installation producing the goods, the electricity producer located in a third country, and in some cases an intermediary) confirming the existence of the PPA. Point D.4.3 of Annex II to the Methodology Act specifies that a PPA must be "*concluded directly between an installation producing [CBAM] goods […] and a producer of electricity […] for the physical delivery of electricity. Where the PPA was concluded through an intermediary, the contractual evidence shall demonstrate that only one single contract was concluded between the three contracting parties*." Thus, electricity producer and electricity consumer must both be parties to the contract, an intermediary may be an additional party to the contract, and the physical delivery of electricity is the subject matter of the contract. Consequently, "virtual PPAs", which are purely financial instruments, do not fall within this definition.

Therefore, if you use electricity generated within your own installation, these criteria i.e. those for a direct technical link can potentially be complied with (in particular smart metering system data), and you should use the **emission factor which you determine using the rules discussed in section 4.8.3**.

[57] Annex IV to the CBAM Regulation defines: *'power purchase agreement' means a contract under which a person agrees to purchase electricity directly from an electricity producer;*

If you receive electricity from a directly technically connected installation (e.g. a CHP unit at your installation's site[58]) and if that installation uses the same monitoring approaches as outlined in the Methodology Act, you may use the emission factor provided by that installation's operator if you have the necessary evidence outlined above. The same applies if your installation has a power purchase agreement with a more remote installation.

In all other cases, i.e. for electricity received from the grid, the **default emission factor for electricity in the country or region** as provided by the European Commission shall be used. Those default values are based on data by the IEA and made accessible in Annex II to the 'Default Values Act'.

Where your installation uses electricity from more than one source (e.g. from the grid and from your own production), Article 9 of the Methodology Act requires you to use a weighted average of the applicable emission factors for electricity. Only if you as the operator of the installation can provide evidence to the verifier that electricity from a single source is used specifically for a given production process, the emission factor of this single source may be used for this production process.

4.8 Rules required for attributing emissions to production processes

Preceding section 4.2.2 describes the approach to attributing emissions from the installation level to production processes, and section 4.2.2.2 gives the formula for the related calculation. From there it is apparent that for determining attributed emissions of a production process, further parameters beyond the installation's emissions need to be determined. These are the topic of this section, which is structured as follows:

- Some generic rules for attribution parameters to production processes are explained in section 4.8.1. This applies e.g. to splitting source stream data or attributing heat flows, etc.;
- Monitoring rules for flows of heat are discussed in section 4.8.2;
- Electricity monitoring rules are the subject of section 4.8.3;
- Heat and electricity can be produced by 'cogeneration' (CHP), i.e. in a single process. The related joint calculation rules are discussed in section 4.8.4.
- Rules for waste gases are provided in section 4.8.5.

Thereafter, section 4.9 deals with the parameters needed to calculate embedded emissions of goods based on the attributed emissions of the production process, as outlined in section 4.2.2.3, providing guidance on how to determine activity levels of the production process (i.e. the amount of goods produced, section 4.9.1, and data on precursors, section 4.9.2).

[58] It is a frequently found situation that a central heat and/or electricity supply serves several installations at the same site. Usually there is a close link also in the company structure, or clear contractual relations between operators at the site, so that the conditions of a "power purchase agreement" can be easily complied with.

4.8.1 *Generic rules for metering of parameters to be attributed to production processes*

Annex III to the Methodology Act provides generic rules for how to attribute various data sets (source streams, heat, electricity, waste gases) to production processes, as follows:

- Where data for a specific data set are not available for each production process, an appropriate method for determining the required data for each individual production process shall be chosen. For this purpose, either of the following principles should be applied depending on which principle yields more accurate results:
  - Where over time, different goods are produced one after the other in the same production line, inputs, outputs, and corresponding emissions shall be attributed sequentially to relevant goods/production processes based on the usage time per year for each;
  - Where products are produced in parallel at the same time or in the same production process, inputs, outputs, and corresponding emissions shall be attributed based on a suitable correlating parameter, such as:
    - The mass or volume of individual goods produced; or
    - Estimates based on the ratio of free reaction enthalpies of the chemical reactions involved; or
    - Based on another suitable distribution key that is corroborated by a sound scientific methodology.

A new element of the Methodology Act is a general rule for attributing emissions to goods where they are co-products of a "multifunctional process". In short, it regulates that the attribution has to be made based on the functional units of each co-product, which is usually the mass of products (or mass of its main component). A special rule only exists for chemicals (section A.2.1 of Annex III), which is currently only relevant for production of hydrogen. In this case the Methodology Act gives a concrete formula for attributing emissions to the different co-products based on molar ratios.[59]

Another issue is how to correlate different measurements at installation level and at the level of production processes (or specific physical units of the installation, such as individual boilers, furnaces, etc.). The following text box and *Figure 4-5* give guidance on these issues.

Text taken from Commission's EU ETS Guidance document No.5 (see footnote 44) with CBAM-related changes.

One of the most common situations at installations is that a fuel is used in several physical units of the installation. This situation is chosen for its simplicity here to illustrate the basic principles of splitting data into production processes. However,

[59] For making the rule future-proof (i.e. for the potential inclusion of other chemicals in the CBAM), the Regulation also specifies that where the molar mass of a good is unknown, the attribution shall be made relative to the mass of the co-products involved.

similar approaches apply to all kinds of materials and energy flows, e.g. the attribution of heat or electricity consumption to production processes.

In the example fuel (e.g. natural gas) consumption is determined using continual metering. In installations there is often one central measurement (a main gas meter) where the gas is entering the installation, and further sub-meters at individual process units. The quality of the meters may differ. The main meter is the one of highest importance for economic reasons, and both the operator and the gas supplier are interested in accurate measurement results. In many countries such meters are therefore subject to National Legal Metrological Control (NLMC). But also, where this is not the case, the owner of the instrument (often the gas supplier or grid operator) will ensure regular maintenance and calibration of the instrument (including the instruments for temperature and pressure compensation). For cost reasons the sub-meters are often of lower accuracy (higher uncertainty). Furthermore, there may be some units which have no separate meters, or the locations of the meters may not coincide with the boundaries of the sub-installations.

The example (see *Figure 4-5*) deals with a fictitious installation where natural gas is used in three physical units serving two production processes. Units 1 and 2 belong to production process 1, and unit 3 belongs to production process 2. The figure shows different situations that can be found in typical installations:

- Case 1: In this simple, cost-effective situation the total amount of gas is metered by the measuring instrument MI_{total}. This instrument is also used in MP. The second measuring instrument (MI-1) relates directly to production process 1. Its results should be used for CBAM purposes. The gas quantity for production process 2 is simply calculated as difference between the readings of MI_{total} and MI-1.
- Case 2: This is another simple case with two meters for two production processes. As there is no meter for the total gas entering the installation, it is to be assumed that the operator determines the gas consumption for calculating the installation-level emissions as sum of the readings of those two meters.
- Case 3: Although here two meters are found, they are located in a way that they cannot be used for determining the production process-level gas consumption. The operator will have to establish a situation more like that in case 1, i.e. the operator should install a sub-meter either at a position like MI-1 or like MI-2 in case 2, and then continue as under case 1.
- Case 4: In this case the gas consumption is “over-determined”, i.e. there are more measuring instruments than required. In such situation it is often observed that the sum of the sub-meters’ readings (MI-1a, MI-1b and MI-2) differs from the reading of the main meter MI_{total}. As explained above, it is usually assumed that the result of MI_{total} is the most reliable one, i.e. it represents most accurate available data. Therefore, the production processes’ data must be adjusted such that their sum is identical to the installation-level data. This is achieved by applying a “reconciliation factor” (see below). The readings of the sub-meters are thereafter corrected by multiplying them with that reconciliation factor.

Note: Case 4 assumes that clearly MI_{total} is the best instrument, and the others are of lower quality. This is not always the case. It might as well be that e.g. MI-2 is of considerably higher quality than the other two sub-meters. In this case it would be justified to use the method described in case 1 instead. The instruments MI-1a and MI-1b would then be used only as corroborating data source.

The calculation for case 4 above is given by the Methodology Act as follows:

$$RecF = D_{Inst} / \Sigma\, D_{PP} \quad \text{(Equation 41)}$$

Where:

$RecF$… is the reconciliation factor

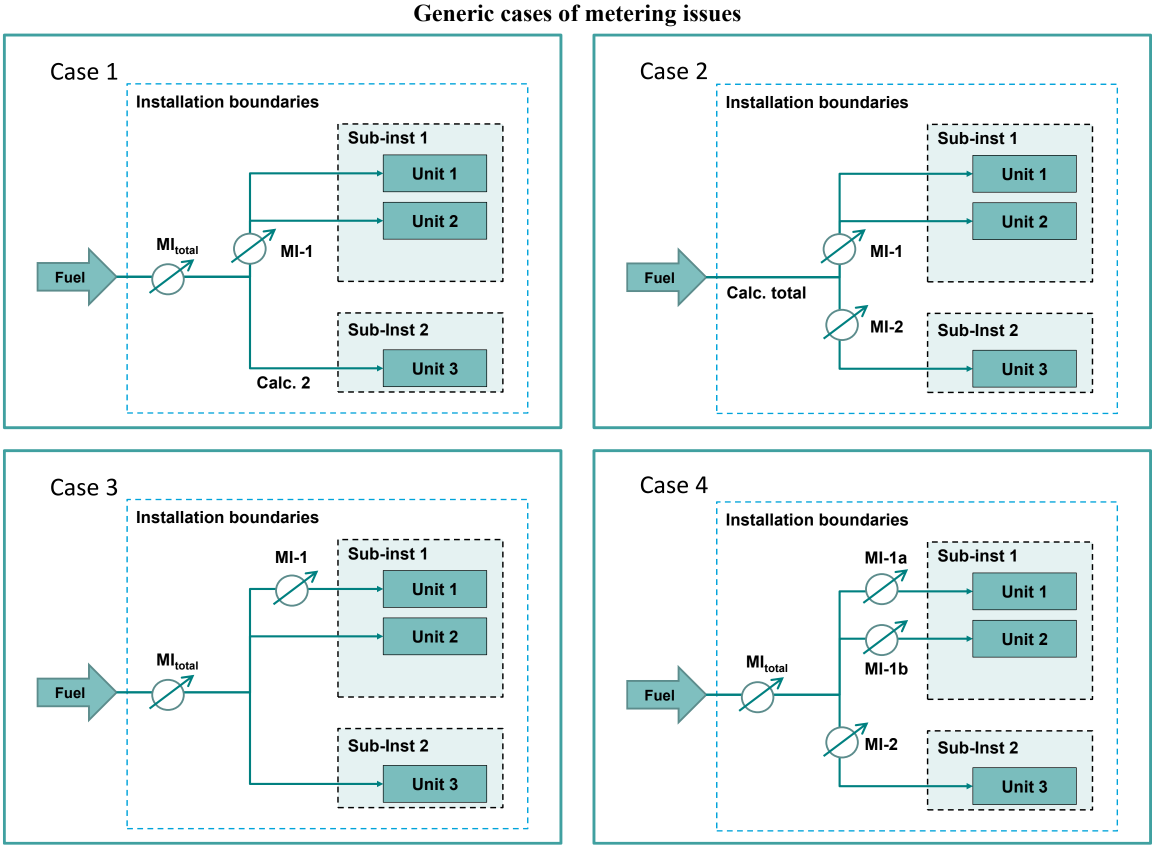
D_{Inst}… is the data value determined for the installation as a whole

D_{PP}… are the data values for the different production processes

The data for each production process are then corrected as follows, with $D_{PP,corr}$ being the corrected value of D_{PP}:

$$D_{PP,corr} = D_{PP} \times RecF \quad \text{(Equation 42)}$$

Figure 4-5: Generic cases explaining basic concepts for splitting data to production processes. "Sub-Inst." should be read as "production process" (i.e. part of an installation). Please see main text for more information.



Source: European Commission/Umweltbundesamt[60]

umweltbundesamt

[60] Commission's EU ETS Guidance document No.5 (see footnote 44).

4.8.2 *Rules for heat energy and emissions*

This section discusses the quantification of net measurable heat flows and the calculation of heat emissions factors. Heat is a relevant parameter for attributed emissions of a production process where either heat is received from another installation, another production process or from a central heat supply serving more than one production process, or where heat is exported from the process to other production processes within the installation, or to other installations. 'Other installations' here includes also district heating networks.

The treatment of waste gases, combined heat and power (CHP) and biomass energy and emissions are discussed separately as special cases in the following sections.

4.8.2.1 Quantification of net heat flows

Where measurable heat[61] is produced in, consumed by, imported into, or exported from the production process, the net quantity of measurable heat flows and emissions associated with the production of that heat must be monitored and attributed, in line with the methods laid out in Section C.1.2, Annex II and Section A.2.2 Annex III to the Methodology Act.

Measurable heat has the following characteristics:

- All measurable heat is to be understood as '**net measurable heat**', i.e. the amount of heat (enthalpy) consumed by a production process[62] is determined by subtracting the heat content entering a process or external user (as forward flow) and the heat content returning from that process (as return flow);
- The heat flows (forward and return) are transported using a heat transfer medium, which is typically hot water or steam, but may also be heated oil, hot air etc.;
- The heat flows are transported through pipework or ducts (for hot air); and
- The heat flows are or could be measured by a heat meter[63].

In determining the net quantity of measurable heat consumed by a production process, considerations that may apply include:

- Whether there are imports or exports of measurable heat (cross-boundary heat flows) – the amount of heat imported or exported should be quantified, as the emissions associated with the production of that heat must be monitored.
- The number of production processes consuming the same heat transfer medium – the quantity of heat consumed by each heat consuming process should be

[61] 'Measurable heat' means a net heat flow transported through identifiable pipelines or ducts using a heat transfer medium, such as, in particular, steam, hot air, water, oil, liquid metals and salts, for which a heat meter is or could be installed. 'Non-measurable heat' means all heat other than measurable heat.

[62] The heat consumer can be a production process within the installation or outside the installation. Also where heat is used to provide cooling via an absorption chiller, that cooling process is also considered to be a heat consuming process.

[63] 'Heat meter' means a thermal energy meter or any other device to measure and record the amount of thermal energy produced based upon flow volumes and temperatures.

determined separately, unless these form part of the same overall production process of the same good.

- The quantity of heat consumed in the operation of the installation's heat distribution network[64], as well as heat losses, should be taken into account.

Therefore, a precise monitoring of the net quantity of measurable heat requires measurement of the following parameters:

- Flow rate of the heat transfer medium (volumetric or mass flow) to the process.
- State of the heat transfer medium entering the heat consuming process, where "state" includes all parameters relevant for determining the specific enthalpy of the medium:
  - Temperature;
  - Pressure (in case of steam or other gases);
  - Type of the medium (hot water, steam, heated oil etc.);
  - In the case of steam information on saturation or degree of super-heating; etc.
- State of the heat transfer medium leaving the heat consuming process;
- If the flow rate of the returned heat transfer medium (condensate in case of steam) is different from the forward flow, or if unknown, suitable assumptions for its enthalpy are required.

Based on the measured values, you, as the operator, determine the enthalpy and the specific volume of the heat transfer medium using suitable steam tables or engineering software.

Such determination is a difficult task, in particular because industrial installations may have complex heat networks with several heat sources and a multitude of consumers. Therefore, Annex II Section C.1.2 to the Methodology Act provides several different methods that may be used to determine the net quantity of measurable heat, depending on what data sources are available.

4.8.2.2 Monitoring requirements

For monitoring, you, as the operator, must establish processes for direct, and where necessary indirect, measurement of heat flows, using your own measurement system. These procedures must be established, documented in your monitoring plan, implemented, and maintained through written procedures. These must include the regular checking and review of heat flows in the installation to confirm:

- Any additions or removals of heat consuming units in the installation or production process.
- Any changes in the types of heat flows in the installation i.e. heat imports, production, consumption or exports.
- Any resulting modifications that may be required to the monitoring methodology, if relevant.

---

[64] Equipment deaerators, make-up water preparation, boiler blow-off or blow-down systems, including any heat losses in the heat distribution pipework.

Methodologies for determining net measurable heat

Where a production process consumes measurable heat produced within the installation, you, as the operator, may use one of the following methods to determine the net quantity of measurable heat produced and corresponding emissions. Methods 1 to 3 relate to decreasing data quality and monitoring effort. Therefore method 1 is preferred over method 2, which is preferred over method 3 (see section 4.5.4 on selecting best available data sources):

Method 1: Using measurements

In this method, all relevant parameters listed above are measured or otherwise known. In case steam condensate is not returned or its flow is unknown, a reference temperature of 90°C is to be used[65]. The mass flow rate and heat flow rate of the medium are calculated as below:

$$\dot{m} = \dot{V}/v \quad \text{(Equation 30)}$$

$$\dot{Q} = \left(h_{flow} - h_{return}\right) \cdot \dot{m} \quad \text{(Equation 31)}$$

Where:

$\dot{m}$…is the mass flow rate in kg/s

$\dot{V}$…is the volumetric flow rate in m^3/s

v… is the specific volume in m^3/kg

$\dot{Q}$…is the heat flow rate in kJ/s

h_{flow}… is the enthalpy of the transmitted flow in kJ/kg

h_{return}…is the enthalpy of the return flow in kJ/kg

Where the mass flow rate is assumed to be the same for the transmitted and returned heat transfer medium, the heat flow rate is calculated using the difference in enthalpy between the transmitted flow and the return flow.

If the mass flow rates are known to be different, the following consideration should apply, if it is confirmed that:

- Some condensate remains in the product, the respective amount of condensate enthalpy is not deducted.
- Some condensate is lost (leaks or sewerage), the respective amount of condensate is estimated and deducted from the mass flow of the heat transfer medium.

The net annual heat flow can be determined from the above data, by either of the following methods:

65 Even if not all condensate is returned to the supply, net measurable heat should be calculated assuming 100% return of the condensate.

- Determine annual average values for the parameters determining the annual average enthalpy of the transmitted and returned heat medium, and multiply with the total annual mass flow;
- Determine hourly values of the heat flow and sum up those values over the annual total operating time of the heat system. Subject to the data processing system, hourly values may be substituted by other time intervals as appropriate.

Method 2: Calculation of a proxy based on measured efficiency

This method builds on the energy input of all fuels and determines the amount of net measurable heat based on the efficiency of production of the heat (boiler efficiency) and its transmission to the consuming production process, using the following equations:

$$Q = \eta_H \cdot E_{In} \quad \text{(Equation 32)}$$

$$E_{In} = \sum_i AD_i \cdot NCV_i \quad \text{(Equation 33)}$$

Where:

Q…is the net amount of heat [TJ] produced over the reporting period

η_H…is the measured efficiency of heat production and transmission

E_{In}…is the energy input [TJ] from fuels determined using the second equation over the reporting period

AD_i…Annual activity data (i.e. quantities consumed) of fuels i [tonnes or Nm^3]

NCV_i…Net calorific value [TJ/t or TJ/Nm^3] of fuels i

This method refers to the 'measured efficiency' of heat production because you, as the operator, are advised to measure it 'over a reasonably long period' of time, in order to take into account different load states of the installation.

Alternatively, the efficiency of heat production can be taken from the boiler manufacturer's documentation (which is the less preferred approach, considering the generic hierarchy of approaches). In this case, the specific part load curve should be taken into account by using an annual load factor, calculated as follows:

$$L_F = \frac{E_{In}}{E_{Max}} \quad \text{(Equation 34)}$$

Where:

L_F…is the load factor

E_{In}…is the energy input [TJ] from fuels determined over the reporting period

E_{Max}…is the maximum fuel input if the heat producing unit had been running at 100 % nominal load for the full calendar year

In the case of a steam raising boiler the efficiency should be based on a situation in which all condensate is returned. A temperature of 90 °C should be assumed for the returned condensate, if no actual values are available.

Method 3: **Calculating a proxy based on the reference efficiency**

This approach is meant for situations where heat production efficiencies are not known. This Method is the same as Method 2 but uses a reference efficiency of 70 % as a conservative assumption ($\eta_{Ref,H}$ = 0,7).

Specific requirements for cross-boundary heat flows

In the case of cross-boundary heat flows (imports and exports) of measurable heat, you, as the operator, should where possible determine the quantity of these heat flows using your own measuring system, ensuring that the monitoring approach covers the following:

- The quantity of heat imported, where applicable separately for each source, and record its origin.
- Obtained data from the supplier of the imported heat for determining emissions[66], for the reporting period during which the heat is consumed.
- The quantity of heat exported, if applicable.

Heat energy balance

In practical terms, where an installation has complex heat flows i.e. it imports, exports or transfers measurable heat between different production processes on the same installation, the precise split between the different heat production and consumption processes may be determined using a **heat energy balance**, which is used to:

- Determine the precise split for the annual quantities of all flows of measurable heat into and out of the production process.
- Attribute the corresponding fuel input emissions to the production processes, in proportion to the split of heat flows[67]. Where heat losses are not attributed to specific production processes, they shall be attributed proportionally to the split of consumed heat[68].
- Corroborate overall consumption and corresponding emissions.

[66] In principle the emission factor of the fuel mix used by the heat supplier is required. This should be taken from a verification report of the heat supplying installation.

[67] Where emissions from source streams or emission sources cannot be attributed in accordance with other approaches, they may be attributed using correlated parameters, which have already been attributed to production processes. For that purpose, source stream amounts and their respective emissions are attributed proportionally to the ratio in which those parameters are attributed to production processes. Appropriate parameters include the mass of goods produced, mass or volume of fuel or material consumed, amount of non-measurable heat produced, operating hours, or known equipment efficiencies.

[68] See Sections A.2 and A.2.2 of Annex III to the Methodology Act, 'Further rules for the attribution of emissions from measurable heat'.

Methodologies for determining emission factors for measurable heat

Where measurable heat is consumed within a production process or exported from it, the heat related emissions are determined by one of the following approaches:

- Approach 1 – used for heat produced in the installation by ways other than CHP;
- Approach 2 – used for heat produced in the installation by CHP;
- Approach 3 – heat was produced outside of the installation;
- Approach 4 – heat as co-product of production processes and from unknown heat sources.

Approaches 1 and 2 apply for heat production processes which can be found either directly within the boundaries of a production process (either because the boiler or CHP is strongly technically connected to a single production process, or because it serves only this process within the installation), or as separate units serving several production processes.

If the heat production unit (boilers or CHPs) serves exclusively one process, only heat exported (e.g. to district heating) needs to be determined. In the case where a separate heat production unit serves several production processes, the heat imports to each of these processes need to be determined. In both cases, the fuel mix for the production of measurable heat can be different than the fuel mix for the overall production process (as the latter can for example. also include input for non-measurable heat). It is assumed that it can be determined separately.

Approach 1 – Emission factor of non-CHP measurable heat produced in the installation

For non-CHP measurable heat produced from the combustion of fuels within the installation, the emission factor of the relevant fuel mix is determined and the emissions attributable to the production process are calculated as:

$$Em_{Heat} = EF_{mix} \cdot Q_{consumed} / \eta \qquad \text{(Equation 44)}$$

Where:

Em_{Heat}…is the heat-related emissions of the production process in t CO_2

EF_{mix}…is the emission factor of the respective fuel mix expressed as t CO_2/TJ including emissions from flue gas cleaning, where applicable

$Q_{consumed}$…is the amount of measurable heat consumed in the production process in TJ

η … is the efficiency of the heat production process

EF_{mix} is separately calculated using the following equation:

$$EF_{mix} = (\Sigma\, AD_i \cdot NCV_i \cdot EF_i + Em_{FGC}) / (\Sigma\, AD_i \cdot NCV_i) \qquad \text{(Equation 45)}$$

Where:

AD_i…is the annual activity data (i.e. quantities consumed) of fuels *i* [tonnes or Nm^3] used for measurable heat production

NCV_i…is the net calorific value [TJ/t or TJ/Nm^3] of fuels *i*

EF_i ...*is* the emission factors of fuels *i* expressed in t CO_2/TJ.

Em_{FGC} ...are process emissions from flue gas cleaning expressed in t CO_2.

These parameters are readily available if the calculation-based approach is used for monitoring of direct emissions (see section 4.6.1).
Where a waste gas (for definition see section 4.8.5) is part of the fuel mix used, and where the emission factor of the waste gas is higher than the standard emission factor of natural gas, that standard emission factor is used to calculate EF_{mix} instead of the emission factor of the waste gas.

Approach 2 – heat produced in the installation by CHP

The emissions of the total fuel input to the CHP unit are split in accordance with the method described in section 4.8.4 to give emissions for heat and emissions for electricity.

Approach 3 – Emission factor of measurable heat imports, produced outside of the installation

When a production process consumes imported measurable heat that is provided by a third-party supplier outside the installation or production process, the emissions associated with the production of that heat are requested from the heat supplier; and are to be determined by that supplier using either Approach 1 or Approach 2, as applicable, using a verification report on the emissions of the heat producing installation of the current reporting period. In order to guarantee the availability of such data you, as the operator of the heat consuming installation, should ensure the heat delivery contract with the third-party supplier covers this requirement.

If actual emissions data is not available from the heat supplier, or where the heat is received from a district heating or other heat network, where emissions data of at least one heat delivering installation are unknown, then a standard value emission factor should be used, based on the fuel most commonly used in the relevant country and industrial sector, and assuming a boiler efficiency of 90%. For the selection of that standard value, see approach 4 below.

Approach 4 – heat as co-product of production processes and from unknown heat sources.

For the attribution of emissions to heat leaving a production process as a co-product, the factor $Em_{H,exp}$ in equation 55 (see section 4.2.2.2) is to be determined. Where applicable, the fuel mix fed to the production process is applied. However, if the fuel mix is not known or not applicable (e.g. because the heat is imported from other process or installations), the emission factor is to be determined using "*the fuel most commonly used in the relevant country and industrial sector, and assuming a boiler efficiency of 90%*". This assumes to establish an equivalent to typical heat produced from combustion of fuels. The same emission factor for heat is then to be used in the term $Em_{H,imp}$ in that equation for the production process that uses that heat.

The same phrase "*the fuel most commonly used in the relevant country and industrial sector, and assuming a boiler efficiency of 90%*" is used in the Regulation for all cases of heat of unknown origin. In the absence of a default value for heat in the legislation, as a recommendation, natural gas should be considered such a "most common fuel", as it is indeed a widely used fuel, and at the same time is the proxy where waste gases are consumed. Applying the 90% efficiency, this gives the **recommended emission factor for measurable heat of unknown sources**:

$$EF_{heat,default} = 62{,}3 \text{ t } CO_2e \text{ / TJ}$$

Exceptions

In quantifying net measurable heat, no distinction is made between its different origins, provided it is in scope for the CBAM. However, there are a number of exceptions to this rule:

- **Heat produced from exothermic chemical processes (not combustion)**[69] – where a production process consumes measurable heat produced from an exothermic chemical process, in particular nitric acid or ammonia production, you should:
  - Determine the amount of measurable heat consumed separately from other measurable heat; and
  - Assign zero CO_2 emissions to that heat consumption.
- **Heat recovered from electricity-driven processes**[70] – you should:
  - Determine the amount of measurable heat consumed that has been recovered from the electricity driven process, such as heat recovered from air compressors and used for supplying hot process water (separately from other measurable heat); and
  - Assign zero CO_2 emissions to that heat consumption.
- **Heat produced via heat pumps**: This is a special case of heat from electricity. Here, only a minor part of the heat stems from electricity. The main amount of heat comes either from ambient air, or from another production process, depending on the inputs used for the heat pump. In alignment with the EU ETS methodology, the following approach should be applied:
  - Compose the emission factor for the heat as the weighted average of the following components:
  - EF (emission factor) of electricity consumed = 0
  - EF of heat coming from ambient air = 0
  - EF of heat coming from another production process = the standard factor given under Approach 4 above.

4.8.3 Rules for electrical energy and its emissions

The following section covers the quantification of electricity produced within the installation or consumed for the production of goods (i.e. for indirect emissions, where relevant). It also deals with the calculation of emissions factors of electricity used for the attribution of emissions to production processes (see section 4.2.2.2 for how produced

69 For *consumption* of such heat see Section C.1.3, Annex III, Methodology Act. For *production* of such heat: Section A.2.2 of Annex III

70 See Section A.3, Annex III, Methodology Act

electricity is relevant in the calculation of direct attributed emissions, and section 4.7 for consumed electricity and attributed indirect emissions).

The treatment of CHP electrical energy and its related emissions are discussed separately in section 4.8.4.

4.8.3.1 Quantification of electricity amounts

For monitoring, you as the operator must establish processes for direct and where necessary indirect measurement of electricity consumed, using your own measurement system. For choosing best available data sources see section 4.5.4.

In order to determine the quantity of electricity consumed or produced by a production process, electricity supplies should be metered. Metering should apply to real power, not apparent power (complex power), i.e. only the active power component consumed by the installation should be metered, and the reactive power (or return) component should be disregarded.

As only the consumption by the installation is being considered, any transmission and distribution losses for imported electricity before the installation boundary, i.e. between the grid supply point and the installation boundary, should be disregarded.

4.8.3.2 Monitoring requirements – Emission factor

In order to determine the indirect emissions for the electricity consumed you will need to either calculate the relevant emission factor for the supply of electricity (if self-supplied), obtain the data or emission factor to use actual data from the electricity producer (see section 4.7), or use a default emission factor value (see section 4.10.2).

The rules for determining the emission factor of electricity from fuel-based generation, both self-generated or in a specified external installation, are given below for CHP or non-CHP cases. Furthermore, electricity can also originate from other sources (such as solar, wind, geothermal, hydropower etc.) which do not lead to CO_2 emissions. If such energy sources contribute to the electricity production in your own or your supplier's installation, equation 38 below can be used, with the quantity of non-CO_2 electricity added in the denominator. If your electricity supplier's installation uses exclusively such energy sources, special (simplified) verification requirements for that installation apply. However, the use of zero-rateable biomass does not lead to such simplified verification.

Emission factor for self-supplied electricity or for electricity provided from a specified installation

For **electricity produced from fuels by separate (i.e. non-CHP) production**, the emission factor of electricity EF_{El} is calculated using the specific fuel mix using the following equation:

$$EF_{El} = (\Sigma\, AD_i \cdot NCV_i \cdot EF_i + Em_{FGC)}) / El_{prod} \quad \text{(Equation 38)}$$

Where:

AD_i are the annual activity data (i.e., quantities consumed) of fuels i used for the electricity production expressed in tonnes or Nm^3,

NCV_i is the net calorific values of fuels i expressed in TJ/t or TJ/Nm^3,

EF_i is the emission factors of fuels i expressed in t CO_2/TJ,

Em_{FGC} are process emissions from flue gas cleaning expressed in t CO_2,

El_{prod} is the net amount of electricity produced expressed in MWh. It may include quantities of electricity produced from other sources than by combustion of fuels.

These parameters are readily available if the calculation-based approach is used for monitoring of direct emissions (see section 4.6.1).

Where a waste gas (for definition see section 4.8.5) is part of the fuel mix used, the standard emission factor for natural gas given in Section G[71] (Table 1) of Annex II to the Methodology Act should be used to calculate EF_{El} instead of the emission factor of the waste gas (unless the EF for the waste gas is lower).

In the case of **electricity produced within the installation through CHP (cogeneration)**, the emissions of the total fuel input to the CHP unit are split in accordance with the method described in section 4.8.4 to give emissions for heat and emissions for electricity. From there, the emission factor for electricity can be calculated.

Where electricity is exported from a specific production process within the installation, which cannot be directly assigned to a specific fuel mix, e.g. generated from the expansion of compressed gases, a surrogate emission factor needs to be used. The best choice for this is the emission factor of the grid in the installation's country (Annex II to the Default Values Act), as indicated below. Where this value is inserted as parameter $Em_{el,prod}$ in the calculation of attributed emissions (see section 4.2.2.2), the emission factor for the "Other countries and territories" should be used instead.

If the **electricity is not produced by the installation itself but is provided by a specific installation** for which the conditions given in section 4.7 are fulfilled, the electricity emission factor is determined as above (i.e. using the same approaches as if the electricity were produced in the installation), but the relevant data must be made available by the electricity supplier and verified.

Emission factor for electricity received from the grid for the purpose of indirect emissions

For electricity received from the grid, the default approach is to use a **default emission factor value** provided by the Commission, which is an average emission factor of the country of origin's electricity grid, based on data from the International Energy Agency (IEA). These default values are published in Annex II to the 'Default Values Act' (see section 4.10.1). Note that these factors are different from the emission factors to be used

[71] Those values can also be found in Annex D of this guidance document.

for electricity imported to the EU as CBAM good, which are found in Annex III to that Regulation.

You will also be able to use country-specific **alternative default emission factor values** for calculating indirect emissions, for specific years, where third countries (or groups of third countries) have provided the required evidence for these to the Commission (see section 4.10.2). However, in practice they will also be published in an implementing act (or as amendment to the existing one). Therefore, the use of those alternative values will not change your monitoring methodology. However, it is a reason to check the Commission's website for the latest version of the Default Values Act or the Emissions report template before filling your annual emissions report.

Weighted average emission factor for electricity received from different sources

Article 9 of the Methodology Act states that where an installation producing goods receives during a reporting period electricity from multiple sources (e.g. electricity from the grid and from a dedicated installation or its own installation), the embedded indirect emissions of the goods shall be determined by average of the emission factors of each electricity source, weighted by the share of total electricity consumed in that installation, that the electricity received from each source represents.

However, if you as the operator can demonstrate to the verifier that for a given production process, only electricity from a single source (or a subset of sources) was used then the embedded indirect emissions of goods produced through that production process shall be determined based on the emission factor of that single source (or for the weighted average of the subset of the sources).

Note that the determination of specific emission factors by using market-based instruments such as "guarantees of origin" or "green certificates" for renewable energy sources etc. is not allowed.

4.8.4 Rules for combined heat and power

Combined heat and power (CHP), also referred to as 'cogeneration', is the simultaneous generation of heat and power in a single integrated process.

The heat produced from CHP is recovered for a useful heat consuming purpose[72] in the form of hot water, steam or hot air, whilst the power output is usually electricity (may be mechanical power). As this is a single combined process, the split of emissions between heat and power must be calculated using certain assumptions and formulae, to allocate emissions to each output.

The following text box gives the references to the relevant annex sections.

[72] Where heat is used to provide cooling via an absorption cooling process, that cooling process is considered as the heat consuming process.

Methodology Act references:

Annex II, Section C Heat flows, C.1 Rules for determining net measurable heat and Annex III section A.2.2 Heat flows and cogeneration.

Annex II, Section D Electricity, D.3 Rules for determining electricity quantities for the production of goods other than electricity and D.4.2 Emission factor of electricity produced by cogeneration.

Annex III, Section C, Harmonised efficiency reference values for separate production of electricity and heat, Tables 1 and 2.

The Methodology Act provides an approach for attributing CHP-related emissions to production processes, which is based on calculating specific emission factors for CHP heat and power[73] outputs. This approach is outlined below, alongside the information required for these calculations.

Information required to attribute CHP emissions to production processes

In order to calculate the split in emissions between heat and power outputs from CHP, you need to collect the following information, as relevant:

(a) Total amount of fuel input into CHP in the reporting period:

$$E_{In} = \sum_i AD_i \cdot NCV_i \quad \text{(Equation 33)}$$

Where:

E_{In}…is the energy input from fuels

AD_i…Activity data (i.e. quantities consumed) of fuels i [tonnes or Nm^3]

NCV_i…Net calorific value [TJ/t or TJ/Nm^3] of fuels i

These parameters are readily available if the calculation-based approach is used for monitoring of direct emissions (see section 4.6.1).

(b) Heat produced from CHP: the activity level here is the net amount of measurable heat Q_{net} produced by CHP in TJ during the reporting period. Rules for determining heat flows are given in section 4.8.2.

(c) Electricity produced from CHP: The activity level here is the net amount of electricity (or mechanical energy, where applicable) in TJ, produced by the CHP during the reporting period. The net amount of electricity means the amount of electricity exported (leaving the system boundaries) of the CHP unit, after subtraction of internally consumed electricity ('parasitic load').

[73] The rules regarding electricity apply also to the production of mechanical energy, if relevant.

(d) Total emissions from CHP: which comprise the emissions from fuel input to CHP, as well as the amount of emissions from flue gas cleaning, in tonnes of CO_2 per year. The total amount of emissions in t CO_2 is calculated using the following equation.

$$Em_{CHP} = \sum_i AD_i \cdot NCV_i \cdot EF_i + Em_{FGC} \quad \text{(Equation 46)}$$

Where:

Em_{CHP}…is the emissions from CHP in the reporting period [t CO_2]

Em_{FGC}… process emissions from flue gas cleaning [t CO_2]

AD_i, NCV_i and EF_i have the same meaning as above under (a)

(e) Average efficiencies for heat and electricity over the reporting period: these dimensionless values are calculated from inputs (a) to (c) above, according to the following equations. However, if inputs (a) to (c) are not available, use instead the efficiencies presented under (f).

$$\eta_{heat} = \frac{Q_{net}}{E_{In}} \quad and \quad \eta_{el} = \frac{E_{El}}{E_{In}} \quad \text{(Equations 47 and 48)}$$

Where:

η_{heat}…is the average heat efficiency during the reporting period

Q_{net}…is the net amount of heat [TJ] produced during the reporting period

E_{In}…is the energy input [TJ] calculated from (a) above

η_{el}…is the average electrical efficiency during the reporting period

E_{el}… is the net amount of electricity [TJ] produced during the reporting period, from (c) above

(f) Design or standard efficiencies: if it is not technically feasible for you, as the operator, to separately determine the efficiencies of heat and electricity, or this would incur unreasonable cost, then values based on the **manufacturer's technical documentation** (i.e. the **design values**) should be used. If these are also not available, then conservative standard efficiency values of **55% for heat** and **25% for electricity** may be used in the following calculations.

(g) Reference efficiencies: are used in the calculation of the attribution factors for emissions. The reference efficiency values used are for heat production in a stand-alone boiler, and for electricity production without cogeneration. You, as the operator, should select the appropriate fuel-specific electricity and heat reference efficiency value from Tables 1 and 2 in Annex III of the Methodology Act. Those factors are also included in Annex D of this guidance document.

(h) The attribution factors for heat and electricity are then calculated as follows.

$$F_{CHP,Heat} = \frac{\eta_{heat}/\eta_{ref,heat}}{\eta_{heat}/\eta_{ref,heat}+\eta_{el}/\eta_{ref,el}} \quad \text{(Equation 49)}$$

$$F_{CHP,El} = \frac{\eta_{el}/\eta_{ref,el}}{\eta_{heat}/\eta_{ref,heat}+\eta_{el}/\eta_{ref,el}} \quad \text{(Equation 50)}$$

Where:

$F_{CHP,Heat}$…is the attribution factor for heat

$F_{CHP,El}$… is the attribution factor for electricity (or mechanical energy, if applicable)

$\eta_{ref,\ heat}$… is the reference efficiency for heat production in a stand-alone boiler

$\eta_{ref,el}$…is the reference efficiency of electricity production without cogeneration

(i) Specific emission factors for CHP-related measurable heat and electricity: The factors to be used for the attribution of related (direct and indirect) emissions to production processes are calculated as follows:

$$EF_{CHP,Heat} = Em_{CHP} \cdot F_{CHP,Heat} / Q_{net} \quad \text{(Equation 51)}$$

$$EF_{CHP,El} = Em_{CHP} \cdot F_{CHP,El} / E_{El,prod} \quad \text{(Equation 52)}$$

Where:

$EF_{CHP,\ heat}$…is the emission factor for the production of measurable heat in the CHP unit expressed as t CO_2/TJ

$EF_{CHP,El}$…is the emission factor for the production of electricity in the CHP unit expressed as t CO_2/TJ

Q_{net}…is the net heat produced by the cogeneration unit expressed in TJ

$E_{El,prod}$… is the electricity produced in the CHP unit expressed in TJ

4.8.5 Rules for waste gas energy and emissions

Waste gases result from incomplete combustion or chemical reactions in certain production processes, particularly in the iron and steel sector; for example, coke oven gas (COG), blast furnace gas (BFG) and basic oxygen furnace gas (BOFG), which is also known as ‘converter gas’.

These waste gases are a mixture of CO_2 and incompletely oxidised carbon, usually carbon monoxide (CO), and sometimes hydrogen (H_2) and further gases, hence they have an energy content recoverable through use as a fuel, as well as containing ‘inherent’ emissions arising from the production process.

The textbox below gives the references to the relevant annex sections.

Methodology Act references:

Annex I, Production routes for goods, Iron and steel sections 3.11 to 3.16

Annex II, Sections B4 requirements for activity data, B5 requirements for calculation factors for CO_2, B.8 Requirements for monitoring of CO_2 transfers between installations

Annex II, Section G, Standard factors used in the monitoring of direct emissions at installation level.

Annex III, Section A.2.3. Waste gases, Section A.3. Calculation methods.

The recovery and use of waste gases as a fuel to produce electricity or heat is preferable over venting or flaring, as this is energy efficient and avoids emissions that would otherwise be produced through combustion of another fuel to produce this energy.

The following sections cover the quantification of energy and the attribution of direct emissions from waste gases to production processes. The treatment of flares is also discussed below as a special case.

4.8.5.1 Determining activity data for waste gases

According to the definition given in the Methodology Act, a waste gas must satisfy the following three conditions:

- Contain incompletely oxidised carbon – usually in the form of CO.
- Be in a gaseous state under standard conditions (note that it is possible that some of the organic fractions in the waste gas stream may condense under these conditions).
- Occur as a result of one of the processes listed in the definition of process emissions, in particular: (a) the chemical, electrolytic or pyrometallurgical reduction of metal compounds in ores, concentrates and secondary materials; (b) the removal of impurities from metals and metal compounds; (d) chemical syntheses of products and intermediate products where the carbon bearing material participates in the reaction; (e) the use of carbon containing additives or raw materials; (f) the chemical or electrolytic reduction of metalloid oxides or non-metal oxides such as silicon oxides and phosphates.

Waste gases that are recovered are either used in the production process or installation in which they originate, or are transferred to a different production process or installation; for example, in integrated steel works, blast furnace gas and converter gas may be used for both upstream processes (e.g. coke making) and downstream processes (e.g. rolling) as well as for electricity production.

Industrial processes do not rely solely on waste gases and must also operate in stand-alone configurations and hence use waste gas interchangeably with other fuels e.g. natural gas.

In order to determine the volume of waste gas consumed by a production process, waste gas supplies should be metered.

4.8.5.2 Monitoring requirements for waste gases and flares

For waste gases, both the calculation factors (NCV, and emission factor or carbon content) and volume in normal cubic metres of the respective waste gas should be monitored as set out in the Implementation Regulation Annex II, sections B.4 and B.5. The relevant requirements are explained in sections 4.6.1.3 and 4.6.1.4, respectively. Furthermore, the rules on selecting best available data sources (section 4.5.4) should be taken into account.

Flares

For flares, monitoring should cover both routine and operational flaring (trips, start-up and shutdown and emergency relieves) in production processes using waste gas.

When calculating emissions from flared gases, you should include:

- Emissions from the combusted flared gas;
- Emissions from the combustion of fuels required to operate the flare i.e. pilot flame and fuels to combust the flared gas; and
- **Inherent CO_2** in the flared gas source stream.

If accurate monitoring is technically not feasible or would lead to unreasonable costs, a reference emission factor of **0,00393 t CO_2/Nm^3** should be used[74].

***Recommended improvement**: for the monitoring of flares is to determine installation-specific emission factors derived from an estimate of the molecular weight of the flare stream, using process modelling based on industry standard models. By considering the relative proportions and the molecular weights of each of the contributing streams, a weighted annual average figure shall be derived for the molecular weight of the flare gas.*

4.8.5.3 Attribution of direct emissions

Waste gases may be fully used within the same production process in which they were produced, or they may be transferred across the system boundaries of the production process producing the good. For situations where they are not used within the same production process, the formulae given in section 4.2.2.2 are used for calculating the attributed emissions of the production process.

4.9 Calculation of embedded emissions of goods

Preceding section 4.2.2 describes the approach to attributing emissions from the installation level to production processes, and section 4.2.2.3 gives the formulae for the calculation of embedded emissions of goods from those attributed emissions. From there it is apparent that for determining embedded emissions of goods, further parameters need to be determined. These are the topic of this section:

- Rules for monitoring type and quantity of CBAM goods for determining the 'activity level' of the production process are explained in section 4.9.1;
- Guidance on monitoring of data on precursors is offered in section 4.9.2.

74 The reference EF used here is derived from the combustion of pure ethane, and is used as a conservative proxy for flare gases.

4.9.1 *Rules for goods produced*

Following on from section 4.2.2.3 above, you, as the operator, need to determine the activity level of each production process at your installation, i.e. the total quantity of goods produced within the system boundaries of a production process to which the same functional unit applies, for the reporting period. As explained in the section 4.3, functional units of all goods of the same CN code, possibly aggregated to a wider production process, are summed up to give the activity level. Where the functional unit deviates from the tonnes of good produced, this requires some additional monitoring effort, as not only the quantity (mass) of the goods produced must be tracked, but also the content of functional unit in each batch produced, if batches of different composition are produced, as described below in section 4.9.1.1.

4.9.1.1 Quantity of goods produced (Activity level)

The quantity produced of a good produced by your installation is calculated as the total mass of goods leaving the production process that meet the product specification for a CN goods category listed in the CBAM Regulation. This may include both final products and precursors used for the production of other goods. Where several CN codes are aggregated in a production process, the mass of all goods under these CN codes is determined jointly.

Converting quantity of goods to activity level

Activity levels have to be determined both as mass of good produced and in terms of the functional unit. However, for calculating embedded emissions, activity levels expressed using the functional units have to be used. Where the functional unit of goods is the tonnes of good under this CN code, the activity level equals the mass of goods produced. This is the case for hydrogen, iron and steel and aluminium. It also applies to pure cement clinker. However, for cement and fertilisers, the following needs to be taken into account:

- **Cement**: If the total amount of clinker is used for cement production under a single CN code, the consumed clinker equals the activity level. However, if there are losses in the production process, the activity level must be determined as the sum of amounts of clinker contained in each type of cement produced. In many installations this will be possible by using a simple mass balance based on the production "recipes" for each cement type.

- **Fertilisers**: For the precursor substances under the cited CN codes, the following stoichiometric factors can be applied to the 100% pure substance:

  - Ammonia (CN 2814nnnn, NH_3): F= 822,5 kg N/t product

  - Nitric acid (CN 28080000, HNO_3): F= 222,3 kg N/t product

  - Urea (CN 310210nn, $H_2N\text{-}CO\text{-}NH_2$): F = 466,5 kg N/t product

  - These factors can also be used for calculating the N content of mixed fertilisers based on the stoichiometry of the final product. Alternatively, as in this sector products usually have to undergo laboratory analysis for checking the compliance with the N content declared on packaging or in product specifications, the N content can be derived from these laboratory analyses for each batch of fertiliser produced.

- The total amount of N contained in all products of the specified CN code or aggregated wider production process gives then the activity level of that production process.

Avoidance of 'double counting'

In order to avoid any **double counting** of production, only the quantity of final product under the same CN code leaving the system boundaries of the production process is counted in the activity level. Only products meeting the required specifications, i.e. saleable products or products being used as precursor within the same installation, are taken into account. Hence, the following are excluded from the reported activity level:

- Product that does not meet the desired quality or specification and is returned to the same production process[75] for re-processing.
- Scrap, by-product or waste materials from the production process, including where this is sent to a different installation for re-processing or disposal.

As a consequence, all attributed emissions of the production process are accounted for on saleable goods, while scrap and waste have zero embedded emissions, i.e. double counting is effectively avoided. From an environmental point of view, this incentivises a decrease of material consumption, or the avoidance of scrap and waste, as a process producing little scrap will have lower embedded emissions.

4.9.1.2 Monitoring requirements

As an operator, you must first identify all goods produced at your installation, along with their applicable CN codes. Procedures must be put in place to track the list of goods and to determine the quantity of goods produced by each production process. These procedures must be documented in the installation's **Monitoring Plan**. Key aspects are discussed below.

Tracking of goods

A comprehensive list of products (and precursors) produced in the installation should be established and regularly reviewed, including the following:

- The product specifications of the listed goods should be reviewed to make sure these match the CN codes given in Annex I to the CBAM Regulation, and Table 1 section 2 of Annex II to the Methodology Act (see section 3 of this guidance document).
- The listed goods are to be correctly attributed to the production processes of the installation.
- The list of goods is to be updated to include any new goods produced for the first time. The CN code for the new product is to be identified.
- If the new product belongs to a CN code which cannot be included in a production process previously found in the installation, also considering the 'bubble approach'

[75] Or to another production process in the installation belonging to the same value chain (e.g. scrap from cold rolling may be re-introduced in the process at the point of melting in the electric arc furnace).

(using the approach described in section 4.3), you as the operator will have to define an additional production process for separate monitoring of the embedded emissions of that good.

- Any related inputs, outputs and emissions for the new good produced are to be attributed to the relevant production process.

The addition of a new type of good may change the existing attribution of inputs, outputs and emissions to existing goods at an installation, and so the review should also take this into account. The monitoring plan must be updated without undue delay, and the monitoring using the updated methodology is to start immediately.

Methods to determine the quantity of goods

In principle, the same methods like for the monitoring of activity data for source streams apply also to the quantification of goods produced. Details are discussed in section 4.6.1.3. The rules for selecting best available data sources (section 4.5.4) apply.

Since quantities of produced and sold goods are usually essential elements of a company's financial report, such data should be available for the CBAM without additional effort. Operators should ensure consistency of their CBAM data with financially audited reports and use those reports for corroboration of their embedded emissions calculation.

Monitoring the quality of goods

Depending on the industry sector and the goods produced, further parameters are to be reported by the authorised CBAM declarant (the importer) in the annual CBAM declaration. Therefore, you as the operator need to provide the relevant information to the importer. Some of these parameters require quality information of your products, for example: the clinker content of cement ('clinker to cement ratio' expressed as a percentage); the content of certain alloy elements in crude steel and iron or steel products; the amount of scrap and percentage of scrap that is pre-consumer scrap used for the production of crude steel, iron or steel products, unwrought aluminium and aluminium products; the concentration of nitric acid or of hydrous ammonia, and the total content of nitrogen as well as in different forms of nitrogen (as ammonium, as nitrate, as urea and in organic forms in mixed fertilisers).

As this is information on the quality of materials, in principle the rules given for calculation factors in section 4.6.1.4 apply. This means that – where relevant – laboratory analyses may have to be carried out. However, in many cases such analyses will be carried out anyway as a part of the production quality control, for ensuring the client's specifications are met. In some cases, it may be more appropriate to calculate the required parameters based on a mass balance of process inputs. However, it is assumed that determining the required parameters will be possible without unreasonable effort. The methods used must be contained in the monitoring plan, which must be regularly reviewed.

As a general rule, operators may use the annual average of the quality measure for the whole production process for reporting purposes under the same CN code.

4.9.2 Rules for precursors

In order to perform the calculation for embedded emissions of complex goods as outlined in section 4.2.2.3, the embedded emissions of precursor materials need to be added to the direct and where applicable indirect emissions attributed to the production process.

The following cross-sectoral rules clarify how precursor embedded emissions are accounted for, depending on where precursors are produced, either on-site within your installation or acquired elsewhere from another installation.

Monitoring requirements for precursors produced within your installation

The approach you take on the monitoring and calculation of embedded emissions for precursors produced within your installation will depend on whether it is possible to define a joint production process ('bubble approach'), or whether separate production processes for precursor and complex goods must be defined.

- **Joint production process** – this may be defined where precursors are produced within the same installation as the complex goods and the precursor goods are wholly used to produce the complex good, with no precursor being sold or transferred off-site. In this case the 'bubble approach' (see section 4.3) may be used and therefore no separate monitoring and calculation of precursor embedded emissions is required; the system boundary will contain both the production of the precursor and its complex good. Furthermore, the quantity of precursor does not need to monitored, only the quantity of the final complex good produced.

  In this case, only precursors from other production processes or obtained from another installation need to be monitored.

- **Separate production processes** – where a joint production process cannot be defined, then separate production processes and system boundaries for the monitoring and calculation of embedded emissions of precursors and complex goods should be defined; for example, where there are transfers or sales of precursor produced at the installation off-site to another installation. In this case:
  - The quantity of precursor(s) produced, and consumed by each of the installation's processes producing complex goods should be determined.
  - The specific direct and where applicable indirect embedded emissions of the precursor should be calculated separately and should be the average over the reporting period.

Monitoring requirements for purchased precursors

Where precursors are obtained from elsewhere you as the operator should monitor the:

- Quantities of precursor(s) received under a given CN code from other installations (this information may be necessary for calculating the weighted average of precursor embedded emissions);
- Quantities of precursor(s) consumed by each of your production process;
- Precursor embedded direct and, if applicable, indirect emissions. You may use default values, or actual values providing this data meets certain quality criteria.

The precursor specific direct and if applicable indirect embedded emissions have to be communicated by the operator of the producer installation supplying the precursor.

The required data include:

- Installation details: Identification of the operator(s) and installation(s) where the precursor was produced;
- The country of origin, where imported precursor good was produced
- The production period of the precursor[76];
- The specific direct and indirect embedded emissions of the precursor;
- Where actual data is provided for the precursor, the relevant verification report covering the reporting period during which the precursor was produced.
- The production route used as defined in Section 3 of Annex I to the Methodology Act;
- The values of sector-specific parameters required for determining the embedded emissions, as listed in Section 2 of Annex IV to the Methodology Act;
- Information on the 'specific embedded free allocation' of the precursor;
- Information on the carbon price paid for the precursor, if relevant.

Rules for precursors acquired from elsewhere

There are cross-sectoral rules for utilising data on the embedded emissions of precursors that have been obtained from elsewhere, as explained below.

Data quality and the use of actual data

For precursors produced outside the installation, if actual data is to be used this must be taken from a verification report issued by an accredited verifier, and that report must cover the reporting period during which the precursor was produced.

In order to ensure data completeness, the operator producing the precursor must use the **'annual emissions report'** template for reporting data on the precursor to that operator's verifier.

However, if the data provided from the precursor producer are not duly verified[77] then default values must be used for calculating the total embedded emissions resulting from the quantity of precursor consumed (see section 4.10).

[76] By default, the reporting period of a precursor is the year of production of the complex good, unless sufficient evidence identifies the actual time of production.

[77] This can be the case in situations including the following: There is no verification report made available to the user of the precursor at all, or it does not fit the required reporting period, or the verifier has come to a negative opinion (e.g. because the emissions report is incomplete or containing material misstatements), or the verifier did not have an active accreditation for the appropriate industry sector and activities.

Simplification of the period of production for precursors Simplified!

Where actual data (in the form of a verification report) is not available for precursor goods purchased from elsewhere, default values must be used for the embedded emissions, the embedded free allocation, and a potential carbon price paid in the third country. The latter two parameters depend on the production year of the precursor. If actual data are used, the verification report of the appropriate reporting period for the precursor must be available. A presumption is made that the purchased precursor used to produce the complex good was produced (by default) in the same calendar year as the complex good, thereby simplifying the administrative tracking of raw material production timelines. You may deviate from that default reporting period only where you provide evidence to the verifier that the precursor was produced in a certain year. The earliest year possible is 2026, as before 2026 no data using the Methodology Act is available.

Averaging of embedded emissions for precursors under the same CN code

Where there are multiple precursor suppliers and/or multiple periods in which precursors have been purchased and held in stock at your installation to produce a complex good, you as the operator should (by default) calculate the weighted average specific embedded emissions for the purchased precursors. The weighted average SEE values for these precursors should be used in the determination of the embedded emissions of the complex goods produced, and the weighted average SEE values should be reported in the annual 'operators emissions report' as required. The weighted average SEE values should be calculated in the following circumstances:

- **Multiple periods** – if the precursor used is obtained from one other installation and has been produced during different reporting periods, then the embedded emissions in the precursors should, by default, be determined as the weighted average of emissions embedded in the precursors that have been produced during those different reporting periods.
- **Multiple suppliers** – if the precursor used has been obtained from multiple installations, then the embedded emissions in the precursors should, by default, be determined as the weighted average of emissions embedded in the precursors received from the different installations.

If both circumstances apply at the same time for a particular installation, then the weighted average for multiple periods and suppliers can be calculated in a single step.

If you as the operator producing complex goods can provide evidence to the verifier that only precursor obtained from a particular installation and year or subset of installations have been used in a specific production process, then the data for those specific precursors can be used in preference to the default value.

For linking the calculation of the above-mentioned weighted averages to a simple monitoring approach for tracking various purchases and stockpiles of each type of precursor, operators can apply the 'First-In-First-Out' (FIFO) principle, for which the stock of a precursor of the previous year to the production year is consumed first, i.e. before the precursor purchased the same year of production. This is not a requirement and can be applied on a voluntary basis. However, FIFO cannot be used in the year 2026 for which the reporting period can only 2026, according to Article 7 of the Methodology Act. This is due to the lack of verification in the years before 2026.

Zero-rating of embedded emissions for precursors produced in the EU

Where precursor goods produced in the EU (or in exempted countries/territories) are exported elsewhere and go on to be used to produce complex goods imported into the EU, then the precursor's specific embedded direct and if applicable indirect emissions are counted as zero for the embedded emissions calculation of the complex good. Under the same conditions, the specific free allocation and carbon price paid need to be reported as zero for such precursors.

Accounting for precursor indirect embedded emissions in complex goods

Given that only direct emissions are to be taken into account for the goods listed in Annex II to the CBAM Regulation, cross-sectoral rules have been introduced on how to account for the indirect embedded emissions of precursors that may be used in the production of complex goods, whereby:

- If the complex good is listed in Annex II (aluminium, chemicals – hydrogen, electricity or iron and steel sectors), and its production process includes one or more precursors not listed in that Annex, then the precursor's indirect embedded emissions are still to be included in the calculation of the embedded emissions of the complex good. For example, agglomerated iron ores and concentrates (CN 26011200) are used as a precursor in the production of pig iron. Agglomerated iron ore is listed in Annex I but not Annex II, therefore, its indirect emissions are taken into account along the value chain producing the final complex good.
- If the complex good is not listed in Annex II (cement and fertilisers sectors), and its production process includes one or more precursors listed in that Annex, then the precursor's indirect embedded emissions are not counted in the calculation of the embedded emissions of the complex good. For example, hydrogen is listed in Annex II and is used as a precursor in the production of ammonia, which is not listed there. Therefore, hydrogen's indirect emissions are not counted even though ammonia as a good must take into account indirect emissions. However, this applies only where hydrogen from external installations or separate production processes (e.g. an electrolysis process on the ammonia production site) is used in the synthesis of ammonia. In cases of generic Haber-Bosch processes, where the production of hydrogen is only a highly integrated intermediate step of the overall production process (and indirect emissions from hydrogen production can thus not be determined separately), the indirect emissions of the complete process are to be included.

Precursors produced before 2026

For goods produced in 2026, all stocks of precursors from previous years have to be treated as if they were produced in 2026 i.e. the reporting year should be indicated as 2026:

- For purchased precursors, the default values of 2026 should be applied, as no verified actual values are available.
- For precursors produced in your own installation before 2026, the operator can use the actual 2026 values as a proxy.

4.10 Use of default values

Whenever you as an operator do not have all necessary data available for calculation of embedded emissions, you need to close those data gaps by the best available data or estimation method. For **minor data gaps** in your installation's data (e.g. missing an analysis of one batch of fuel), you should have a suitable estimation method in your Monitoring Plan (see section 4.10.3).

For other situations, there are "**default values**" for the **specific embedded emissions** of goods and precursors, which you as the operator can use for your **purchased precursors** under certain conditions (see section 4.10.1).

EU authorised CBAM declarants may also use default values for all types of CBAM goods, where actual embedded emissions data for the goods are not available, to ensure their compliance with the CBAM requirements; for example, in case that authorised CBAM declarants do not receive the relevant data from operators of installations producing CBAM goods in time. Authorised CBAM declarants could also use default values as a tool to check the plausibility of the actual data they receive.

Furthermore, default values for **electricity emission factors** for calculating indirect emissions are made available in the Default Values Act (see section 4.10.2). The latter are different from the default values for the electricity imported into the EU as CBAM good, which are also made available in the Default Values Act.

4.10.1 The 'Default Values Act' as authoritative source

The default values for the definitive period are published in the Annexes to Implementing Regulation (EU) 2025/2621[78], which is referred to as the 'Default Values Act' in this document. This section explains its use.

Country-specific default emission values have been calculated by the European Commission for the definitive period, based on the most up-to-date and reliable data available for direct and indirect (if relevant) embedded emissions for all CBAM goods by CN code. Where codes are referenced with fewer than 8 digits (i.e. 4- or 6-digits) this refers to all 8-digit CN codes that share the same initial 4 or 6-digits, i.e.:

- Default values with a 4-digit code apply to all 8-digit CN code goods within this category (i.e. independent of the digits following these first 4 digits).
- Default values with a 6-digit code apply to all 8-digit CN code goods falling within this category.
- Default values with an 8-digit CN code apply only to the specific 8-digit category of good.

In many cases the same default value applies to several CN codes, e.g. where the same technological assumptions have been made for the production processes involved.

[78] Implementing Regulation (EU) 2025/2621 laying down rules for the application of Regulation (EU) 2023/956 of the European Parliament and the Council as regards the establishment of default values. See https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:L_202502621

When using the template for the operator's emissions report, the appropriate default values and mark-ups will be provided automatically to a large extent. However, for looking up default values directly in the 'Default Values Act', this is where to look depending on the value's purpose:

- **Annex I** – provides default values in t CO_2e per tonne of good for embedded emissions by CN code and country to be used for final CBAM goods as well as for precursor goods (where the embedded emissions of complex goods are determined on the basis of actual values). That annex is structured such that countries of origin are listed in alphabetical (English) order, with a separate table for each country. These default values are given for circa 120 countries, but only for the goods that were found to be produced in that country and for which reliable data were available.

  Where the CBAM good is not explicitly listed for the country of production in Annex I or where it is listed but the relevant field shows a "-", CBAM declarants have to use the default values from the table '**Other countries and territories'** in Annex I.

  Operators using precursors of unknown country of origin have to use the default value for that precursor in Annex IV.

  Default values for 2026, 2027 and 2028 onwards shall be increased by a percentage mark-up which is discussed further below. These values including the mark-up are understood to be "total specific embedded emissions", i.e. they take into account whether the indirect emissions have to be included for a CBAM good.

- **Annex II** – provides country-specific, average grid **default emission factor** values in units of t CO_2e per MWh, for circa 126 countries, to be used for calculating the indirect emissions of electricity consumed in producing CBAM goods.

  Where the country of production for the CBAM good is not listed in Annex II, the default value given at the end of the table ('Other countries and territories') should be used. The default values are based on licensed IEA data to be used for the purposes of the CBAM only[79].

- **Annex III** – provides **default emission factor** values in units of t CO_2e per MWh to be used for electricity imported 'as a good' into the customs territory of the EU. Default values are provided for 17 countries.

  A value is also given for the European Union, and this value must be used as the default emission factor value for any country not listed in this Annex. The default values are based on licensed IEA data.

- **Annex IV** – provides the highest default values for specific embedded emissions by CN code in t CO_2e per tonne of good, that must be used for precursor goods when the country of production of the precursor good cannot be identified. Default values for 2026, 2027 and 2028 onwards shall be increased by a percentage mark-up which is discussed further below. These values take into account whether indirect emissions are relevant for the good.

[79] Note that these data are intended for the purpose of determining embedded emissions of CBAM goods under the CBAM Regulation. Any further use or redistribution of the data is permitted for non-commercial purposes only. Anyone wishing to use emissions factors data for commercial purposes is invited to contact the IEA to acquire an appropriate licence.

Annexes I and IV are of particular relevance to operators and to authorised CBAM declarants, who should note that those values in Annex IV should only be used where the country of production for the precursor is not known. Furthermore, Annexes I and IV contain an indicator in the last column which refers to the underlying production route determining the CBAM benchmark (BM).

The Default Values Act will be revised by 2027 at the latest.

When operators must use default values for precursor goods

You as the operator must use default values where data on the actual embedded emissions of precursor goods you have purchased are not available to you; for example, if you have purchased a precursor from another installation to use in your production process, but the supplier does not provide the relevant verified data in time for your reporting, you can use the relevant precursor default values (increased by the relevant mark-up) from Annex I above, provided that the country of production is known. Otherwise, the values from Annex IV (increased by the relevant mark-up) need to be used.

Default values for precursor goods can be used:

- For each quantity of precursor (for one or more precursor goods) purchased that lacks the relevant data from the supplier; and
- In combination with actual data from the production process at your installation to determine the embedded emissions of the complex good.

I.e. in the case of the last bullet point, the specific embedded emissions of the complex good would be calculated from and comprise different shares of default and actual embedded emissions. This split by type of embedded emissions is reported in the operator's emissions report. Furthermore, mixing of default and actual data is possible even where for the same type of precursor some batches have actual data available and some do not.

Using default values versus actual data

The default values for CBAM goods shall be increased by a proportionately designed percentage '**mark-up**' in their value:

- The mark-up is set at a specified percentage level, which is being phased in over 2026 to 2028 in order to give operators time to adapt. These mark-ups are

  10% in 2026,

  20% in 2027, and

  30% from 2028 onwards.
- A lower mark-up applies to the fertiliser sector.

  This mark-up is 1% from 2026 onwards.

The default values including mark-up have been determined to ensure that embedded emissions are not underestimated when applying default values. Therefore, it should in most cases be more advantageous for operators and authorised CBAM declarants to use the actual values for precursor goods or final CBAM goods where these are available, than to use default values.

Default value is year-dependent (2026, 2027 or 2028 onwards)

In the first three years of the definitive period, as noted above, the default value mark-up is year-dependent. In selecting which year to use, two presumptions given in the Methodology Act need to be taken into account:

- The first is that for an imported good the reporting period shall (by default) be the calendar year during which the good was imported[80], unless sufficient evidence is available to confirm the period in which the good was produced (which then becomes the reporting period).
- The second is that the default reporting period of the precursor shall (by default) be the same calendar year as the year of production of the complex good[81] (see section 4.9.2); unless sufficient evidence is available to confirm the period in which the good was produced (which then becomes the reporting period).

Given that no data prior to the start of the definitive period should be used, if the year of import of the complex good is 2026, then the relevant precursor default value and mark-up for 2026 should be used in determining the embedded emissions of the complex good.

However, after 2026 the year of production of the complex good becomes more relevant; for example, if the year of import is 2027 but the complex good was produced in 2026 (as confirmed by sufficient evidence), then you as the operator should select the precursor default value and mark-up for 2026 to use. And so on.

Note that if it was necessary for the authorised CBAM declarant to use a default value for the final complex good imported, this would always be for the year of import for the good.

4.10.2 Default and alternative default emission factors for grid electricity

For electricity received from the grid that is consumed in producing CBAM goods, the default approach for calculating indirect emissions is to use a **default emission factor value** that is provided by the Commission in Annex II to the Default Values Act (see section 4.10.1). This default value is an average emission factor of the country of origin's electricity grid, based on licensed IEA data. It reflects the average emissions of the country's power generation.

Alternative default emissions factor values for calculating indirect emissions[82]

Where sufficient evidence is provided to the Commission that demonstrates that the average CO_2 emission factor or the average grid emission factor for a third country is lower than the respective default value provided, then the Commission will determine an alternative (modified) default emission factor based on that evidence provided. These alternative default values may then be used for determining the indirect emissions due to

---

80 Article 7 'Identification of the reporting period' of the Methodology Act.

81 Article 13 'Identification of the reporting period' of the Methodology Act.

82 Annex II to the Methodology Act, Section D.2.3 with regard to electricity imported into the EU, section D.4.4. with regard to indirect emissions

the electricity consumed in the production of goods imported in a given year. In this context, for that year:

- The alternative evidence provided by the third country (or group of third countries) must be reliable official data such as national statistics;
- The alternative emission factor for the average grid emission factor for indirect emissions shall be calculated by the third country as an average of the most recent 5 years data using equations 39 and 40 given in section D.4.4 of Annex II to the Methodology Act (e.g. to reflect changes in the generation mix resulting from decarbonisation policies).
- The data should be provided to the Commission by 30 June of that year to allow time to review, amend and publish the modified default value by 30 June of the following year.

Provided the Commission considers the data sufficient, then the alternative default value would apply from the year in which the data was provided to the Commission. The alternative default value would be formally adopted and would be made available by the Commission through regular amendments to Annex II to the Default Values Act.

4.10.3 Minor data gaps in installation's monitoring data

Where data gaps occur in everyday activities of monitoring emissions in the installation, the Methodology Acts requests that substitute data shall consist of conservative estimates, i.e. by data that ensures that emissions are not under-estimated, and that activity levels (production data) are not over-estimated. The following guidance can be given:

- If a calculation factor in a calculation-based methodology is missing (e.g. because a sample has not been taken in time or no laboratory analysis was made), substitution by a standard value will be simple (see section 4.6.1.4).
- If activity data (section 4.6.1.3) are missing (e.g. because a truck was not weighed), it may be a good idea to use the average mass of similar truck loads in the same reporting period, adding some supplement (e.g. one standard deviation) to the data to ensure the estimate's conservativeness.
- If a measurement instrument is not functioning properly, it shall be replaced as soon as possible. In the meantime, an instrument exhibiting higher uncertainty may be used, if available. If no other instrument is available, the missing data should be estimated conservatively. For flow meters, an average flow rate determined during the same reporting period might be used, adding some supplement (e.g. one standard deviation) to the data to ensure the estimate's conservativeness. In other cases, e.g. heat measurements, an estimate may be based on the energy efficiency of the process determined over the reporting period, adding some supplement.
- The chosen approach for filling the data gap must be put down in the Monitoring Plan for future use. Furthermore, a regular review must be performed to identify options to avoid similar data gaps in the future (e.g. by ensuring that reserve units are kept in stock for critical measurement instruments).

Annex A List of abbreviations

Abbreviation	Full term
AD	Activity Data
AEM	Anode Effect Minutes
AEO	Anode Effect Overvoltage
AL	Activity Level
AOD	Argon Oxygen Decarburisation.
BAT	Best Available Techniques
BF	Biomass Fraction
BFG	Blast Furnace Gas
BM	Benchmark
BOF	Basic Oxygen Furnace
BOFG	Basic Oxygen Furnace Gas
BREFs	Best Available Techniques Reference documents
CA	Competent Authority
CBAM	Carbon Border Adjustment Mechanism, the
CCR	Clinker to Cement Ratio
CCS	Carbon Capture and Storage
CCU(S)	Carbon Capture and Utilisation (and Storage)
CEMS	Continuous Emission Measurement Systems
CF	Conversion Factor
CFP	Carbon footprint of products
CHP	Combined Heat and Power
CKD	Cement Kiln Dust
CN	Combined nomenclature
COG	Coke Oven Gas
DRI	Direct Reduced Iron
EAF	Electric Arc Furnace
EEA	European Economic Area (EU-27, Iceland, Norway, Liechtenstein)
EF	Emission Factor
EFTA	European Free Trade Area
EORI	Economic Operator Registration and Identification
ETS	Emissions Trading System
EU ETS	EU Emissions Trading System
EUA	EU Allowances (used in the EU ETS)
EUR	Euro (currency)

Abbreviation	Full term
FAR	Free Allocation Rules (Regulation 2019/331)[83]
FIFO	First-In-First-Out principle
GHG	Greenhouse Gas
GWP	Global Warming Potential
HBI	Hot Briquetted Iron
HS	Harmonised System (for international trade)
IEA	International Energy Agency
ISO	International Organization for Standardization
LULUCF	Land-use, land change and forestry (criteria)
MP	Monitoring Plan
MRR	Monitoring and Reporting Regulation (Regulation 2018/2066)[84]
MRV	Monitoring, Reporting and Verification
MS	Member State(s)
MWh	Megawatt-hour
NCV	Net Calorific Value
NPI	Nickel pig iron
OF	Oxidation Factor
PCI	Pulverised Coal Injection
PEMS	Predictive Emission Monitoring System
PFC	Perfluoro-carbon
PoS	Proofs of Sustainability
RED II	Renewable Energy Directive, re-cast
SEE	Specific embedded emissions
SEFA	Specific embedded free allocation
TARIC	Integrated Tariff of the European Union database
TJ	Terajoules
TSO	Transmission System Operator
UCC	Union Custom Code
UN/LOCODE	United Nations Code for Trade and Transport Location

[83] Free Allocation Rules (Commission Delegated Regulation (EU) 2019/331 of 19 December 2018 determining transitional Union-wide rules for harmonised free allocation of emission allowances pursuant to Article 10a of Directive 2003/87/EC of the European Parliament and of the Council)

[84] Monitoring and Reporting Regulation (Commission Implementing Regulation (EU) 2018/2066 of 19 December 2018 on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council and amending Commission Regulation (EU) No 601/2012

Annex B List of definitions

Term	Definition
'Accuracy'	means the closeness of the agreement between the result of a measurement and the true value of the particular quantity or a reference value determined empirically using internationally accepted and traceable calibration materials and standard methods, taking into account both random and systematic factors
'Activity data'	means the amount of fuels or materials consumed or produced by a process relevant for the calculation-based methodology, expressed in terajoules (TJ), mass in tonnes or (for gases) volume in normal cubic metres, as appropriate
'Actual emissions'	means the emissions calculated based on primary data from the production processes of goods and from the production of electricity consumed during those processes as determined in accordance with the methods set out in Annex IV [to the Methodology Act]
'Activity level'	means the quantity of goods to which the same functional unit applies that are produced within the system boundaries of a production process during a reporting period
'Aggregated goods categories'	means aggregated goods categories pursuant to Table 1 of point 2 of Annex I. A group of CBAM goods with their CN codes, used for the purpose of defining system boundaries of production processes.
'Agricultural, aquaculture, fisheries and forestry residues'	means residues that are directly generated by agriculture, aquaculture, fisheries and forestry and that do not include residues from related industries or processing
'Authorised CBAM declarant'	means a person authorised by the competent authority in accordance with Article 17 [of the CBAM Regulation]. The 'authorised CBAM declarant' [which replaces the term 'reporting declarant' from the transitional period] may be importers of CBAM goods, or their indirect customs representatives, who have applied for and been granted the status of authorised CBAM declarant.
'Batch'	means an amount of fuel or material representatively sampled and characterised, and transferred as one shipment or continuously over a specific period of time
'Biomass'	means biomass as defined in Article 2, point (24) of the Renewable Energy Directive (RED II)[85]; it includes bioliquids and biofuels as defined in Article 2, point (32) and (33), biomass fuels as defined in Article 2, point (27) and biogas as defined in Article 2 point (28) of the RED II;

85 Directive (EU) 2018/2001

Term	Definition
'Biomass fraction'	means the ratio of carbon stemming from biomass to the total carbon content of a fuel or material, expressed as a fraction
'Calculation factors'	means net calorific value, emission factor, preliminary emission factor, oxidation factor, conversion factor, carbon content or biomass fraction
'Calibration'	means the set of operations, which establishes, under specified conditions, the relations between values indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material and the corresponding values of a quantity realised by a reference standard
'Carbon price'	means the monetary amount paid in a third country, under a carbon emissions reduction scheme, in the form of a tax, levy or fee or in the form of emission allowances under a greenhouse gas emissions trading system, calculated on greenhouse gases covered by such a measure, and released during the production of goods
'CBAM certificate'	means a certificate in electronic format corresponding to one tonne of CO_2e of embedded emissions in goods
'CO_2 emission factor'	means the weighted average of the CO_2 intensity of electricity produced from fossil fuels within a geographic area. The CO_2 emission factor is the result of the division of the CO_2 emission data of the electricity sector by the gross electricity generation based on fossil fuels in the relevant geographic area. It is expressed in tonnes of CO_2 per megawatt-hour
'Combined nomenclature' (CN)	means the classification of goods, designed to meet the needs of: i) the Common customs tariff, setting import duties for products imported into the European Union (EU), as well as the Integrated tariff of the European Communities (Taric), incorporating all EU and trade measures applied to goods imported into and exported out of the EU; ii) the international trade statistics of the EU. The CN provides the means of collecting, exchanging and publishing data on EU international trade statistics. It is also used for the collection and publication of international trade statistics in intra-EU trade.[86]
'Combustion emissions'	means greenhouse gas emissions occurring during the exothermic reaction of a fuel with oxygen
'Competent authority'	means the authority designated by each Member State in accordance with Article 11 [of the CBAM Regulation]

[86] For definition see: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Combined_nomenclature_(CN)

Term	Definition
'Continuous emission measurement' (CEM)	means a set of operations having the objective of determining the value of a quantity by means of periodic measurements, applying either measurements in the stack or extractive procedures with a measuring instrument located close to the stack, whilst excluding measurement methodologies based on the collection of individual samples from the stack
'Control system'	means the operator's risk assessment and entire set of control activities, including the continuous management thereof, that an operator has established, documented, implemented and maintained pursuant to point A.2. of Annex II
'Complex goods'	means goods other than simple goods
'Conservative'	means that a set of assumptions is defined in order to ensure that no under-estimation of reported emissions or over-estimation of production of heat, electricity or goods occurs
'Conversion factor'	means the ratio of carbon emitted as CO_2 to the total carbon contained in the source stream before the emitting process takes place, expressed as a fraction, considering CO emitted to the atmosphere as the molar equivalent amount of CO_2
'Co-product'	means any of two or more products resulting from the same production process
'Customs declarant'	means a declarant as defined in Article 5, point (15) of Regulation (EU) No 952/2013 lodging a customs declaration for release for free circulation of goods in its own name or the person in whose name such a declaration is lodged
'CCUS system'	means a group of economic operators with technically connected installations and transport equipment for CO_2 capture, transport, use in production of goods, or geological storage
'Data flow activities'	mean activities related to the acquisition, processing and handling of data that are needed to draft an emissions report from primary source data
'Data set'	means one type of data, either at installation level or production process level as relevant in the circumstances, as any of the following: (a) the amount of fuels or materials consumed or produced by a production process as relevant for the calculation-based methodology, expressed in terajoules, mass in tonnes, or for gases as volume in normal cubic metres, as appropriate, including for waste gases; (b) a calculation factor;

Term	Definition
	(c) net quantity of measurable heat, and the relevant parameters required for determining this quantity, in particular: i) mass flow of heat transfer medium; and ii) enthalpy of transmitted and returned heat transfer medium, as specified by composition, temperature, pressure and saturation; (d) quantities of non-measurable heat, specified by the relevant quantities of fuels used for producing the heat, and the net calorific value (NCV) of the fuel mix; (e) quantities of electricity; (f) quantities of CO_2 transferred between installations; (g) quantities of precursors received from outside the production process, and their relevant parameters, such as country of origin, used production route, specific direct and indirect emissions;
'Default value'	means a value, which is calculated or drawn from secondary data, which represents the embedded emissions in goods
'Direct emissions'	means emissions from the production processes of goods including emissions from the production of heating and cooling that is consumed during the production processes, irrespective of the location of the production of the heating or cooling
'Embedded emissions'	means direct emissions released during the production of goods and indirect emissions from the production of electricity that is consumed during the production processes, calculated in accordance with the methods set out in Annex IV and further specified in the implementing acts adopted pursuant to Article 7(7)
'Emissions'	mean the release of greenhouse gases into the atmosphere from the production of goods
'Emission factor'	means the average emission rate of a greenhouse gas relative to the activity data of a source stream assuming complete oxidation for combustion and complete conversion for all other chemical reactions
'Emission factor' for electricity	means the default value, expressed in CO_2e, representing the emission intensity of electricity consumed in production of goods.
'Emission source'	means a separately identifiable part of an installation or a process within an installation, from which relevant greenhouse gases are emitted
EU ETS	means the system for greenhouse gas emissions allowance trading within the Union in respect of activities listed in Annex I to Directive 2003/87/EC other than aviation activities

Term	Definition
'EU ETS allowance'	means an allowance as defined in Article 3, point (a), of Directive 2003/87/EC in respect of activities listed in Annex I to that Directive other than aviation activities
'Fossil carbon'	means inorganic and organic carbon that is not biomass
'Fossil fraction'	means the ratio of fossil carbon to the total carbon content of a fuel or material, expressed as a fraction
'Fugitive emissions'	means irregular or unintended emissions from sources that are not localised, or too diverse or too small to be monitored individually
'Functional unit'	means the reference unit used for the calculation of embedded emissions in goods
'Goods'	means goods listed in Annex I [to the CBAM the CBAM Regulation]
'Greenhouse gases'	mean greenhouse gases as specified in Annex I [to the CBAM the CBAM Regulation] in relation to each of the goods listed in that Annex
'Heat meter'	means a thermal energy meter or any other device to measure and record the amount of thermal energy produced based upon flow volumes and temperatures
'Importer'	means either the person lodging a customs declaration for release for free circulation of goods or a bill of discharge in accordance with Article 175(5) of Delegated Regulation (EU) 2015/2446 in its own name and on its own behalf or, where the customs declaration is lodged by an indirect customs representative in accordance with Article 18 of Regulation (EU) No 952/2013, the person on whose behalf such a declaration is lodged
'Importation'	means release for free circulation as provided for in Article 201 of Regulation (EU) No 952/2013
'Indirect customs Representative'	A customs representative appointed by an importer established in a Member State. If the importer appoints an indirect customs representative and they agree, they can act as an authorised CBAM declarant and submit the application for an authorisation on behalf of the importer. The indirect customs representative is liable for all operations made for the importers it represents
'Indirect emissions'	means emissions from the production of electricity which is consumed during the production processes of goods, irrespective of the location of the production of the consumed electricity
'Inherent CO_2'	means CO_2 which is part of a source stream.
'Installation'	means a stationary technical unit where a production process is carried out

Term	Definition
'Legal metrological control'	means the control exercised by a public authority or regulator of the measurement tasks intended for the field of application of a measuring instrument, for reasons of public interest, public health, public safety, public order, protection of the environment, the levying of taxes and duties, the protection of consumers and fair trading
'Measurable heat'	means a net heat flow transported through identifiable pipelines or ducts using a heat transfer medium, such as, in particular, steam, hot air, water, oil, liquid metals and salts, for which a heat meter is or could be installed
'Measurement point'	means the emission source for which continuous emission measurement systems (CEMS) are used for emission measurement, or the cross-section of a pipeline system for which the CO_2 flow is determined using continuous measurement systems
'Measurement system'	means a complete set of measuring instruments and other equipment used to determine variables for the monitoring and calculation of emissions
'Minimum requirements'	means monitoring methods using the minimum efforts allowed for determining data in order to result in emission data acceptable for the purpose of the CBAM Regulation.
'Mixed fuel'	means a fuel which contains both biomass and fossil carbon
'Mixed material'	means a material which contains both biomass and fossil carbon
'Multifunctional process'	means a process that delivers multiple outputs or whose outputs feed into several production processes
'Net calorific value' (NCV)	means the specific amount of energy released as heat when a fuel or material undergoes complete combustion with oxygen under standard conditions, less the heat of vaporisation of any water formed
'Non-CBAM good'	means any good produced in the installation that is not included in Annex I to the CBAM Regulation
'Non-measurable heat'	means all heat other than measurable heat
'Operator'	means any person who operates or controls an installation in a third country, including a parent company that controls an installation in a third country
'Oxidation factor'	means the ratio of carbon oxidised to CO_2 as a consequence of combustion to the total carbon contained in the fuel, expressed as a fraction, considering carbon monoxide (CO) emitted to the atmosphere as the molar equivalent amount of carbon dioxide (CO_2)
'Power purchase agreement'	means a contract under which a person agrees to purchase electricity directly from an electricity producer

Term	Definition
'Precursor'	means any input material into a production process included in the list of goods set out in Annex I to the CBAM Regulation;
'Preliminary emission factor'	means the assumed total emission factor of a fuel or material based on the carbon content of its biomass fraction and its fossil fraction before multiplying it by the fossil fraction to produce the emission factor
'Production process'	means the chemical and physical processes carried out to produce goods in an installation
'Production route' [87]	means a specific technology used in a production process to produce goods
'Process emissions'	means greenhouse gas emissions other than combustion emissions occurring as a result of intentional and unintentional reactions between substances or their transformation, for a primary purpose other than the generation of heat, including from the following processes: (a) the chemical, electrolytic or pyrometallurgical reduction of metal compounds in ores, concentrates and secondary materials; (b) the removal of impurities from metals and metal compounds; (c) the decomposition of carbonates, including those used for flue gas cleaning; (d) chemical syntheses of products and intermediate products where the carbon bearing material participates in the reaction; (e) the use of carbon containing additives or raw materials; (f) the chemical or electrolytic reduction of metalloid oxides or non-metal oxides such as silicon oxides and phosphates.
'Proxy data'	means annual values which are empirically substantiated or derived from accepted sources and which an operator uses to substitute a data set[88] for the purpose of ensuring complete reporting
'Rebate'	means any amount that reduces the amount due or paid by a person liable for the payment of a carbon price, before its payment or after, in a monetary form or in any other form.
'Recommended improvements'	means monitoring methods which are proven means to ensure that data are more accurate or less prone to mistakes than by mere application of minimum requirements
'Related emissions'	means: – the direct emissions caused by the source stream or emission source concerned; – emissions attributed to a quantity of measurable heat; – the indirect emissions related to the quantity of electricity concerned; – embedded emissions of a material produced or of a precursor consumed.

[87] Note that different production routes can fall within the same production process.

[88] Refers to the activity data or the calculation factors.

Term	Definition
'Reporting period'	means the period corresponding to the calendar year during which the good was produced and used by the authorised CBAM declarant as reference for the determination of embedded emissions
'Residue'	means a substance that is not the end product that a production process directly seeks to produce; it is not a primary aim of the production process and the process has not been deliberately modified to produce it
'Simple goods'	means goods produced in a production process requiring exclusively input materials (precursors) and fuels having zero embedded emissions
'Source stream'	means either of the following: (a) a specific fuel type, raw material or product giving rise to emissions of relevant greenhouse gases at one or more emission sources as a result of its consumption or production; (b) a specific fuel type, raw material or product containing carbon and included in the calculation of greenhouse gas emissions using a mass-balance method
'Specific embedded emissions'	means the embedded emissions of one tonne of goods, expressed as tonnes of CO_2e emissions per tonne of goods
'Standard conditions'	means temperature of 273,15 K and pressure conditions of 101 325 Pa defining normal cubic metres (Nm^3)
'System boundary'	means the group of chemical or physical processes included in the calculation of embedded emissions of goods under the same aggregated goods category. The system boundaries shall cover direct emissions, indirect emissions for goods not listed in Annex II to the CBAM Regulation, and the embedded emissions of any precursor.
'Third country'	means a country or territory outside the customs territory of the [European] Union
'Tonne of $CO_{2(e)}$'	means one metric tonne of carbon dioxide ('CO_2'), or an amount of any other greenhouse gas listed in Annex I [to the CBAM Regulation] with an equivalent global warming potential ['CO_2e']
'Transmission system operator'	means an operator as defined in Article 2, point (35) of Directive (EU) 2019/944 of the European Parliament and of the Council ([89]).

[89] Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity and amending Directive 2012/27/EU (OJ L 158, 14.6.2019, p. 125).

Term	Definition
'Uncertainty'	means a parameter, associated with the result of the determination of a quantity, that characterises the dispersion of the values that could reasonably be attributed to the particular quantity, including the effects of systematic as well as of random factors, expressed in percent, and describes a confidence interval around the mean value comprising 95% of inferred values taking into account any asymmetry of the distribution of values
'Waste'	means any substance or object which the holder discards or intends or is required to discard, excluding substances that have been intentionally modified or contaminated in order to meet this definition
'Waste gas'	means a gas containing incompletely oxidised carbon in a gaseous state under standard conditions which is a result of any of the processes listed under 'process emissions'

Annex C Further information on biomass

As has been explained in section 4.6.3, emissions from biomass may be "zero-rated" only if certain of **sustainability and GHG savings criteria** (which are summarised as "**RED II criteria**" are complied with. These are defined in the "RED II" (re-cast Renewable Energy Directive[90]). This Annex provides further practical advice on the practical application of these criteria.

The following short introduction to the sustainability and GHG savings criteria is based on the Commission's EU ETS Guidance document No.3 "Biomass and other zero-rating in the EU ETS"[91].

1. Definitions

For easier understanding of the text below, the following definitions will be useful:

- 'Biomass' means the biodegradable fraction of products, waste and residues from biological origin from agriculture, including vegetal and animal substances, from forestry and related industries, including fisheries and aquaculture, as well as the biodegradable fraction of waste, including industrial and municipal waste of biological origin; it includes bioliquids and biofuels, biomass fuels and biogas;
- 'Biofuels' means liquid fuels for transport produced from biomass;
- 'Bioliquids' means liquid fuel for energy purposes other than for transport, including electricity and heating and cooling, produced from biomass;
- 'Biomass fuels' means gaseous and solid fuels produced from biomass;
- 'Biogas' means gaseous fuels produced from biomass;
- 'Waste' means any substance or object which the holder discards or intends or is required to discard, excluding substances that have been intentionally modified or contaminated in order to meet this definition;
- 'Residue' means a substance that is not the end product(s) that a production process directly seeks to produce; it is not a primary aim of the production process and the process has not been deliberately modified to produce it;
- 'Agricultural, aquaculture, fisheries and forestry residues' means residues that are directly generated by agriculture, aquaculture, fisheries and forestry and that do not include residues from related industries or processing;
- 'Municipal waste' means: (a) mixed waste and separately collected waste from households, including paper and cardboard, glass, metals, plastics, bio- waste, wood, textiles, packaging, waste electrical and electronic equipment, waste batteries and accumulators, and bulky waste, including mattresses and furniture; (b) mixed waste and separately collected waste from other sources, where such waste is similar in nature

[90] Directive (EU) 2018/2001, on the promotion of the use of energy from renewable sources (recast). See: http://data.europa.eu/eli/dir/2018/2001/2022-06-07

[91] https://climate.ec.europa.eu/document/download/2289952b-4d59-494c-8c49-c0a559c403d6_en?filename=gd3_biomass_issues_en.pdf&prefLang=de

and composition to waste from households; Municipal waste does not include waste from production, agriculture, forestry, fishing, septic tanks and sewage network and treatment, including sewage sludge, end-of-life vehicles or construction and demolition waste.

2. **Which criteria apply?**

The RED II criteria apply irrespective of the geographical origin of the biomass. Figure 4-6 presents a "decision tree" to which an operator may adhere in order to determine which written procedures have to be included in the MP, and to determine the emission factor of biomass. The numbered steps in this picture mean the following:

1. The first step is to determine if the source stream consists exclusively of biomass, or whether it is mixed with a fossil fraction. In the latter case, the relevant analyses of the biomass fraction or the application of a reasonable default value is necessary (see last sub-heading in section 4.6.1.4). The possibility to apply an emission factor of zero applies only to the biomass fraction of the source stream.

   The biomass fraction might also be determined based on proofs of sustainability from a certification scheme.

   If only a part of the source stream is biomass, the following steps apply only to that biomass fraction. However, if the necessary evidence for meeting the RED II criteria is available only for a part of that biomass fraction, there are three fractions (one fossil, one biomass part that is treated like being fossil (non-zero-rated), and a biomass part which is zero-rated because it fulfils the RED II criteria).
2. Determine if the source stream is used (primarily) for energy purposes. Only if this is the case, the following steps are needed.
3. If the source stream is municipal solid waste, no further criteria need to be taken into account. The biomass fraction may be zero-rated.
4. Determine if the source stream is any type of forest or agricultural biomass, or (produced from) "residues from agriculture, aquaculture, fisheries or forestry", as for such source streams the "land-related" sustainability criteria[92] apply. For other residues or waste (including all kinds of industrial wastes, if containing biomass), only GHG savings criteria need to be complied with[93].

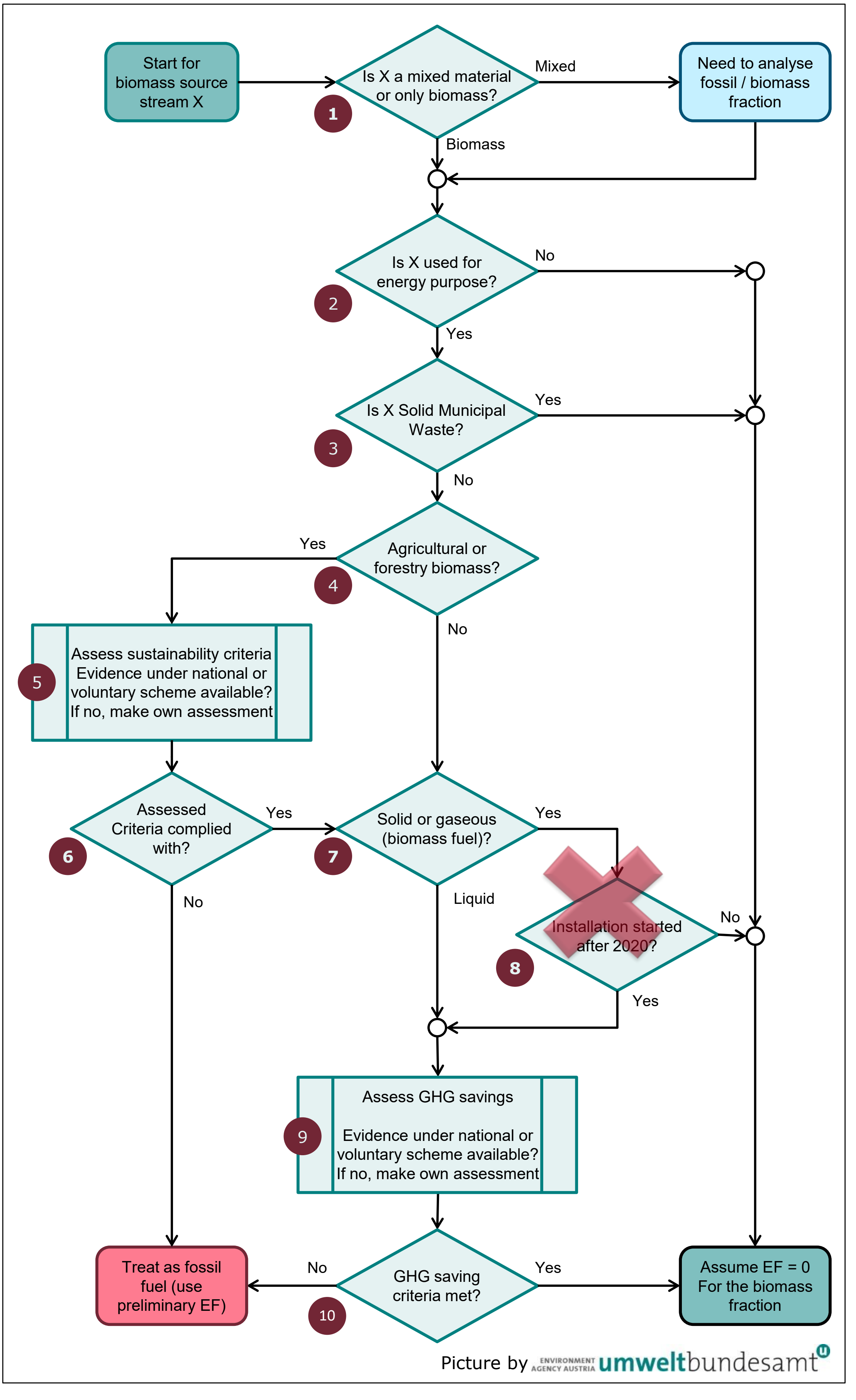
   Note, however, that for biomass stemming from residues from animals, aquaculture and fisheries, the RED II does not list specific land-related sustainability criteria. For such materials operators will have to determine only GHG savings. Therefore, go to step 7.

---

92 Article 29(2) to (7) of RED II

93 In line with the methodology given in the Annexes of the RED II, "no emissions shall be allocated to wastes and residues" [at the first point of collection] when calculating life cycle emissions and GHG savings. This means effectively that for waste of biological origin which is generated directly at the [CBAM] installation, the GHG savings criteria will usually be fulfilled, and this will be easily demonstrated.
The tricky point here is to determine if a material is indeed waste, or whether it is a product, by-product or residue from a production process. For this, the definition of "waste" as given at the start of this Annex must be applied. It excludes explicitly "substances that have been intentionally modified or contaminated in order to meet this definition". A case-by-case assessment may be required. Some RED II certification schemes may give support by providing confirmation if a material is to be considered waste.

Figure 4-6: Decision tree for applying sustainability and GHG saving criteria of the RED II to the monitoring of EU ETS source streams.



5. Depending on step 4, the (land-related) sustainability criteria for the production of biofuels, bioliquids or biomass fuel are to be assessed. In short, the operator can rely on the certification of the used material/fuel under an (international) voluntary scheme recognised by the Commission.

   If no proof of sustainability under a certification scheme is available to the operator, the operator would have to perform the assessment of the relevant criteria itself. More details on steps 4 and 5 are given in sections 3.1 and 3.2 of this Annex.

6. If the previous step shows that the relevant sustainability criteria are not complied with, then the operator has to treat the material as if it were fossil, i.e. the preliminary emission factor becomes the emission factor.

7. If the source stream is liquid, the assessment of GHG savings is mandatory. Go to step 9.

8. As the additional requirement for "biomass fuels", i.e. solid or gaseous biomass, applies only to installations starting operation from 1 January 2021, older installations (more exactly: installations which used biomass already before 2021) do not have to carry out further assessment. For "biomass fuels", i.e. solid or gaseous biomass, the GHG savings threshold depends on the starting date of the installation using them. However, the 2023 amendment of the RED II introduced this criterion also to installations starting operation[94] before 1 January 2021. Therefore, older installations (more exactly: installations which used biomass already before 2021) also have to carry out further assessment. In the updated version of Figure 4-6, step 8 has therefore been indicated as deleted. The thresholds given in Table 4-6 apply.

9. The required GHG savings[95] have to be calculated in accordance with the outline given in section 3.2 of this Annex. The required savings are:

   a. For the use of biofuels and bioliquids: at least 50% if produced in installations in operation before 5 October 2015, at least 60% if produced in installations starting operation until 31 December 2020, and at least 65% if produced in installations starting operation from 1 January 2021.

   b. For the production of electricity, heating and cooling from biomass fuels (i.e. for the *use* of solid or gaseous biomass): the thresholds given in Table 4-6 apply.

10. If the GHG savings are above the applicable threshold, the biomass can be zero-rated, otherwise it has to be treated as if it were fossil. With this step, the assessment is finished.

---

[94] Article 29(10) of the RED II is to be applied: "*An installation shall be considered to be in operation once the physical production of biofuels, biogas consumed in the transport sector and bioliquids, and the physical production of heating and cooling and electricity from biomass fuels has started.*"

[95] Article 29(10) of the RED II requires that GHG savings have to be calculated in accordance with Article 31(1) of the RED II.

Table 4-6: Greenhouse gas savings required for installations using biomass fuels depending on their starting date of operation[94]. The letter in brackets indicates the point in Article 29(10) of the RED II which defines this threshold

Start of operation	**Biomass fuels in general**	**Biomass fuels Installations >= 10 MW**	**Gaseous biomass fuels <=10MW[96]**
after 20 November 2023	(d) 80%	–	–
between 1 January 2021 and 20 November 2023	–	(e) 70% until 31 December 2029; 80% from 1 January 2030	(f) 70% for first 15 years; 80% after 15 years operation
before 1 January 2021	–	(g) 80% after operation of 15 years; at earliest from 1 January 2026, at latest from 31 December 2029	(h) 80% after operation of 15 years, at earliest from 1 January 2026

3. How to provide evidence for RED II criteria

This section explains how compliance against RED II criteria is checked. As has been mentioned in section 4.6.3, the preferred method to demonstrate compliance with RED II criteria is the use of one of the voluntary certification schemes recognised by the Commission. Another option is the use of a proof of sustainability (PoS) from the 'Union Database'. Only if no such proofs are available, you as the operator of an installation may perform the necessary calculations yourself, using the guidance in the following sections.

Information on voluntary schemes for certification of biofuels and biomass fuels can be found at https://energy.ec.europa.eu/topics/renewable-energy/bioenergy/voluntary-schemes_en

Depending on the needs identified using the "decision tree" (section 2 of this Annex), either sustainability criteria, GHG savings criteria, or both or none of these apply. It is therefore possible to discuss sustainability criteria (section 3.1 of this Annex) and GHG savings criteria (section 3.2 of this Annex) separately. Furthermore, the operator will have to ensure completeness of information by using a mass balance as required by Article 30(1) of the RED II, which is necessary to ensure that all criteria are tracked without gaps or double counting throughout the full chain of custody from the first collection point (harvest of biomass) to the use in the installation.

For more details, please refer to the legal text of the RED II. The aim of the following sections is meant only as a short overview for orientation in the RED II. Furthermore, an implementing act on "*rules to verify sustainability and greenhouse gas emissions saving criteria and low indirect land-use change-risk criteria*" gives detailed guidance[97]. This implementing act also gives the framework with which voluntary certification schemes have to comply.

---

96 Column included only for completeness, but relevant for EU ETS installations only in exceptional cases (for activities where Annex I of the EU ETS Directive gives a threshold in terms of production volume but not as rated thermal input).

97 Commission Implementing Regulation (EU) 2022/996 on rules to verify sustainability and greenhouse gas emissions saving criteria […], http://data.europa.eu/eli/reg_impl/2022/996/2025-02-24

3.1 Sustainability criteria

The sustainability criteria are defined in Articles 29(2) to (7) of RED II. They can be summarised as follows:

- Biofuels, bioliquids and biomass fuels produced from residues derived from **agricultural land** (not from forestry) must comply with the conditions laid down in Article 29(2) of the RED II:
  "Operators or national authorities [must] have monitoring or management plans in place in order to address the impacts on soil quality and soil carbon."
- Biofuels, bioliquids and biomass fuels produced from agricultural biomass (this includes the main product of that land, as well as residues) must comply with all of the following paragraphs of Article 29 of the RED II:
  - Article 29(3) excludes raw material obtained from land with a high biodiversity value, namely land that had a specified status in or after January 2008, whether or not the land continues to have that status. Relevant statuses listed are (a) primary forest and similar, (b) highly biodiverse forest and similar, (c) areas that are nature protected, and (d) highly biodiverse grassland. For Point (d), further criteria are given in an implementing act[98].
  - Article 29(4) prevents the use of land which was converted from land with high carbon stocks, namely land that had a specified status in or after January 2008 and no longer has that status, in particular wetland and continuously forested areas.
  - Article 29(5) excludes biomass from former peatland, except if evidence is provided that no drainage of previously undrained soil is involved.
- Biofuels, bioliquids and biomass fuels produced from **forest biomass** (including residues from forestry) must meet certain criteria to minimise the risk of using forest biomass derived from unsustainable production (RED II Article 29(6)), and must meet specified land-use, land-use change and forestry (LULUCF) criteria given by Article 29(7).

  The criteria for agricultural and forestry biomass were updated by the 2023 amendment of the RED II. However, usually these amendments will have impact on the work of the RED II certification system, not directly on CBAM operators.

  An implementing act[99] provides further guidance.
- For **other biomass** (e.g. animal waste or by-products; products, wastes or residues from aquaculture and fisheries; biomass from microorganisms, e.g. from industrial fermentation, etc.), no sustainability criteria are defined in the RED II. Therefore, no further assessments for these types of biomass are relevant. However, it will be useful for an operator to have evidence available that the source stream under discussion indeed falls within this category, i.e. it is a waste and not a material intentionally

---

[98] Commission Regulation (EU) No 1307/2014 on defining the criteria and geographic ranges of highly biodiverse grassland. See http://data.europa.eu/eli/reg/2014/1307/oj

[99] Commission Implementing Regulation (EU) 2022/2448 on establishing operational guidance on the evidence for demonstrating compliance with the sustainability criteria for forest biomass: http://data.europa.eu/eli/reg_impl/2022/2448/oj

modified or contaminated in order to become waste. Some certification schemes might provide the classification as part of their services, but this should only be necessary for borderline cases.

3.2 GHG savings

When the RED II requires GHG savings to be demonstrated, it means that the energy produced from biomass must lead to lower **life cycle emissions** than the use of comparable fossil fuels. The methodology for calculating GHG savings from biofuels and bioliquids is given in section C of Annex V to the RED II. For biomass fuels (biogas and solid biomass), the methodology is given in section B of Annex VI to the RED II. A short summary of the methodology is given here:

Step 1: Calculate the emissions E from the biomass use using the formula:

$$E = e_{ec} + e_l + e_p + e_{td} + e_u - e_{sca} - e_{ccs} - e_{ccr}$$

Where

e_{ec} = emissions from the extraction or cultivation of raw materials[100];

e_l = annualised emissions from carbon stock changes caused by land-use change;

e_p = emissions from processing;

e_{td} = emissions from transport and distribution;

e_u = emissions from the fuel in use[101];

e_{sca} = emission savings from soil carbon accumulation via improved agricultural management;

e_{ccs} = emission savings from CO_2 capture and geological storage;

e_{ccr} = emission savings from CO_2 capture and replacement.

For e_{ec}, e_p and e_{td}, Annexes V and VI provide typical and default values for many feedstock types and processes for biofuel and biomass fuel production. In the case of solid biomass, transport emissions are given dependent of transport distance.

Installations often consume several types of waste materials or residues for which no default values can be found in the RED II. As a simplifying assumption, life cycle emissions of waste at the place and time when the material starts to comply with the definition of waste may be considered zero, if the emissions of sourcing (cultivation, transport to upstream processing, and that processing itself) can be reasonably attributed to the main products instead of the waste. Therefore, for such wastes, only the transport

[100] Default emission factors at regional (NUTS2) level are available from the Commission's website https://energy.ec.europa.eu/topics/renewable-energy/biofuels/biofuels_en and https://energy.ec.europa.eu/system/files/2018-07/pre-iluc_directive_nuts2_report_values_mj_kg_july_2018_0.pdf

[101] Annexes V and VI of the RED II clarify: "Emissions of the fuel in use, e_u, shall be taken to be zero for **biofuels and bioliquids**. Emissions of non-CO_2 greenhouse gases (N_2O and CH_4) of the fuel in use shall be included in the e_u factor for bioliquids.
Emissions of CO_2 from fuel in use, e_u, shall be taken to be zero for **biomass fuels**. Emissions of non-CO_2 greenhouse gases (CH_4 and N_2O) from the fuel in use shall be included in the e_u factor."

emissions up to the installation (if any) as well as potential emissions from processing before combustion (if any) in the installation would have to be taken into account for determining their life cycle emissions.

For e_u the methodology in the RED II also gives instructions how the production of heat and electricity is to be handled if produced separately or by CHP[102]. Note that the approach to taking into account CHP is different from the approach used in the CBAM.

A special case regarding e_u is the biomass fraction of municipal or industrial waste. This may always be considered to be so low that it does not impact the final result. Hence, if other factors are also negligible, in particular e_p and e_{td} which is the case for waste directly[103] used for combustion, the assessment of GHG savings may be omitted.

e_{sca} may only be taken into account if solid and verifiable evidence is provided. e_{ccs} and e_{ccr} are only relevant if CCS/CCU are applied.

Greenhouse gases to be taken into account and are CO_2, N_2O and CH_4.[104]

Where a proof of sustainability from a certification scheme is available at least for some parts of the value chain, the relevant *e* values for the formula above should be available from that proof. Also the GHG savings as calculated below should be given.

Step 2: Calculate the GHG savings as follows:

- For the use of (transport) biofuels:

  $SAVING = (E_{F(t)} – E_{B(t)})/E_{F(t)}$

  Where:

  E_B = total emissions from the biofuel;

  E_F = total emissions from the fossil fuel comparator

- For the production of heating (and cooling) and electricity:

  $SAVING = (EC_{F(h\&c,el)} – EC_{B(h\&c,el)})/EC_{F(h\&c,el)}$

  Where:

  $EC_{B(h\&c,el)}$ = total emissions from the biomass fuel or bioliquid;

---

102 Combined Heat and Power (Cogeneration)

103 For waste transported from a distance of more than 1 000 km to the site, it is recommended that the economic operator confirms whether the omission of e_{td} is justified taking into account the relevant mode of transport.

104 GWP means the Global Warming Potential. Unfortunately, the GWP values given in the RED II have not yet been updated to those of the IPCC's 5th Assessment Report, which are used by most EU climate legislation such as the CBAM. However, an update of these values by the Commission at a later stage is planned.

The Implementing Act on verification of RED II criteria (see footnote 97) contains in Annex IX the newer GWP values as follows: GWP of N2O = 265, GWP of CH4 = 28. These newer values should be used.

$EC_{F(h\&c,el)}$ = total emissions from the fossil fuel comparator for heating, cooling or electricity, as applicable

The generation efficiency η for heating, cooling or electricity has to be taken into account as follows:

$EC = E / \eta$

The following fossil fuel comparators apply[105]:

Purpose	Value of the fossil fuel comparator
Transport fuels (liquid): $E_{F(t)}$	94 g CO_2e/MJ of fuel
Production of electricity: $EC_{F(el)}$	183 g CO_2e/MJ of electricity
Production of useful heat, and heating and/or cooling: $EC_{F(h\&c)}$	80 g CO_2e/MJ of heat

In installations, "useful heat" can mean both, measurable and non-measurable heat. When measurable heat is generated, an efficiency for heat generation from the fuel is known (or can be at least determined in principle). The fossil fuel comparator takes such efficiency into account. For non-measurable heat, however, a fictitious heat generation efficiency of η = 90% needs to be applied for making the amount of fuel used compatible with the comparator, except if a more appropriate efficiency of the process is demonstrated by the operator.

Secondly, if both, heat and electricity are produced in the installation, the respective fuel quantities have to be checked against the respective fossil fuel comparators separately. If a certification scheme is used, the economic operator (which may be the installation's operator) doing the calculation must take the information on the efficiency of heat and electricity generation into account appropriately.

Step 3: Compare the GHG savings to the criteria given in Article 29(10) of the RED II:

- For **biofuels, biogas consumed in the transport sector and bioliquids**, savings must be at least 50% if produced[106] in installations in operation before 5 October 2015, at least 60% for installations starting operation until 31 December 2020, and at least 65% for installations starting operation from 1 January 2021. However, this calculation is usually performed by the producer of the biofuel, not by installations *consuming* such bioliquid or biogas (in this case, the bioliquid consumer should inform the bioliquid producer about its efficiency of heat or electricity production in order to make the calculation). However, if an installation also uses diverse liquid biomass wastes or biogas[106], it may consider itself to be the *producer* of the bioliquid or biogas. In such

[105] For liquid transport fuels, the comparator refers to the energy content of the fuel (NCV), while for the production of heat and electricity, the comparator refers to the amount of heat / electricity produced (taking into account the CHP calculation, where relevant).

[106] This criterion is relevant if the installation produces these fuels and delivers them to other users who have to provide proof for RED II compliance, but also if the installation consumes these fuels itself. Regarding biogas, the "for transport" purpose would then not be given. Instead, the criterion for biomass fuels in the next bullet point would apply.

case, the GHG savings calculation may have to be performed by the operator of the installation, or by a certification scheme on its behalf.

- For **biomass fuels (i.e. solid and gaseous biomass)** *consumed* in installations, GHG savings must be higher than the percentages given in Table 4-6 (page 133), depending on the installation's start of operation (which refers to the first use of biomass).

3.3 Setting up a mass balance

The mass balance in accordance with Article 30(1) of the RED II is basically a database, tracking quantities (physical consignments) over time. Each addition or withdrawal of a quantity of fuel or material must be entered, where processing and mixing steps may be treated as withdrawal from one consignment and adding it to another one. For each consignment the information on already proven sustainability needs to be stored, as well as lifecycle GHG emissions already caused by that biomass. If a quantity is withdrawn and passed on to another economic operator, the information on sustainability and GHG emissions is passed on, too.

When setting up such a mass balance, operators have to keep in mind that it must be complete and transparent (auditable), and that data is protected against unintended change or loss. Hence, a simple spreadsheet will only be sufficient in very simple cases.

Annex D Standard values for emission calculations

Methodology Act: Annex II section G

Standard factors used in the monitoring of direct emissions at installation level

Fuel emission factors related to net calorific values (NCV)

Table 4-7: Fuel emission factors related to net calorific value (NCV) and net calorific values per mass of fuel.

Fuel type description	Emission factor (t CO_2/TJ)	Net calorific value (TJ/Gg)	Source
Crude oil	73,3	42,3	IPCC 2006 GL
Orimulsion	77,0	27,5	IPCC 2006 GL
Natural gas liquids	64,2	44,2	IPCC 2006 GL
Motor gasoline	69,3	44,3	IPCC 2006 GL
Kerosene (other than jet kerosene)	71,9	43,8	IPCC 2006 GL
Shale oil	73,3	38,1	IPCC 2006 GL
Gas/Diesel oil	74,1	43,0	IPCC 2006 GL
Residual fuel oil	77,4	40,4	IPCC 2006 GL
Liquefied petroleum gases	63,1	47,3	IPCC 2006 GL
Ethane	61,6	46,4	IPCC 2006 GL
Naphtha	73,3	44,5	IPCC 2006 GL
Bitumen	80,7	40,2	IPCC 2006 GL
Lubricants	73,3	40,2	IPCC 2006 GL
Petroleum coke	97,5	32,5	IPCC 2006 GL
Refinery feedstocks	73,3	43,0	IPCC 2006 GL
Refinery gas	57,6	49,5	IPCC 2006 GL
Paraffin waxes	73,3	40,2	IPCC 2006 GL
White spirit and SBP	73,3	40,2	IPCC 2006 GL
Other petroleum products	73,3	40,2	IPCC 2006 GL
Anthracite	98,3	26,7	IPCC 2006 GL
Coking coal	94,6	28,2	IPCC 2006 GL
Other bituminous coal	94,6	25,8	IPCC 2006 GL
Sub-bituminous coal	96,1	18,9	IPCC 2006 GL
Lignite	101,0	11,9	IPCC 2006 GL
Oil shale and tar sands	107,0	8,9	IPCC 2006 GL
Patent fuel	97,5	20,7	IPCC 2006 GL
Coke oven coke and lignite coke	107,0	28,2	IPCC 2006 GL
Gas coke	107,0	28,2	IPCC 2006 GL
Coal tar	80,7	28,0	IPCC 2006 GL
Gas works gas	44,4	38,7	IPCC 2006 GL
Coke oven gas	44,4	38,7	IPCC 2006 GL
Blast furnace gas	260	2,47	IPCC 2006 GL
Oxygen steel furnace gas	182	7,06	IPCC 2006 GL
Natural gas	56,1	48,0	IPCC 2006 GL

Fuel type description	Emission factor ($t\ CO_2/TJ$)	Net calorific value (TJ/Gg)	Source
Industrial wastes	143	n.a.	IPCC 2006 GL
Waste oils	73,3	40,2	IPCC 2006 GL
Peat	106,0	9,76	IPCC 2006 GL
Waste tyres	85,0 ([107])	n.a.	WBCSD CSI
Carbon monoxide	155,2 ([108])	10,1	J. Falbe and M. Regitz, Römpp Chemie Lexikon, Stuttgart, 1995
Methane	54,9 ([109])	50,0	J. Falbe and M. Regitz, Römpp Chemie Lexikon, Stuttgart, 1995

Table 4-8: Fuel emission factors related to net calorific value (NCV) and net calorific values per mass of biomass material.

Biomass material	Preliminary EF [$t\ CO_2$ / TJ]	NCV [GJ/t]	Source
Wood / Wood waste (air dry ([110]))	112	15,6	IPCC 2006 GL
Sulphite lyes (black liquor)	95,3	11,8	IPCC 2006 GL
Other primary solid biomass	100	11,6	IPCC 2006 GL
Charcoal	112	29,5	IPCC 2006 GL
Bio gasoline	70,8	27,0	IPCC 2006 GL
Biodiesels	70,8	37,0	IPCC 2006 GL ([111])
Other liquid biofuels	79,6	27,4	IPCC 2006 GL
Landfill gas ([112])	54,6	50,4	IPCC 2006 GL
Sludge gas ([112])	54,6	50,4	IPCC 2006 GL
Other biogas ([112])	54,6	50,4	IPCC 2006 GL
Municipal waste (biomass fraction) ([113])	100	11,6	IPCC 2006 GL

([107]) This value is the preliminary emission factor, i.e., before application of a biomass fraction, if applicable.

([108]) Based on NCV of 10,12 TJ/t.

([109]) Based on NCV of 50,01 TJ/t.

([110]) The given emission factor assumes around 15% water content of the wood. Fresh wood can have water content of up to 50%. For determining the NCV of completely dry wood, the following equation shall be used:

$$NCV = NCV_{dry} \cdot (1 - w) - \Delta H_v \cdot w$$

Where NCV_{dry} is the NCV of the absolute dry material, w is the water content (mass fraction) and $\Delta H_v = 2{,}4 GJ/t\ H_2O$ is the evaporation enthalpy of water. Using the same equation, the NCV for a given water content can be back-calculated from the dry NCV.

([111]) The NCV value is taken from Annex III of Directive (EU) 2018/2001.

([112]) For landfill gas, sludge gas and other biogas: Standard values refer to pure Biomethane. For arriving at the correct standard values, a correction is required for the methane content of the gas.

([113]) The IPCC guidelines also give values for the fossil fraction of municipal waste: EF = 91,7 t CO_2/TJ; NCV = 10 GJ/t

Emission factors related to process emissions

Table 4-9: Stoichiometric emission factor for process emissions from carbonate decomposition (Method A)

Carbonate	Emission factor [t CO_2/ t Carbonate]
$CaCO_3$	0,440
$MgCO_3$	0,522
Na_2CO_3	0,415
$BaCO_3$	0,223
Li_2CO_3	0,596
K_2CO_3	0,318
$SrCO_3$	0,298
$NaHCO_3$	0,524
$FeCO_3$	0,380
General	Emission factor = $[M(CO_2)] / \{Y * [M(x)] + Z *[M(CO_3^{2-})]\}$ X = metal M(x) = molecular weight of X in [g/mol] $M(CO_2)$ = molecular weight of CO_2 in [g/mol] $M(CO_3^{2-})$ = molecular weight of CO_3^{2-} in [g/mol] Y = stoichiometric number of X Z = stoichiometric number of CO_3^{2-}

Table 4-10: Stoichiometric emission factor for process emissions from carbonate decomposition based on alkali earth oxides (Method B)

Oxide	Emission factor [t CO_2/ t Oxide]
CaO	0,785
MgO	1,092
BaO	0,287
general: X_YO_Z	Emission factor = $[M(CO_2)] / \{Y * [M(x)] + Z * [M(O)]\}$ X = alkali earth or alkali metal M(x) = molecular weight of X in [g/mol] $M(CO_2)$ = molecular weight of CO_2 [g/mol] M(O) = molecular weight of O [g/mol] Y = stoichiometric number of X = 1 (for alkali earth metals) = 2 (for alkali metals) Z = stoichiometric number of O = 1

Table 4-11: Emission factors for process emissions from other process materials (production of iron or steel, and processing of ferrous metals) ([114])

Input or output material	Carbon content (t C/t)	Emission factor (t CO_2/t)
Direct reduced iron (DRI)	0,0191	0,07
EAF carbon electrodes	0,8188	3,00
EAF charge carbon	0,8297	3,04
Hot briquetted iron (HBI)	0,0191	0,07
Oxygen steel furnace gas	0,3493	1,28
Petroleum coke	0,8706	3,19
Pig iron	0,0409	0,15
Iron / iron scrap	0,0409	0,15
Steel / steel scrap	0,0109	0,04

Global warming potentials for non-CO_2 greenhouse gases

Table 4-12: Global warming potentials

Gas	Global warming potential
N_2O	265 t CO_2e / t N_2O
CF_4	6 630 t CO_2e / t CF_4
C_2F_6	11 100 t CO_2e / t C_2F_6

([114]) IPCC 2006 Guidelines for National Greenhouse Gas Inventories

Annex E Harmonised efficiency reference values for separate production of electricity and heat

Methodology Act: Annex III.

In the tables below the harmonised efficiency reference values for separate production of electricity and heat are based on net calorific value and standard atmospheric ISO conditions (15 °C ambient temperature, 1,013 bar, 60 % relative humidity).

Table 4-13: Reference efficiency factors for electricity production

Category		Type of fuel	Year of construction		
			Before 2012	**2012-2015**	**From 2016**
Solids	S1	Hard coal including anthracite, bituminous coal, sub-bituminous coal, coke, semi-coke, pet coke	44,2	44,2	44,2
	S2	Lignite, lignite briquettes, shale oil	41,8	41,8	41,8
	S3	Peat, peat briquettes	39,0	39,0	39,0
	S4	Dry biomass including wood and other solid biomass including wood pellets and briquettes, dried woodchips, clean and dry waste wood, nut shells and olive and other stones	33,0	33,0	37,0
	S5	Other solid biomass including all wood not included under S4 and black and brown liquor	25,0	25,0	30,0
	S6	Municipal and industrial waste (non-renewable) and renewable/bio-degradable waste	25,0	25,0	25,0
Liquids	L7	Heavy fuel oil, gas/diesel oil, other oil products	44,2	44,2	44,2
	L8	Bio-liquids including bio-methanol, bioethanol, bio-butanol, biodiesel, and other bio-liquids	44,2	44,2	44,2
	L9	Waste liquids including biodegradable and non-renewable waste (including tallow, fat and spent grain)	25,0	25,0	29,0
Gaseous	G10	Natural gas, LPG, LNG and biomethane	52,5	52,5	53,0
	G11	Refinery gases hydrogen and synthesis gas	44,2	44,2	44,2
	G12	Biogas produced from anaerobic digestion, landfill, and sewage treatment	42,0	42,0	42,0
	G13	Coke oven gas, blast furnace gas, mining gas, and other recovered gases (excluding refinery gas)	35,0	35,0	35,0
Other	O14	Waste heat (including high temperature process exhaust gases, product from exothermic chemical reactions)			30,0

Table 4-14: Reference efficiency factors for heat production

Category		Type of fuel	Year of construction					
			Before 2016			From 2016		
			Hot water	Steam (115)	Direct use of exhaust gases (116)	Hot water	Steam (115)	Direct use of exhaust gases (116)
Solids	S1	Hard coal including anthracite, bituminous coal, sub-bituminous coal, coke, semi-coke, pet coke	88	83	80	88	83	80
	S2	Lignite, lignite briquettes, shale oil	86	81	78	86	81	78
	S3	Peat, peat briquettes	86	81	78	86	81	78
	S4	Dry biomass including wood and other solid biomass including wood pellets and briquettes, dried woodchips, clean and dry waste wood, nut shells and olive and other stones	86	81	78	86	81	78
	S5	Other solid biomass including all wood not included under S4 and black and brown liquor	80	75	72	80	75	72
	S6	Municipal and industrial waste (non-renewable) and renewable/bio-degradable waste	80	75	72	80	75	72
Liquids	L7	Heavy fuel oil, gas/diesel oil, other oil products	89	84	81	85	80	77

(115) If steam plants do not account for the condensate return in their calculation of CHP (combined heat and power) heat efficiencies, the steam efficiencies shown in the table above shall be increased by 5 percentage points.

(116) Values for direct use of exhaust gases shall be used if the temperature is 250 °C or higher.

Category		Type of fuel	Year of construction					
			Before 2016			From 2016		
			Hot water	**Steam** (115)	**Direct use of exhaust gases** (116)	**Hot water**	**Steam** (115)	**Direct use of exhaust gases** (116)
	L8	Bio-liquids including bio-methanol, bioethanol, bio-butanol, biodiesel, and other bio-liquids	89	84	81	85	80	77
	L9	Waste liquids including biodegradable and non-renewable waste (including tallow, fat and spent grain)	80	75	72	75	70	67
Gaseous	G10	Natural gas, LPG, LNG and biomethane	90	85	82	92	87	84
	G11	Refinery gases hydrogen and synthesis gas	89	84	81	90	85	82
	G12	Biogas produced from anaerobic digestion, landfill, and sewage treatment	70	65	62	80	75	72
	G13	Coke oven gas, blast furnace gas, mining gas, and other recovered gases (excluding refinery gas)	80	75	72	80	75	72
Other	O14	Waste heat (including high temperature process exhaust gases, product from exothermic chemical reactions)	—	—	—	92	87	—

Annex F List of relevant CBAM Legislation

CBAM Regulation: Regulation (EU) 2023/956 of the European Parliament and of the Council of 10 May 2023 establishing a carbon border adjustment mechanism;
consolidated version: http://data.europa.eu/eli/reg/2023/956/2025-10-20

Methodology Act (i.e. monitoring and reporting rules explained in this document): Commission Implementing Regulation (EU) 2025/2547 of 10 December 2025 laying down rules for the application of Regulation (EU) 2023/956 of the European Parliament and the Council as regards the methods for the calculation of emissions embedded in goods; http://data.europa.eu/eli/reg_impl/2025/2547/oj

Default values Act: Commission Implementing Regulation (EU) 2025/2621 of 16 December 2025 laying down rules for the application of Regulation (EU) 2023/956 of the European Parliament and the Council as regards the establishment of default values; http://data.europa.eu/eli/reg_impl/2025/2621/oj

Verification Principles Act: Commission Implementing Regulation (EU) 2025/2546 of 10 December 2025 on the application of the principles for verification of declared embedded emissions pursuant to Regulation (EU) 2023/956 of the European Parliament and of the Council; http://data.europa.eu/eli/reg_impl/2025/2546/oj

Accreditation & Verification Requirements Act: Commission Delegated Regulation (EU) 2025/2551 of 20 November 2025 supplementing Regulation (EU) 2023/956 of the European Parliament and of the Council by specifying the conditions for granting accreditation to verifiers, for the control and oversight of accredited verifiers, for the withdrawal of accreditation and for mutual recognition and peer evaluation of accreditation bodies; http://data.europa.eu/eli/reg_del/2025/2551/oj

Free Allocation Adjustment Act: Commission Implementing Regulation (EU) 2025/2620 of 16 December 2025 laying down rules for the application of Regulation (EU) 2023/956 of the European Parliament and of the Council as regards the calculation of the free allocation adjustment to the number of CBAM certificates to be surrendered;
http://data.europa.eu/eli/reg_impl/2025/2620/oj

Carbon Price Paid Act: <PLACEHOLDER>

Authorisation of Declarants: Commission Implementing Regulation (EU) 2025/486 of 17 March 2025 laying down rules for the application of Regulation (EU) 2023/956 of the European Parliament and of the Council as regards the conditions and procedures related to the status of authorised CBAM declarant;
http://data.europa.eu/eli/reg_impl/2025/486/oj *[Note: Link to consolidated version after 2025 amendment not yet available]*

Registry: Commission Implementing Regulation (EU) 2024/3210 of 18 December 2024 laying down rules for the application of Regulation (EU) 2023/956 of the European Parliament and of the Council as regards the CBAM registry;
http://data.europa.eu/eli/reg_impl/2024/3210/oj *[Note: Link to consolidated version after 2025 amendment not yet available]*

Certificates price: Commission Implementing Regulation (EU) 2025/2548 of 10 December 2025 laying down rules for the application of Regulation (EU) 2023/956 of the

European Parliament and of the Council as regards the calculation and publication of the price of CBAM certificates; http://data.europa.eu/eli/reg_impl/2025/2548/oj

Information by customs authorities: Commission Implementing Regulation (EU) 2025/2619 of 16 December 2025 laying down rules for the application of Regulation (EU) 2023/956 of the European Parliament and of the Council as regards the information communicated by customs authorities; http://data.europa.eu/eli/reg_impl/2025/2619/oj

Clarification of geographical scope: Commission Implementing Regulation (EU) 2025/2210 of 31 October 2025 laying down rules for the application of Regulation (EU) 2023/956 of the European Parliament and of the Council as regards goods and processed products brought to the continental shelf or the exclusive economic zone of Member States; http://data.europa.eu/eli/reg_impl/2025/2210/oj

Other EU Legislation cited in the Methodology Act:

EU ETS Directive: Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC, http://data.europa.eu/eli/dir/2003/87/2024-03-01

RED II (recast Renewable Energy Directive): Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources, http://data.europa.eu/eli/dir/2018/2001/2024-07-16

MRR (EU ETS monitoring and Reporting Regulation): Commission Implementing Regulation (EU) 2018/2066 of 19 December 2018 on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council; http://data.europa.eu/eli/reg_impl/2018/2066/2025-05-27.

Permanent CCU: Commission Delegated Regulation (EU) 2024/2620 of 30 July 2024 supplementing Directive 2003/87/EC of the European Parliament and of the Council as regards the requirements for considering that greenhouse gases have become permanently chemically bound in a product; http://data.europa.eu/eli/reg_del/2024/2620/oj

Fertilisers Directive: Regulation (EU) 2019/1009 of the European Parliament and of the Council of 5 June 2019 laying down rules on the making available on the market of EU fertilising products and amending Regulations (EC) No 1069/2009 and (EC) No 1107/2009 and repealing Regulation (EC) No 2003/2003;
http://data.europa.eu/eli/reg/2019/1009/2025-12-30 .

Definition of CN codes: Council Regulation (EEC) No 2658/87 of 23 July 1987 on the tariff and statistical nomenclature and on the Common Customs Tariff; http://data.europa.eu/eli/reg/1987/2658/2026-01-01. This list is regularly updated. When consulting this website, please make sure to check whether it indicates “in force”, or whether a more recent version exists.

EUROPEAN COMMISSION
DIRECTORATE-GENERAL
TAXATION AND CUSTOMS UNION
Indirect Taxation and Tax Administration
CBAM, Energy and Green Taxation

Brussels, 14 August 2026

GUIDANCE DOCUMENT 4: CBAM CALCULATION OF THE FREE ALLOCATION ADJUSTMENT TO THE NUMBER OF CBAM CERTIFICATES TO BE SURRENDERED

Disclaimer: This guidance document is not legally binding and it is of an explanatory nature. Legal provisions of Union law take precedence over the contents of this document and should always be consulted. The authentic texts of the EU legal instruments are those published in the Official Journal of the European Union. This guidance was prepared by Commission services and does not represent an official position of the Commission. Only the Court of Justice of the European Union is competent to authoritatively interpret Union law.

VERSION HISTORY

Date	Version notes
14.08.2026	First Publication of this document for the definitive period.

CONTENTS

1 PREFACE

1.1 Structure and content of the guidance documents

This series of documents has been written to support stakeholders by explaining the requirements of the CBAM Regulation in a non-legislative language. This series of guidance documents should benefit a variety of stakeholders. A specific focus has been put on clarifying the **requirements for operators of installations producing CBAM goods outside of the EU for the definitive period.**

- **Guidance 1** provides an overview of the main changes to the CBAM methodology between the definitive period and the concluded transitional period. It also introduces the CBAM and an overview of the compliance cycle, roles and responsibilities, as well as milestones and deadlines for operators of installations outside the EU during the definitive period and explains the general exemptions from the CBAM.

- **Guidance 2** provides a quick guidance for the intended reader of this document, the operator of an installation producing CBAM goods. It provides a roadmap of the most important concepts of CBAM emissions monitoring and where to find more information in this series of documents.

- **Guidance 3** sets out the monitoring and reporting obligations and recommendations which are potentially applicable to any affected producer of CBAM goods.

- **Guidance 4** provides an overview of how the adjustment for free allocation is to be determined and what information is needed.

- **Guidance documents 5a, 5b, 5c, 5d, 5e and 5f** present an overview per sector of the production processes and value chains for goods that are included in the scope of the CBAM, as well as sector-specific monitoring and reporting considerations for each CBAM good where this is relevant. These sections are supplemented by examples for each sector.

The series of guidance documents is accompanied by an electronic template for information that should be used by installation operators to communicate information to the authorised CBAM declarants and CBAM Registry.

Presentation of numbers in EU documents

To align with EU legal documents, this guidance document uses the following convention when presenting numbers.

The decimal separator used to separate the integral part of a number from its fractional part is a comma, e.g.: 0,890

Thousands, and powers of 10^{3n} thereafter, are separated by a space, e.g.:

- fifteen thousand is written as 15 000
- fifteen million is written as 15 000 000

1.2 Reference regulations and legal acts

Several regulations and legal acts are referred to throughout this series of guidance documents. For ease of reading and to avoid ambiguity, simplified references are used when citing these acts.

- **CBAM Regulation**: Regulation (EU) 2023/956 and Regulation (EU) 2025/2083 amending Regulation (EU) 2023/956. Notably, where article numbers are given in this document without further specification, they always refer to the CBAM Regulation.

  It can be accessed at the following link (consolidated version): **http://data.europa.eu/eli/reg/2023/956/2025-10-20**

- **Methodology Act:** Commission Implementing Regulation (EU) 2025/2547, in legal texts referred to as "Implementing act pursuant to Article 7(7) of the CBAM Regulation".

  It can be accessed at the following link: **http://data.europa.eu/eli/reg_impl/2025/2547/oj**

- **Default Values Act**: Commission Implementing Regulation (EU) 2025/2621, in legal texts referred to as "Implementing act pursuant to Article 7(7) of the CBAM Regulation", also referred to as "default values determined in accordance with Annex IV to the CBAM Regulation".

  It can be accessed at the following link: **http://data.europa.eu/eli/reg_impl/2025/2621/oj**

- **Verification Principles Act**: Commission Implementing Regulation (EU) 2025/2546, in legal texts referred to as "Implementing act pursuant to Article 8(3) of the CBAM Regulation".

  It can be accessed at the following link: **http://data.europa.eu/eli/reg_impl/2025/2546/oj**

- **Accreditation & Verification Requirements Act**: Commission Delegated Regulation (EU) 2025/2551, in legal texts referred to as "Delegated act pursuant to Article 18(3) of the CBAM Regulation".

  It can be accessed at the following link: **http://data.europa.eu/eli/reg_del/2025/2551/oj**

- **Free Allocation Adjustment Act**: Commission Implementing Regulation (EU) 2025/2620, in legal texts referred to as "Implementing act pursuant to Article 31(2) of the CBAM Regulation".

  It can be accessed at the following link: **http://data.europa.eu/eli/reg_impl/2025/2620/oj**

For acronyms and definitions used in this document, please see **Annex B** and **Annex A**.

2 DETERMINATION OF THE ADJUSTMENT FOR FREE ALLOCATION

This section outlines the operator's monitoring requirements and the calculation rules for determining the free allocation adjustment which authorised CBAM declarants can deduct from the embedded emissions to determine the "CBAM obligation", i.e. the number of CBAM certificates to be surrendered for the imported CBAM goods.

The numbering of equations in this chapter corresponds to that used in the Free Allocation Adjustment Act.

2.1 Understanding the need to adjust the CBAM obligation for free allocation

The EU ETS industry sectors exposed to a significant risk of carbon leakage are entitled to receive a part of their emission allowances free of charge. While the CBAM is being phased in, free allocation in the EU ETS will be phased out accordingly for sectors covered by the CBAM. During that phase-out period, the CBAM obligation is adjusted to mirror the free allocation received under the EU ETS and to ensure an equivalent carbon price.

2.1.1 Free allocation under the EU ETS

The basis for free allocation under the EU ETS is performance benchmarks which are determined using an average emissions intensity per unit of production of the 10% most efficient installations in the EU ETS in each sector. There are 54 benchmarks in total – 52 product benchmarks[1] and 2 so-called "fallback approaches"[2] based on heat or fuel consumption, respectively. These were developed in extensive technical work and consultations with various stakeholders. The following EU ETS benchmarks are relevant for the free allocation adjustment under the CBAM and were the basis for the development of CBAM benchmarks:

<u>Product benchmarks:</u>

- Agglomerated iron ore;
- Hot metal[3];
- EAF (electric arc furnace) – carbon steel;
- EAF (electric arc furnace) – high alloy steel;
- Iron casting;
- Primary aluminium;
- Grey cement clinker;
- White cement clinker;

[1] System boundaries of product benchmarks in the EU ETS are found in Annex I to the "FAR" (Free Allocation Rules pursuant to Article 10a(1) of the EU ETS Directive), Commission Delegated Regulation (EU) 2019/331. http://data.europa.eu/eli/reg_del/2019/331/2024-01-01

[2] A third "fallback" approach is used for process emissions, which is not based on a benchmark.

[3] Pig iron or other forms of iron before steel making

- Nitric acid;
- Ammonia;
- Hydrogen.

Fallback Benchmarks:

- Heat benchmark;
- Fuel benchmark.

The calculation of free allocation under the EU ETS can be summarised as follows:

- Each installation covered by the EU ETS is divided into one or more "sub-installations", the system boundaries of which are defined in accordance with the relevant benchmarks (an example is provided in Figure 2-2). This concept is similar to splitting an installation into production processes in the CBAM methodology.
- The free allocation of each sub-installation is calculated by multiplying the relevant benchmark by the corresponding historical activity level[4] (usually the production level in tonnes for product benchmarks, and heat or fuel consumption in TJ for fallback benchmarks).
- In case of sub-installations in sectors covered by the CBAM, this preliminary free allocation is reduced by applying the "CBAM factor", reflecting the phasing-out of free allocation in the EU ETS to mirror the phasing-in of the CBAM.
- Thereafter, the free allocation for all the installation's sub-installations is added up to give the total (preliminary) free allocation to the installation.
- The European Commission then adds up the preliminary free allocation of all installations to determine whether it exceeds the total amount available for free allocation at EU level. If the total amount is exceeded, the allocation per installation must be reduced by applying a cross-sectoral correction factor (CSCF)[5] published by the Commission.

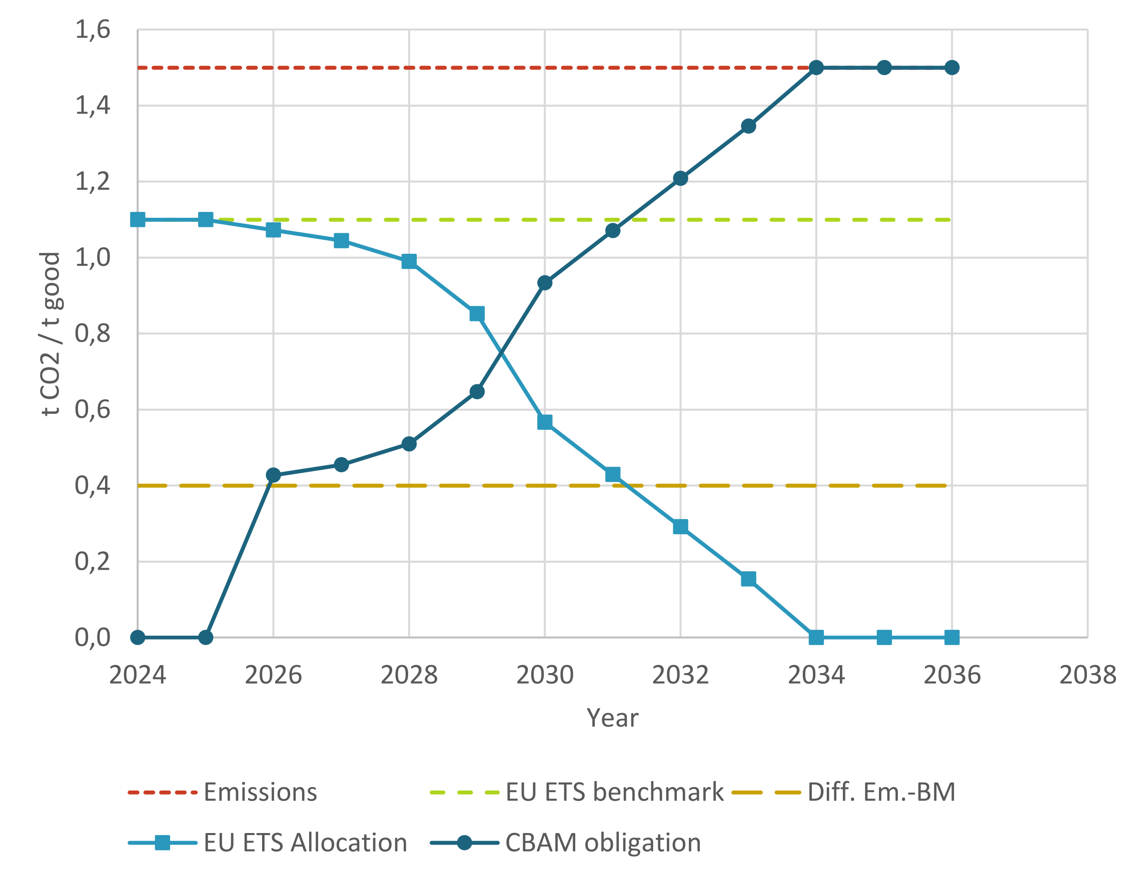
As will be shown in subsequent sections, the concept of benchmarks, the CSCF and the CBAM factor are also relevant for the free allocation adjustment of the CBAM obligation, as is evident in particular from Equations 2 and 6. The values of the CBAM factor and (preliminary) CSCF are listed in Table 2-1 on page 13. The effect of this CBAM factor is illustrated in Figure 2-1.

---

[4] This is based typically on a 5-year period ahead of the five-year "allocation period". In case of significant activity level changes, an adjustment of this ex-ante calculated allocation can be granted, but such detailed rules are not relevant for the CBAM.

[5] The CSCF is defined as "available allocation in the EU ETS divided by the total preliminary free allocation of all EU ETS installations". Because the total available amount declines annually, the CSCF is year-dependent.

Figure 2-1: Correlation between the free allocation in the EU ETS and the CBAM obligation using the "CBAM factor". It is assumed that the actual emissions are 1,5 t CO_2/t of good, and the benchmark is 1,1 t CO_2/t. Note that from the start of the definitive phase of the CBAM in 2026, the carbon costs in the EU ETS (emissions minus EU ETS free allocation) and CBAM (CBAM obligation) are the same.



2.1.2 From EU ETS benchmarks to CBAM benchmarks

While carbon pricing under the EU ETS is based on installation-level emissions, the carbon pricing mechanism of the CBAM is based on the embedded emissions of a good at the point of entry into the EU. A similar difference applies to free allocation: since there is not always a clear relationship between CN code and EU ETS benchmark, the definition of dedicated CBAM benchmarks[6] was necessary for two reasons: (a) the CBAM approach should be as simple as possible. Therefore, the Methodology Act avoids the use of fallback approaches and the Free Allocation Adjustment Act follows this approach, and (b) the effect of precursors on embedded emissions as well as on the free allocation adjustment needs to be taken into account. An illustrative example is given in Figure 2-2, which shows the EU ETS benchmarks relevant for an integrated steel production such as in the first worked example of iron and steel products. As shown in Figure 2-2,

- the production of sintered ore is covered in the EU ETS by the agglomerated iron ore benchmark,

6 See section 5 of the Annex to the Free Allocation Adjustment Act

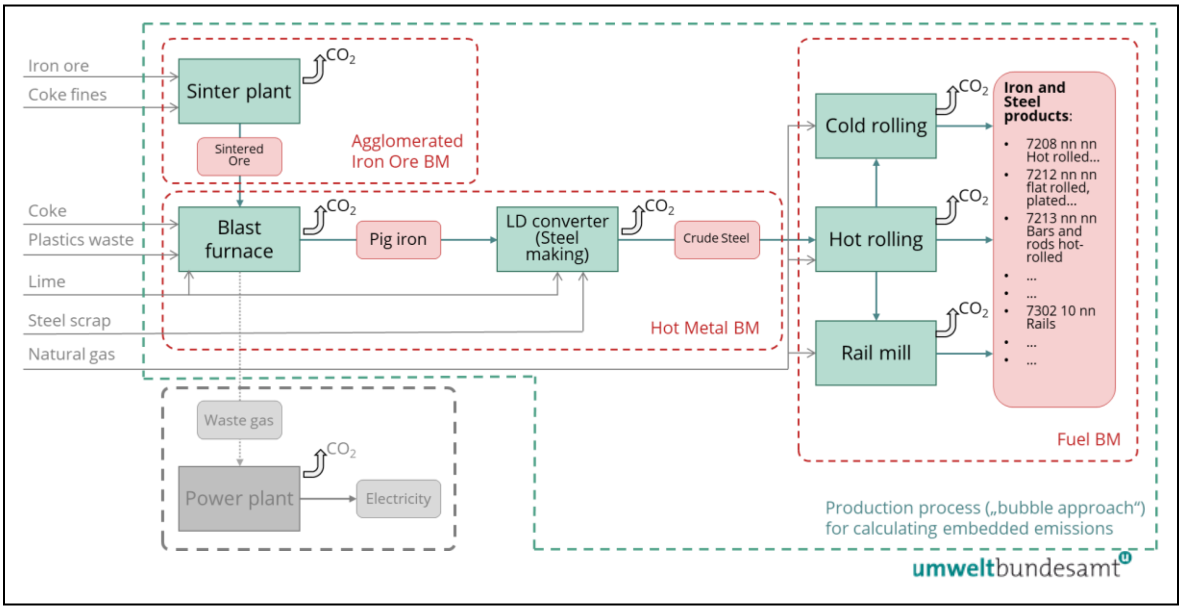
- the production of pig iron and crude steel is covered in the EU ETS by the hot metal benchmark,
- and the final production steps (such as rolling) are covered by the fuel benchmark, but in rare cases also the heat benchmark may be relevant.

If all production steps are performed in an integrated steel plant, actual data may be available for each production step. If, however, steel is bought on the market and only the final production step is performed within the installation, no data on previous production steps may be available. Therefore, CBAM benchmarks are defined for:

- every simple or complex CBAM good (both, intermediate and final products) and
- single production processes[7] and whole production chains[8].

This facilitates the use of the best available data. Note that the calculation methodology for the free allocation adjustment is strongly aligned with the methodology for determining embedded emissions, thereby limiting the administrative burden on operators.

Figure 2-2: Comparing the CBAM production processes to the system boundaries of EU ETS benchmarks..



2.2 How to determine the free allocation adjustment

The embedded emissions, free allocation adjustment and carbon price already paid are factored into the calculation of the CBAM obligation. This chapter elaborates on the free allocation adjustment. First, in section 2.2.1 the calculation rules are explained. Thereafter section 2.2.2 summarises the monitoring requirements for being able to perform this calculation.

7 Column A of section 5 of the Annex to the Free Allocation Adjustment Act

8 Column B of section 5 of the Annex to the Free Allocation Adjustment Act

2.2.1 *Calculation approach for the free allocation adjustment*

No calculation is needed for determining the free allocation adjustment (FAA) for electrical energy (CN code 2716 00 00), as it is zero according to Article 1 of the Free Allocation Adjustment Act (electricity producers do not get free allocation in the EU ETS).

For calculating the free allocation adjustment of all other goods, the following equation is given in point 2 of the Annex to the Free Allocation Adjustment Act:

$$FAA_g = SEFA_{g,y} \cdot M_g \qquad \text{Equation (1)}$$

The parameters have the following meaning:

FAA_g	is the free allocation adjustment of the imported good *g*;
$SEFA_{g,y}$	is the specific embedded free allocation of good *g* in year *y* expressed as t CO_2e / tonne of good *g;*
M_g	is the mass of good *g* imported during the year to which the CBAM declaration applies;
y	is the reporting period identified in accordance with Article 7 of the Methodology Act: • The default reporting period is the year during which the good was imported; • If there is sufficient evidence to identify the actual time of production, the reporting period is the period during which the good was produced; • If the good is imported during the year 2026, the reporting period is 2026, independently of the actual time of production of the good.

The calculation of FAA_g is only relevant for the CBAM declaration, i.e. responsibility of the authorised CBAM declarant. The declarant has two options to perform this calculation:

- If the authorised declarant uses default values for the specific embedded emissions, then *SEFA* must also be determined based on default values (see section 2.2.1.2);
- If the authorised declarant has sufficient evidence for the use of actual data, i.e. if you as the operator of the installation producing the imported good have provided a verified emissions report for year *y* and made this available to the declarant. This emission report also contains all necessary information on $SEFA_{g,y}$.

To determine *SEFA* by you, the operator of an installation*,* different calculation steps are necessary, depending on:

- whether *SEFA* are calculated for a simple or a complex good, and
- whether actual values or default values are used for precursors.

The necessary calculations are described in section 2.2.1.1 below.

2.2.1.1 *Calculation of specific embedded free allocation (SEFA) of a good using actual data*

The methodology to determine the specific embedded free allocation follows the same logic as for specific embedded emissions: both take into account the value chain and the way how installations are split into production processes. However, the determination of actual emissions data requires more effort than the determination of specific free allocation. In case of the latter, major elements of the calculation are themselves based on benchmarks, i.e. values determined for all installations in similar situations.

Figure 2-3 shows a decision tree outlining the relevant steps for calculating the SEFA. As shown in the figure, determining the SEFA of a simple good is the simplest case: the process ends above the dotted box. This is because no precursors are relevant and therefore, the specific embedded free allocation equals the specific free allocation (SFA) of the production process of the simple good.

Production process

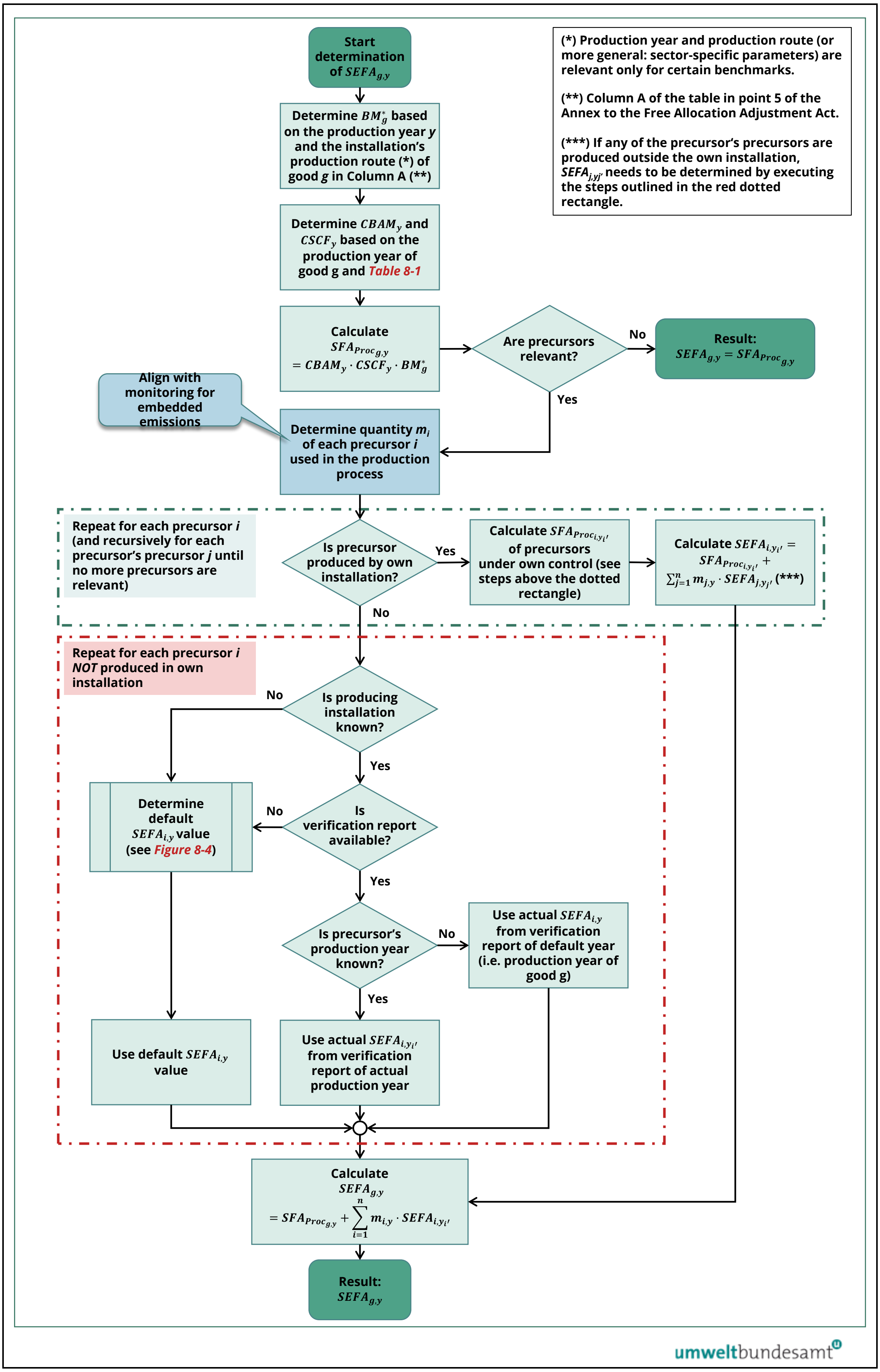
For a single production process, you as the operator must calculate the process-level specific free allocation using the following equation:

$$SFA_{Proc_{g,y}} = CBAM_y \cdot CSCF_y \cdot BM_g^* \qquad \text{Equation (2)}$$

Where:

$SFA_{Proc\ g,y}$	is the process-level specific free allocation in year y calculated for the production process which yields good g, expressed as t CO_2e / tonne of good g;
y	is the reporting period related to the production of good g (i.e. the calendar year during which the good is produced);
$CBAM_y$	is the CBAM factor referred to in Article 10a(1a) of the EU ETS Directive for the year y (dimensionless) – see Table 2-1;
$CSCF_y$	is the cross-sectoral correction factor for year y in accordance with Article 10a(5) of the EU ETS Directive (dimensionless) – see Table 2-1;
BM_g^*	is the process-related CBAM benchmark for the production process which yields good g, expressed as t CO_2e / tonne of g produced, as set out in point 5, Column A, of the Annex to the Free Allocation Adjustment Act.

Figure 2-3: Process description (decision tree) for determining SEFA by an operator. The sub-process "Determine $SEFA_{i,y}$" is described in section 2.2.1.2.



The value BM_g^* has been determined by the Commission based on the EU ETS benchmarks, adjusted for the system boundaries of the relevant processes in the CBAM. Unlike default values for embedded emissions, BM_g^* values apply equally for all countries. However, benchmarks in the EU ETS in a few cases require adjustment for the production route or other parameters which are not deductible from the CN code of the good. Furthermore, a dependency on the production year follows from a change of the factor for reducing the allocation to process emissions in the EU ETS[9]. As a consequence, in some cases, there are several BM_g^* values listed in the Annex to the Free Allocation Adjustment Act for a single CN code (for details see Table 2-2).

Table 2-1: CBAM factor and (partly preliminary) CSCF values[10] – Note: At the time of writing this guidance document, the CSCF values have not yet been calculated by the Commission. Therefore, the given values have to be considered preliminary and are provided for information only.

Year	CBAM factor	CSCF (preliminary)
2025	100,0%	1,0
2026	97,5%	1,0
2027	95,0%	1,0
2028	90,0%	1,0
2029	77,5%	1,0
2030	51,5%	1,0
2031	39,0%	1,0
2032	26,5%	1,0
2033	14,0%	1,0
2034	0,0%	1,0

For interpretation of Table 2-2, the Free Allocation Adjustment Act provides the following definitions and rules:

- ‘White cement clinker’ means cement clinker for use as main binding component in the formulation of materials such as joint fillers, ceramic tile adhesives, insulation, and anchorage mortars, industrial floor mortars, ready mixed plaster, repair mortars, and water-tight coatings with maximum average contents of 0,4 mass-% Fe_2O_3, 0,003 mass-% Cr_2O_3 and 0,03 mass-% Mn_2O_3.
- ‘Grey cement clinker’ means other cement clinker than white cement clinker.

9 The factor determining the free allocation for process emissions sub-installations under the EU ETS is 0,97 until 31 December 2027 and 0,91 for the years 2028 and onwards, as defined in Article 16(e) of Commission Delegated Regulation (EU) 2019/331.

10 CSCF values for the period 2026 to 2030 have been published in Commission Implementing Decision (EU) 2026/1862 (http://data.europa.eu/eli/dec_impl/2026/1862/oj). The values applying from 2031 are expected to be published by the Commission in late 2030. Therefore, the table must be interpreted as containing only preliminary data for years from 2031.

- In the case of other hydraulic cements (CN 2523 90 00) containing a mixture of white clinker and of grey clinker and/or calcined clay, the CBAM benchmark shall be calculated as a weighted average that reflects the composition.
- 'Stainless steel' means alloy steels containing, by weight, 1,2 % or less of carbon and 10,5 % or more of chromium, with or without other elements.
- 'High alloy steel' means steel other than stainless steel, containing 8 % or more metallic alloying elements or steel where high surface quality and processability is required.
- 'Low alloy steel' means alloy steel other than high-alloy steel.
- 'Carbon steel' means steel other than stainless steel, high alloy or low alloy steel.

Table 2-2: Overview of special parameters relevant for selecting a CBAM benchmark value where more than one value is given for a single CN code in the Annex to the Free Allocation Adjustment Act.

Code	Condition to apply the value
(1)	Value is to be used for production years 2026-27
(2)	Value is to be used for production years 2028-30
(A)	Grey clinker / cement
(B)	White clinker / cement
(C)	Carbon Steel based on BF/BOF (production route: Blast Furnace / Basic Oxygen Furnace)
(D)	Carbon Steel based on DRI/EAF (production route: Direct Reduced Iron / Electric Arc Furnace)
(E)	Carbon Steel based on Scrap/EAF (production route: Electric Arc Furnace, with scrap as main input material)
(F)	Low alloy Steel based on BF/BOF (production route: Blast Furnace / Basic Oxygen Furnace)
(G)	Low alloy Steel based on DRI/EAF (production route: Direct Reduced Iron / Electric Arc Furnace)
(H)	Low alloy Steel based on scrap/EAF (production route: Electric Arc Furnace, with scrap as main input material)
(J)	High alloy Steel (based on EAF) (Electric Arc Furnace, with scrap as main input material)
(K)	Primary Aluminium (i.e. aluminium produced by electrolysis from alumina)
(L)	Secondary Aluminium (i.e. aluminium produced by remelting of aluminium scrap as main input)

SEFA of a simple good

As explained above and shown in

Figure 2-3, the *SEFA* value of a simple good *g* equals the *SFA* of the production process of good *g*:

$$SEFA_{g,y} = SFA_{Proc_{g,y}} \qquad \text{Equation (3)}$$

Where:

$SFA_{Proc\ g,y}$ is the direct result of Equation (2).

SEFA of a complex good

For a complex good, the calculation of the *SEFA* is more complicated, as the $SEFA_i$ of each precursor needs to be considered in addition to the *SFA* of the production process.

In determining the *SEFA* of complex goods, only precursors falling themselves under the CBAM are to be considered. This means that the specific free allocation of any precursor originating in the customs territory of the European Union shall be zero. The same applies to precursors originating from third countries or territories that are exempted pursuant to point 1 of Annex III to CBAM Regulation[11]. The quantity of the precursor used, however, must be included in the operator's emissions report.

It is important to note that the CBAM benchmarks used for calculating *SEFA* are based on EU ETS benchmarks, and specific rules for system boundaries apply. For how to select appropriate benchmarks, please see section 2.2.1.4.

The following equation is given in point 3.3 of the Annex to the Free Allocation Adjustment Act for calculating the SEFA of a complex good:

$$SEFA_{g,y} = SFA_{Proc_{g,y}} + \sum_{i=1}^{n} m_{i,y} \cdot SEFA_{i,y_i'} \qquad \text{Equation (4)}$$

Parameter explanations are as follows:

$SEFA_{g,y}$	is the specific embedded free allocation for the complex good *g* in year *y*, expressed as t CO_2e / tonne of good *g*
$SFA_{Proc\ g,y}$	is the process-related specific free allocation in year *y* calculated for the production process which yields good *g* in accordance with Equation (2) expressed as t CO_2e / tonne of good *g*
$m_{i,y}$	is the specific mass of precursor *i* consumed for the production of one tonne of good *g* during reporting period *y*, as determined in accordance with the rules set out in Methodology Act, expressed as t/t
$SEFA_{i,y'}$	is the specific embedded free allocation of precursor *i* in year y_i', expressed as t CO_2e / tonne of precursor *i*
y	is the reporting period identified in accordance with Article 7 of the Methodology Act: • The default reporting period is the year during which the good was imported; • If there is sufficient evidence to identify the actual time of production, the reporting period is the period during which the good was produced; *From the perspective of you as the operator of the installation, y is always known to be the actual production year.*

[11] The countries currently listed in point 1 of Annex III to the CBAM Regulation are: Iceland, Liechtenstein, Norway and Switzerland; the listed territories are: Büsingen, Heligoland, Livigno, Ceuta, Melilla.

	• If the good is imported during the year 2026, the reporting period is 2026, independently of the actual time of production of the good. *This rule means that no earlier reporting year than 2026 may be applied.*
y_i'	Is the production year of the precursor i, defined as the reporting period used in the calculation of $SEFA_i$ for precursor i as identified in accordance with Article 13 of the Methodology Act: • The default reporting period of a precursor is the year of production of the complex good; • Where operators provide the verifier with sufficient evidence to identify the actual time of production, the reporting period is the period during which the precursor was produced, but not earlier than 2026.

The specific mass $m_{i,y}$ of each precursor used shall be determined using the following equation:

$$m_{i,y} = \frac{M_{i,y}}{AL_{g,y}} \qquad \text{Equation (5)}$$

Where:

$M_{i,y}$	is the total mass of the precursor i expressed in tonnes consumed during reporting period y for the production process to which good g belongs. $M_{i,y}$ is determined in accordance with the Methodology Act;
$AL_{g,y}$	is the activity level, meaning the quantity of goods produced within the system boundaries of the production process producing good g, in year y expressed in tonnes. $AL_{g,y}$ is determined in accordance with the Methodology Act[12];
y	is the reporting period identified in accordance with Article 7 of the Methodology Act: • The default reporting period is the year during which the good was imported; • If there is sufficient evidence to identify the actual time of production, the reporting period is the period during which the good was produced; • If the good is imported during the year 2026, the reporting period is 2026, independently of the actual time of production of the good.

Where precursors are themselves complex goods, the calculation of $SEFA_{i,y'}$ shall be repeated recursively using Equations (2), (3), (4) and (5), as appropriate, until no more precursors are relevant. This means that the equations are applied along the value chain

[12] AL_g is to be determined in accordance with point F of Annex II to the Methodology Act. For purposes of the embedded emissions, AL_g is always expressed in functional units. However, for purposes of SEFA, AL_g must be converted to values per tonne of good. This is described in sectoral Guidance document 5a (for cement) and 5c (for fertilisers) respectively.

until the first precursor is reached (i.e. a precursor that itself has no further precursors). In other words: until the precursor is a simple good for which *SEFA* equals *SFA* – see Equation 3). If either all precursors are produced within the operator's own installation or verification reports are available for all externally sourced precursors, the actual values for $SEFA_{i,y'}$ of precursors shall be used. If, however, no verification reports are available for externally sourced precursors, the $SEFA_{i,y'}$ values of these precursors need to be determined using default values (see section 2.2.1.2). This means that (as required by the Free Allocation Adjustment Act), the $SEFA_{i,y'}$ for each precursor shall be determined using one of the following methods:

- where the value for the precursor i is provided by the producer and verified in accordance with Article 8 of the CBAM Regulation, the default reporting period of the precursor (i.e. the production year of good g) is used unless there is sufficient evidence to identify the actual year of production.
- where the value for the precursor i is not provided by the producer, the default reporting period of the precursor is used (i.e. the same year as the production of the complex good) and is determined by selecting the appropriate value from point 5, Column B, of the Annex to the Free Allocation Adjustment Act (see section 2.2.1.2).

2.2.1.2 *Calculation of specific embedded free allocation (SEFA) of a good using default values*

Where default values are used for the specific embedded emissions of a final good imported, no difference is made between simple and complex goods. The following equation for calculating *SEFA* is given in point 4 of the Annex to the Free Allocation Adjustment Act:

$$SEFA_{g,y} = CBAM_y \cdot CSCF_y \cdot BM_g \qquad \text{Equation (6)}$$

Where:

$CBAM_y$	is the CBAM factor referred to in Article 10a(1a) of the EU ETS Directive for the year y (dimensionless) – see Table 2-1;
$CSCF_y$	is the cross-sectoral correction factor for the reporting period y determined by the Commission pursuant to Article 10a(5) of the EU ETS Directive (dimensionless) – Table 2-1;
BM_g	is the default CBAM benchmark set out in Column B of the Annex to the Free Allocation Adjustment Act. Where relevant, this value includes the embedded free allocation for all precursors.
y	is the reporting period as identified in accordance with Article 7 of the Methodology Act: • The default reporting period is the year during which the good was imported; • If there is sufficient evidence to identify the actual time of production, the reporting period is the period during which the good was produced;

- If the good is imported during the year 2026, the reporting period is 2026, independently of the actual time of production of the good.

For the purpose of selecting the appropriate value for BM_g the following parameters shall be taken into account:

- the country of origin of good *g*;
- the CN code for good *g*;
- if applicable, further parameters defining the good *g*, as specified in Annex I of the Default Values Act (such as grey / white cement clinker), as presented in Table 2-2 above;
- if applicable, the production route specified for the country of origin in Annex I to the Default Values Act (such as the blast furnace / electric arc furnace route).

By way of derogation from the approach when using actual data, for precursors included in the default CBAM benchmark, the year *y* is always the same year in which the final complex good is produced. This rule has already been applied when determining the CBAM benchmarks BM_g and do not require any action by users of those values.

If the operator uses the calculation above for a purchased precursor instead to a final product, the only difference is in the determination of the precursor's production year, to which the usual rule for precursors applies (parameter y_i' explained above for Equation 4).

A common process for selecting the correct CBAM benchmark is described in the next section.

2.2.1.3 Determining the applicable CBAM benchmark

As shown in the previous sections, a distinction must be made between the process-related CBAM benchmark (BM_g*) and the default CBAM benchmark (BM_g) which takes into account precursors. Table 2-3 presents an excerpt from Section 5 of the Annex to the Free Allocation Adjustment Act for selected iron and steel products. Column A contains CBAM benchmarks for individual process steps and is relevant when actual data are used to determine *SEFA*. CBAM benchmarks provided in column B cover the entire production chain of the respective good (i.e. precursors are already taken into account) and are relevant for determining the *SEFA* where default values are used for the specific embedded emissions. Accordingly, for simple goods, column A and column B contain the same values, as no precursors are relevant (see e.g. agglomerated iron ore CN 2601 12 00 in Table 2-3).

Table 2-3: Example view of the Table in Section 5 of the Annex to the Free Allocation Adjustment Act

CN code	CN description	Column A *BMg** [tCO_2e/t]	Column B *BMg* [tCO_2e/t]
Iron & Steel			
2601 12 00	Agglomerated iron ores and concentrates (excl. roasted iron pyrites)	0,086	0,086
7201 10 19	Non-alloy pig iron in pigs, blocks or other primary forms, containing by weight ≤ 0,5 % phosphorus, ≥ 0,4 % manganese and > 1 % silicon	1,089	1,210
7207 11 11	Semi-finished products, of non-alloy free-cutting steel, containing by weight < 0,25 % carbon, of square or rectangular cross-section, the width < twice the thickness, rolled or obtained by continuous casting	0,188 (C) 0,065 (D) 0,065 (E)	1,364 (C) 0,475 (D) 0,066 (E)
7202 11 20	Ferro-manganese, containing by weight > 2 % carbon, with a granulometry ≤ 5 mm and a manganese content by weight > 65 %	1,361 (1) 1,277 (2)	1,361 (1) 1,277 (2)
7318 15 20	Screws and bolts, of iron or steel "whether or not with their nuts and washers", for fixing railway track construction material (excl. coach screws)	0,038	1,364 (C) 0,475 (D) 0,066 (E)
7318 15 35	Screws and bolts, of stainless steel "whether or not with their nuts and washers", without heads (excl. screws and bolts for fixing railway track construction material)	0,038	1,154 (1) 1,116 (2)

In the example of crude steel (CN 7207 11 11), the CBAM benchmark depends on the production route which may be one of the following:

- (C) Carbon Steel based on BF/BOF (Blast Furnace/Basic Oxygen Furnace);
- (D) Carbon Steel based on DRI/EAF (Direct Reduced Iron/Electric Arc Furnace);
- (E) Carbon Steel based on Scrap/EAF.

Ferro-manganese (CN 7202 11 20) illustrates a good for which the CBAM benchmark is year-dependent:

- (1) Value is to be used for production years 2026-27;
- (2) Value is to be used for production years 2028-30.[13]

The complete list of parameters used in the Annex of the Free Allocation Adjustment Act has been given above in Table 2-2.

Rules when working with actual data

For selecting the appropriate year for the benchmark, the rules laid out above (e.g. under Equation 4 in section 2.2.1.1) have to be applied. You as the operator know the year of

[13] This year-dependency stems from the factor determining the free allocation for process emissions sub-installations under the EU ETS, which is 0,97 for the years until 31 December 2027 and 0,91 for the years 2028 and onwards, as defined in Article 16(e) of Commission Delegated Regulation (EU) 2019/331.

production of the goods in your installation for this purpose. Furthermore, you also know the applicable production route for your products[14].

Rules when using default values

Where the specific embedded emissions are based on default values, the relevant CBAM benchmarks are also determined fully using default CBAM benchmarks, i.e. those values provided in column B of section 5 of the Annex of the Free Allocation Adjustment Act, as illustrated in Table 2-3. However, in this case, the authorised declarant importing a final CBAM good will not know the production route or other parameters needed to select the appropriate value from that table. You as operator of an installation using a precursor may be in the same situation for that precursor.

To determine the appropriate CBAM benchmark in this situation, an **interim step** must be made before looking up the CBAM benchmark: to determine the parameter in question, the **list of default values for specific embedded emissions needs to be consulted** as follows[15]:

- If the country of origin of the good or precursor is known, the applicable production route shall be identified in the last column of the table set out in Annex I to the Default Values Act for the respective country and CN code.
- If the country of origin of the good or precursor is unknown, the applicable production route shall be identified in the last column of the table set out for "Other countries and Territories" in Annex I to the Default Values Act for a good, or in Annex IV for a precursor, for the applicable CN code.

To illustrate this process, an excerpt from Annex I to the Default Values Act is presented in Table 2-4 for screws and bolts (CN 7318 15) from Algeria. This product illustrates a case where CBAM benchmarks are provided at 8-digit CN code level (see Table 2-3), while the SEE default value is provided at the 6-digit level.

To determine the CBAM benchmark of screws and nuts under CN 7318 15 20 the production route specified in Annex I to the Default Values Act shall be used – (C) Carbon Steel based on BF/BOF in this case. On the other hand, for the CN 7318 15 35, the CBAM benchmark is independent of the production route and instead depends on the year of production, as shown in Table 2-3. This illustrates a case where a a production route is indicated for a group of CN codes at HS code level (i.e. with 4 or 6 digits) and the CBAM benchmark for one or more of the CN codes at 8-digit-level in that group has no production route, the CBAM benchmark (BM) for the concerned CN code being independent of the production route. The year to be used for determining the applicable CBAM benchmark is determined in line with the rules laid out above (e.g. under Equation 4 in section 2.2.1.1).

The whole process of selecting the correct CBAM BM value is summarised below in Figure 2-4.

---

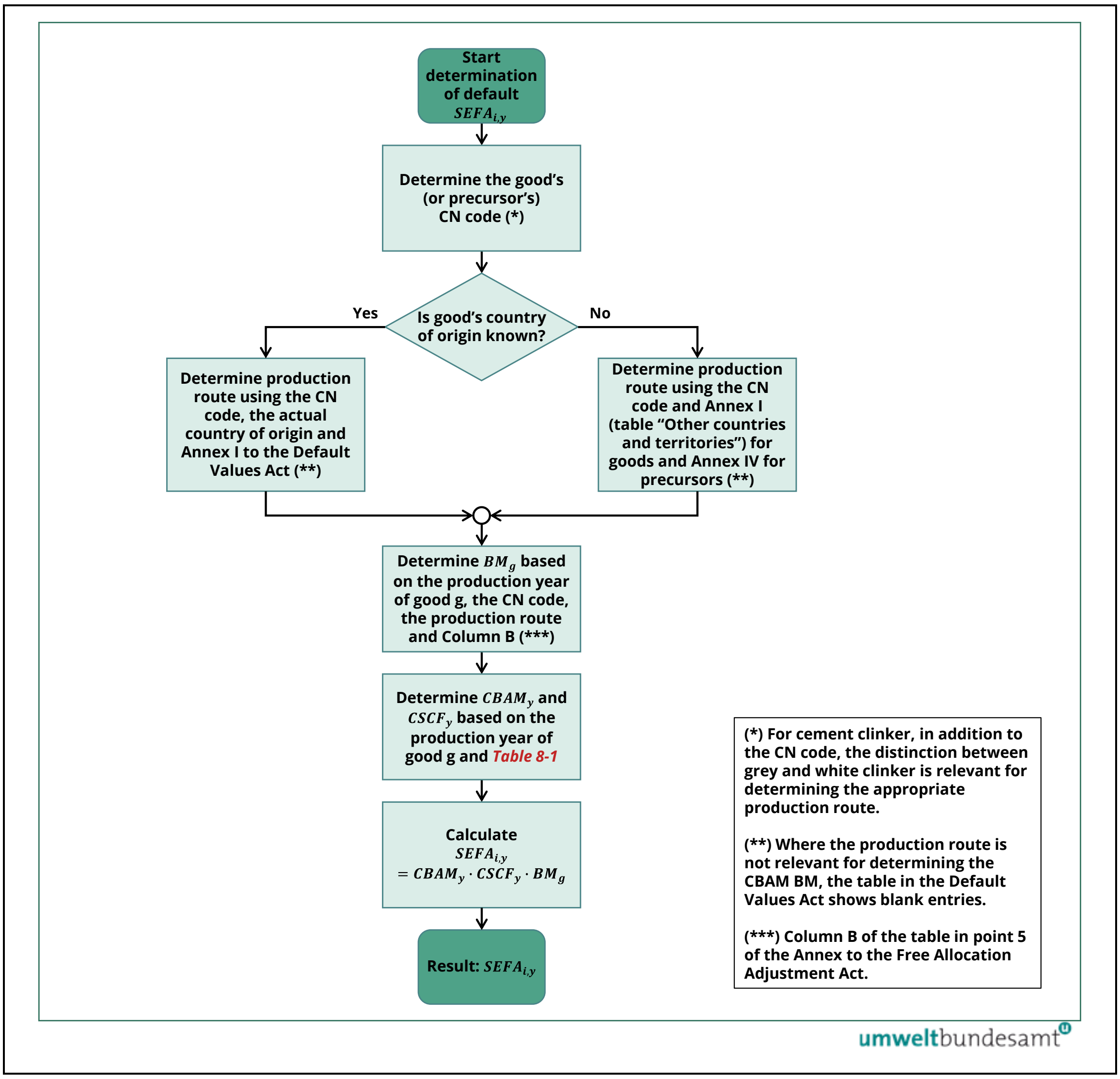
14 In some cases, you will have to determine SEFA values at a more granular level than SEE.

15 This is no additional process, since this look-up of the default SEE value has to be performed anyway.

Table 2-4: Exemplary excerpt of Annex I to the Default Values Act

Algeria								
Product CN Code	**Description**	**Default Value (direct emissions)**	**Default Value (indirect emissions)**	**Default Value (total emissions)**	**2026 Default Value (including mark-up)**	**2027 Default Value (including mark-up)**	**2028 and onwards Default Value (including mark-up)**	**Underlying production route determin-ing CBAM BM**
Iron and steel					**10 % mark-up**	**20 % mark-up**	**30 % mark-up**	
7318 15	Threaded screws and bolts, of iron or steel, whether or not with their nuts and washers (excl. coach screws and other wood screws, […])	3,000	N/A	3,000	3,300	3,600	3,900	(C)

Figure 2-4: Process description for determination of SEFA using only default values



2.2.1.4 *Composing the correct value chains*

Some more granularity is required because of the EU ETS-consistent differentiation of CBAM benchmarks by production route or precursor selection, i.e. because of the sub-categories (A) to (L) listed in Table 2-2 (page 14). This selection may be necessary either at the point of the production process (when selecting the value in column A in Section 5 of the Annex to the Free Allocation Adjustment Act), or for a final CBAM good (Column B of that Annex). This is illustrated below in examples.

Special cases:

- Pig iron / crude steel: In the EU ETS, the "hot metal" product benchmark covers jointly the CBAM production processes for the aggregated goods categories "pig iron" and "crude steel" (only for the blast furnace production route). However, in the CBAM, separate benchmarks for these two aggregated goods categories (or rather for the relevant CN codes within each category) are provided in the Free Allocation Adjustment Act. For the EAF production routes, system boundaries are like in the EU ETS.
- Calcined clay (CN 2507 00 80) receives free allocation using the grey cement clinker benchmark in the EU ETS, because they are competing materials. This is reflected also in the CBAM benchmarks.
- Ammonia production: In the CBAM, hydrogen may have to be considered as separate precursor for the calculation of embedded emissions if it is produced in a clearly separate production process or separate installation. However, for the calculation of the free allocation adjustment, hydrogen production is already included in the system boundary of the CBAM benchmark (mirroring the ammonia EU ETS benchmark). Therefore, no separate free allocation for any hydrogen production within ammonia production should be taken into account[16], even when hydrogen comes from a separate production process.

Examples: Different cement types

As illustrated in Figure 2-5, it is a relatively simple situation in this sector: Where grey cement is produced, there is also a benchmark for grey cement clinker as the main precursor, and the same applies to white clinker/cement. The example also shows the optional use of calcined clays, for which no differentiation of the default values exists. However, there may also be cements consisting of mixtures of grey and white clinkers. In this latter case, the following applies:

- An authorised CBAM declarant importing this cement, has two options:
    - If it is clear whether the cement is a white or grey cement, the declarant will select the appropriate default value for both the *SEE* (specific embedded emissions) and *SEFA*. Default values are independent of the clinker content (i.e. functional unit), hence the values are automatically consistent with each other. If the mixed nature of the cement does not allow a decision regarding grey or white clinker, the

[16] This is different from the approach for specific embedded emissions, where precursors must always be taken into account if coming from a separate production process.

conservative approach is to select the higher default value (white cement, as in Figure 2-5).

- If the authorised declarant has received verified values from the operator of the producing installation, these have been determined as described in the next bullet point, and the declarant can use them as provided.

- The operator producing this mixed cement who determines actual data, has to apply the provision given in section 5.2.1 of the Annex to the Free Allocation Adjustment Act: "*In the case of other hydraulic cements (CN 2523 90 00) containing a mixture of white clinker and of grey clinker and/or calcined clay, the CBAM benchmark shall be calculated as a weighted average that reflects the composition.*". Consequently, the operator will apply the value chain description given on the right side of Figure 2-5 starting at the bottom:

  - The benchmark for the production process (the cement grinding) BM_g* is taken from column A of the Free Allocation Adjustment Act.

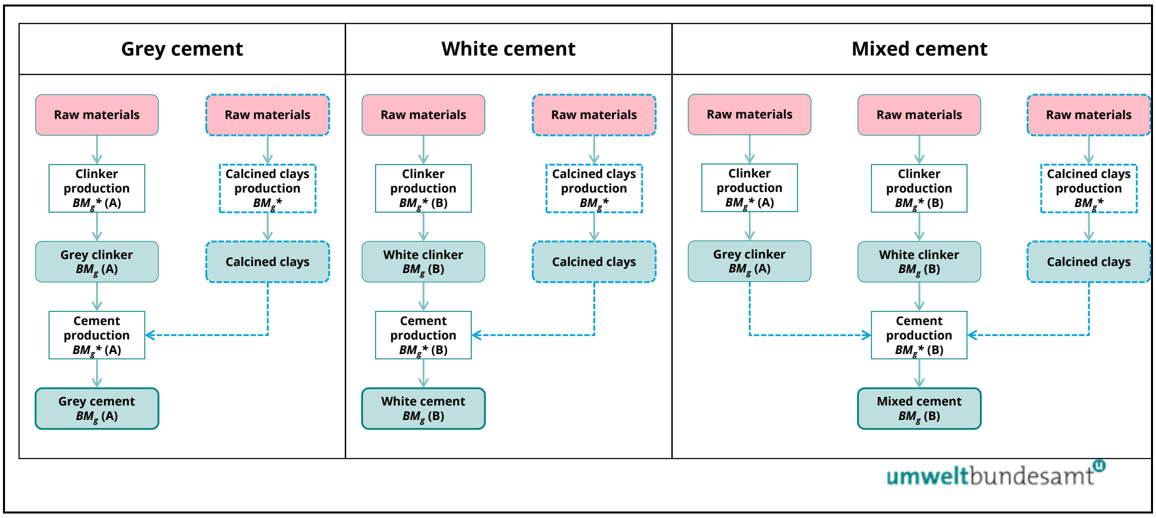
  - The weighted average (using the monitored values of m_i for each of the precursors, i.e. clinkers / calcined clays) of the contribution of the precursors is determined:

    - If for example the operator produces the white clinker in its own installation, the operator applies the BM_g* given under the index "(B)" for white clinker in column A of the Annex to the Free Allocation Adjustment Act.

    - Assuming that in the example the operator uses purchased grey clinker without having a verification report, the operator uses the default value BM_g for finished grey clinker, as taken from Column B of that Annex, and given with the index "(A)" for grey clinker.

- Should the operator also use calcined clay, there is no distinction between sub-categories applicable, and the applicable value can easily be taken from the Annex of the Free Allocation Adjustment Act.

Figure 2-5: Examples for selecting default CBAM benchmarks, cement sector.



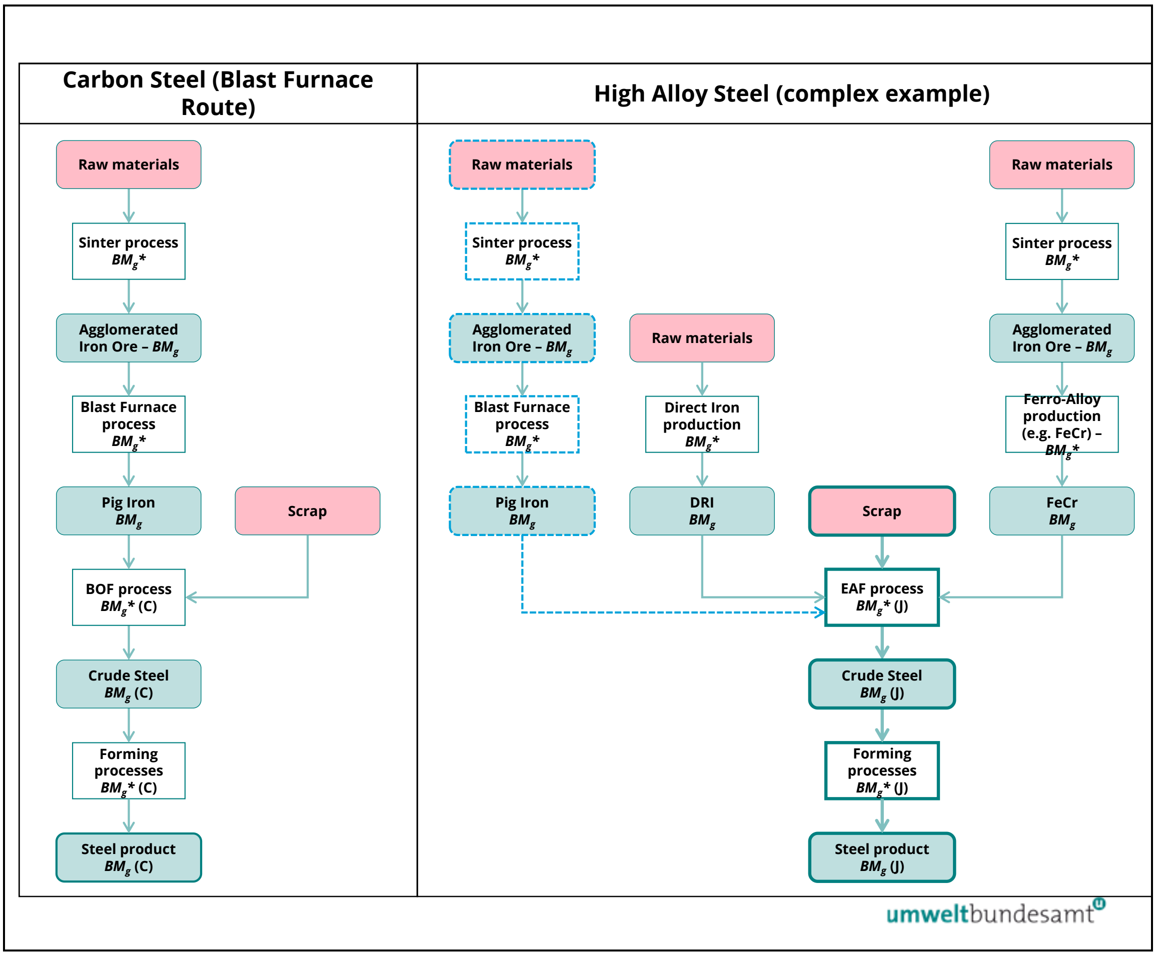
Examples: Steel products

For steel, Figure 2-6 illustrates a simple (left side) and a complex (right side) example.

The **simple example**, steel from an integrated steel plant using the blast furnace route, demonstrates that the index "(C)" as indicator for carbon steel/blast furnace route can apply throughout the value chain to each subsequent product after the blast furnace. For each of the relevant processes (sintering of the ore, pig iron production, crude steel production, final production of steel products), there is a separate CBAM benchmark found in the Table of Section 5 of the Free Allocation Adjustment Act. Note that unlike in the EU ETS, there is a differentiation of the production steps for pig iron and crude steel, while in the EU ETS both steps are covered in one go by the "hot metal" benchmark.

Note: If you as the operator use the "bubble approach", you must take into account the additional monitoring requirements explained in the box in section 2.2.2. Without this additional monitoring you would have insufficient data to correctly calculate the *SEFA* for your goods.

Figure 2-6: Examples for selecting default CBAM benchmarks, steel sector.



The **complex example** shows the production of a high-alloy steel product using the main route "(J)", i.e. high-alloy (but not stainless) steel produced by the EAF (electric arc furnace) route, where the main input is (high alloy) scrap. However, the example assumes that for achieving the appropriate alloy grade of the final product, the operator uses also some virgin materials (FeCr, pig iron from a blast furnace and Direct reduced iron (DRI)). It is assumed that all those precursors are received from other installations.

The calculation of *SEFA* should, as usual, start from the bottom of the picture, i.e. from the final product:

- In the role of an authorised declarant, there is no need to know about the production route. If the declarant imports a good without verification report, only the final BM_g relevant for the specific CN code and country of origin have to be looked up using the process described in section 2.2.1.3, Figure 2-4.
- In the role of the operator producing this high-alloy steel product, you start by selecting the BM_g* value for the final production process, with the indicator "(J)".
- As precursor of this last process, you use the SEFA value you have determined for the crude steel, using the BM_g* for the crude steel according to its CN code and the appropriate indicator "(J)". To this value you need to add *SEFA* values of the following precursors, using their applicable m_i values which you have determined from your monitoring:
  - The main input is scrap, which is not a CBAM good. Therefore, it has zero embedded emissions, and for consistency also no specific embedded free allocation.
  - For the ferrochromium (FeCr) the operator can, as usual, take its applicable *SEFA* value from the verification report of the producing installation (in which case the value would be composed of the applicable BM_g* values of the alloy production plus, if applicable, the *SEFA* of the used sintered iron ore), or calculate it using the *BMg* value from the Free Allocation Adjustment Act.
    As there is no differentiation for different production processes or material compositions, the process described in section 2.2.1.3 does not have to be followed in full. However, as the BM values are inclusive of process emissions, a differentiation by production year does apply.
  - The same applies to the DRI used: Either take the value from a verification report or from the annex to the Free Allocation Adjustment Act. Note that in this example it is assumed that the producer of the DRI has used iron ore that does not require an additional sintering step. The default BM_g value, however, is different from the BM_g* value for CN 7203nnnn, because a contribution of sintered ore is assumed (in line with assumptions for default SEE values). If the operator using this DRI wants to benefit from this more efficient production and omit the contribution of agglomerated iron ore, this is only possible if the producer of DRI provides verified actual data[17].
  - The example also assumes that some pig iron is added to the electric arc furnace process for adjusting the alloy grade. Again, the operator can either use a value obtained from the verification report of the pig iron producing installation, which would then take into account the components of the above value chain, or the default value for the pig iron.

[17] These actual data would then show provide evidence that no agglomerated iron ore was used, and consequently both *SEE* and *SEFA* values would be lower than the default ones, accordingly.

2.2.2 Monitoring requirements for the free allocation adjustment

In principle, the calculation methodology of the free allocation adjustment is similar to the methodology for the determination of embedded emissions. As can be concluded from the equations in the previous sections, crucial data to be monitored are:

- For the authorised declarant, only the mass of the imported good (M_g) and the value $SEFA_g$;
- For the operator, the specific mass of each precursor used (m_i), if applicable, and the appropriate BM_g and BM_g* values.

Table 2-5: Analogy between embedded emissions and embedded free allocation calculation methodologies

Specific Embedded Emissions (SEE)	Specific Embedded Free Allocation (SEFA)
$\boldsymbol{SEE_{dir} = AttrEm_{Proc,dir} + \sum_{i=1}^{n} m_i \cdot SEE_{i,dir}}$	$SEFA_{g,y} = SFA_{Proc_{g,y}} + \sum_{i=1}^{n} \boldsymbol{m_{i,y}} \cdot SEFA_{i,y_i'}$
$\boldsymbol{SEE_{dir}}$ are the direct embedded emissions of the production process for the complex good	$SEFA_{g,y}$ is the embedded free allocation for the complex good *g* in year *y*
$\boldsymbol{AttrEm_{Proc,dir}}$ are the attributed emissions of the production process	$SFA_{Proc_{g,y}}$ is the free allocation calculated for the production process
$\boldsymbol{m_i}$ is the mass of precursor *i* used in the process per tonne of complex good	$m_{i,y}$ is the mass of precursor *i* used in the process in year *y*
$\boldsymbol{SEE_{i,dir}}$ is the reported value of specific direct embedded emissions of precursor *i*	$SEFA_{i,y_i'}$ is the reported value of specific embedded free allocation of precursor *i* in year y_i'
	y is the reporting period during which good *g* was produced
	y_i' is the reporting period during which precursor *i* was produced, and used in the calculation of $SEFA_{i,y_i'}$

Except for the mass parameters, all other data can be looked up from tables or taken from other operators' verification reports. However, the m_i values are monitored by operators already for the purpose of determining *SEE* (the specific embedded emissions of the goods produced). As demonstrated in Table 2-5, the calculation methods for SEE and SEFA are fully aligned, as m_i are the same.

Some specific features of the EU ETS benchmarks (e.g. differentiation by production routes and steel grades for steel, or grey/white cement clinker for cement – see section 2.1.1), may require the following additional information to identify the appropriate CBAM benchmark:

- the country of origin of the good (and precursors if applicable),
- the CN code for the good (and precursors if applicable),

- if applicable, further sector-specific parameters defining the good (e.g. grey / white cement clinker), as specified in Annex I[18] of the Default Values Act (and defining precursors, if applicable),
- if applicable, the production route of the good or the default production route specified for the country of origin of the good (e.g. blast furnace route or electric arc furnace).

Further factors needed for the calculation of the free allocation adjustment are the CBAM factor and the Cross-Sectoral Correction Factor (CSCF), which are year-dependent. Therefore, a further monitoring requirement is:

- the reporting period related to the production of the good (and precursors, if applicable).

Note on additional monitoring requirements, if the bubble approach is used

While CN codes and m_i values of intermediate products are not relevant for determining specific embedded emissions using the bubble approach, they are crucial for calculating the specific embedded free allocation. This can be illustrated using the example of an integrated steel plant (see Figure 2-2 above). Given that different CBAM benchmarks apply to the production of sintered ore, pig iron, crude steel and final products, the following additional data (beyond those required for the calculation of SEE) are necessary to calculate *SEFA*:

- The CN code of each intermediate product listed below;
- The mass of sintered ore consumed for the production of one tonne of pig iron;
- The mass of pig iron consumed for the production of one tonne of crude steel;
- The mass of crude steel consumed for the production of one tonne of final product.

These additional m_i values are the only element that needs to be added to the monitoring methodology only for the purpose of the free allocation adjustment.

18 If the country of origin is unknown, Annex IV of the Default Values Act is to be used instead.

Annex A List of definitions

Term	Definition
‘Accuracy’	means the closeness of the agreement between the result of a measurement and the true value of the particular quantity or a reference value determined empirically using internationally accepted and traceable calibration materials and standard methods, taking into account both random and systematic factors
‘Activity data’	means the amount of fuels or materials consumed or produced by a process relevant for the calculation-based methodology, expressed in terajoules (TJ), mass in tonnes or (for gases) volume in normal cubic metres, as appropriate
‘Actual emissions’	means the emissions calculated based on primary data from the production processes of goods and from the production of electricity consumed during those processes as determined in accordance with the methods set out in Annex IV [to the Methodology Act]
‘Activity level’	means the quantity of goods to which the same functional unit applies that are produced within the system boundaries of a production process during a reporting period
‘Aggregated goods categories’	means aggregated goods categories pursuant to Table 1 of point 2 of Annex I. A group of CBAM goods with their CN codes, used for the purpose of defining system boundaries of production processes.
‘Agricultural, aquaculture, fisheries and forestry residues’	means residues that are directly generated by agriculture, aquaculture, fisheries and forestry and that do not include residues from related industries or processing
‘Authorised CBAM declarant’	means a person authorised by the competent authority in accordance with Article 17 [of the CBAM Regulation]. The ‘authorised CBAM declarant’ [which replaces the term ‘reporting declarant’ from the transitional period] may be importers of CBAM goods, or their indirect customs representatives, who have applied for and been granted the status of authorised CBAM declarant.
‘Batch’	means an amount of fuel or material representatively sampled and characterised, and transferred as one shipment or continuously over a specific period of time
‘Biomass’	means biomass as defined in Article 2, point (24) of the Renewable Energy Directive (RED II)[19]; it includes bioliquids and biofuels as defined in Article 2, point (32) and (33), biomass fuels as defined in Article 2, point (27) and biogas as defined in Article 2 point (28) of the RED II;

[19] Directive (EU) 2018/2001

Term	Definition
'Biomass fraction'	means the ratio of carbon stemming from biomass to the total carbon content of a fuel or material, expressed as a fraction
'Calculation factors'	means net calorific value, emission factor, preliminary emission factor, oxidation factor, conversion factor, carbon content or biomass fraction
'Calibration'	means the set of operations, which establishes, under specified conditions, the relations between values indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material and the corresponding values of a quantity realised by a reference standard
'Carbon price'	means the monetary amount paid in a third country, under a carbon emissions reduction scheme, in the form of a tax, levy or fee or in the form of emission allowances under a greenhouse gas emissions trading system, calculated on greenhouse gases covered by such a measure, and released during the production of goods
'CBAM certificate'	means a certificate in electronic format corresponding to one tonne of CO_2e of embedded emissions in goods
'CO_2 emission factor'	means the weighted average of the CO_2 intensity of electricity produced from fossil fuels within a geographic area. The CO_2 emission factor is the result of the division of the CO_2 emission data of the electricity sector by the gross electricity generation based on fossil fuels in the relevant geographic area. It is expressed in tonnes of CO_2 per megawatt-hour
'Combined nomenclature' (CN)	means the classification of goods, designed to meet the needs of: i) the Common customs tariff, setting import duties for products imported into the European Union (EU), as well as the Integrated tariff of the European Communities (Taric), incorporating all EU and trade measures applied to goods imported into and exported out of the EU; ii) the international trade statistics of the EU. The CN provides the means of collecting, exchanging and publishing data on EU international trade statistics. It is also used for the collection and publication of international trade statistics in intra-EU trade.[20]
'Combustion emissions'	means greenhouse gas emissions occurring during the exothermic reaction of a fuel with oxygen
'Competent authority'	means the authority designated by each Member State in accordance with Article 11 [of the CBAM Regulation]

[20] For definition see: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Combined_nomenclature_(CN)

Term	Definition
'Continuous emission measurement' (CEM)	means a set of operations having the objective of determining the value of a quantity by means of periodic measurements, applying either measurements in the stack or extractive procedures with a measuring instrument located close to the stack, whilst excluding measurement methodologies based on the collection of individual samples from the stack
'Control system'	means the operator's risk assessment and entire set of control activities, including the continuous management thereof, that an operator has established, documented, implemented and maintained pursuant to point A.2. of Annex II
'Complex goods'	means goods other than simple goods
'Conservative'	means that a set of assumptions is defined in order to ensure that no under-estimation of reported emissions or over-estimation of production of heat, electricity or goods occurs
'Conversion factor'	means the ratio of carbon emitted as CO_2 to the total carbon contained in the source stream before the emitting process takes place, expressed as a fraction, considering CO emitted to the atmosphere as the molar equivalent amount of CO_2
'Co-product'	means any of two or more products resulting from the same production process
'Customs declarant'	means a declarant as defined in Article 5, point (15) of Regulation (EU) No 952/2013 lodging a customs declaration for release for free circulation of goods in its own name or the person in whose name such a declaration is lodged
'CCUS system'	means a group of economic operators with technically connected installations and transport equipment for CO_2 capture, transport, use in production of goods, or geological storage
'Data flow activities'	mean activities related to the acquisition, processing and handling of data that are needed to draft an emissions report from primary source data
'Data set'	means one type of data, either at installation level or production process level as relevant in the circumstances, as any of the following: (a) the amount of fuels or materials consumed or produced by a production process as relevant for the calculation-based methodology, expressed in terajoules, mass in tonnes, or for gases as volume in normal cubic metres, as appropriate, including for waste gases; (b) a calculation factor;

Term	Definition
	(c) net quantity of measurable heat, and the relevant parameters required for determining this quantity, in particular: i) mass flow of heat transfer medium; and ii) enthalpy of transmitted and returned heat transfer medium, as specified by composition, temperature, pressure and saturation; (d) quantities of non-measurable heat, specified by the relevant quantities of fuels used for producing the heat, and the net calorific value (NCV) of the fuel mix; (e) quantities of electricity; (f) quantities of CO_2 transferred between installations; (g) quantities of precursors received from outside the production process, and their relevant parameters, such as country of origin, used production route, specific direct and indirect emissions;
'Default value'	means a value, which is calculated or drawn from secondary data, which represents the embedded emissions in goods
'Direct emissions'	means emissions from the production processes of goods including emissions from the production of heating and cooling that is consumed during the production processes, irrespective of the location of the production of the heating or cooling
'Embedded emissions'	means direct emissions released during the production of goods and indirect emissions from the production of electricity that is consumed during the production processes, calculated in accordance with the methods set out in Annex IV and further specified in the implementing acts adopted pursuant to Article 7(7)
'Emissions'	mean the release of greenhouse gases into the atmosphere from the production of goods
'Emission factor'	means the average emission rate of a greenhouse gas relative to the activity data of a source stream assuming complete oxidation for combustion and complete conversion for all other chemical reactions
'Emission factor' for electricity	means the default value, expressed in CO_2e, representing the emission intensity of electricity consumed in production of goods.
'Emission source'	means a separately identifiable part of an installation or a process within an installation, from which relevant greenhouse gases are emitted
EU ETS	means the system for greenhouse gas emissions allowance trading within the Union in respect of activities listed in Annex I to Directive 2003/87/EC other than aviation activities

Term	Definition
'EU ETS allowance'	means an allowance as defined in Article 3, point (a), of Directive 2003/87/EC in respect of activities listed in Annex I to that Directive other than aviation activities
'Fossil carbon'	means inorganic and organic carbon that is not biomass
'Fossil fraction'	means the ratio of fossil carbon to the total carbon content of a fuel or material, expressed as a fraction
'Fugitive emissions'	means irregular or unintended emissions from sources that are not localised, or too diverse or too small to be monitored individually
'Functional unit'	means the reference unit used for the calculation of embedded emissions in goods
'Goods'	means goods listed in Annex I [to the CBAM the CBAM Regulation]
'Greenhouse gases'	mean greenhouse gases as specified in Annex I [to the CBAM the CBAM Regulation] in relation to each of the goods listed in that Annex
'Heat meter'	means a thermal energy meter or any other device to measure and record the amount of thermal energy produced based upon flow volumes and temperatures
'Importer'	means either the person lodging a customs declaration for release for free circulation of goods or a bill of discharge in accordance with Article 175(5) of Delegated Regulation (EU) 2015/2446 in its own name and on its own behalf or, where the customs declaration is lodged by an indirect customs representative in accordance with Article 18 of Regulation (EU) No 952/2013, the person on whose behalf such a declaration is lodged
'Importation'	means release for free circulation as provided for in Article 201 of Regulation (EU) No 952/2013
'Indirect customs Representative'	A customs representative appointed by an importer established in a Member State. If the importer appoints an indirect customs representative and they agree, they can act as an authorised CBAM declarant and submit the application for an authorisation on behalf of the importer. The indirect customs representative is liable for all operations made for the importers it represents
'Indirect emissions'	means emissions from the production of electricity which is consumed during the production processes of goods, irrespective of the location of the production of the consumed electricity
'Inherent CO_2'	means CO_2 which is part of a source stream.
'Installation'	means a stationary technical unit where a production process is carried out

Term	Definition
'Legal metrological control'	means the control exercised by a public authority or regulator of the measurement tasks intended for the field of application of a measuring instrument, for reasons of public interest, public health, public safety, public order, protection of the environment, the levying of taxes and duties, the protection of consumers and fair trading
'Measurable heat'	means a net heat flow transported through identifiable pipelines or ducts using a heat transfer medium, such as, in particular, steam, hot air, water, oil, liquid metals and salts, for which a heat meter is or could be installed
'Measurement point'	means the emission source for which continuous emission measurement systems (CEMS) are used for emission measurement, or the cross-section of a pipeline system for which the CO_2 flow is determined using continuous measurement systems
'Measurement system'	means a complete set of measuring instruments and other equipment used to determine variables for the monitoring and calculation of emissions
'Minimum requirements'	means monitoring methods using the minimum efforts allowed for determining data in order to result in emission data acceptable for the purpose of the CBAM Regulation.
'Mixed fuel'	means a fuel which contains both biomass and fossil carbon
'Mixed material'	means a material which contains both biomass and fossil carbon
'Multifunctional process'	means a process that delivers multiple outputs or whose outputs feed into several production processes
'Net calorific value' (NCV)	means the specific amount of energy released as heat when a fuel or material undergoes complete combustion with oxygen under standard conditions, less the heat of vaporisation of any water formed
'Non-CBAM good'	means any good produced in the installation that is not included in Annex I to the CBAM Regulation
'Non-measurable heat'	means all heat other than measurable heat
'Operator'	means any person who operates or controls an installation in a third country, including a parent company that controls an installation in a third country
'Oxidation factor'	means the ratio of carbon oxidised to CO_2 as a consequence of combustion to the total carbon contained in the fuel, expressed as a fraction, considering carbon monoxide (CO) emitted to the atmosphere as the molar equivalent amount of carbon dioxide (CO_2)
'Power purchase agreement'	means a contract under which a person agrees to purchase electricity directly from an electricity producer

Term	Definition
‘Precursor’	means any input material into a production process included in the list of goods set out in Annex I to the CBAM Regulation;
‘Preliminary emission factor’	means the assumed total emission factor of a fuel or material based on the carbon content of its biomass fraction and its fossil fraction before multiplying it by the fossil fraction to produce the emission factor
‘Production process’	means the chemical and physical processes carried out to produce goods in an installation
‘Production route’ [21]	means a specific technology used in a production process to produce goods
‘Process emissions’	means greenhouse gas emissions other than combustion emissions occurring as a result of intentional and unintentional reactions between substances or their transformation, for a primary purpose other than the generation of heat, including from the following processes: (a) the chemical, electrolytic or pyrometallurgical reduction of metal compounds in ores, concentrates and secondary materials; (b) the removal of impurities from metals and metal compounds; (c) the decomposition of carbonates, including those used for flue gas cleaning; (d) chemical syntheses of products and intermediate products where the carbon bearing material participates in the reaction; (e) the use of carbon containing additives or raw materials; (f) the chemical or electrolytic reduction of metalloid oxides or non-metal oxides such as silicon oxides and phosphates.
‘Proxy data’	means annual values which are empirically substantiated or derived from accepted sources and which an operator uses to substitute a data set[22] for the purpose of ensuring complete reporting
‘Rebate’	means any amount that reduces the amount due or paid by a person liable for the payment of a carbon price, before its payment or after, in a monetary form or in any other form.
‘Recommended improvements’	means monitoring methods which are proven means to ensure that data are more accurate or less prone to mistakes than by mere application of minimum requirements
‘Related emissions’	means: – the direct emissions caused by the source stream or emission source concerned; – emissions attributed to a quantity of measurable heat; – the indirect emissions related to the quantity of electricity concerned; – embedded emissions of a material produced or of a precursor consumed.

[21] Note that different production routes can fall within the same production process.

[22] Refers to the activity data or the calculation factors.

Term	Definition
‘Reporting period’	means the period corresponding to the calendar year during which the good was produced and used by the authorised CBAM declarant as reference for the determination of embedded emissions
‘Residue’	means a substance that is not the end product that a production process directly seeks to produce; it is not a primary aim of the production process and the process has not been deliberately modified to produce it
‘Simple goods’	means goods produced in a production process requiring exclusively input materials (precursors) and fuels having zero embedded emissions
‘Source stream’	means either of the following: (a) a specific fuel type, raw material or product giving rise to emissions of relevant greenhouse gases at one or more emission sources as a result of its consumption or production; (b) a specific fuel type, raw material or product containing carbon and included in the calculation of greenhouse gas emissions using a mass-balance method
‘Specific embedded emissions’	means the embedded emissions of one tonne of goods, expressed as tonnes of CO_2e emissions per tonne of goods
‘Standard conditions’	means temperature of 273,15 K and pressure conditions of 101 325 Pa defining normal cubic metres (Nm^3)
‘System boundary’	means the group of chemical or physical processes included in the calculation of embedded emissions of goods under the same aggregated goods category. The system boundaries shall cover direct emissions, indirect emissions for goods not listed in Annex II to the CBAM Regulation, and the embedded emissions of any precursor.
‘Third country’	means a country or territory outside the customs territory of the [European] Union
‘Tonne of $CO_{2(e)}$’	means one metric tonne of carbon dioxide (‘CO_2’), or an amount of any other greenhouse gas listed in Annex I [to the CBAM Regulation] with an equivalent global warming potential [‘CO_2e‘]
‘Transmission system operator’	means an operator as defined in Article 2, point (35) of Directive (EU) 2019/944 of the European Parliament and of the Council ([23]).

[23] Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity and amending Directive 2012/27/EU (OJ L 158, 14.6.2019, p. 125).

Term	Definition
‘Uncertainty’	means a parameter, associated with the result of the determination of a quantity, that characterises the dispersion of the values that could reasonably be attributed to the particular quantity, including the effects of systematic as well as of random factors, expressed in percent, and describes a confidence interval around the mean value comprising 95% of inferred values taking into account any asymmetry of the distribution of values
‘Waste’	means any substance or object which the holder discards or intends or is required to discard, excluding substances that have been intentionally modified or contaminated in order to meet this definition
‘Waste gas’	means a gas containing incompletely oxidised carbon in a gaseous state under standard conditions which is a result of any of the processes listed under ‘process emissions’

Annex B List of abbreviations

Abbreviation	Full term
AD	Activity Data
AEM	Anode Effect Minutes
AEO	Anode Effect Overvoltage
AL	Activity Level
AOD	Argon Oxygen Decarburisation.
BAT	Best Available Techniques
BF	Biomass Fraction
BFG	Blast Furnace Gas
BM	Benchmark
BOF	Basic Oxygen Furnace
BOFG	Basic Oxygen Furnace Gas
BREFs	Best Available Techniques Reference documents
CA	Competent Authority
CBAM	Carbon Border Adjustment Mechanism, the
CCR	Clinker to Cement Ratio
CCS	Carbon Capture and Storage
CCU(S)	Carbon Capture and Utilisation (and Storage)
CEMS	Continuous Emission Measurement Systems
CF	Conversion Factor
CFP	Carbon footprint of products
CHP	Combined Heat and Power
CKD	Cement Kiln Dust
CN	Combined nomenclature
COG	Coke Oven Gas
DRI	Direct Reduced Iron
EAF	Electric Arc Furnace
EEA	European Economic Area (EU-27, Iceland, Norway, Liechtenstein)
EF	Emission Factor
EFTA	European Free Trade Area
EORI	Economic Operator Registration and Identification
ETS	Emissions Trading System
EU ETS	EU Emissions Trading System
EUA	EU Allowances (used in the EU ETS)
EUR	Euro (currency)

Abbreviation	Full term
FAR	Free Allocation Rules (Regulation 2019/331)[24]
FIFO	First-In-First-Out principle
GHG	Greenhouse Gas
GWP	Global Warming Potential
HBI	Hot Briquetted Iron
HS	Harmonised System (for international trade)
IEA	International Energy Agency
ISO	International Organization for Standardization
LULUCF	Land-use, land change and forestry (criteria)
MP	Monitoring Plan
MRR	Monitoring and Reporting Regulation (Regulation 2018/2066)[25]
MRV	Monitoring, Reporting and Verification
MS	Member State(s)
MWh	Megawatt-hour
NCV	Net Calorific Value
NPI	Nickel pig iron
OF	Oxidation Factor
PCI	Pulverised Coal Injection
PEMS	Predictive Emission Monitoring System
PFC	Perfluoro-carbon
PoS	Proofs of Sustainability
RED II	Renewable Energy Directive, re-cast
SEE	Specific embedded emissions
SEFA	Specific embedded free allocation
TARIC	Integrated Tariff of the European Union database
TJ	Terajoules
TSO	Transmission System Operator
UCC	Union Custom Code
UN/LOCODE	United Nations Code for Trade and Transport Location

[24] Free Allocation Rules (Commission Delegated Regulation (EU) 2019/331 of 19 December 2018 determining transitional Union-wide rules for harmonised free allocation of emission allowances pursuant to Article 10a of Directive 2003/87/EC of the European Parliament and of the Council)

[25] Monitoring and Reporting Regulation (Commission Implementing Regulation (EU) 2018/2066 of 19 December 2018 on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council and amending Commission Regulation (EU) No 601/2012

EUROPEAN COMMISSION
DIRECTORATE-GENERAL
TAXATION AND CUSTOMS UNION
Indirect Taxation and Tax Administration
CBAM, Energy and Green Taxation

Brussels, 14 August 2026

GUIDANCE DOCUMENT 5A: SECTOR-SPECIFIC GUIDANCE DOCUMENT ON CEMENT

Disclaimer: This guidance document is not legally binding and it is of an explanatory nature. Legal provisions of Union law take precedence over the contents of this document and should always be consulted. The authentic texts of the EU legal instruments are those published in the Official Journal of the European Union. This guidance was prepared by Commission services and does not represent an official position of the Commission. Only the Court of Justice of the European Union is competent to authoritatively interpret Union law.

Commission européenne/Europese Commissie, 1049 Bruxelles/Brussel, BELGIQUE/BELGIË – Tel. +32 22991111

VERSION HISTORY

Date	Version notes
14.08.2026	First Publication of this document for the definitive period.

CONTENTS

1 PREFACE

1.1 Structure and content of the guidance documents

This series of documents has been written to support stakeholders by explaining the requirements of the CBAM Regulation in a non-legislative language. This series of guidance documents should benefit a variety of stakeholders. A specific focus has been put on clarifying the **requirements for operators of installations producing CBAM goods outside of the EU for the definitive period.**

- **Guidance 1** provides an overview of the main changes to the CBAM methodology between the definitive period and the concluded transitional period. It also introduces the CBAM and an overview of the compliance cycle, roles and responsibilities, as well as milestones and deadlines for operators of installations outside the EU during the definitive period and explains the general exemptions from the CBAM.

- **Guidance 2** provides a quick guidance for the intended reader of this document, the operator of an installation producing CBAM goods. It provides a roadmap of the most important concepts of CBAM emissions monitoring and where to find more information in this series of documents.

- **Guidance 3** sets out the monitoring and reporting obligations and recommendations which are potentially applicable to any affected producer of CBAM goods.

- **Guidance 4** provides an overview of how the adjustment for free allocation is to be determined and what information is needed.

- **Guidance documents 5a, 5b, 5c, 5d, 5e and 5f** present an overview per sector of the production processes and value chains for goods that are included in the scope of the CBAM, as well as sector-specific monitoring and reporting considerations for each CBAM good where this is relevant. These sections are supplemented by examples for each sector.

The series of guidance documents is accompanied by an electronic template for information that should be used by installation operators to communicate information to the authorised CBAM declarants and CBAM Registry.

Presentation of numbers in EU documents

To align with EU legal documents, this guidance document uses the following convention when presenting numbers.

The decimal separator used to separate the integral part of a number from its fractional part is a comma, e.g.: 0,890

Thousands, and powers of 10^{3n} thereafter, are separated by a space, e.g.:

- fifteen thousand is written as 15 000
- fifteen million is written as 15 000 000

1.2 Reference regulations and legal acts

Several regulations and legal acts are referred to throughout this series of guidance documents. For ease of reading and to avoid ambiguity, simplified references are used when citing these acts.

- **CBAM Regulation**: Regulation (EU) 2023/956 and Regulation (EU) 2025/2083 amending Regulation (EU) 2023/956. Notably, where article numbers are given in this document without further specification, they always refer to the CBAM Regulation.

  It can be accessed at the following link (consolidated version): **http://data.europa.eu/eli/reg/2023/956/2025-10-20**

- **Methodology Act:** Commission Implementing Regulation (EU) 2025/2547, in legal texts referred to as "Implementing act pursuant to Article 7(7) of the CBAM Regulation".

  It can be accessed at the following link: **http://data.europa.eu/eli/reg_impl/2025/2547/oj**

- **Default Values Act**: Commission Implementing Regulation (EU) 2025/2621, in legal texts referred to as "Implementing act pursuant to Article 7(7) of the CBAM Regulation", also referred to as "default values determined in accordance with Annex IV to the CBAM Regulation".

  It can be accessed at the following link: **http://data.europa.eu/eli/reg_impl/2025/2621/oj**

- **Verification Principles Act**: Commission Implementing Regulation (EU) 2025/2546, in legal texts referred to as "Implementing act pursuant to Article 8(3) of the CBAM Regulation".

  It can be accessed at the following link: **http://data.europa.eu/eli/reg_impl/2025/2546/oj**

- **Accreditation & Verification Requirements Act**: Commission Delegated Regulation (EU) 2025/2551, in legal texts referred to as "Delegated act pursuant to Article 18(3) of the CBAM Regulation".

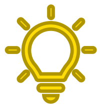
  It can be accessed at the following link: **http://data.europa.eu/eli/reg_del/2025/2551/oj**

- **Free Allocation Adjustment Act**: Commission Implementing Regulation (EU) 2025/2620, in legal texts referred to as "Implementing act pursuant to Article 31(2) of the CBAM Regulation".

  It can be accessed at the following link: **http://data.europa.eu/eli/reg_impl/2025/2620/oj**

For acronyms and definitions used in this document, please see **Annex B** and **Annex A**.

A series of icons are used throughout to help guide the reader:

Icon	Description of use
	Points to information of particular importance for operators of installations producing CBAM goods.
Simplified!	Highlights simplified approaches of the general requirements of the CBAM.
	Used where recommended improvements are presented.
	Used where other documents, templates or electronic tools are available from other sources.
	Points to examples given for the topics discussed in the surrounding text.

2 CBAM GOODS AND PRODUCTION ROUTES

This section provides guidance on industry-sector-specific rules that apply for the definitive period (from 2026 onwards), for the cement sector. It deals with the specification of products covered by the CBAM and the relevant production routes.

2.1 Foreword to sector-specific sections

The following sections provide an overview of the different production routes for the goods under cement sector in CBAM and provide sector specific guidance. Where goods to which the same functional unit applies are produced in one installation via different production routes, the embedded emissions shall be determined in accordance with the averaging rules applicable in the definitive period.

Additional information on the production processes of the goods can also be found in the BREF[1] documents for best available techniques (BAT).

Diagrams used in the following sections.

For the system boundary graphics presented in the sections below, the **following conventions** are applied:

- **Production processes** (for which monitoring of the direct emissions would take place) are shown as **rectangles with white background**.
- **Optional** processes (e.g. CCS/CCU) are shown in **blue** boxes. In particular, CCS/CCU would not be taken into account for developing default values, but where you (as an operator) use them, the related emissions or emission savings should be taken into account for determining actual embedded emissions in line with the CBAM Regulation and the Methodology Act.
- **Materials** which are considered to have no embedded emissions are shown in **pink** boxes, materials with embedded emissions (precursor materials and final products, i.e. goods under the CBAM) in **green** boxes. Simple goods are shown in normal font, complex goods in **bold** font. Materials which are **optional** are shown in boxes with a **blue dashed** outline and must be included where actually used at the installation.
- Input materials are presented without trying to be complete. This means that the focus is on materials which are relevant for demonstrating the differences between different production routes. As a consequence, less important input materials and in particular fuels are usually omitted in order to keep graphs simple.
- **Electricity** as input is shown only in cases where it is the main "precursor" of the process (i.e. in particular for electric arc furnaces and electrolysis processes). Electricity is shown in **light grey** boxes.

[1] BAT Reference document (BREF), BAT being "Best Available Techniques" as defined by the IED (Industrial Emissions Directive). Relevant BREF documents are those for: the production of cement; for iron and steel production; large volume inorganic chemicals (which includes fertilisers); for Chlor-alkali; and for non-ferrous metals (which includes both aluminium and ferro-alloys). All BREFs can be found at the European IPPC Bureau, under https://eippcb.jrc.ec.europa.eu/reference.

2.2 Cement sector goods and production routes

- The textbox below signposts sector-specific sections in the Methodology Act, relevant for the CBAM definitive period.

Methodology Act references:

- **Annex I,** Table 1 "Mapping of CN codes to aggregated goods categories" of the Methodology Act.
- **Annex I**, points 3.2 – Calcined clay, 3.3 – Cement clinker, 3.4 – Cement and 3.5 – Aluminous cement, which define the functional unit, system boundaries and possible precursors for cement-sector goods.
- **Annex II**, point B.9.2 "Additional rules for emissions from cement clinker production", providing sector-specific rules for monitoring and calculation of emissions for cement clinker.

2.2.1 Unit of production and embedded emissions for industry sector

The quantity of declared cement goods imported into the EU must be expressed in the production unit applicable to each cement-sector CBAM good in line with Article 4(5) of the Methodology Act. You must record the quantity of CBAM good(s) produced by the installation or production process(s), for the purposes of reporting.

Industrial sector	Cement
Production unit of goods	Tonnes (metric), reported separately for each type of CBAM good produced, by the installation or production process in the country of origin. Tonnes (metric) for calcined clay, cement clinker and aluminous cement, and tonnes of clinker content for cement goods (i.e., CN codes 2523 10 00, 2523 21 00, 2523 29 00 and 2523 90 00), reported separately for each type of CBAM good produced, by the installation or production process in the country of origin, in line with Annex I, points 3.2 to 3.5 of the Methodology Act.
Associated activities	Producing cement clinkers and calcined clays, grinding and blending cement clinker to produce cement.
Relevant greenhouse gas emissions	Carbon dioxide (CO_2)
Direct Emissions	Tonnes (metric) of CO_2e
Indirect Emissions	Quantity of electricity consumed (MWh), source and emissions factor used to calculate the indirect emissions in tonnes (metric) of CO_2 or CO_2e. Indirect emissions resulting from electricity consumption in the relevant production process shall be monitored and taken into account in the embedded emissions of cement CBAM goods, in accordance with Article 3(2) and Annex IV to the CBAM Regulation and with the Methodology Act

Industrial sector	Cement
Unit for embedded emissions	Tonnes CO_2e emissions per tonne of good, reported separately for each type of CBAM good, by the installation or production process in the country of origin. Tonnes CO_2e emissions per tonne of calcined clay, cement clinker or aluminous cement, and tonnes CO_2e emissions per tonne of clinker content for cement (excl. aluminous cement), reported separately for each type of CBAM good, by the installation or production process in the country of origin.

The cement sector has to account for both direct emissions and indirect emissions, in the definitive period, since cement goods are not listed in Annex II ("Goods for which only direct emissions are taken into account") to the CBAM Regulation and are therefore subject to the general rule in Article 3(2) of that Regulation on the inclusion of indirect emissions. Both direct and indirect emissions must therefore be taken into account in the embedded emissions of cement-sector CBAM goods, with direct and indirect components determined separately in line with the Methodology Act.

For cement (excl. aluminous cement), embedded emissions are determined per tonne of clinker content, and where cement is produced and placed on the market with different clinker contents, emissions shall be calculated and averaged in line with the composition-based rules set out in Annex III to the Methodology Act.

Emissions must be reported in metric tonnes of CO_2 equivalent (t CO_2e) emissions, per tonne of good output. This figure must be calculated for the specific installation or production process in your country of origin.

The following sections set out how the system boundaries of cement sector goods should be defined and identify elements of the production processes that must be included for the purposes of monitoring and reporting.

2.2.2 Definition and explanation of goods covered

The following Table 2-1 lists the relevant goods in scope for the CBAM definitive period in the cement industry sector. The CN/TARIC codes in the central column are the starting point for which a 'production process' is to be identified for the purpose of monitoring emissions, encompassing all production routes used within the installation in line with Annex I to the Methodology Act.

Table 2-1: CBAM goods in the cement sector[2]

Aggregated goods category	CN/TARIC Code	Description
Calcined clay	2507 00 80 80[3]	Other kaolinic clays, calcined
Cement clinker	2523 10 00[4]	Cement clinkers
Cement	2523 21 00	White Portland cement, whether or not artificially coloured
	2523 29 00	Other Portland cement
	2523 90 00[5]	Other hydraulic cements
Aluminous cement	2523 30 00	Aluminous cement[6]

The aggregated goods categories listed in Table 2-1 include both finished cement goods and precursor goods (intermediate products) that are consumed in the production of cement.

The system boundaries specified in the Methodology Act do not mention explicitly which precursors are relevant for the production process. Therefore, Table 2-2 should help to identify the possible precursors by aggregated goods category and production route.

Table 2-2: Aggregated goods categories, their production routes and possible precursors

Aggregated Goods Category ***Production route***	**Precursors**
Calcined clay	None
Cement clinker	None
Cement	Cement clinker; calcined clay (if used in the process).
Aluminous cement	None

Precursor goods relevant to the system boundary are 'cement clinker[7]' (CN code 2523 10 00), which includes both white clinker (used to make white cement) and grey clinker, and 'calcined clay' (TARIC code 2507 00 80 80), which is a clinker substitute and may be used to modify the properties of the cement produced.

2 Source: Annex I to the CBAM Regulation and Annex I ("Mapping of CN codes to aggregated goods categories") to the Methodology Act.

3 Non-calcined clays are found under CN code 2507 00 80, but they are excluded from the CBAM scope.

4 TARIC codes 2523 10 00 10 (White cement clinker) and 2523 10 00 90 (Other cement clinkers including grey clinker) apply.

5 TARIC codes 2523 90 00 10 (White hydraulic cement) and 2523 90 00 90 (Other hydraulic cements including grey hydraulic cement) apply.

6 Also referred to as 'Calcium Aluminate Cement'.

7 Distinction is made between grey and white clinker through the TARIC codes to be applied.

These precursors are defined as simple goods, as they cannot be produced out of other CBAM goods.

The finished cement goods listed in Table 2-1 comprise both white Portland cement, grey Portland cement, other hydraulic cements and aluminous cement. These goods are defined as complex goods (with the exception of aluminous cement) as they include the embedded emissions from precursor goods in accordance with the definitions of simple and complex goods in the CBAM Regulation and the definition of precursors in Article 1 of the Methodology Act.

Other constituents used in cement manufacture, in particular granulated blast furnace slag, fly ash and natural pozzolana that are used in the manufacture of other hydraulic cement goods (including blended or 'composite' cements) are not CBAM goods and therefore are not in scope for the CBAM as precursors. Their use and the associated emissions are taken into account through the direct and indirect emissions of the cement production process, but no additional embedded emissions of these constituents are added as separate precursors under the CBAM rules.

Cement sector goods are produced by a number of different production process and routes, outlined below.

2.2.3 Definition and explanation of relevant production processes and routes

The system boundaries of precursors and cement goods are distinct and may, under certain conditions, be added together to include all processes directly or indirectly linked to the production processes for these goods, including input activities to the process and output activities from the process.

2.2.3.1 Calcined clay production process

Calcined clay may be used as a clinker substitute. Kaolinic clay that is calcined (metakaolin) can be added to cement in place of clinker in varying proportions in order to modify the properties of the cement mixture.

The Methodology Act, in particular Annex I, point 3.2 ("Calcined clay"), sets out the functional unit and system boundaries for the calcined clay production route. For the purposes of this guidance, the system boundaries for direct emissions monitoring can be described as encompassing the following:

> *" – All processes directly or indirectly linked to the production processes, such as raw material preparation, mixing, drying, and calcining, and flue gas cleaning.*
>
> *– CO_2 emissions from the combustion of fuels as well as from raw materials, where relevant."*

There are no precursors for this production process. Indirect emissions that result from electricity consumed by the production process shall also be determined and taken into account in the embedded emissions of calcined clay, in accordance with Article 3(2) of the CBAM Regulation and the rules on indirect emissions and system boundaries in the Methodology Act.

Note that CN code 2507 00 80 includes both calcined and non-calcined kaolinic clays. As Simplified
a result of simplification, only calcined kaolinic clays (TARIC code 2507 00 80 80) are included in the scope of CBAM in the definitive phase.

2.2.3.2 Cement clinker production process

Cement clinker is produced in clinker plants (kilns) by the thermal decomposition of calcium carbonate to form calcium oxide, followed by the clinkering process in which the calcium oxide reacts at high temperatures with silica, alumina and ferrous oxide to form a clinker. Grey and white clinkers may be produced depending on the temperature of the process and purity of raw materials.

The Methodology Act, in particular Annex I, point 3.3 and Annex II, point B.9.2, sets out the functional unit, system boundaries and specific rules for monitoring emissions from cement clinker production. For the purposes of this guidance, the system boundaries for direct emissions monitoring can be described as encompassing:

> *“ – Calcination of limestone and other carbonates in the raw materials, conventional fossil kiln fuels, alternative fossil-based kiln fuels and raw materials, biomass kiln fuels (such as waste-derived fuels), non-kiln fuels, non-carbonate carbon content in raw materials, or alternative raw materials such as fly ash used in the raw meal in the kiln and raw materials used for flue gas scrubbing.”*

Typical raw materials include limestones and shales. Direct emissions of the cement clinker production process result from the combustion of both kiln and non-kiln fuels and from raw materials used in the process such as limestone. In line with the Methodology Act (in particular Annex I, point 3.3 and Annex II, point B.9.2), direct emissions include both process emissions from the calcination of carbonates in the raw materials and combustion emissions from all relevant fuels used in the kiln system and for drying of raw materials and fuels.

Indirect emissions that result from electricity consumed by the production process shall also be determined and taken into account in the embedded emissions of cement clinker, in accordance with Article 3(2) of the CBAM Regulation and the rules on indirect emissions and system boundaries in the Methodology Act.

In line with the above definition of system boundaries, the following production steps may be regarded as being within the system boundaries of cement clinker installations:

- Raw material preparation – grinding, milling, homogenisation.
- Fuel storage and preparation – for conventional and waste derived fuels.
- Clinker production (‘clinker burning’) – all steps for the integrated kiln system including preheating, kiln processing and clinker cooling.
- Intermediate storage – storage of cement clinker under cover before export off site or cement grinding.
- Emissions control – for treating releases to air, water or ground.

A variation on the clinker production process may be with permanent geological storage i.e. carbon capture and sequestration (CCS). Where CO_2 is captured and permanently stored or used in accordance with the CBAM rules, this should be reflected in the determination of embedded emissions in line with the Methodology Act; however, CCS/CCUS is not taken into account when establishing default values.

Note that distinction is made between white clinker and other clinker (incl. grey) used in the production of cement.

2.2.3.3 Cement production process

Cement (apart from aluminous cement) is defined as a complex good as it is produced from precursors cement clinker and possibly calcined clay.

Cement is produced in a grinding plant (cement mill), which may be located at the same installation that produced the cement clinker, or at a separate standalone plant. Cement clinker is ground and blended with certain other constituents to produce the finished cement product. Depending on the mix of different constituents this may be Portland cement, blended cement (containing a mix of Portland cement and other hydraulic constituents) or other hydraulic cements.

The Methodology Act, in particular Annex I, point 3.4, sets out the functional unit and system boundaries for cement production. For the purposes of this guidance, the system boundaries for direct emissions monitoring can be described as encompassing:

> *" – All processes directly or indirectly linked to the production processes, where relevant for drying of materials."*

Precursors are cement clinker and calcined clay (if used in the process). Indirect emissions that result from electricity consumed by the cement production process shall also be determined and taken into account in the embedded emissions of cement, in accordance with Article 3(2) of the CBAM Regulation and the rules on indirect emissions and system boundaries in the Methodology Act.

In line with the above definition of system boundaries, the following production steps may be regarded as being within the system boundaries of cement installations:

- Material preparation – materials (cement clinker, calcined clay and mineral additives) handling and pre-treatment e.g. preheating and drying mineral additives.

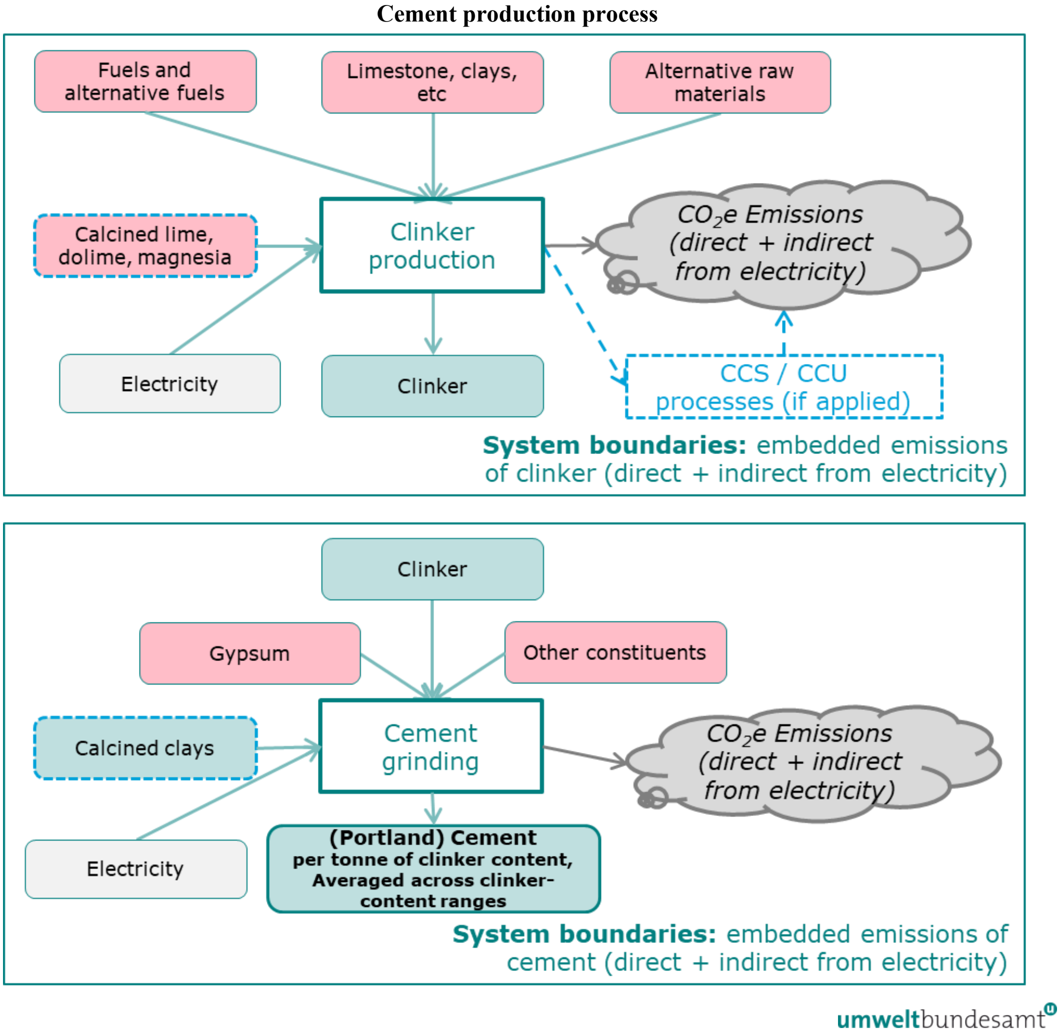
- Cement production – all steps, including crushing, grinding, further milling and separation by particle size.

- Cement storage, packaging and dispatch.

- Emissions control – for treating releases to air, water or ground.

Figure 2-1 following shows how the cement clinker and cement production processes relate to each other.

Figure 2-1: *System boundaries of cement clinker and cement production processes.*



Notes to figure: In this figure, the green or blue boxes with a blue dashed outline (e.g. calcined clays) represent optional precursors or process steps that are only included where they are actually used at the installation. Note that embedded emissions (and therefore SEEs) need to be reported separately for white hydraulic cements and for other hydraulic cements (incl. grey).

For hydraulic cements, note that embedded emissions (and therefore SEEs) need to be reported separately for white hydraulic cements and for other hydraulic cements (incl. grey).

2.2.3.4 Aluminous cement production process

Aluminous cement is regarded as a simple good as it is produced directly from aluminous clinker by a continuous production process and is ground without the addition of further additives in line with the definition of simple goods and the aggregated goods category “Aluminous cement” in Annex I to the Methodology Act.

The Methodology Act, in particular Annex I, point 3.5, sets out the functional unit and system boundaries for the aluminous cement production route. For the purposes of this guidance, the system boundaries for direct emissions monitoring can be described as encompassing:

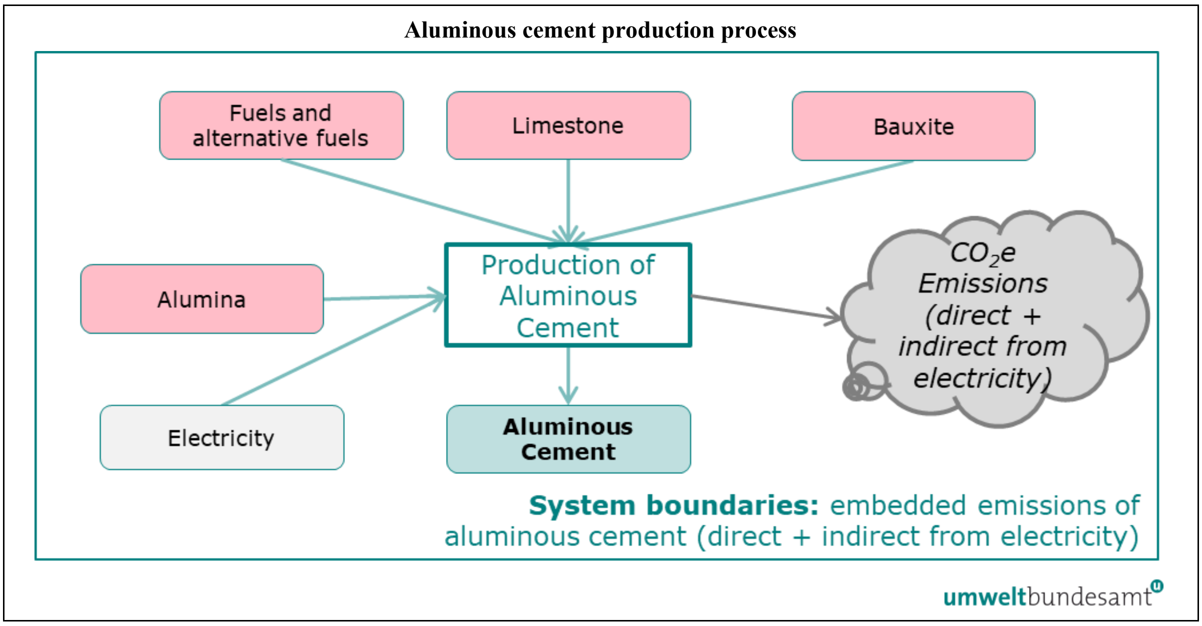
> *“ – All processes directly or indirectly linked to the production process where fuel is combusted.*

– Process emissions from carbonates in raw materials, if applicable, and flue gas cleaning.”

There are no precursors for this production process. Indirect emissions that result from electricity consumed by the production process shall be determined and taken into account in the embedded emissions of cement-sector CBAM goods, in accordance with Article 3(2) of the CBAM Regulation and the rules on indirect emissions in the Methodology Act.

In line with the above definition of systems boundaries, the integrated production of aluminous cement includes both clinkering and cement grinding production steps, from raw material preparation through to emissions control.

Figure 2-2: System boundaries of the aluminous cement production process



Note that alumina (produced from bauxite) is treated as a raw material for the purposes of the aluminous cement aggregated goods category and is not a precursor under Annex I to the Methodology Act. Its contribution to embedded emissions is taken into account through the direct and indirect emissions of the aluminous cement production process, and no separate embedded emissions of alumina are added as a precursor.

3 Cement sector-specific requirements

The textbox below signposts sector-specific sections in the Methodology Act, relevant for the CBAM definitive period.

Methodology Act references:

- **Annex I, point 3** – Functional unit and system boundaries. Sub-sections 3.2 to 3.5 (cement sector aggregated goods categories).

- **Annex II**, **Section B** – Monitoring of direct emissions at installation level, sub-section **B.9.2**. Sector specific requirements, additional rules for process emissions from the cement sector, covering: **B.9.2.1** additional rule for Method A (input based); **B.9.2.2** additional rule for Method B (output based); **B.9.2.3** additional rule for emissions related to discarded cement kiln dust/bypass dust.
- **Annex IV, point 2** – Sector-specific parameters to be included in the operator's emissions report.

3.1 Sector-specific requirements for monitoring and reporting

Direct and indirect embedded emissions should be monitored in line with the methodology set out in the Methodology Act and outlined above.

3.1.1 Emissions covered

Relevant direct emissions that must be monitored and reported for the cement sector are:

- Carbon dioxide emissions (direct) from the fuel combustion process[8] from stationary plant only (excludes emissions from any mobile plant such as vehicles).
- Carbon dioxide emissions (direct) from the process, resulting from:
    - Thermal decomposition of carbonate containing raw materials (such as limestone, dolomite etc);
    - Non-carbonate carbon content in the raw materials (such as carbonaceous clay, limestone, shale);
    - Alternative raw material (such as fly ash used in the raw meal), or from any fossil/biomass additives used.
    - Discarded cement kiln dust (CKD) or bypass dust.
- Carbon dioxide emissions (direct) resulting from the production of measurable heating (e.g. steam) and cooling that is consumed within the system boundaries of the production process, regardless of the location of the production of the heat (i.e. from on-site generation or from imports from off-site).
- Carbon dioxide emissions (direct) resulting from emissions control (e.g. from carbonate raw materials such as soda ash used for acidic flue gas cleaning). This is included for any good where this is applicable.

Direct emissions from the different source streams above are not reported separately but are added together to result in the total direct emissions for the installation or production process.

Indirect emissions from electricity consumed must be reported separately from direct emissions.

8 For both kiln and non-kiln fuels. Cement kiln fuels include conventional fossil fuels such as natural gas and coal, alternative fossil-based fuels such as petroleum coke or waste chipped vehicle tyres, and biomass fuels (biomass wastes). Non-kiln fuels refers to fuels used outside of kilns e.g. to calcine clays in flash calciners, and where cement materials are dried.

3.1.2 Additional rules

Determining process emissions

For determining direct emissions from cement clinker production, additional rules also apply for the monitoring of process emissions from raw meal components depending on whether the **activity data** refers to:

- Process **input** material (e.g. limestone) based on:
  - the carbonate content of the process input (calculation **Method A**); and
  - an adjustment is made for cement kiln dust (CKD) or bypass dust that leaves the kiln system.
- Process **output** material e.g. the amount of clinker produced (calculation **Method B).**

Note that both methods are considered equivalent, i.e. you, as the operator, should choose the method which leads to the more reliable data, which is more applicable for your equipment, and that avoids unreasonable costs.

Calculation of emissions related to discarded CKD or bypass dust

As the operator, you shall add CO_2 process emissions, from bypass dust or cement kiln dust (CKD) leaving the kiln system, corrected for a partial calcination ratio of CKD.

- Minimum requirements: An emission factor of 0,525 t CO_2/t dust is applied.

Recommended improvement**: The emission factor (EF) is determined at least once annually in line with the provisions of Methodology Act Annex II, point B.5.4. requirements for laboratory analyses and using **the following formula:

$$EF_{CKD} = \left(\frac{EF_{Cli}}{1+EF_{Cli}} \cdot d\right) / \left(1 - \frac{EF_{Cli}}{1+EF_{Cli}} \cdot d\right) \quad \text{(Equation 28)}$$

Where:

EF_{CKD} … Emission factor of partially calcined cement kiln dust [t CO_2/t CKD];

EF_{Cli} … Installation-specific emission factor of clinker [t CO_2/t clinker];

d … Degree of CKD calcination (released CO_2 as percentage of total carbonate CO_2 in the raw mix).

Method B - clinker output based

For this method, a sector-specific rule is given in the Methodology Act:

Activity data AD_j for clinker production [t] over the reporting period may be determined by either:

- Direct weighing of clinker (if technically feasible); or
- Based on cement deliveries, by material balance using the following stock adjustment calculation:

$$Cli_{prod} = (Cem_{deliv} - Cem_{SV}) \cdot CCR - Cli_s + Cli_d - Cli_{SV} \text{ (Equation 27)}$$

Where

Cli_{prod} is the amount of clinker produced expressed in tonnes,

Cem_{deliv} the amount of cement deliveries expressed in tonnes,

Cem_{SV} the cement stock variations expressed in tonnes,

CCR the clinker to cement ratio (tonnes clinker per tonne cement),

Cli_s the amount of clinker supplied expressed in tonnes,

Cli_d the amount of clinker dispatched, and

Cli_{SV} the amount of clinker stock variations expressed in tonnes.

As a minimum requirement to determine the emission factor, a standard value of 0,525 t CO_2/t clinker shall be applied. Recommended improvement would be to perform analyses of the clinker to determine the EF.

For the **conversion factor** CF_j (see Methodology Act Annex II, point B.3.1.2). It is allowed to always use the conservative assumption that $CF_j = 1$ in order to reduce monitoring efforts.

Clinker to cement ratio (CCR)

In calculating the embedded emissions in cement goods, the majority of emissions result from cement clinker. Therefore, the CCR, which is the mass ratio of tonnes cement clinker consumed per tonne of cement produced (also known as the 'clinker factor'), must be taken into account. For CN codes 2523 10 00, 2523 21 00, 2523 29 00 and 2523 90 00, the functional unit is the tonnes of clinker contained in the goods. For the other CN codes, the default functional unit is the tonnes of product.

The CCR should be derived either:

- Separately for each of the different cement products, based on laboratory analyses in line with the provisions of Annex II point B.5.4; or
- By calculation, as ratio from the difference of cement deliveries and stock changes and all materials used as additives to the cement including by-pass dust and cement kiln dust.

The CCR is expressed as a percentage (%) value, which typically ranges from 80 up to 95 % for Portland cement. The CCR is particularly relevant for the calculation of relevant embedded emissions for blended or composite cements that are produced, where the clinker content can range widely for different types of composite cement[9] with the balance

[9] European standard EN 197-1 defines five main common cement types CEM I (Portland cement) to V (Composite cement) and 27 different product types, where the clinker content in blended and composite cements (CEM II to V) may range from 95% down to as low as 5-20%.

being made up of other constituents such as mineral additives,[10] with zero embedded emissions.

For cement goods sold in different ranges of composition, you as the operator will need to calculate the specific embedded emissions of the goods according to the tonnes of clinker contained in the goods, using the following equation.

$$SEE_{g(cki)} = SEE_g \cdot CK_i \qquad \text{(Equation 64)}$$

Where:

$SEE_{g(cki)}$ is the specific embedded emissions of the good with clinker content CK_i expressed as t CO_2e per tonne of cement;

SEE_g is the specific embedded emissions calculated in Equation 59 or 62 (i.e. expressed as t CO_2e per tonne of clinker), and

CK_i is the average clinker content of the goods of a given composition in tonnes of clinker per tonnes of goods.

Note that for cement goods that are sold in custom-made compositions at the request of the client, you as the operator are required to issue a declaration of clinker content for each consignment of the good; and in substituting into equation 64, CKi will be the specific clinker content of the consignment.

White clinker vs. other clinkers (incl. grey)

For cement clinker, TARIC codes 2523 10 00 10 (White cement clinker) and 2523 10 00 90 (Other cement clinkers including grey clinker) apply. In practice, embedded emissions (and therefore SEEs) for clinker goods need to be calculated separately for white cement clinker and for other cement clinkers. This also applies to hydraulic cements, for which TARIC codes 2523 90 00 10 (White hydraulic cement) and 2523 90 00 90 (Other hydraulic cements including grey hydraulic cement) apply.

3.1.3 Additional reporting parameters

The following Table 3-1 lists out the additional information that needs to be provided by you as an operator to importers, in your verified operator's emissions report and a summary thereof to them, as set out in Methodology Act Annex IV, Part 2 (Sector-specific parameters to be included in the emissions report).

Table 3-1: Additional cement sector parameters requested in the CBAM declaration

Aggregated goods category	**Reporting parameter**
Calcined clay[11]	– N.a. (not applicable)
Cement clinker	– N.a. (not applicable)

[10] Mineral additives (mainly gypsum) along with secondary mineral additives (blast furnace slag and fly ash) are not treated as precursors for the purposes of calculating embedded emissions for cement goods and are therefore treated as having zero embedded emissions in that calculation.

[11] Note that CN code 2507 00 80 includes non-calcined kaolinic clays. Only calcined clays under TARIC code 2507 00 80 80 are to be reported.

Cement	– Clinker content of cement. This is the: – Mass ratio of tonnes cement clinker consumed per produced tonne of cement (clinker to cement ratio expressed in per cent);
Aluminous cement	– N.a. (not applicable)

You need to ensure that you collect all the parameters necessary for your CBAM goods and communicate them to the importers of your goods. The importer will need to report the additional parameters in their annual CBAM declaration for the relevant reporting period.

3.2 Example for splitting a cement installation into separate production processes

In defining the system boundary for a production process, you as an operator will need to decide what physical production units belong to the production process(es) and what inputs, outputs, and emissions are relevant. An example of this is given as shown in the Table 3-2 below for the cement sector.

For a notional cement plant that both produces and exports cement clinker (CN 2523 10 00) and cement (CN 2523 29 00), the operator would need to go through the following steps to split the cement plant into separate production processes under the CBAM:

Step 1: List all goods, physical units, inputs, outputs and emissions to/from the installation.

In this first step, the operator uses the existing information available on their installation, such as lists of industrial equipment and plans, to identify the:

- Physical units carrying out the production processes at their installation, such as kilns, boilers, dryers, flue gas cleaning, ball mills, bagging plant.
- Process inputs required for making the goods e.g. raw materials, fuel, electricity.
- Outputs from the process e.g. goods produced, by-products, heat, waste gases.
- Emissions from the process.

These are then listed out in Table 3-2 below. Note that emissions caused by the "*purchase and maintenance of infrastructure and equipment*" are to be excluded from this listing exercise.

Table 3-2: Checklist for inputs, physical units, outputs and emissions for an example cement installation.

Inputs	**Physical units**	**Outputs**	**Relevant CBAM Emissions**
Kiln – fossil fuels[12] e.g. coal, HFO[13] Kiln – alternative and waste fuels (to cement clinker kiln) e.g. high CV fraction of MSW[14] Kiln – electricity consumed by clinker kiln and associated equipment Mill – fossil fuels to cement dryer Mill – electricity consumed by cement grinding plant and associated equipment Kiln – raw materials[15]: Limestone, clays Kiln – alternative raw materials: e.g. fly ash Mill – cement clinker from kiln Mill – additives used in cement manufacture	Kiln system and associated equipment e.g. for raw meal preparation Mill – grinding equipment (including dryer) and associated plant e.g. for bagging cement Other industrial equipment unrelated to cement production (to be excluded from system boundaries). Heat exchanger for district heating Flue gas cleaning equipment (for treating gaseous and dust emissions)	Kiln – cement clinker[16] Mill – cement goods, by type[17] Kiln – other outputs[18]: e.g. cement kiln dust District heating, (or cooling or electricity)[19]	Kiln – direct emissions from combustion of fuels Kiln – direct emissions from alternative and waste fuels Kiln – indirect emissions from electricity consumed. Kiln – direct process emissions from carbonates Mill – indirect emissions from electricity consumed.

12 Fuels combusted to generate heat for the use in the process under consideration or elsewhere. Both the fuel quantity (and in particular its carbon content / emission factor) as well its energy content are relevant for attributing it to different production processes.

13 Heavy Fuel Oil.

14 High calorific value fraction of municipal solid waste.

15 Raw materials are materials which participate in other chemical reactions or which are physically modified in the process for generating the product.

16 Precursor or intermediate good or product: where the production process also includes a 'finished' good. The precursor product may also be an output from the installation; for example, if the operator exported both cement clinker and cement from the installation.

17 Cement finished good – physical product output of the installation/production process monitored.

18 Other products (by-products) and waste: only need to be monitored if relevant in terms of carbon content for the determination of the production process's emissions, and energy content for corroboration purposes.

19 Measurable heat (or cooling or electricity, if fuels are used in their generation) exported from a CBAM installation or production process should be treated like a second product, i.e. a certain amount of emissions must be subtracted from the emissions of that production process.

Step 2: Identify relevant production processes and production routes.

In this step, the operator identifies that the installation produces cement clinker and cement, each of which is an aggregated goods category listed in Annex I, Table 1 ("Mapping of CN codes to aggregated goods categories") of the Methodology Act.

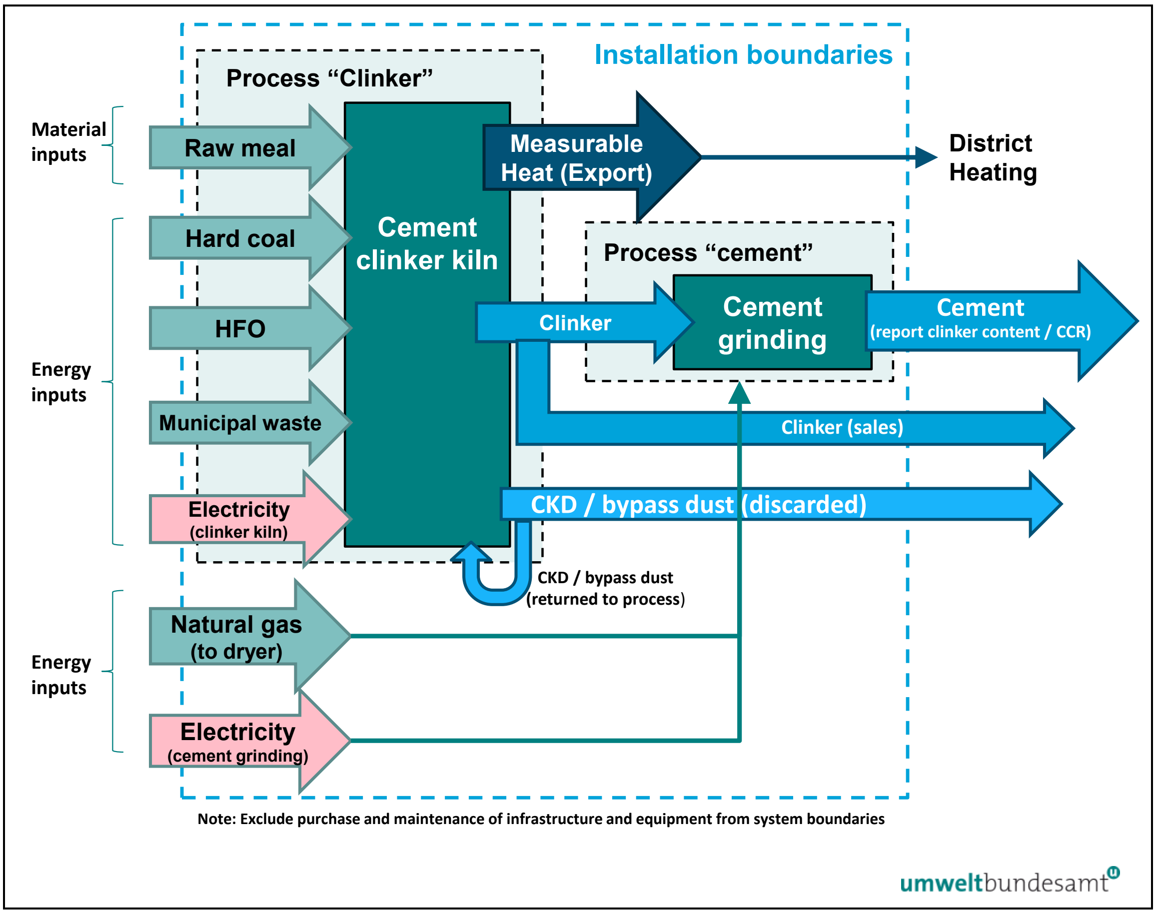
Each aggregated goods category defines system boundaries to be considered when defining which CN codes or groups of CN codes define a 'production process' for the purpose of monitoring, covering goods to which the same functional unit applies and, where relevant, encompassing all production routes used within the installation. The operator uses the Table 3-2 as a checklist for assigning the relevant inputs, outputs and emissions to each production processes. This is relatively simple in most cases, for example:

- Cement clinker (CN 2523 10 00) production process:
    - Physical units: Cement kiln, including preheaters, pre-calciner, clinker cooler, and associated auxiliary equipment such as flue gas cleaning.
    - Inputs / sources streams: Fuels, electricity, raw materials and alternative raw materials for the process.
    - Outputs (goods): Cement clinker, kiln dust (re-introduced it into the clinker production process).
    - Other outputs: measurable heat exported to district heating network.
    - Emission sources: direct (combustion and process) and indirect emissions (electricity consumed) related to the kiln system.
- Cement (CN 2523 29 00 and 2523 90 00)[20] production process:
    - Physical units: Grinding plant, direct fired dryer and associated auxiliary equipment e.g. cement bagging plant.
    - Inputs / source streams: Cement clinker, electricity, fuels for the dryer, additive materials used in making cement such as gypsum.
    - Outputs (goods): Cement.
    - Emission sources: direct (from cement dryer, if applicable) and indirect emissions (from electricity consumed) related to the grinding process.

Using a schematic helps to visualise the respective system boundaries of each production process and production route, and to assign inputs, outputs and emissions accordingly.

[20] For this example it is assumed that grey Portland cement and other hydraulic cements are produced.

Figure 3-1: *Schematic used to define the system boundaries of an example cement clinker and cement production processes*



In the case of the above cement installation, both the kiln system and cement grinding plant are relatively self-contained parts of the installation, without shared equipment, and there is no doubt about the system boundaries of each production process. The only element that is not widely found in this industry is the heat recovery from the clinker kiln for the purpose of district heating. In practice it would not be a separate production process, but in calculating the attributed emissions of the clinker production process, the heat would be taken into account.

The following worked example for the cement sector shows how, for the production processes defined, relevant emissions are calculated and assigned to production processes, and specific embedded emissions are calculated. For simplification, the district heating is omitted in that example, as are the additional direct emissions from the dryer before the cement grinding.

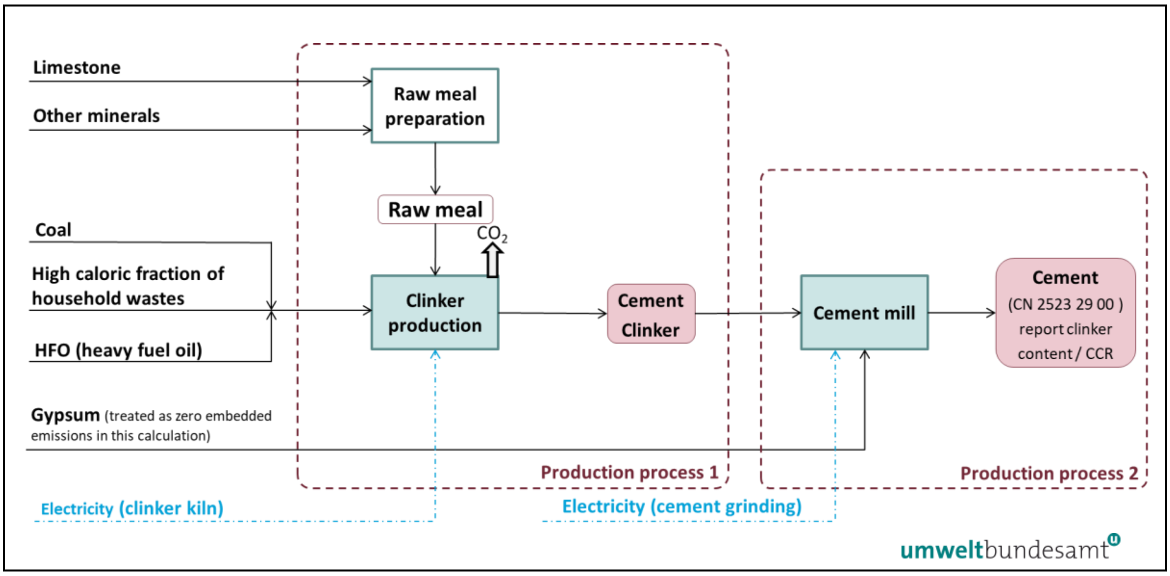
4 Worked example for the cement sector

The following worked example shows how specific embedded emissions are derived for cement sector goods. The resulting embedded emissions of imports into the EU are then calculated at the end of the example for reporting by the importer in their annual CBAM declaration for the relevant reporting period.

In this example the installation produces two products, cement clinker and cement, each of which is treated as a separate production process, as these goods refer to separate CN codes and each is a separate category of CBAM aggregated good. The example refers to clinker and cement in general without specifying whether the goods are grey or white clinker/cement. The example is thus illustrative of both cases.

Figure 4-1 gives an outline view of the installation and shows the system boundaries as a hatched line for each production process. The physical units carrying out each production process have been grouped under 'Clinker production' and 'Cement mill' and the different inputs and outputs and sources of emissions have been identified for each production process. Note that for the cement sector, indirect emissions are to be included, and therefore electricity is included in the calculation for this example.

Figure 4-1: Cement example – Overview



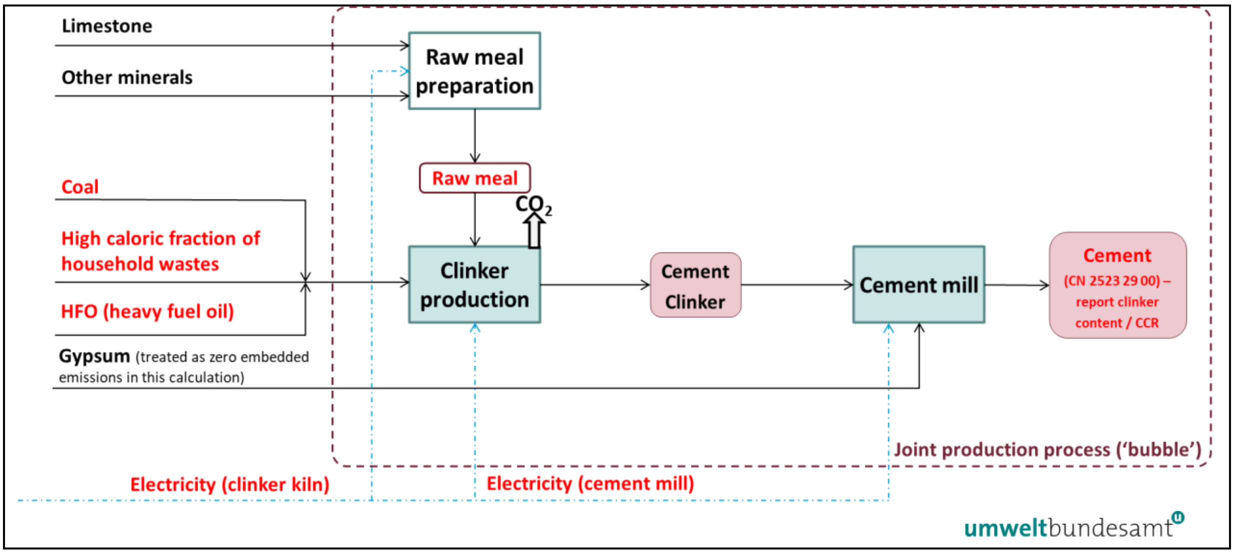
The two relevant production processes defined above are:

- Production process 1 – cement clinker produced in a cement kiln. The system boundaries of this production process have been defined as including inputs of raw materials (limestone and other minerals), fuels (coal, heavy fuel oil (HFO) and fractions of household waste) and electrical energy. Output from the process is cement clinker that is a precursor for production process 2.

- Production process 2 – cement produced in a cement mill. The system boundaries of this production process have been defined as including the inputs gypsum (which as a raw material is not a precursor (not included in Annex I to the CBAM Regulation), and therefore treated as having zero embedded emissions for the purposes of this calculation), precursor cement clinker (which has embedded emissions) and electrical energy. Output from the process is cement (with a need to report clinker content / CCR).

In this case, where all the output from production process 1 of precursor cement clinker goes directly into production process 2, it is possible to define a joint production process, or '**bubble**', whereby the system boundaries of the production processes are combined, as shown in *Figure 4-2*.

Figure 4-2: Cement example – joint production process ('bubble approach') and complete monitoring approach – red elements indicate inputs/outputs/activity data to be monitored within the combined system boundary.



The system boundary has been redrawn to encompass both production processes previously defined for each CBAM aggregated good.

The inputs and outputs highlighted in red text above are the parameters that would need to be monitored by the operator in order to attribute emissions and determine direct and indirect specific embedded emissions within the joint production process ('bubble').

The direct and indirect emissions that are monitored in this example result from:

- Direct emissions from fuel combustion – fossil fuels (coal and HFO) and from a mixed fossil/biomass fuel derived from household waste (an alternative fuel).
- Direct emissions from the process – resulting from the thermal decomposition of carbonates in the raw meal input (produced from limestone and other minerals) to the cement kiln system.
- Indirect emissions from the electrical energy consumed by the joint production process.

The activity level of cement also needs to be monitored in terms of the tonnes of clinker contained in the cement goods. It appears that the monitoring becomes simpler with this 'bubble approach". However, as the clinker amount is the functional unit for the cement produced, its quantity (as well as the quantity of other inputs used such as gypsum) need to be monitored for each type of cement produced. The associated embedded emissions of clinker do not have to be monitored separately but are the result of the overall bubble approach, divided by the total amount of clinker produced. Similarly, there is no need to split quantities of electrical energy consumed according to the two processes.

The following tables summarise the fuel, electrical energy and raw material inputs monitored for determining specific embedded emissions (SEE). The calculation of the SEE values is carried out in two steps:

- Step 1 – derives SEE values for the functional unit cement clinker; and

- Step 2 – derives SEE values for cement, taking into account i) embedded emissions of the bubble production process, and ii) the clinker to cement ratio (CCR) of each type of cement produced, to determine the tonnes of clinker contained in the cement goods.

Note that if any cement clinker produced by the installation were to be diverted and separately sold, the embedded emissions calculated under step 1 would have to be determined separately (without indirect emissions of the cement grinding plant) and would also need to be communicated by the operator to the purchaser of the cement clinker goods. In that case the 'bubble approach' would not be allowed.

In the following, we demonstrate both approaches, calculation with bubble approach and without, i.e. using two separate production processes.

4.1 Calculation using separate processes

Table 4-1: Calculation of direct and indirect emissions, and SEE values for cement clinker

Direct emissions	**AD (t)**	**NCV (GJ/t)**	**EF (t CO_2/t or t CO_2/TJ)**	**Biomass %**	**Emissions fossil (t CO_2)**	**Emissions biomass[21] (t CO_2)**
Process emissions						
Cement clinker (standard factor)[22]	1 255 000		0,525		658 875	
Combustion emissions						
Coal	88 000	25	95		209 000	0
High NCV household waste[23]	25 000	20	83	15%	35 275	6 225
HFO	43 000	40	78		134 160	0
Total direct emissions					**1 037 310**	
Indirect emissions	**AD (MWh)**		**EF (t CO_2 / MWh)**		**Emissions (t CO_2)**	
Electricity consumed	81 575		0,626		51 066	
Clinker production (tonnes)	1 255 000					
Step 1: Specific embedded emission (SEE) values are derived using direct and indirect emissions and activity data for cement clinker.						
Cement clinker	**Direct**	**Indirect**				
SEE	**0,82654**	**0,04069**	**t CO_2 / t**			

[21] Zero-rated biomass, i.e. compliant with the RED II criteria, where applicable.

[22] Standard emission factor for cement clinker given in Implementing Regulation Annex II Section B.9.2.2., which states that as a minimum requirement to determine the emission factor, a standard value of 0,525 t CO_2/t cement clinker is applied.

[23] Biomass being the biodegradable fraction in municipal waste. If the emission factor and/or NCV for municipal waste is not known, the standard values in Implementing Regulation Annex II, Section G, Table 2 should be used, which are 11,6 GJ/t and 100 t CO_2/TJ.

In the Table 4-1 above, step 1 is to calculate and attribute direct and indirect emissions associated with the production of cement clinker in the reporting period and derive SEE values for the amount of clinker produced.

Note that the emission factor used for raw meal above is a standard emission factor given in section B.9.2.2 of Annex II to the Methodology Act, which states that, as a minimum requirement to determine the emission factor, a standard value of 0,525 t CO_2/t cement clinker is applied. For using more accurate values, chemical analyses of the raw meal would have to be performed.

Note also that the direct emissions associated with the biomass content of the household waste is calculated separately and is deducted from the total direct emissions. This is because the biodegradable fraction of municipal waste (given as 15% above) is treated as biomass and is effectively zero-rated for total emissions, as the RED II sustainability criteria do not apply to household / municipal waste.

The emission factor used for electricity consumed is the default value for indirect emissions of goods, as provided in Annex II to the Default Values Act. In the example above, the emission factor applied to electricity consumed in the production of cement clinker is the value provided for Lebanon. As an operator, you shall select the emission factor relevant for country where the installation is located.

Table 4-2: Calculation of total direct and indirect SEE values for cement final product (Step 2)

Portland cement production			**Comment**
tonnes clinker / tonne cement ratio	0,95		This is the CCR for Portland cement. The CCR is specific to the cement product produced.
	MWh/t cement	**t CO_2/t**	
Additional electricity consumption	0,085	0,05321	For the cement grinding production process. Calculated as MWh/t x EF for electricity.
Step 2: SEE values are derived for final cement product including the embedded emissions from the precursor cement clinker			
Cement	SEE **Direct**	SEE **Indirect**	
	t CO_2 / t cement	t CO_2 / t cement	
Contribution of precursor (clinker)	0,7852	0,0387	Calculated using the CCR, for example for SEE direct as 0,8265 t CO_2 / t x 0,95 = 0,7852 t CO_2 / t
Production process		0,05321	As above
Total specific embedded emissions	**0,7852**	**0,0919**	Sum of SEEs
Total (direct + indirect) SEE	**0,8771**		Value for which CBAM certificates need to be surrendered, before subtraction of free allocation adjustment (and carbon price paid in third country)

4.2 Calculation using bubble approach

Here, we only outline the different path of the calculation. The explanation for the values chosen can be found in section 4.1.

Table 4-3: Calculation of total direct and indirect SEE values for cement using the bubble approach

Activity level			
Total production of clinker:	1 255 000	t clinker / yr	
Clinker to cement ratio (CCR)	0,950		
Total production of cement:	1 321 053	t cement / yr	
expressed as functional unit:	1 255 000	t clinker / yr	
Emissions / Cement:	**direct**	**indirect**	
total bubble's emissions:	1 037 310	121 359	t CO_2 / yr
SEE per functional unit	0,8265	0,0967	t CO_2 / t clinker
SEE per tonne of cement:	0,7852	0,0919	t CO_2 / t cement

4.3 Calculation of free allocation adjustment and CBAM obligation

As the operator is monitoring and reporting actual data for the cement produced in its installation, also the free allocation adjustment can be composed. The calculation is outlined below:

- CBAM BM for cement = 0 (Column A of the Table in the Annex to the Free Allocation Adjustment Act)[24,25]
    - CBAM BM for grey clinker = 0,666 (column A)
    - M_i (clinker) = 0,95 (in line with the operator's monitoring)
    - $SEFA_{cement} = 0 + 0{,}95 \times 0{,}666 = 0{,}6327$ t CO_2 / t cement
    - Assumption: Year = 2026.:
        - CSCF = 1,00
        - CBAM = 97,5%
    - Specific embedded free allocation (SEFA) = 0,6327 × 0,975 × 1,00 = = **0,617 t CO_2 / t cement**

The total embedded emissions to be reported by the authorised declarant (EU importer) for the import of Portland cement into the EU during the definitive period may then be determined, for example, for the import of **100 tonnes of Portland cement**:

24 The Free Allocation Adjustment Act provides values for products based on grey cement clinker with indicator "(A)" and white clinker with indicator "(B)". The operator here knows that the product is grey clinker and selects the values accordingly.

25 In most installations, no direct emissions occur when producing cement using cement clinker. Therefore, the benchmark of the cement production process is zero, while the benchmark of the total process is significantly higher, as it reflects the clinker production's benchmark.

- **Definitive period:**
  - Direct embedded emissions = 100 t × 0,7852 t CO_2 / t = 78,52 t CO_2
  - Indirect embedded emissions = 100 t × 0,0919 t CO_2 / t = 9,19 t CO_2

Total embedded emissions: **87,71 t CO_2**

Minus Free Allocation adjustment: **61,7 t CO_2**

(Further deduction could be made if a carbon price was paid in the country of production – outside the scope of this guidance)

Total CBAM obligation to be covered by the authorised declarant with CBAM certificates: 87,7 – 61,7 = **26 certificates**

Annex A List of definitions

Term	Definition
'Accuracy'	means the closeness of the agreement between the result of a measurement and the true value of the particular quantity or a reference value determined empirically using internationally accepted and traceable calibration materials and standard methods, taking into account both random and systematic factors
'Activity data'	means the amount of fuels or materials consumed or produced by a process relevant for the calculation-based methodology, expressed in terajoules (TJ), mass in tonnes or (for gases) volume in normal cubic metres, as appropriate
'Actual emissions'	means the emissions calculated based on primary data from the production processes of goods and from the production of electricity consumed during those processes as determined in accordance with the methods set out in Annex IV [to the Methodology Act]
'Activity level'	means the quantity of goods to which the same functional unit applies that are produced within the system boundaries of a production process during a reporting period
'Aggregated goods categories'	means aggregated goods categories pursuant to Table 1 of point 2 of Annex I. A group of CBAM goods with their CN codes, used for the purpose of defining system boundaries of production processes.
'Agricultural, aquaculture, fisheries and forestry residues'	means residues that are directly generated by agriculture, aquaculture, fisheries and forestry and that do not include residues from related industries or processing
'Authorised CBAM declarant'	means a person authorised by the competent authority in accordance with Article 17 [of the CBAM Regulation]. The 'authorised CBAM declarant' [which replaces the term 'reporting declarant' from the transitional period] may be importers of CBAM goods, or their indirect customs representatives, who have applied for and been granted the status of authorised CBAM declarant.
'Batch'	means an amount of fuel or material representatively sampled and characterised, and transferred as one shipment or continuously over a specific period of time
'Biomass'	means biomass as defined in Article 2, point (24) of the Renewable Energy Directive (RED II)[26]; it includes bioliquids and biofuels as defined in Article 2, point (32) and (33), biomass fuels as defined in Article 2, point (27) and biogas as defined in Article 2 point (28) of the RED II;

[26] Directive (EU) 2018/2001

Term	Definition
'Biomass fraction'	means the ratio of carbon stemming from biomass to the total carbon content of a fuel or material, expressed as a fraction
'Calculation factors'	means net calorific value, emission factor, preliminary emission factor, oxidation factor, conversion factor, carbon content or biomass fraction
'Calibration'	means the set of operations, which establishes, under specified conditions, the relations between values indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material and the corresponding values of a quantity realised by a reference standard
'Carbon price'	means the monetary amount paid in a third country, under a carbon emissions reduction scheme, in the form of a tax, levy or fee or in the form of emission allowances under a greenhouse gas emissions trading system, calculated on greenhouse gases covered by such a measure, and released during the production of goods
'CBAM certificate'	means a certificate in electronic format corresponding to one tonne of CO_2e of embedded emissions in goods
'CO_2 emission factor'	means the weighted average of the CO_2 intensity of electricity produced from fossil fuels within a geographic area. The CO_2 emission factor is the result of the division of the CO_2 emission data of the electricity sector by the gross electricity generation based on fossil fuels in the relevant geographic area. It is expressed in tonnes of CO_2 per megawatt-hour
'Combined nomenclature' (CN)	means the classification of goods, designed to meet the needs of: i) the Common customs tariff, setting import duties for products imported into the European Union (EU), as well as the Integrated tariff of the European Communities (Taric), incorporating all EU and trade measures applied to goods imported into and exported out of the EU; ii) the international trade statistics of the EU. The CN provides the means of collecting, exchanging and publishing data on EU international trade statistics. It is also used for the collection and publication of international trade statistics in intra-EU trade.[27]
'Combustion emissions'	means greenhouse gas emissions occurring during the exothermic reaction of a fuel with oxygen
'Competent authority'	means the authority designated by each Member State in accordance with Article 11 [of the CBAM Regulation]

[27] For definition see: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Combined_nomenclature_(CN)

Term	Definition
'Continuous emission measurement' (CEM)	means a set of operations having the objective of determining the value of a quantity by means of periodic measurements, applying either measurements in the stack or extractive procedures with a measuring instrument located close to the stack, whilst excluding measurement methodologies based on the collection of individual samples from the stack
'Control system'	means the operator's risk assessment and entire set of control activities, including the continuous management thereof, that an operator has established, documented, implemented and maintained pursuant to point A.2. of Annex II
'Complex goods'	means goods other than simple goods
'Conservative'	means that a set of assumptions is defined in order to ensure that no under-estimation of reported emissions or over-estimation of production of heat, electricity or goods occurs
'Conversion factor'	means the ratio of carbon emitted as CO_2 to the total carbon contained in the source stream before the emitting process takes place, expressed as a fraction, considering CO emitted to the atmosphere as the molar equivalent amount of CO_2
'Co-product'	means any of two or more products resulting from the same production process
'Customs declarant'	means a declarant as defined in Article 5, point (15) of Regulation (EU) No 952/2013 lodging a customs declaration for release for free circulation of goods in its own name or the person in whose name such a declaration is lodged
'CCUS system'	means a group of economic operators with technically connected installations and transport equipment for CO_2 capture, transport, use in production of goods, or geological storage
'Data flow activities'	mean activities related to the acquisition, processing and handling of data that are needed to draft an emissions report from primary source data
'Data set'	means one type of data, either at installation level or production process level as relevant in the circumstances, as any of the following: (a) the amount of fuels or materials consumed or produced by a production process as relevant for the calculation-based methodology, expressed in terajoules, mass in tonnes, or for gases as volume in normal cubic metres, as appropriate, including for waste gases; (b) a calculation factor;

Term	Definition
	(c) net quantity of measurable heat, and the relevant parameters required for determining this quantity, in particular: i) mass flow of heat transfer medium; and ii) enthalpy of transmitted and returned heat transfer medium, as specified by composition, temperature, pressure and saturation; (d) quantities of non-measurable heat, specified by the relevant quantities of fuels used for producing the heat, and the net calorific value (NCV) of the fuel mix; (e) quantities of electricity; (f) quantities of CO_2 transferred between installations; (g) quantities of precursors received from outside the production process, and their relevant parameters, such as country of origin, used production route, specific direct and indirect emissions;
'Default value'	means a value, which is calculated or drawn from secondary data, which represents the embedded emissions in goods
'Direct emissions'	means emissions from the production processes of goods including emissions from the production of heating and cooling that is consumed during the production processes, irrespective of the location of the production of the heating or cooling
'Embedded emissions'	means direct emissions released during the production of goods and indirect emissions from the production of electricity that is consumed during the production processes, calculated in accordance with the methods set out in Annex IV and further specified in the implementing acts adopted pursuant to Article 7(7)
'Emissions'	mean the release of greenhouse gases into the atmosphere from the production of goods
'Emission factor'	means the average emission rate of a greenhouse gas relative to the activity data of a source stream assuming complete oxidation for combustion and complete conversion for all other chemical reactions
'Emission factor' for electricity	means the default value, expressed in CO_2e, representing the emission intensity of electricity consumed in production of goods.
'Emission source'	means a separately identifiable part of an installation or a process within an installation, from which relevant greenhouse gases are emitted
EU ETS	means the system for greenhouse gas emissions allowance trading within the Union in respect of activities listed in Annex I to Directive 2003/87/EC other than aviation activities

Term	Definition
'EU ETS allowance'	means an allowance as defined in Article 3, point (a), of Directive 2003/87/EC in respect of activities listed in Annex I to that Directive other than aviation activities
'Fossil carbon'	means inorganic and organic carbon that is not biomass
'Fossil fraction'	means the ratio of fossil carbon to the total carbon content of a fuel or material, expressed as a fraction
'Fugitive emissions'	means irregular or unintended emissions from sources that are not localised, or too diverse or too small to be monitored individually
'Functional unit'	means the reference unit used for the calculation of embedded emissions in goods
'Goods'	means goods listed in Annex I [to the CBAM the CBAM Regulation]
'Greenhouse gases'	mean greenhouse gases as specified in Annex I [to the CBAM the CBAM Regulation] in relation to each of the goods listed in that Annex
'Heat meter'	means a thermal energy meter or any other device to measure and record the amount of thermal energy produced based upon flow volumes and temperatures
'Importer'	means either the person lodging a customs declaration for release for free circulation of goods or a bill of discharge in accordance with Article 175(5) of Delegated Regulation (EU) 2015/2446 in its own name and on its own behalf or, where the customs declaration is lodged by an indirect customs representative in accordance with Article 18 of Regulation (EU) No 952/2013, the person on whose behalf such a declaration is lodged
'Importation'	means release for free circulation as provided for in Article 201 of Regulation (EU) No 952/2013
'Indirect customs Representative'	A customs representative appointed by an importer established in a Member State. If the importer appoints an indirect customs representative and they agree, they can act as an authorised CBAM declarant and submit the application for an authorisation on behalf of the importer. The indirect customs representative is liable for all operations made for the importers it represents
'Indirect emissions'	means emissions from the production of electricity which is consumed during the production processes of goods, irrespective of the location of the production of the consumed electricity
'Inherent CO_2'	means CO_2 which is part of a source stream.
'Installation'	means a stationary technical unit where a production process is carried out

Term	Definition
‘Legal metrological control’	means the control exercised by a public authority or regulator of the measurement tasks intended for the field of application of a measuring instrument, for reasons of public interest, public health, public safety, public order, protection of the environment, the levying of taxes and duties, the protection of consumers and fair trading
‘Measurable heat’	means a net heat flow transported through identifiable pipelines or ducts using a heat transfer medium, such as, in particular, steam, hot air, water, oil, liquid metals and salts, for which a heat meter is or could be installed
‘Measurement point’	means the emission source for which continuous emission measurement systems (CEMS) are used for emission measurement, or the cross-section of a pipeline system for which the CO_2 flow is determined using continuous measurement systems
‘Measurement system’	means a complete set of measuring instruments and other equipment used to determine variables for the monitoring and calculation of emissions
‘Minimum requirements’	means monitoring methods using the minimum efforts allowed for determining data in order to result in emission data acceptable for the purpose of the CBAM Regulation.
‘Mixed fuel’	means a fuel which contains both biomass and fossil carbon
‘Mixed material’	means a material which contains both biomass and fossil carbon
‘Multifunctional process’	means a process that delivers multiple outputs or whose outputs feed into several production processes
‘Net calorific value’ (NCV)	means the specific amount of energy released as heat when a fuel or material undergoes complete combustion with oxygen under standard conditions, less the heat of vaporisation of any water formed
‘Non-CBAM good’	means any good produced in the installation that is not included in Annex I to the CBAM Regulation
‘Non-measurable heat’	means all heat other than measurable heat
‘Operator’	means any person who operates or controls an installation in a third country, including a parent company that controls an installation in a third country
‘Oxidation factor’	means the ratio of carbon oxidised to CO_2 as a consequence of combustion to the total carbon contained in the fuel, expressed as a fraction, considering carbon monoxide (CO) emitted to the atmosphere as the molar equivalent amount of carbon dioxide (CO_2)
‘Power purchase agreement’	means a contract under which a person agrees to purchase electricity directly from an electricity producer

Term	Definition
'Precursor'	means any input material into a production process included in the list of goods set out in Annex I to the CBAM Regulation;
'Preliminary emission factor'	means the assumed total emission factor of a fuel or material based on the carbon content of its biomass fraction and its fossil fraction before multiplying it by the fossil fraction to produce the emission factor
'Production process'	means the chemical and physical processes carried out to produce goods in an installation
'Production route' [28]	means a specific technology used in a production process to produce goods
'Process emissions'	means greenhouse gas emissions other than combustion emissions occurring as a result of intentional and unintentional reactions between substances or their transformation, for a primary purpose other than the generation of heat, including from the following processes: (a) the chemical, electrolytic or pyrometallurgical reduction of metal compounds in ores, concentrates and secondary materials; (b) the removal of impurities from metals and metal compounds; (c) the decomposition of carbonates, including those used for flue gas cleaning; (d) chemical syntheses of products and intermediate products where the carbon bearing material participates in the reaction; (e) the use of carbon containing additives or raw materials; (f) the chemical or electrolytic reduction of metalloid oxides or non-metal oxides such as silicon oxides and phosphates.
'Proxy data'	means annual values which are empirically substantiated or derived from accepted sources and which an operator uses to substitute a data set[29] for the purpose of ensuring complete reporting
'Rebate'	means any amount that reduces the amount due or paid by a person liable for the payment of a carbon price, before its payment or after, in a monetary form or in any other form.
'Recommended improvements'	means monitoring methods which are proven means to ensure that data are more accurate or less prone to mistakes than by mere application of minimum requirements
'Related emissions'	means: – the direct emissions caused by the source stream or emission source concerned; – emissions attributed to a quantity of measurable heat; – the indirect emissions related to the quantity of electricity concerned; – embedded emissions of a material produced or of a precursor consumed.

[28] Note that different production routes can fall within the same production process.

[29] Refers to the activity data or the calculation factors.

Term	Definition
'Reporting period'	means the period corresponding to the calendar year during which the good was produced and used by the authorised CBAM declarant as reference for the determination of embedded emissions
'Residue'	means a substance that is not the end product that a production process directly seeks to produce; it is not a primary aim of the production process and the process has not been deliberately modified to produce it
'Simple goods'	means goods produced in a production process requiring exclusively input materials (precursors) and fuels having zero embedded emissions
'Source stream'	means either of the following: (a) a specific fuel type, raw material or product giving rise to emissions of relevant greenhouse gases at one or more emission sources as a result of its consumption or production; (b) a specific fuel type, raw material or product containing carbon and included in the calculation of greenhouse gas emissions using a mass-balance method
'Specific embedded emissions'	means the embedded emissions of one tonne of goods, expressed as tonnes of CO_2e emissions per tonne of goods
'Standard conditions'	means temperature of 273,15 K and pressure conditions of 101 325 Pa defining normal cubic metres (Nm^3)
'System boundary'	means the group of chemical or physical processes included in the calculation of embedded emissions of goods under the same aggregated goods category. The system boundaries shall cover direct emissions, indirect emissions for goods not listed in Annex II to the CBAM Regulation, and the embedded emissions of any precursor.
'Third country'	means a country or territory outside the customs territory of the [European] Union
'Tonne of CO_{2}(e)'	means one metric tonne of carbon dioxide ('CO_2'), or an amount of any other greenhouse gas listed in Annex I [to the CBAM Regulation] with an equivalent global warming potential ['CO_2e']
'Transmission system operator'	means an operator as defined in Article 2, point (35) of Directive (EU) 2019/944 of the European Parliament and of the Council ([30]).

[30] Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity and amending Directive 2012/27/EU (OJ L 158, 14.6.2019, p. 125).

Term	Definition
'Uncertainty'	means a parameter, associated with the result of the determination of a quantity, that characterises the dispersion of the values that could reasonably be attributed to the particular quantity, including the effects of systematic as well as of random factors, expressed in percent, and describes a confidence interval around the mean value comprising 95% of inferred values taking into account any asymmetry of the distribution of values
'Waste'	means any substance or object which the holder discards or intends or is required to discard, excluding substances that have been intentionally modified or contaminated in order to meet this definition
'Waste gas'	means a gas containing incompletely oxidised carbon in a gaseous state under standard conditions which is a result of any of the processes listed under 'process emissions'

Annex B List of abbreviations

Abbreviation	Full term
AD	Activity Data
AEM	Anode Effect Minutes
AEO	Anode Effect Overvoltage
AL	Activity Level
AOD	Argon Oxygen Decarburisation.
BAT	Best Available Techniques
BF	Biomass Fraction
BFG	Blast Furnace Gas
BM	Benchmark
BOF	Basic Oxygen Furnace
BOFG	Basic Oxygen Furnace Gas
BREFs	Best Available Techniques Reference documents
CA	Competent Authority
CBAM	Carbon Border Adjustment Mechanism, the
CCR	Clinker to Cement Ratio
CCS	Carbon Capture and Storage
CCU(S)	Carbon Capture and Utilisation (and Storage)
CEMS	Continuous Emission Measurement Systems
CF	Conversion Factor
CFP	Carbon footprint of products
CHP	Combined Heat and Power
CKD	Cement Kiln Dust
CN	Combined nomenclature
COG	Coke Oven Gas
DRI	Direct Reduced Iron
EAF	Electric Arc Furnace
EEA	European Economic Area (EU-27, Iceland, Norway, Liechtenstein)
EF	Emission Factor
EFTA	European Free Trade Area
EORI	Economic Operator Registration and Identification
ETS	Emissions Trading System
EU ETS	EU Emissions Trading System
EUA	EU Allowances (used in the EU ETS)
EUR	Euro (currency)

Abbreviation	Full term
FAR	Free Allocation Rules (Regulation 2019/331)[31]
FIFO	First-In-First-Out principle
GHG	Greenhouse Gas
GWP	Global Warming Potential
HBI	Hot Briquetted Iron
HS	Harmonised System (for international trade)
IEA	International Energy Agency
ISO	International Organization for Standardization
LULUCF	Land-use, land change and forestry (criteria)
MP	Monitoring Plan
MRR	Monitoring and Reporting Regulation (Regulation 2018/2066)[32]
MRV	Monitoring, Reporting and Verification
MS	Member State(s)
MWh	Megawatt-hour
NCV	Net Calorific Value
NPI	Nickel pig iron
OF	Oxidation Factor
PCI	Pulverised Coal Injection
PEMS	Predictive Emission Monitoring System
PFC	Perfluoro-carbon
PoS	Proofs of Sustainability
RED II	Renewable Energy Directive, re-cast
SEE	Specific embedded emissions
SEFA	Specific embedded free allocation
TARIC	Integrated Tariff of the European Union database
TJ	Terajoules
TSO	Transmission System Operator
UCC	Union Custom Code
UN/LOCODE	United Nations Code for Trade and Transport Location

[31] Free Allocation Rules (Commission Delegated Regulation (EU) 2019/331 of 19 December 2018 determining transitional Union-wide rules for harmonised free allocation of emission allowances pursuant to Article 10a of Directive 2003/87/EC of the European Parliament and of the Council)

[32] Monitoring and Reporting Regulation (Commission Implementing Regulation (EU) 2018/2066 of 19 December 2018 on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council and amending Commission Regulation (EU) No 601/2012

EUROPEAN COMMISSION
DIRECTORATE-GENERAL
TAXATION AND CUSTOMS UNION
Indirect Taxation and Tax Administration
CBAM, Energy and Green Taxation

Brussels, 14 August 2026

GUIDANCE DOCUMENT 5B: SECTOR-SPECIFIC GUIDANCE DOCUMENT ON CHEMICAL SECTOR - HYDROGEN

Disclaimer: This guidance document is not legally binding and it is of an explanatory nature. Legal provisions of Union law take precedence over the contents of this document and should always be consulted. The authentic texts of the EU legal instruments are those published in the Official Journal of the European Union. This guidance was prepared by Commission services and does not represent an official position of the Commission. Only the Court of Justice of the European Union is competent to authoritatively interpret Union law.

VERSION HISTORY

Date	Version notes
14.08.2026	First Publication of this document for the definitive period.

CONTENTS

1 PREFACE

1.1 Structure and content of the guidance documents

This series of documents has been written to support stakeholders by explaining the requirements of the CBAM Regulation in a non-legislative language. This series of guidance documents should benefit a variety of stakeholders. A specific focus has been put on clarifying the **requirements for operators of installations producing CBAM goods outside of the EU for the definitive period.**

- **Guidance 1** provides an overview of the main changes to the CBAM methodology between the definitive period and the concluded transitional period. It also introduces the CBAM and an overview of the compliance cycle, roles and responsibilities, as well as milestones and deadlines for operators of installations outside the EU during the definitive period and explains the general exemptions from the CBAM.

- **Guidance 2** provides a quick guidance for the intended reader of this document, the operator of an installation producing CBAM goods. It provides a roadmap of the most important concepts of CBAM emissions monitoring and where to find more information in this series of documents.

- **Guidance 3** sets out the monitoring and reporting obligations and recommendations which are potentially applicable to any affected producer of CBAM goods.

- **Guidance 4** provides an overview of how the adjustment for free allocation is to be determined and what information is needed.

- **Guidance documents 5a, 5b, 5c, 5d, 5e and 5f** present an overview per sector of the production processes and value chains for goods that are included in the scope of the CBAM, as well as sector-specific monitoring and reporting considerations for each CBAM good where this is relevant. These sections are supplemented by examples for each sector.

The series of guidance documents is accompanied by an electronic template for information that should be used by installation operators to communicate information to the authorised CBAM declarants and CBAM Registry.

Presentation of numbers in EU documents
To align with EU legal documents, this guidance document uses the following convention when presenting numbers. The decimal separator used to separate the integral part of a number from its fractional part is a comma, e.g.: 0,890 Thousands, and powers of 10^{3n} thereafter, are separated by a space, e.g.: • fifteen thousand is written as 15 000 • fifteen million is written as 15 000 000

1.2 Reference regulations and legal acts

Several regulations and legal acts are referred to throughout this series of guidance documents. For ease of reading and to avoid ambiguity, simplified references are used when citing these acts.

- **CBAM Regulation**: Regulation (EU) 2023/956 and Regulation (EU) 2025/2083 amending Regulation (EU) 2023/956. Notably, where article numbers are given in this document without further specification, they always refer to the CBAM Regulation.

  It can be accessed at the following link (consolidated version): **http://data.europa.eu/eli/reg/2023/956/2025-10-20**

- **Methodology Act:** Commission Implementing Regulation (EU) 2025/2547, in legal texts referred to as "Implementing act pursuant to Article 7(7) of the CBAM Regulation".

  It can be accessed at the following link: **http://data.europa.eu/eli/reg_impl/2025/2547/oj**

- **Default Values Act**: Commission Implementing Regulation (EU) 2025/2621, in legal texts referred to as "Implementing act pursuant to Article 7(7) of the CBAM Regulation", also referred to as "default values determined in accordance with Annex IV to the CBAM Regulation".

  It can be accessed at the following link: **http://data.europa.eu/eli/reg_impl/2025/2621/oj**

- **Verification Principles Act**: Commission Implementing Regulation (EU) 2025/2546, in legal texts referred to as "Implementing act pursuant to Article 8(3) of the CBAM Regulation".

  It can be accessed at the following link: **http://data.europa.eu/eli/reg_impl/2025/2546/oj**

- **Accreditation & Verification Requirements Act**: Commission Delegated Regulation (EU) 2025/2551, in legal texts referred to as "Delegated act pursuant to Article 18(3) of the CBAM Regulation".

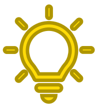
  It can be accessed at the following link: **http://data.europa.eu/eli/reg_del/2025/2551/oj**

- **Free Allocation Adjustment Act**: Commission Implementing Regulation (EU) 2025/2620, in legal texts referred to as "Implementing act pursuant to Article 31(2) of the CBAM Regulation".

  It can be accessed at the following link: **http://data.europa.eu/eli/reg_impl/2025/2620/oj**

For acronyms and definitions used in this document, please see **Annex B** and **Annex A**.

A series of icons are used throughout to help guide the reader:

Icon	Description of use
	Points to information of particular importance for operators of installations producing CBAM goods.
Simplified!	Highlights simplified approaches of the general requirements of the CBAM.
	Used where recommended improvements are presented.
	Used where other documents, templates or electronic tools are available from other sources.
	Points to examples given for the topics discussed in the surrounding text.

2 CBAM Goods and Production Routes

This section provides guidance on industry-sector-specific rules that apply for the definitive period (from 2026 onwards), for the hydrogen sector. It deals with the specification of products covered by the CBAM and the relevant production routes.

2.1 Foreword to sector-specific sections

The following sections provide an overview of the different production routes for the goods under chemical sectors in CBAM (hydrogen) and provide sector specific guidance. Where goods to which the same functional unit applies are produced in one installation via different production routes, the embedded emissions shall be determined in accordance with the averaging rules applicable in the definitive period.

Additional information on the production processes of the goods can also be found in the BREF[1] documents for best available techniques (BAT).

Diagrams used in the following sections.

For the system boundary graphics presented in the sections below, the **following conventions** are applied:

- **Production processes** (for which monitoring of the direct emissions would take place) are shown as **rectangles with white background**.
- **Optional** processes (e.g. CCS/CCU) are shown in **blue** boxes. In particular, CCS/CCU would not be taken into account for developing default values, but where you (as an operator) use them, the related emissions or emission savings should be taken into account for determining actual embedded emissions in line with the CBAM Regulation and the Methodology Act.
- **Materials** which are considered to have no embedded emissions are shown in **pink** boxes, materials with embedded emissions (precursor materials and final products, i.e. goods under the CBAM) in **green** boxes. Simple goods are shown in **normal** font, complex goods in **bold** font. Materials which are **optional** are shown in boxes with a **blue dashed** outline and must be included where actually used at the installation.
- Input materials are presented without trying to be complete. This means that the focus is on materials which are relevant for demonstrating the differences between different production routes. As a consequence, less important input materials and in particular fuels are usually omitted in order to keep graphs simple.
- **Electricity** as input is shown only in cases where it is the main "precursor" of the process (i.e. in particular for electric arc furnaces and electrolysis processes). Electricity is shown in **light grey** boxes.

[1] BAT Reference document (BREF), BAT being "Best Available Techniques" as defined by the IED (Industrial Emissions Directive). Relevant BREF documents are those for: the production of cement; for iron and steel production; large volume inorganic chemicals (which includes fertilisers); for Chlor-alkali; and for non-ferrous metals (which includes both aluminium and ferro-alloys). All BREFs can be found at the European IPPC Bureau, under https://eippcb.jrc.ec.europa.eu/reference.

2.2 Identifying CBAM goods

This section explains how goods covered by the CBAM are defined and identified in the Regulation. The textbox below signposts the key sections for the definition and reporting of CBAM goods, relevant for the CBAM transitional period.

Methodology Act references:

- **Annex I,** point 2 Table 1 "Mapping of CN codes to aggregated goods categories"
- **Annex III** "Rules for attributing emissions to goods".

2.3 Chemicals sector – Hydrogen

The textbox below signposts sector-specific sections in the Methodology Act, relevant for the CBAM definitive period.

Methodology Act references:

- **Annex I,** Table 1 "Mapping of CN codes to aggregated goods categories" (aggregated goods category "Hydrogen") of the Methodology Act adopted pursuant to Article 7(7) of Regulation (EU) 2023/956.
- **Annex I,** point 3.6 "Hydrogen", which defines the functional unit, system boundaries and precursors for hydrogen production routes, and
- **Annex III** to the Methodology Act, which sets out the rules for attributing emissions of an installation to goods.

2.3.1 Unit of production and embedded emissions

The quantity of hydrogen imported into the EU must be expressed in metric tonnes (as pure hydrogen). As an operator, you must record the quantity of hydrogen produced by installation or production process, for the purposes of reporting and for use in the calculation of specific embedded emissions in accordance with the CBAM Regulation and the Methodology Act.

Industrial sector	**Chemicals – Hydrogen**
Production unit of goods	Tonnes (metric) pure hydrogen, reported separately by installation or production process in the country of origin
Associated activities	Producing hydrogen by steam reforming or partial oxidation of hydrocarbons, water electrolysis, Chlor-Alkali electrolysis or production of sodium chlorate, steam cracking of hydrocarbons.
Relevant greenhouse gases	Carbon dioxide (CO_2)
Direct Emissions	Tonnes (metric) of CO_2e

Industrial sector	Chemicals – Hydrogen
Indirect Emissions	Quantity of electricity consumed (MWh), source and emissions factor used to calculate the indirect emissions in Tonnes (metric) of CO_2 or CO_2e. Indirect emissions were monitored and reported during the transitional period but, for the definitive period, hydrogen is included in Annex II to the CBAM Regulation ("Goods for which only direct emissions are taken into account"), so indirect emissions are not taken into account in the embedded emissions of hydrogen for CBAM purposes.
Unit for embedded emissions	Tonnes CO_2e emissions per tonne of good, reported separately for each type of good, by installation in the country of origin

In the definitive period, for CBAM purposes the hydrogen sector has to account for direct emissions only, since hydrogen is listed in Annex II to the CBAM Regulation as a good for which only direct emissions are taken into account. Indirect emissions were reported separately during the transitional period but are not included in the embedded emissions of hydrogen in the definitive period[2]. Emissions must be reported in metric tonnes CO_2 equivalent (t CO_2e) emissions per tonne of output. This figure must be calculated for the specific installation or production process in your country of origin.

The following sections set out how the system boundaries of different hydrogen production routes should be defined and identify elements of the production process that must be included for the purposes of monitoring and reporting.

2.3.2 Definition and explanation of sector CBAM goods covered

The following Table 2-1 lists the relevant goods in scope for the CBAM definitive period in the hydrogen industry sector. The CN codes in the central column are the starting point for which 'production processes' are to be defined for the purpose of monitoring at installation level in a manner consistent with the system boundaries and production routes set out in Annex I to the Methodology Act.

Table 2-1: CBAM goods in the chemicals sector – hydrogen[3]

Aggregated goods category	Product CN Code	Description
Hydrogen	2804 10 00	Hydrogen

2 For this sector indirect emissions were reported during the transitional period, but hydrogen is listed in Annex II to Regulation (EU) 2023/956 as a good for which only direct emissions are taken into account, so indirect emissions are not taken into account in embedded emissions in the definitive period.

3 Source: Annex I to the CBAM Regulation; Annex I ("Mapping of CN codes to aggregated goods categories") to the Methodology Act.

Hydrogen is defined as a simple good in accordance with Article 1 and Annex I of the Methodology Act, as there are no possible precursors listed for the production of hydrogen and the embedded emissions are determined solely from the direct emissions of the hydrogen production process.

There are **no precursors** relevant for hydrogen. However, hydrogen may itself be a precursor for other processes, where it is separately produced for use as a chemical feedstock to produce ammonia, or to produce pig iron or direct reduced iron (DRI).

Where hydrogen is used as a precursor in the production of ammonia and the conditions laid down in the Methodology Act for disregarding indirect emissions of precursors are met (e.g. where the precursor itself is listed in Annex II), the indirect emissions of electricity associated with the hydrogen precursor may be disregarded when determining the embedded emissions of the ammonia CBAM goods.

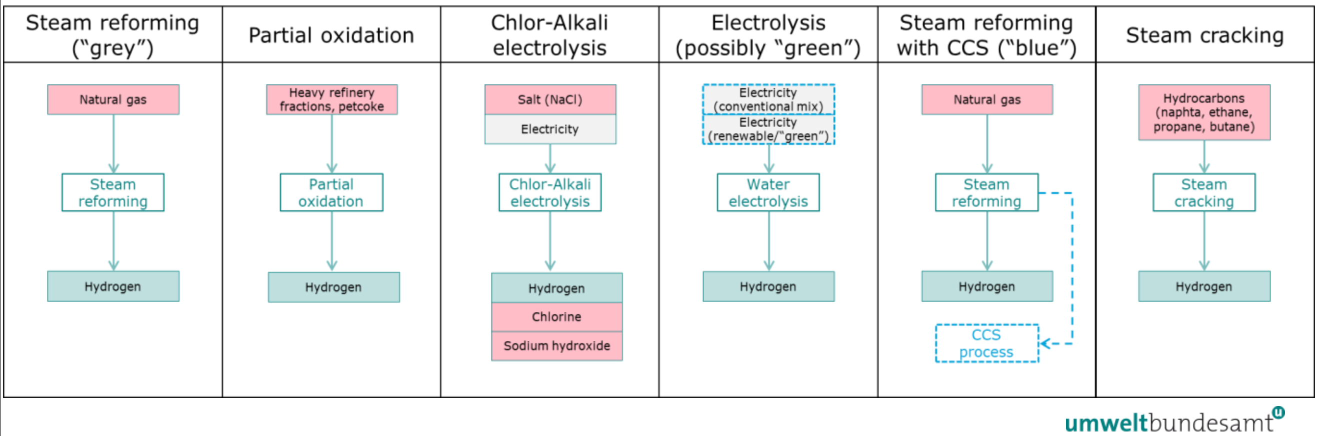
The production of hydrogen is by a number of different production routes, outlined below.

2.3.3 Definition and explanation of relevant production processes and routes

Hydrogen can be produced from various feedstocks including plastic wastes, but currently it is derived mostly from fossil fuels. Hydrogen production units are typically integrated into larger industrial processes e.g. as for an installation producing ammonia. For CBAM purposes, the relevant production routes and their system boundaries are defined for the hydrogen aggregated goods category in Annex I, point 3.6 to the Methodology Act, and emissions are attributed to hydrogen in accordance with Annex III to the Methodology Act.

The following diagram illustrates the variety of different routes by which hydrogen may be produced. Note that chlor-alkali electrolysis and water electrolysis are not mentioned in the Methodology Act, as these production routes include minimal direct emissions.

Figure 2-1: Overview of different production routes for hydrogen relevant for CBAM



Notes to figure: For hydrogen (Annex II goods), only direct emissions are taken into account for embedded emissions; indirect emissions from electricity are not included.

The system boundaries for direct emissions monitoring for hydrogen include all processes directly or indirectly linked to hydrogen production, and all fuels used in the production of hydrogen, in line with Annex I, point 3.6 and Annex III to the Methodology Act.

Note that although other production routes for hydrogen are possible, only the production of pure hydrogen or mixtures of hydrogen with nitrogen usable in ammonia production shall be considered for the purposes of the hydrogen aggregated goods category under Annex I to the CBAM Regulation. Not covered are the production of synthesis gas or of hydrogen within refineries or organic chemical installations, where the hydrogen is exclusively used within those plants, and is not used for the production of goods under the CBAM Regulation and is therefore outside the scope of the hydrogen CBAM good.

2.3.3.1 Hydrogen – Steam reforming and partial oxidation production routes

The fossil gas (methane) feedstock for this process is converted to carbon dioxide and hydrogen through primary and secondary steam reformation. The overall reaction is highly endothermic and process heat is supplied by the combustion of natural gas or other gaseous fuel. Carbon monoxide produced is almost all converted to carbon dioxide by the process.

The Methodology Act, in particular Annex I, point 3.6.2.1 ("Steam reforming and partial oxidation"), defines the system boundaries for direct emissions monitoring for the steam reforming (and partial oxidation[4]) production routes. For the purposes of this guidance, those system boundaries can be described as encompassing:

> *" – All processes directly or indirectly linked to hydrogen production and the separation of hydrogen and carbon monoxide, and flue gas cleaning;*
>
> *– All fuels used in the hydrogen production process irrespective of their energetic or non-energetic use, and fuels used for other combustion processes including for the purpose of producing hot water or steam."*

There are no precursors for this production process. In the definitive period, hydrogen is listed in Annex II to the CBAM Regulation as a good for which only direct emissions are taken into account. Indirect emissions resulting from electricity consumed by the production process are therefore not taken into account in the embedded emissions of hydrogen for CBAM purposes, although operators may still monitor such data for other regulatory or internal purposes.

In line with the above definition of systems boundaries, the following production steps may be regarded as being within the system boundaries of a hydrogen (steam reformation) installation:

- Raw material pre-treatment – natural gas desulphurisation
- Steam reformation – primary and secondary, H_2/CO generation

[4] The partial oxidation production route differs from steam reforming in that heavier hydrocarbon fractions such as residual fuel oil or coal are used as feedstocks to produce hydrogen. The system boundaries for the partial oxidation production route are very similar to those for the steam methane reformation production route, and in addition include the generation of oxygen as a process gas, and gasification to produce a synthesis gas, which is then cleaned to remove soot and sulphur impurities, from which CO / CO_2 are removed to obtain H_2.

- Shift conversion – carbon monoxide to carbon dioxide and hydrogen

- Separation & purification – CO_2 removal, separation processes as present including cryogenic, adsorption, absorption, membrane, hydrogenation (methanation)

- Emissions control – for treating releases to air, water or ground

The stream of carbon dioxide produced by the steam reforming process is very pure and is separated and captured for further use, e.g. for urea production. A variation on this process may be with permanent geological storage i.e. carbon capture and sequestration (CCS). Where CO_2 is captured and permanently stored or chemically bound in accordance with the CBAM rules, this is reflected in the determination of embedded emissions in line with the Methodology Act.

2.3.3.2 Hydrogen – Steam cracking production route

Hydrogen is produced as a co-product of the thermal cracking of hydrocarbons using feedstocks such as naphtha and natural gas condensates (i.e. ethane, propane and butane) alongside the simultaneous production of light olefins such as of ethylene and propylene.

The Methodology Act, in particular Annex I, point 3.6.2.2 ("Steam cracking"), defines the system boundaries for direct emissions monitoring of the steam cracking production route. For the purposes of this guidance, the system boundaries for direct emissions monitoring can be described as encompassing:

> *" – All processes directly linked to hydrogen production;*
>
> *– All processes directly or indirectly linked to the production processes, and from flue gas cleaning."*

There are no precursors for this production process. As for steam methane reforming, in the definitive period only direct emissions are taken into account in the embedded emissions of hydrogen under the CBAM. Indirect emissions from electricity consumption are not taken into account in the embedded emissions of hydrogen, although operators may still monitor such data for other regulatory or internal purposes.

In line with the above definition of systems boundaries, the following production steps may be regarded as being within the system boundaries of a hydrogen (steam cracking) installation:

- Production of hydrogen as a co-product of the steam cracking of hydrocarbons – mixing of hydrocarbon feedstocks with steam, cracking of hydrocarbons in furnaces, generation of hydrogen as a by-product, and collection.

- Gas cooling, drying and purification – removal of water vapour and other impurities from hydrogen gas.

- Emissions control – for treating releases to air, water or ground.

2.3.3.3 *Hydrogen – Electrolysis of water production route*

Water electrolysis is a standalone, non-integrated production process that produces a very pure stream of hydrogen gas. Direct emissions from this process are minimal. Electricity consumption is the main driver of greenhouse gas emissions for this route, and the associated emissions are treated as indirect emissions from electricity generation. However, in the definitive period, those indirect emissions are not taken into account in the embedded emissions of hydrogen for CBAM purposes, as hydrogen is listed in Annex II to the CBAM Regulation as a good for which only direct emissions are taken into account pursuant to Article 3(2) to the Methodology Act.

The Methodology Act removes the route-specific provisions for the electrolysis of water previously listed in section 3.6.2 of the transitional methodology. Consequently, this route is now governed by the generic cross-sectoral rules in Annex I, Section 3.1 and the special provisions for hydrogen in Annex I, Section 3.6.1. For the purposes of this guidance, where relevant, the system boundaries for direct emissions monitoring are defined by the general rule in Section 3.1 as encompassing:

" – all processes directly or indirectly linked to the production processes."

There are no precursors for this production process under Article 1(7), as input materials like water are not CBAM goods listed in Annex I to the CBAM Regulation. Furthermore, because this is a multifunctional chemical process yielding hydrogen and co-product oxygen, operators must attribute emissions based on the molar ratio rule defined in Annex III, Section A.2.1 using equation 43.

During the transitional period pursuant to Implementing Regulation (EU) 2023/1773, indirect emissions resulting from electricity consumed by the production process were monitored and, where the produced hydrogen was certified in accordance with Commission Delegated Regulation (EU) 2023/1184, an emission factor of zero for the electricity could be used, with the applicable rules on indirect embedded emissions in that Regulation applying in other cases. In the definitive period, however, hydrogen is listed in Annex II to the CBAM Regulation as a good for which only direct emissions are taken into account pursuant to Article 3(2) of this Regulation, so indirect emissions from electricity consumption are not taken into account in the embedded emissions of hydrogen for CBAM purposes.

2.3.3.4 *Hydrogen – Chlor-alkali electrolysis (and production of chlorates) production routes*

Hydrogen is produced as a co-product of the electrolysis of brine, alongside the simultaneous production of chlorine and sodium hydroxide. There are three basic chlor-alkali process techniques: mercury cell, diaphragm cell and the membrane cell. All three cell techniques produce hydrogen, which is formed at the cell cathode and which leaves the cell at very high purity. The hydrogen gas produced is cooled, dried and purified to remove water vapour, and other impurities, which may in some cases include oxygen, and is then compressed and stored or exported off site.

The Methodology Act removes the route-specific provisions for the Chlor-alkali electrolysis (and production of chlorates) previously listed in section 3.6.2 of the transitional methodology. Consequently, this route is now governed by the generic cross-sectoral rules in Annex I, Section 3.1 and the special provisions for hydrogen in Annex I, Section 3.6.1. For the purposes of this guidance, where relevant, the system boundaries for direct emissions monitoring are defined by the general rule in Section 3.1 as encompassing:

> *" – all processes directly or indirectly linked to the production processes."*

There are no precursors for this production process under Article 1(7), as input materials are not CBAM goods listed in Annex I to the CBAM Regulation. Furthermore, because this is a multifunctional chemical process yielding chlorine, sodium hydroxide and co-product hydrogen, operators must attribute emissions based on the molar ratio rule defined in Annex III, Section A.2.1.

During the transitional period, indirect emissions that resulted from electricity consumed by the production process also needed to be monitored, and where the produced hydrogen had been certified to comply with Commission Delegated Regulations (EU) 2023/1184 (1), an emission factor of zero for the electricity could be used, with the applicable rules on indirect embedded emissions in that Regulation applying in other cases. In the definitive period, however, hydrogen is listed in Annex II to the CBAM Regulation as a good for which only direct emissions are taken into account pursuant to Article 3(2) of this Regulation, so indirect emissions from electricity consumption are not taken into account in the Sector specific monitoring and reporting

3 CHEMICALS – HYDROGEN SECTOR-SPECIFIC REQUIREMENTS FOR MONITORING AND REPORTING

The textbox below signposts sector-specific sections in the Methodology Act, relevant for the CBAM definitive period.

Methodology Act references:

- **Annex I, point 3** – Functional unit and system boundaries. Sub-section **3.6** (Hydrogen).
- **Annex III, Section A.2.1** – Chemicals and fertilisers
- **Annex IV, point 2** – Sector-specific parameters to be included in the operator's emissions report.

3.1 Sector-specific requirements for monitoring and reporting

Direct embedded emissions should be monitored in line with the methodology set out in the Methodology Act.

Exclusions

As an operator, you should note that only the production of pure hydrogen or mixtures of hydrogen with nitrogen usable in ammonia production shall be considered. Not covered are the production of synthesis gas or of hydrogen as a precursor within refineries or organic chemical installations, where the hydrogen is exclusively used within those plants and not used for the production of goods under the CBAM Regulation.

3.1.1 Emissions monitoring

Relevant emissions that must be monitored and reported for the hydrogen sector are:

- Carbon dioxide emissions (direct) from the fuel combustion process in the hydrogen or synthesis gas production process, primary and secondary steam reforming of natural gas, or partial oxidation other hydrocarbons; from stationary plant only (excludes emissions from any mobile units such as vehicles).

- Carbon dioxide emissions (direct) resulting from the production of measurable heating (for the purpose of producing hot water or steam) and cooling that is consumed within the system boundaries of the production process, regardless of the location of the production of the heat (i.e. from on-site generation or from imports from off-site).

- Carbon dioxide emissions (direct) from electrolysis are minimal and so where these emissions are significant they are likely to result from ancillary plant.

- Carbon dioxide emissions (direct) resulting from emissions control (e.g. from carbonate raw materials such as soda ash used for acidic flue gas cleaning).

Direct emissions from the different source streams above are not reported separately but are added together to result in the total direct emissions for the installation or production process.

In the definitive period, indirect emissions from electricity consumed do not have to be reported.

3.1.2 Additional rules

Attribution of emissions where different products are simultaneously produced

Additional rules apply for the attribution of direct (and where applicable indirect) emissions to the different products of the following production processes that fall under the chemicals aggregated goods category. Where these products have been produced simultaneously as co-products of a single multifunctional production process, the attribution among the different co-products (whether or not they are CBAM goods) shall be based on molar ratio, with the generic formula:

$$Em_i = Em_{total}\left(\frac{\frac{m_{i,prod}}{M_i}}{\sum_{j=1}^{n}\frac{m_{j,prod}}{M_j}}\right) \text{ (Equation 43)}$$

Where:

Em_i … Either direct or indirect emissions attributed to each co-product *i* produced over the reporting period, expressed in tonnes of CO_2

Em_{total} … Either direct or indirect emissions of the whole (multifunctional) production process over the reporting period, expressed in tonnes of CO_2

$m_{i,prod}$ …Mass of the co-product *i* under consideration, produced in the installation over the reporting period, expressed in tonnes

$m_{j,prod}$ …Mass of each co-product j produced in the installation over the reporting period, expressed in tonnes

M_i … Molar mass of the co-product i under consideration

M_j … Molar mass of each co-product j

If the molar mass of one of the co-products is not known, the emissions will be attributed based on mass of the co-products. In that case, the formula would be as follows:

$$Em_i = Em_{total}\left(\frac{m_{i,prod}}{\sum_{j=1}^{n} m_{j,prod}}\right)$$

Worldwide, the most important route for hydrogen production is steam reforming and gasification of coal, where hydrogen is the main product. However, equation 43 is relevant in particular for production routes of hydrogen where hydrogen is not the main product. Taking into account the production routes listed in Annex I to the Methodology Act, this is in particular the case for steam cracking. Depending on the raw material used in the cracker (e.g. naphtha, ethane, etc.) different product mixes are found. The operator should then define which of the co-products are 'high value chemicals' (HVCs), i.e. products that will be used for economic purposes, while other co-products are usually not purified for chemical use, but used as fuel in various parts of the installation. Hence, the molar mass and mass produced of each of the HVCs will have to be used in the equation above. Regarding the steam cracker, a useful approach is to use the scope of HVC aligned with the EU ETS Free Allocation Rules which define the following HVCs as relevant for the steam cracker product benchmark: Hydrogen (H_2), acetylene (C_2H_2), ethylene (C_2H_4), propylene (C_3H_6), butadiene (C_4H_6) and benzene (C_6H_6). Furthermore, where those co-products are separated and used, also the following may be relevant: Toluene, Xylenes, Butenes.

3.1.3 Processes that have only indirect emissions

For hydrogen production, production routes exist that have only indirect emissions. However, those are currently not relevant for hydrogen as CBAM good, as hydrogen is listed in Annex II to the CBAM Regulation. Nevertheless, where an operator uses hydrogen from such sources as precursor, at least the respective production route must be named, and for use of actual values (i.e. zero), verification in line with CBAM rules of the installation producing the hydrogen will be required. However, using a risk-based approach, verifiers may consider a simplified approach for hydrogen free of direct emissions. For example, where hydrogen is certified as an RFNBO (Renewable Fuel of Non-Biological Origin) under the Renewable Energy Directive (RED II)[5], verification can be strongly simplified. Such certification is required for the purpose of importing "green hydrogen" under the EU's renewable energy framework.

Furthermore, specific cases for co-product attribution exist, although they would only be relevant if indirect emissions were relevant for hydrogen. They are mentioned here for reasons of completeness. Such calculation was necessary in the transitional phase.

[5] In accordance with Commission Delegated Regulation (EU) 2023/1184 supplementing Directive (EU) 2018/2001 […] by establishing a Union methodology setting out detailed rules for the production of renewable liquid and gaseous transport fuels of non-biological origin. See http://data.europa.eu/eli/reg_del/2023/1184/oj

- Electrolysis of water – where oxygen is released to the atmosphere, all emissions from the production process are attributed to the hydrogen product. However, if oxygen is collected and used in other production processes or is sold then molar proportions are used to attribute emissions, using equation 43.

- Chlor-Alkali electrolysis and the production of chlorates – molar proportions are used to attribute emissions to the hydrogen produced, using equation 43.

3.1.4 Additional reporting requirements

The following Table 3-1 lists out the additional information that needs to be provided by you as an operator to importers, in your emissions data communication to them.

Table 3-1: Additional chemical sector parameters requested in the CBAM declaration

Aggregated good category	Reporting requirement in the annual report
Hydrogen	– None

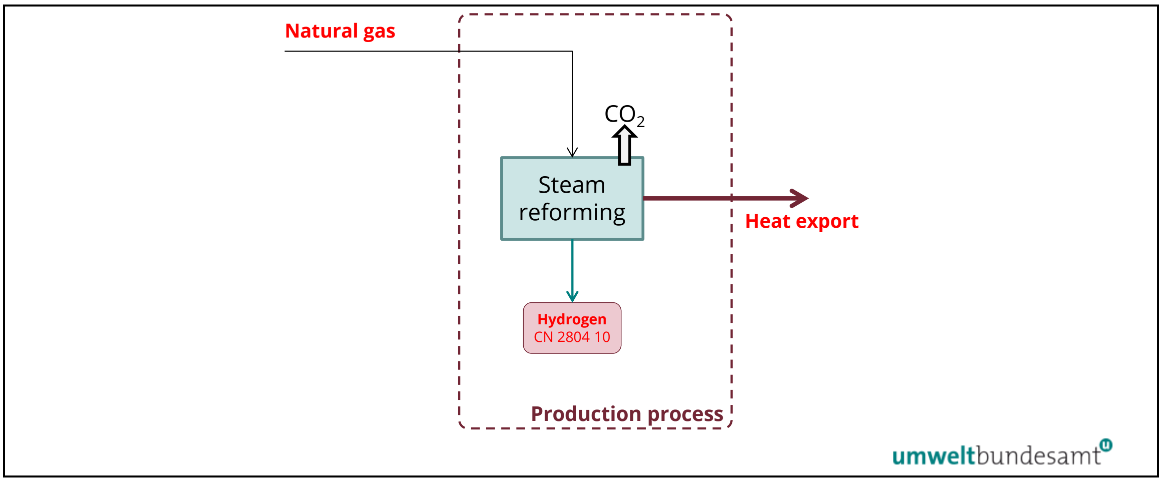
4 Worked example for the hydrogen sector

The following worked example shows how specific embedded emissions are derived for hydrogen produced by the steam reforming production route.

The resulting embedded emissions of imports into the EU are then calculated at the end of the example for reporting in the definitive period.

The diagram below gives an outline view of the installation and shows the system boundaries as a hatched line for the single production process. The physical units carrying out the production process have been grouped under 'steam reforming' and the inputs and outputs and sources of emissions have been identified.

Figure 4-1: Hydrogen example – Overview and complete monitoring approach for hydrogen



A single production process is defined for steam reforming. Inputs are natural gas (both as a raw material / feedstock for the process, and as a fuel). Outputs are hydrogen product and heat exported to other parts of the installation or to a district heating network.

The inputs and outputs highlighted in red text in Table 4-1 are the parameters that would need to be monitored by the operator in order to attribute emissions and determine direct specific embedded emissions for the production process.

The direct emissions that are monitored in this example result from:

- Direct emissions from fuel combustion and from the steam reforming process[6].
- For the purpose of calculating attributed emissions of the process, an equivalent of emissions associated with the heat export needs to be determined, and subtracted from attributed emissions. The latter section explains that for cases of heat of unknown origin, as a default, natural gas with a boiler efficiency of 90% is to be used, if no other data sources can be used. This gives a value of 62,3 t CO_2/TJ.

The activity level of the hydrogen good produced also needs to be monitored.

Table 4-1 summarises the inputs and outputs from the process that are monitored for determining total direct specific embedded emissions.

Table 4-1: Example calculation of total direct emissions attributed to hydrogen net of emissions for a heat export.

Direct emissions	AD (t)	NCV (GJ/t)	Energy (TJ)	EF (t CO_2/TJ)	Emissions (t CO_2)
Input natural gas	190 000	48	9 120	56,1	511 632
Heat export			-800	62,3	-49 867
Total direct emissions of the installation					**461 765**

Total direct emissions of the installation result from one single source stream (natural gas). There is no need to distinguish combustion and process emissions for this purpose. In this example, these are wholly attributed to the hydrogen product, net of emissions attributed to a heat export. If the almost pure CO_2 produced by this process were to be captured and transferred to a geological CO_2 storage site, the related emissions could be deducted, provided the receiving installation carries out monitoring under the CBAM.

Table 4-2: Calculation of embedded emissions of hydrogen product (example)

Product	Activity level (t)	Process total emissions (t CO_2)	SEE (t CO_2 / t H_2)
Hydrogen	55 000	461 765	**8,396**

6 Emissions of carbon monoxide (CO) to the atmosphere from the process are not counted as outgoing source stream in the mass balance but are considered as the molar equivalent amount of CO_2 emissions.

Free allocation adjustment

Hydrogen is a simple good with no differentiation of the EU ETS benchmark for any factors such as production routes. Therefore, the specific free allocation results directly from a look-up of the respective CBAM benchmark from the Annex of the Free Allocation Adjustment Act using the CN code for hydrogen: 5,089 t CO_2 / t H_2.

- Assumption: Year = 2028.:
    - CSCF = 1,00
    - CBAM = 90%

SEFA = 5,089 × 0,90 × 1,00 = **4,580 t CO_2 / t H_2**

CBAM obligation upon import:

Using the above approach, the CBAM reporting obligation for the import of hydrogen product into the EU during the definitive period may then be determined; for example, for the import of 100 tonnes of hydrogen product in year 2028 produced by methane steam reforming:

Definitive period:

- Total direct embedded emissions = 100 t × 8,396 t / t CO_2 = **839,6 t CO_2**

  Minus Free Allocation adjustment: **458,0 t CO_2**

  (Further deduction could be made if a carbon price was paid in the country of production – outside the scope of this guidance).

- **Total CBAM obligation** to be covered by the authorised declarant with CBAM certificates: 839,6 – 458,0 = **381,6 certificates**

Annex A List of definitions

Term	Definition
'Accuracy'	means the closeness of the agreement between the result of a measurement and the true value of the particular quantity or a reference value determined empirically using internationally accepted and traceable calibration materials and standard methods, taking into account both random and systematic factors
'Activity data'	means the amount of fuels or materials consumed or produced by a process relevant for the calculation-based methodology, expressed in terajoules (TJ), mass in tonnes or (for gases) volume in normal cubic metres, as appropriate
'Actual emissions'	means the emissions calculated based on primary data from the production processes of goods and from the production of electricity consumed during those processes as determined in accordance with the methods set out in Annex IV [to the Methodology Act]
'Activity level'	means the quantity of goods to which the same functional unit applies that are produced within the system boundaries of a production process during a reporting period
'Aggregated goods categories'	means aggregated goods categories pursuant to Table 1 of point 2 of Annex I. A group of CBAM goods with their CN codes, used for the purpose of defining system boundaries of production processes.
'Agricultural, aquaculture, fisheries and forestry residues'	means residues that are directly generated by agriculture, aquaculture, fisheries and forestry and that do not include residues from related industries or processing
'Authorised CBAM declarant'	means a person authorised by the competent authority in accordance with Article 17 [of the CBAM Regulation]. The 'authorised CBAM declarant' [which replaces the term 'reporting declarant' from the transitional period] may be importers of CBAM goods, or their indirect customs representatives, who have applied for and been granted the status of authorised CBAM declarant.
'Batch'	means an amount of fuel or material representatively sampled and characterised, and transferred as one shipment or continuously over a specific period of time
'Biomass'	means biomass as defined in Article 2, point (24) of the Renewable Energy Directive (RED II)[7]; it includes bioliquids and biofuels as defined in Article 2, point (32) and (33), biomass fuels as defined in Article 2, point (27) and biogas as defined in Article 2 point (28) of the RED II;

[7] Directive (EU) 2018/2001

Term	Definition
'Biomass fraction'	means the ratio of carbon stemming from biomass to the total carbon content of a fuel or material, expressed as a fraction
'Calculation factors'	means net calorific value, emission factor, preliminary emission factor, oxidation factor, conversion factor, carbon content or biomass fraction
'Calibration'	means the set of operations, which establishes, under specified conditions, the relations between values indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material and the corresponding values of a quantity realised by a reference standard
'Carbon price'	means the monetary amount paid in a third country, under a carbon emissions reduction scheme, in the form of a tax, levy or fee or in the form of emission allowances under a greenhouse gas emissions trading system, calculated on greenhouse gases covered by such a measure, and released during the production of goods
'CBAM certificate'	means a certificate in electronic format corresponding to one tonne of CO_2e of embedded emissions in goods
'CO_2 emission factor'	means the weighted average of the CO_2 intensity of electricity produced from fossil fuels within a geographic area. The CO_2 emission factor is the result of the division of the CO_2 emission data of the electricity sector by the gross electricity generation based on fossil fuels in the relevant geographic area. It is expressed in tonnes of CO_2 per megawatt-hour
'Combined nomenclature' (CN)	means the classification of goods, designed to meet the needs of: i) the Common customs tariff, setting import duties for products imported into the European Union (EU), as well as the Integrated tariff of the European Communities (Taric), incorporating all EU and trade measures applied to goods imported into and exported out of the EU; ii) the international trade statistics of the EU. The CN provides the means of collecting, exchanging and publishing data on EU international trade statistics. It is also used for the collection and publication of international trade statistics in intra-EU trade.[8]
'Combustion emissions'	means greenhouse gas emissions occurring during the exothermic reaction of a fuel with oxygen
'Competent authority'	means the authority designated by each Member State in accordance with Article 11 [of the CBAM Regulation]

[8] For definition see: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Combined_nomenclature_(CN)

Term	Definition
'Continuous emission measurement' (CEM)	means a set of operations having the objective of determining the value of a quantity by means of periodic measurements, applying either measurements in the stack or extractive procedures with a measuring instrument located close to the stack, whilst excluding measurement methodologies based on the collection of individual samples from the stack
'Control system'	means the operator's risk assessment and entire set of control activities, including the continuous management thereof, that an operator has established, documented, implemented and maintained pursuant to point A.2. of Annex II
'Complex goods'	means goods other than simple goods
'Conservative'	means that a set of assumptions is defined in order to ensure that no under-estimation of reported emissions or over-estimation of production of heat, electricity or goods occurs
'Conversion factor'	means the ratio of carbon emitted as CO_2 to the total carbon contained in the source stream before the emitting process takes place, expressed as a fraction, considering CO emitted to the atmosphere as the molar equivalent amount of CO_2
'Co-product'	means any of two or more products resulting from the same production process
'Customs declarant'	means a declarant as defined in Article 5, point (15) of Regulation (EU) No 952/2013 lodging a customs declaration for release for free circulation of goods in its own name or the person in whose name such a declaration is lodged
'CCUS system'	means a group of economic operators with technically connected installations and transport equipment for CO_2 capture, transport, use in production of goods, or geological storage
'Data flow activities'	mean activities related to the acquisition, processing and handling of data that are needed to draft an emissions report from primary source data
'Data set'	means one type of data, either at installation level or production process level as relevant in the circumstances, as any of the following: (a) the amount of fuels or materials consumed or produced by a production process as relevant for the calculation-based methodology, expressed in terajoules, mass in tonnes, or for gases as volume in normal cubic metres, as appropriate, including for waste gases; (b) a calculation factor;

Term	Definition
	(c) net quantity of measurable heat, and the relevant parameters required for determining this quantity, in particular: i) mass flow of heat transfer medium; and ii) enthalpy of transmitted and returned heat transfer medium, as specified by composition, temperature, pressure and saturation; (d) quantities of non-measurable heat, specified by the relevant quantities of fuels used for producing the heat, and the net calorific value (NCV) of the fuel mix; (e) quantities of electricity; (f) quantities of CO_2 transferred between installations; (g) quantities of precursors received from outside the production process, and their relevant parameters, such as country of origin, used production route, specific direct and indirect emissions;
'Default value'	means a value, which is calculated or drawn from secondary data, which represents the embedded emissions in goods
'Direct emissions'	means emissions from the production processes of goods including emissions from the production of heating and cooling that is consumed during the production processes, irrespective of the location of the production of the heating or cooling
'Embedded emissions'	means direct emissions released during the production of goods and indirect emissions from the production of electricity that is consumed during the production processes, calculated in accordance with the methods set out in Annex IV and further specified in the implementing acts adopted pursuant to Article 7(7)
'Emissions'	mean the release of greenhouse gases into the atmosphere from the production of goods
'Emission factor'	means the average emission rate of a greenhouse gas relative to the activity data of a source stream assuming complete oxidation for combustion and complete conversion for all other chemical reactions
'Emission factor' for electricity	means the default value, expressed in CO_2e, representing the emission intensity of electricity consumed in production of goods.
'Emission source'	means a separately identifiable part of an installation or a process within an installation, from which relevant greenhouse gases are emitted
EU ETS	means the system for greenhouse gas emissions allowance trading within the Union in respect of activities listed in Annex I to Directive 2003/87/EC other than aviation activities

Term	Definition
'EU ETS allowance'	means an allowance as defined in Article 3, point (a), of Directive 2003/87/EC in respect of activities listed in Annex I to that Directive other than aviation activities
'Fossil carbon'	means inorganic and organic carbon that is not biomass
'Fossil fraction'	means the ratio of fossil carbon to the total carbon content of a fuel or material, expressed as a fraction
'Fugitive emissions'	means irregular or unintended emissions from sources that are not localised, or too diverse or too small to be monitored individually
'Functional unit'	means the reference unit used for the calculation of embedded emissions in goods
'Goods'	means goods listed in Annex I [to the CBAM the CBAM Regulation]
'Greenhouse gases'	mean greenhouse gases as specified in Annex I [to the CBAM the CBAM Regulation] in relation to each of the goods listed in that Annex
'Heat meter'	means a thermal energy meter or any other device to measure and record the amount of thermal energy produced based upon flow volumes and temperatures
'Importer'	means either the person lodging a customs declaration for release for free circulation of goods or a bill of discharge in accordance with Article 175(5) of Delegated Regulation (EU) 2015/2446 in its own name and on its own behalf or, where the customs declaration is lodged by an indirect customs representative in accordance with Article 18 of Regulation (EU) No 952/2013, the person on whose behalf such a declaration is lodged
'Importation'	means release for free circulation as provided for in Article 201 of Regulation (EU) No 952/2013
'Indirect customs Representative'	A customs representative appointed by an importer established in a Member State. If the importer appoints an indirect customs representative and they agree, they can act as an authorised CBAM declarant and submit the application for an authorisation on behalf of the importer. The indirect customs representative is liable for all operations made for the importers it represents
'Indirect emissions'	means emissions from the production of electricity which is consumed during the production processes of goods, irrespective of the location of the production of the consumed electricity
'Inherent CO_2'	means CO_2 which is part of a source stream.
'Installation'	means a stationary technical unit where a production process is carried out

Term	Definition
‘Legal metrological control’	means the control exercised by a public authority or regulator of the measurement tasks intended for the field of application of a measuring instrument, for reasons of public interest, public health, public safety, public order, protection of the environment, the levying of taxes and duties, the protection of consumers and fair trading
‘Measurable heat’	means a net heat flow transported through identifiable pipelines or ducts using a heat transfer medium, such as, in particular, steam, hot air, water, oil, liquid metals and salts, for which a heat meter is or could be installed
‘Measurement point’	means the emission source for which continuous emission measurement systems (CEMS) are used for emission measurement, or the cross-section of a pipeline system for which the CO_2 flow is determined using continuous measurement systems
‘Measurement system’	means a complete set of measuring instruments and other equipment used to determine variables for the monitoring and calculation of emissions
‘Minimum requirements’	means monitoring methods using the minimum efforts allowed for determining data in order to result in emission data acceptable for the purpose of the CBAM Regulation.
‘Mixed fuel’	means a fuel which contains both biomass and fossil carbon
‘Mixed material’	means a material which contains both biomass and fossil carbon
‘Multifunctional process’	means a process that delivers multiple outputs or whose outputs feed into several production processes
‘Net calorific value’ (NCV)	means the specific amount of energy released as heat when a fuel or material undergoes complete combustion with oxygen under standard conditions, less the heat of vaporisation of any water formed
‘Non-CBAM good’	means any good produced in the installation that is not included in Annex I to the CBAM Regulation
‘Non-measurable heat’	means all heat other than measurable heat
‘Operator’	means any person who operates or controls an installation in a third country, including a parent company that controls an installation in a third country
‘Oxidation factor’	means the ratio of carbon oxidised to CO_2 as a consequence of combustion to the total carbon contained in the fuel, expressed as a fraction, considering carbon monoxide (CO) emitted to the atmosphere as the molar equivalent amount of carbon dioxide (CO_2)
‘Power purchase agreement’	means a contract under which a person agrees to purchase electricity directly from an electricity producer

Term	Definition
'Precursor'	means any input material into a production process included in the list of goods set out in Annex I to the CBAM Regulation;
'Preliminary emission factor'	means the assumed total emission factor of a fuel or material based on the carbon content of its biomass fraction and its fossil fraction before multiplying it by the fossil fraction to produce the emission factor
'Production process'	means the chemical and physical processes carried out to produce goods in an installation
'Production route' [9]	means a specific technology used in a production process to produce goods
'Process emissions'	means greenhouse gas emissions other than combustion emissions occurring as a result of intentional and unintentional reactions between substances or their transformation, for a primary purpose other than the generation of heat, including from the following processes: (a) the chemical, electrolytic or pyrometallurgical reduction of metal compounds in ores, concentrates and secondary materials; (b) the removal of impurities from metals and metal compounds; (c) the decomposition of carbonates, including those used for flue gas cleaning; (d) chemical syntheses of products and intermediate products where the carbon bearing material participates in the reaction; (e) the use of carbon containing additives or raw materials; (f) the chemical or electrolytic reduction of metalloid oxides or non-metal oxides such as silicon oxides and phosphates.
'Proxy data'	means annual values which are empirically substantiated or derived from accepted sources and which an operator uses to substitute a data set[10] for the purpose of ensuring complete reporting
'Rebate'	means any amount that reduces the amount due or paid by a person liable for the payment of a carbon price, before its payment or after, in a monetary form or in any other form.
'Recommended improvements'	means monitoring methods which are proven means to ensure that data are more accurate or less prone to mistakes than by mere application of minimum requirements
'Related emissions'	means: – the direct emissions caused by the source stream or emission source concerned; – emissions attributed to a quantity of measurable heat; – the indirect emissions related to the quantity of electricity concerned; – embedded emissions of a material produced or of a precursor consumed.

[9] Note that different production routes can fall within the same production process.

[10] Refers to the activity data or the calculation factors.

Term	Definition
‘Reporting period’	means the period corresponding to the calendar year during which the good was produced and used by the authorised CBAM declarant as reference for the determination of embedded emissions
‘Residue’	means a substance that is not the end product that a production process directly seeks to produce; it is not a primary aim of the production process and the process has not been deliberately modified to produce it
‘Simple goods’	means goods produced in a production process requiring exclusively input materials (precursors) and fuels having zero embedded emissions
‘Source stream’	means either of the following: (a) a specific fuel type, raw material or product giving rise to emissions of relevant greenhouse gases at one or more emission sources as a result of its consumption or production; (b) a specific fuel type, raw material or product containing carbon and included in the calculation of greenhouse gas emissions using a mass-balance method
‘Specific embedded emissions’	means the embedded emissions of one tonne of goods, expressed as tonnes of CO_2e emissions per tonne of goods
‘Standard conditions’	means temperature of 273,15 K and pressure conditions of 101 325 Pa defining normal cubic metres (Nm^3)
‘System boundary’	means the group of chemical or physical processes included in the calculation of embedded emissions of goods under the same aggregated goods category. The system boundaries shall cover direct emissions, indirect emissions for goods not listed in Annex II to the CBAM Regulation, and the embedded emissions of any precursor.
‘Third country’	means a country or territory outside the customs territory of the [European] Union
‘Tonne of $CO_{2(e)}$’	means one metric tonne of carbon dioxide (‘CO_2’), or an amount of any other greenhouse gas listed in Annex I [to the CBAM Regulation] with an equivalent global warming potential [‘CO_2e‘]
‘Transmission system operator’	means an operator as defined in Article 2, point (35) of Directive (EU) 2019/944 of the European Parliament and of the Council ([11]).

[11] Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity and amending Directive 2012/27/EU (OJ L 158, 14.6.2019, p. 125).

Term	Definition
‘Uncertainty’	means a parameter, associated with the result of the determination of a quantity, that characterises the dispersion of the values that could reasonably be attributed to the particular quantity, including the effects of systematic as well as of random factors, expressed in percent, and describes a confidence interval around the mean value comprising 95% of inferred values taking into account any asymmetry of the distribution of values
‘Waste’	means any substance or object which the holder discards or intends or is required to discard, excluding substances that have been intentionally modified or contaminated in order to meet this definition
‘Waste gas’	means a gas containing incompletely oxidised carbon in a gaseous state under standard conditions which is a result of any of the processes listed under ‘process emissions’

Annex B List of abbreviations

Abbreviation	Full term
AD	Activity Data
AEM	Anode Effect Minutes
AEO	Anode Effect Overvoltage
AL	Activity Level
AOD	Argon Oxygen Decarburisation.
BAT	Best Available Techniques
BF	Biomass Fraction
BFG	Blast Furnace Gas
BM	Benchmark
BOF	Basic Oxygen Furnace
BOFG	Basic Oxygen Furnace Gas
BREFs	Best Available Techniques Reference documents
CA	Competent Authority
CBAM	Carbon Border Adjustment Mechanism, the
CCR	Clinker to Cement Ratio
CCS	Carbon Capture and Storage
CCU(S)	Carbon Capture and Utilisation (and Storage)
CEMS	Continuous Emission Measurement Systems
CF	Conversion Factor
CFP	Carbon footprint of products
CHP	Combined Heat and Power
CKD	Cement Kiln Dust
CN	Combined nomenclature
COG	Coke Oven Gas
DRI	Direct Reduced Iron
EAF	Electric Arc Furnace
EEA	European Economic Area (EU-27, Iceland, Norway, Liechtenstein)
EF	Emission Factor
EFTA	European Free Trade Area
EORI	Economic Operator Registration and Identification
ETS	Emissions Trading System
EU ETS	EU Emissions Trading System
EUA	EU Allowances (used in the EU ETS)
EUR	Euro (currency)

Abbreviation	Full term
FAR	Free Allocation Rules (Regulation 2019/331)[12]
FIFO	First-In-First-Out principle
GHG	Greenhouse Gas
GWP	Global Warming Potential
HBI	Hot Briquetted Iron
HS	Harmonised System (for international trade)
IEA	International Energy Agency
ISO	International Organization for Standardization
LULUCF	Land-use, land change and forestry (criteria)
MP	Monitoring Plan
MRR	Monitoring and Reporting Regulation (Regulation 2018/2066)[13]
MRV	Monitoring, Reporting and Verification
MS	Member State(s)
MWh	Megawatt-hour
NCV	Net Calorific Value
NPI	Nickel pig iron
OF	Oxidation Factor
PCI	Pulverised Coal Injection
PEMS	Predictive Emission Monitoring System
PFC	Perfluoro-carbon
PoS	Proofs of Sustainability
RED II	Renewable Energy Directive, re-cast
SEE	Specific embedded emissions
SEFA	Specific embedded free allocation
TARIC	Integrated Tariff of the European Union database
TJ	Terajoules
TSO	Transmission System Operator
UCC	Union Custom Code
UN/LOCODE	United Nations Code for Trade and Transport Location

[12] Free Allocation Rules (Commission Delegated Regulation (EU) 2019/331 of 19 December 2018 determining transitional Union-wide rules for harmonised free allocation of emission allowances pursuant to Article 10a of Directive 2003/87/EC of the European Parliament and of the Council)

[13] Monitoring and Reporting Regulation (Commission Implementing Regulation (EU) 2018/2066 of 19 December 2018 on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council and amending Commission Regulation (EU) No 601/2012

EUROPEAN COMMISSION
DIRECTORATE-GENERAL
TAXATION AND CUSTOMS UNION
Indirect Taxation and Tax Administration
CBAM, Energy and Green Taxation

Brussels, 14 August 2026

GUIDANCE DOCUMENT 5C: SECTOR-SPECIFIC GUIDANCE DOCUMENT ON FERTILISERS

Disclaimer: This guidance document is not legally binding and it is of an explanatory nature. Legal provisions of Union law take precedence over the contents of this document and should always be consulted. The authentic texts of the EU legal instruments are those published in the Official Journal of the European Union. This guidance was prepared by Commission services and does not represent an official position of the Commission. Only the Court of Justice of the European Union is competent to authoritatively interpret Union law.

VERSION HISTORY

Date	Version notes
14.08.2026	First Publication of this document for the definitive period.

CONTENTS

1 PREFACE

1.1 Structure and content of the guidance documents

This series of documents has been written to support stakeholders by explaining the requirements of the CBAM Regulation in a non-legislative language. This series of guidance documents should benefit a variety of stakeholders. A specific focus has been put on clarifying the **requirements for operators of installations producing CBAM goods outside of the EU for the definitive period**.

- **Guidance 1** provides an overview of the main changes to the CBAM methodology between the definitive period and the concluded transitional period. It also introduces the CBAM and an overview of the compliance cycle, roles and responsibilities, as well as milestones and deadlines for operators of installations outside the EU during the definitive period and explains the general exemptions from the CBAM.

- **Guidance 2** provides a quick guidance for the intended reader of this document, the operator of an installation producing CBAM goods. It provides a roadmap of the most important concepts of CBAM emissions monitoring and where to find more information in this series of documents.

- **Guidance 3** sets out the monitoring and reporting obligations and recommendations which are potentially applicable to any affected producer of CBAM goods.

- **Guidance 4** provides an overview of how the adjustment for free allocation is to be determined and what information is needed.

- **Guidance documents 5a, 5b, 5c, 5d, 5e and 5f** present an overview per sector of the production processes and value chains for goods that are included in the scope of the CBAM, as well as sector-specific monitoring and reporting considerations for each CBAM good where this is relevant. These sections are supplemented by examples for each sector.

The series of guidance documents is accompanied by an electronic template for information that should be used by installation operators to communicate information to the authorised CBAM declarants and CBAM Registry.

Presentation of numbers in EU documents

To align with EU legal documents, this guidance document uses the following convention when presenting numbers.

The decimal separator used to separate the integral part of a number from its fractional part is a comma, e.g.: 0,890

Thousands, and powers of 10^{3n} thereafter, are separated by a space, e.g.:

- fifteen thousand is written as 15 000
- fifteen million is written as 15 000 000

1.2 Reference regulations and legal acts

Several regulations and legal acts are referred to throughout this series of guidance documents. For ease of reading and to avoid ambiguity, simplified references are used when citing these acts.

- **CBAM Regulation**: Regulation (EU) 2023/956 and Regulation (EU) 2025/2083 amending Regulation (EU) 2023/956. Notably, where article numbers are given in this document without further specification, they always refer to the CBAM Regulation.

  It can be accessed at the following link (consolidated version): **http://data.europa.eu/eli/reg/2023/956/2025-10-20**

- **Methodology Act:** Commission Implementing Regulation (EU) 2025/2547, in legal texts referred to as "Implementing act pursuant to Article 7(7) of the CBAM Regulation".

  It can be accessed at the following link: **http://data.europa.eu/eli/reg_impl/2025/2547/oj**

- **Default Values Act**: Commission Implementing Regulation (EU) 2025/2621, in legal texts referred to as "Implementing act pursuant to Article 7(7) of the CBAM Regulation", also referred to as "default values determined in accordance with Annex IV to the CBAM Regulation".

  It can be accessed at the following link: **http://data.europa.eu/eli/reg_impl/2025/2621/oj**

- **Verification Principles Act**: Commission Implementing Regulation (EU) 2025/2546, in legal texts referred to as "Implementing act pursuant to Article 8(3) of the CBAM Regulation".

  It can be accessed at the following link: **http://data.europa.eu/eli/reg_impl/2025/2546/oj**

- **Accreditation & Verification Requirements Act**: Commission Delegated Regulation (EU) 2025/2551, in legal texts referred to as "Delegated act pursuant to Article 18(3) of the CBAM Regulation".

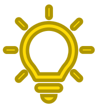
  It can be accessed at the following link: **http://data.europa.eu/eli/reg_del/2025/2551/oj**

- **Free Allocation Adjustment Act**: Commission Implementing Regulation (EU) 2025/2620, in legal texts referred to as "Implementing act pursuant to Article 31(2) of the CBAM Regulation".

  It can be accessed at the following link: **http://data.europa.eu/eli/reg_impl/2025/2620/oj**

For acronyms and definitions used in this document, please see **Annex B** and **Annex A**.

A series of icons are used throughout to help guide the reader:

Icon	Description of use
	Points to information of particular importance for operators of installations producing CBAM goods.
Simplified!	Highlights simplified approaches of the general requirements of the CBAM.
	Used where recommended improvements are presented.
	Used where other documents, templates or electronic tools are available from other sources.
	Points to examples given for the topics discussed in the surrounding text.

2 CBAM Goods and Production Routes

This section provides guidance on industry-sector-specific rules that apply for the definitive period (from 2026 onwards) in the fertilisers sector. It deals with the specification of products covered by the CBAM and the relevant production routes.

2.1 Foreword to sector-specific sections

The following sections provide an overview of the different production routes for the goods under fertilisers sector in CBAM and provide sector specific guidance. Where goods to which the same functional unit applies are produced in one installation via different production routes, the embedded emissions shall be determined in accordance with the averaging rules applicable in the definitive period.

Additional information on the production processes of the goods can also be found in the BREF[1] documents for best available techniques (BAT).

Diagrams used in the following sections.

For the system boundary graphics presented in the sections below, the **following conventions** are applied:

- **Production processes** (for which monitoring of the direct emissions would take place) are shown as **rectangles with white background**.
- **Optional** processes (e.g. CCS/CCU) are shown in **blue** boxes. In particular, CCS/CCU would not be taken into account for developing default values, but where you (as an operator) use them, the related emissions or emission savings should be taken into account for determining actual embedded emissions in line with the CBAM Regulation and the Methodology Act.
- **Materials** which are considered to have no embedded emissions are shown in **pink** boxes, materials with embedded emissions (precursor materials and final products, i.e. goods under the CBAM) in **green** boxes. Simple goods are shown in **normal** font, complex goods in **bold** font. Materials which are **optional** are shown in boxes with a **blue dashed** outline and must be included where actually used at the installation.
- Input materials are presented without trying to be complete. This means that the focus is on materials which are relevant for demonstrating the differences between different production routes. As a consequence, less important input materials and in particular fuels are usually omitted in order to keep graphs simple.
- **Electricity** as input is shown only in cases where it is the main "precursor" of the process (i.e. in particular for electric arc furnaces and electrolysis processes). Electricity is shown in **light grey** boxes.

---

1 BAT Reference document (BREF), BAT being "Best Available Techniques" as defined by the IED (Industrial Emissions Directive). Relevant BREF documents are those for: the production of cement; for iron and steel production; large volume inorganic chemicals (which includes fertilisers); for Chlor-alkali; and for non-ferrous metals (which includes both aluminium and ferro-alloys). All BREFs can be found at the European IPPC Bureau, under https://eippcb.jrc.ec.europa.eu/reference.

2.2 Fertilisers sector goods and production routes

The textbox below signposts sector-specific sections in the Methodology Act, relevant for the CBAM definitive period.

Methodology Act references:

- **Annex I**, Table 1 "Mapping of CN codes to aggregated goods categories" (aggregated goods categories "Ammonia", "Nitric acid", "Urea" and "Mixed fertilisers") to the Methodology Act.
- **Annex I**, points 3.7–3.10 ("Ammonia", "Nitric acid", "Urea", "Mixed fertilisers"), which define the functional unit, system boundaries and possible precursors for nitrogenous fertiliser goods, together with the cross-sectoral rules on emissions monitoring and attribution in **Annex II and Annex III**.

2.2.1 Unit of production and embedded emissions

The quantity of declared nitrogen containing fertiliser sector goods imported into the EU must be expressed using the functional unit applicable to the relevant fertiliser CBAM good (i.e. kilograms of nitrogen content or the relevant supplementary units, as applicable). As an operator, you must record the quantity of CBAM goods produced by installation or production process, for the purposes of reporting and calculating specific embedded emissions in accordance with the CBAM Regulation and the Methodology Act. For the purposes of calculating specific embedded emissions, the functional unit for fertiliser CBAM goods is defined in Article 4(4) of the Methodology Act, as kilograms of nitrogen contained in the goods produced under CN codes 2808 00 00, 2814 and 3105, and the relevant supplementary units laid down in Regulation (EEC) No 2658/87 for other fertiliser CN codes, which are defined as kilograms of nitrogen contained in the goods as well.

Industrial sector	Fertilisers
Production unit of goods	Functional unit as defined in Article 4(4) of the Methodology Act (kilograms of nitrogen contained in the goods for CN codes 2808 00 00, 2814 and 3105, or the relevant supplementary units laid down in Regulation (EEC) No 2658/87 for other fertiliser CN codes), reported separately for each type of CBAM good, by installation or production process in the country of origin.
Associated activities	Producing chemical precursors for nitrogenous fertiliser production, producing nitrogenous fertilisers by physical mixing or chemical reaction, and processing into their final form.
Relevant greenhouse gas emissions	Carbon dioxide (CO_2) and nitrous oxide (N_2O)
Direct Emissions	Tonnes (metric) of CO_2e

Industrial sector	Fertilisers
Indirect emissions	Quantity of electricity consumed (MWh), source and emissions factor used to calculate the indirect emissions in tonnes (metric) of CO_2 or CO_2e. Indirect emissions resulting from electricity consumption must be monitored and taken into account in the embedded emissions of fertiliser CBAM goods, in accordance with Article 3(2) of the CBAM Regulation and the Methodology Act, since fertiliser CBAM goods are not listed in Annex II (“Goods for which only direct emissions are taken into account”).
Unit for embedded emissions	Tonnes CO_2e emissions per functional unit of goods (kilogram of nitrogen contained in the fertiliser), reported separately for each type of goods, by installation in the country of origin.

During the transitional period, the fertiliser industry sector reported both direct and indirect emissions, with indirect emissions reported separately. In the definitive period, fertiliser CBAM goods are subject to the general rule in Article 3(2) of the CBAM Regulation: both direct and indirect emissions, as well as the embedded emissions of any precursors, must be taken into account when determining embedded emissions, since fertiliser CBAM goods are not listed in Annex II (“Goods for which only direct emissions are taken into account”). Emissions must be reported in metric tonnes CO_2 equivalent (t CO_2e) per functional unit of fertiliser good (per kg of nitrogen content), calculated for the specific installation or production process in your country of origin. Where fertiliser goods are produced and placed on the market with different nitrogen contents, emissions shall be calculated and averaged in line with the composition-based rules set out in Annex III, Section B to the Methodology Act (i.e. by averaging across nitrogen-content ranges, with ranges not exceeding 10%, see equation 66).

The following sections set out how the system boundaries of fertiliser sector goods should be defined and identify elements of the production process that must be included for the purposes of monitoring and reporting.

2.2.2 Definition and explanation of sector CBAM goods covered

The following Table 2-1 lists the relevant goods in scope for the CBAM definitive period in the fertiliser industry sector. The CN codes in the central column are the starting point for which ‘production processes’ are to be defined for the purpose of monitoring at installation level and, where multiple CN codes share the same precursors and production steps, may be grouped within one production process, in line with Annex I, Table 1 to the Methodology Act.

Table 2-1: CBAM goods in the fertiliser sector[2]

Aggregated goods category	Product CN Code[3]	Description
Nitric acid	2808 00 00	Nitric acid; sulphonitric acids
Urea	3102 10[4]	Urea, whether or not in aqueous solution
Ammonia	2814	Ammonia, anhydrous or in aqueous solution
Mixed fertilisers	2834 21 00, 3102, 3105 - Except 3102 10 (Urea) and 3105 60 00	2834 21 00 – Nitrates of potassium 3102 – Mineral or chemical fertilisers, nitrogenous - Except 3102 10 (Urea) 3105 – Mineral or chemical fertilisers containing two or three of the fertilising elements nitrogen, phosphorus, and potassium; other fertilisers - Except: 3105 60 00 – Mineral or chemical fertilisers containing the two fertilising elements phosphorus and potassium[5]

The aggregated goods categories listed in Table 2-1 include both the finished nitrogenous fertiliser goods and chemical precursor goods (intermediate products) that are consumed in the production of fertiliser.

The system boundaries specified in the Methodology Act do not mention explicitly which precursors are relevant for the production process. Therefore, Table 2-2 should help to identify the possible precursors by aggregated goods category and production route.

---

2 Source: Annex I to the CBAM Regulation; Annex I ("Mapping of CN codes to aggregated goods categories") to the Methodology Act.

3 Where the CN codes indicated in this table consist of 4, 5 or 6 digits, all 8-digit CN codes sharing the same initial digits shall be considered included, unless otherwise specified.

4 The urea six-digit code includes at eight-digit CN code level: 3102 10 12; 3102 10 15; 3102 10 19; 3102 10 90

5 Only nitrogen (N) containing fertilisers have significant embedded emissions, therefore their precursors are included in the CBAM.

Table 2-2: Aggregated goods categories, their production routes and possible precursors

Aggregated Goods Category ***Production route***	**Precursors**
Ammonia *Haber Bosch with steam reforming* *Haber Bosch with gasification*	Hydrogen[6].
Nitric Acid	Ammonia (as 100% ammonia).
Urea	Ammonia (as 100% ammonia).
Mixed fertiliser	If used in the process: ammonia (as 100% ammonia), nitric acid (as 100% nitric acid), urea, mixed fertilisers (in particular salts containing ammonium or nitrate).

For the production of mixed fertiliser, not all precursors will apply in every case. Note in particular that in some instances an aggregated goods category (mixed fertiliser itself) may be used as a precursor for its own category, depending on the final formulation of the mixed fertiliser product required.

The final nitrogenous chemical fertiliser goods produced from the precursors (in bulk in integrated plants) are defined as complex goods as they include the embedded emissions from precursor goods.

The production of fertiliser sector goods is by a number of different process routes, outlined below.

2.2.3 Definition and explanation of relevant production processes and routes

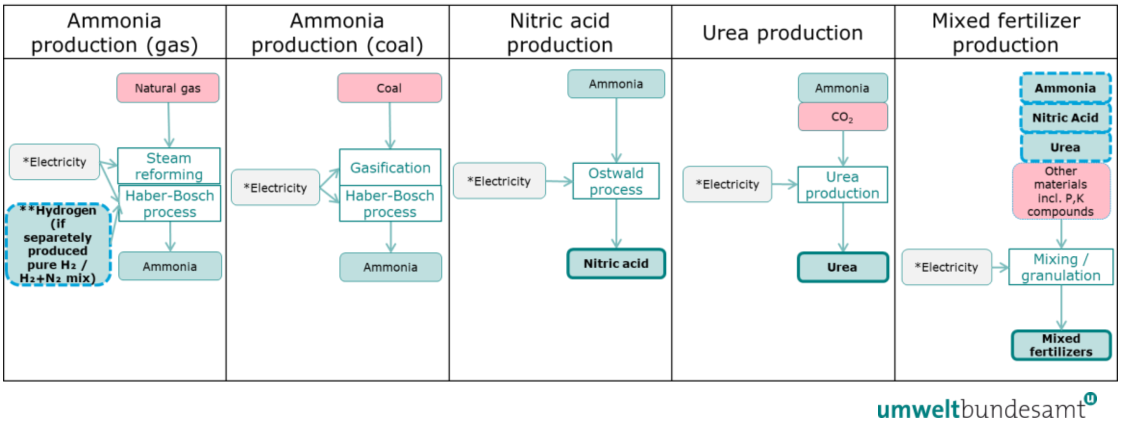
The system boundaries of chemical precursors and fertilisers are distinct and may, under certain conditions, be added together to include all processes directly or indirectly linked to the production processes for these goods, including input activities to the process, and output activities from the process in line with the definitions of functional units, system boundaries and precursors for “Ammonia”, “Nitric acid”, “Urea” and “Mixed fertilisers” in Annex I, points 3.7–3.10, and the rules for attributing emissions to goods in Annex III of the Methodology Act.

---

[6] Where hydrogen is used in the process, it shall be treated as a precursor with its own embedded emissions determined in accordance with the rules applicable to the hydrogen aggregated goods category. Indirect emissions of electricity associated with the hydrogen precursor may be disregarded when determining the embedded emissions of ammonia CBAM goods. However, this applies only where hydrogen from external installations or separate production processes (e.g. an electrolysis process on the ammonia production site) is used in the synthesis of ammonia. In cases of generic Haber-Bosch processes, where the production of hydrogen is only a highly integrated intermediate step of the overall production process (and indirect emissions from hydrogen production can thus not be determined separately), the indirect emissions of the complete process are to be included.

The following Figure 2-1 provides an overview of the different processes and process routes for the production of nitrogenous fertiliser and its precursors.

Figure 2-1: System boundaries and value chain for the production of nitrogenous fertiliser and its precursors – overview



Notes to figure:

- Functional unit for embedded emissions (fertilisers): kg N content for relevant CN codes.
- Where the functional unit is based on nitrogen content, embedded emissions are calculated by averaging across nitrogen-content ranges (≤10%).
- *Indirect emissions from electricity are included in embedded emissions for fertiliser goods where indirect emissions are in scope.
- ** The production of hydrogen is typically fully integrated in the process so it is unfeasible to distinguish a separate production process of hydrogen. However, separately-produced Hydrogen in another production process may be used as an input to ammonia synthesis.

Urea is used as a precursor in mixed fertiliser production but may also be used as a convenient fertiliser on its own due to its high nitrogen content and is therefore both a CBAM good in its own right (aggregated goods category “Urea”) and, where applicable, a precursor for mixed fertilisers as defined in Annex I, Table 1 of the Methodology Act.

Mixed fertilisers comprise all kinds of nitrogen (N) containing fertilisers, including ammonium nitrate, calcium ammonium nitrate, ammonium sulphate, ammonium phosphates, urea ammonium nitrate solutions, as well as nitrogen-phosphorus (NP), nitrogen-potassium (NK) and nitrogen-phosphorus-potassium (NPK) fertilisers falling under the “Mixed fertilisers” aggregated goods category of the Methodology Act. In addition, the amounts of different nitrogen compounds contained in the final product shall be recorded in accordance with Annex I, point 3.10.1 of the Methodology Act.

2.2.3.1 Ammonia – Haber-Bosch with steam reforming production route

Ammonia is synthesised from nitrogen and hydrogen via the Haber-Bosch process. Hydrogen for the process is obtained in this production route by steam reforming natural gas or biogas, whilst nitrogen is obtained from the air. The overall reaction is highly endothermic, and process heat is supplied by the combustion of natural gas or other gaseous fuel. Any carbon monoxide produced is almost all converted to carbon dioxide. The production of hydrogen is typically fully integrated in the process, so it is unfeasible to distinguish a separate production process of hydrogen. On some occasions, hydrogen produced from other separated production processes can be also used and its embedded emissions shall be accounted.

The Methodology Act and its annexes (in particular the provisions for the "Ammonia" aggregated goods category) define the system boundaries for direct emissions monitoring for the Haber–Bosch process with steam reforming production route. For the purposes of this guidance, those system boundaries can be described as encompassing:

> *" – All processes directly or indirectly linked to the production process, and from flue gas cleaning.*
>
> *– All fuels shall be monitored, irrespective of whether used as energetic or non-energetic input.*
>
> *– Where biogas is used, the provisions of Section B.3.3 of Annex II shall be applied."*

If hydrogen used in the process is separately produced, it is a precursor with its own embedded direct emissions.

Indirect emissions that result from electricity consumed by the ammonia production process must be monitored and taken into account in embedded emissions in accordance with the CBAM Regulation and the Methodology Act.

In line with the above definition of system boundaries, the following production steps may be regarded as being within the system boundaries of the Haber-Bosch with steam reforming process:

- Steam reforming natural gas or biogas.
- Synthesis of ammonia – from hydrogen and nitrogen, at high temperature and pressure in the presence of a catalyst; ammonia condensation, purification and storage (if applicable).
- Emissions control – for treating releases to air, water or ground.

The stream of carbon dioxide from the production of ammonia is of high purity and can be separated, captured and transferred elsewhere for other uses e.g. for urea production.

Note that the ammonia produced is reported as 100% ammonia, whether in hydrous or anhydrous form.

2.2.3.2 Ammonia – Haber-Bosch with gasification production route

With this production route, hydrogen is obtained by the gasification of hydrocarbons, typically from heavy feedstocks such as coal, heavy refinery fuels or other fossil feedstocks. A synthesis gas containing hydrogen is produced, which has to be purified before it can be used for the next production step. Ammonia is then synthesised from the hydrogen produced and from nitrogen obtained from the air, at high temperature and pressure in the presence of a catalyst. Any carbon monoxide produced is almost all converted to carbon dioxide. The production of hydrogen is typically fully integrated in the process so it is unfeasible to distinguish a separate production process of hydrogen. In some occasion, hydrogen produced from other separated production processes can be also used and its embedded emissions shall be accounted.

The Methodology Act and its annexes (in particular the provisions for the "Ammonia" aggregated goods category) also define the system boundaries for direct emissions monitoring for the Haber–Bosch process with gasification production route. For the purposes of this guidance, those system boundaries can be described as encompassing:

> *“ – All processes directly or indirectly linked to the production processes, and from flue gas cleaning.*
>
> *– Each fuel input shall be monitored as one fuel stream, irrespective of whether it is used as energetic or non-energetic input.”*

If hydrogen used in the process is separately produced, it is a precursor with its own embedded direct emissions.

Indirect emissions that result from electricity consumed by the ammonia production process must be monitored and taken into account in embedded emissions in accordance with the CBAM Regulation and the Methodology Act.

In line with the above definition of system boundaries, the following production steps may be regarded as being within the system boundaries of the Haber-Bosch with gasification process:

- Gasification (partial oxidation).
- Synthesis of ammonia – from hydrogen and nitrogen, at high temperature and pressure in the presence of a catalyst; ammonia condensation, purification and storage (if applicable).
- Emissions control – for treating releases to air, water or ground.

Note that the ammonia produced is reported as 100% ammonia, whether in hydrous or anhydrous form.

2.2.3.3 Nitric acid (and sulphonitric acids) production process

Nitric acid is mostly produced via the oxidation of ammonia by Ostwald process. Ammonia is first oxidised in the presence of a catalyst to form nitrogen oxide, which is then further oxidised to nitrogen dioxide, followed by absorption in water in an absorption tower to form nitric acid. The reaction is exothermic and heat and power may be recovered to the process.

The Methodology Act and its annexes (in particular the provisions for the “Nitric acid” aggregated goods category) define the system boundaries for direct emissions monitoring for the nitric acid production route. For the purposes of this guidance, those system boundaries can be described as encompassing:

> *“ –* All processes *directly or indirectly linked to the production processes, and from flue gas cleaning.*
>
> – All sources emitting *N_2O from the production process, including unabated and abated emissions. Any N_2O emissions from the combustion of fuels are excluded from monitoring.”*

A precursor is ammonia (as 100% ammonia). Indirect emissions that result from electricity consumed by the production process must be monitored and taken into account in embedded emissions in accordance with the CBAM Regulation and the Methodology Act.

In line with the above definition of systems boundaries, the following production steps may be regarded as being within the system boundaries of the nitric acid process production:

- Raw material preparation – evaporation and filtration of ammonia and process air.
- Oxidation of ammonia – to nitrogen oxide, all process steps.
- Further oxidation and absorption – to nitrogen dioxide and absorption in water to form nitric acid, all process steps.
- Emissions control – for treating releases to air, water or ground.

Note that nitric acid produced is reported as 100% nitric acid.

2.2.3.4 Urea production process

Urea is synthesised by reacting ammonia and carbon dioxide together at high pressure, to form ammonium carbamate, which is then dehydrated to form urea.

The Methodology Act and its annexes (in particular the provisions for the "Urea" aggregated goods category) define the system boundaries for direct emissions monitoring for the urea production route. For the purposes of this guidance, those system boundaries can be described as encompassing:

> *" – All processes directly or indirectly linked to the production processes, and from flue gas cleaning.*
>
> *– Where CO_2 is received from another installation as process input, the CO_2 received shall be considered an emission, if not already counted as emission of the installation where the CO_2 was produced."*

A precursor is ammonia (as 100% ammonia). Indirect emissions that result from electricity consumed by the production process must be monitored and taken into account in embedded emissions in accordance with the CBAM Regulation and the Methodology Act.

In line with the above definition of systems boundaries, the following production steps may be regarded as being within the system boundaries of the urea production process:

- Raw material preparation – evaporation and filtration of ammonia, CO_2.
- Production of urea – all process steps, from synthesis to particle formation.
- Emissions control – for treating releases to air, water or ground.

The ammonia and CO_2 consumed by this production process are usually delivered from other production processes on the same site.

2.2.3.5 Mixed fertilisers production process

A wide range of operations are included in the production of all kinds of nitrogen containing mixed fertilisers (especially ammonium salts and NP, NK and NPK), such as mixing, neutralisation[7], particle formation (such as by granulation or prilling), irrespective of whether only physical mixing or chemical reactions take place.

The Methodology Act and its annexes (in particular the provisions for the "Mixed fertilisers" aggregated goods category) define the system boundaries for direct emissions monitoring for the mixed fertiliser production route. For the purposes of this guidance, those system boundaries can be described as encompassing:

> *" – All processes directly or indirectly linked to the production processes, such as driers and for heating input materials, and from flue gas cleaning.*

Precursors (if used in the process) are: ammonia (as 100% ammonia); nitric acid (as 100% nitric acid); urea; mixed fertilisers (in particular salts containing ammonium or nitrate). Indirect emissions that result from electricity consumed by the production process must be monitored and taken into account in embedded emissions in accordance with the CBAM Regulation and the Methodology Act.

In line with the above definition of systems boundaries, the following production steps may be regarded as being within the system boundaries of the mixed fertiliser production process:

- Raw material preparation.
- Production of mixed fertiliser – all process steps.
- Emissions control – for treating releases to air, water or ground.

3 FERTILISERS SECTOR-SPECIFIC REQUIREMENTS

The textbox below signposts sector-specific sections in the Methodology Act, relevant for the CBAM definitive period.

Methodology Act references:

- **Annex I, point 3** – Functional unit and system boundaries. Sub-sections 3.7 to 3.10 (fertiliser sector aggregated goods categories).
- **Annex II**. **Section B.6** Requirements for a measurement-based methodology for CO_2 and N_2O. Section **B.8.** Requirements for CO_2 transfers between installations. Section **B.9.3** Additional rules for determining emissions from nitric acid production, covering: **B.9.3.1** General rules for measurement-of N_2O emissions; **B.9.3.2** Determination of flue gas flow; **B.9.3.3** Oxygen (O_2) concentrations.
- **Annex III: Section A.2.1,** for attribution rules for co-products in the case of chemicals and fertilisers.
- **Annex IV, point 2** – Sector-specific parameters to be included in the operator's emissions report.

---

[7] Nitrogen containing chemical fertilisers are produced by the neutralisation of an acid with ammonia to form the corresponding ammonium salt. Fertilisers produced in this way include ammonium nitrate, calcium ammonium nitrate, ammonium sulphate, ammonium phosphates, urea ammonium nitrate.

3.1 Sector-specific requirements for monitoring and reporting

Direct and indirect embedded emissions must be monitored in line with the methodology set out in the Methodology Act and outlined in this of the guidance document.

3.1.1 Emissions monitoring

Relevant emissions that must be monitored and reported for the fertilisers sector are:

- Carbon dioxide emissions (direct) from the fuel combustion process, from stationary plant only (excludes emissions from any mobile plant such as vehicles).
- Carbon dioxide and nitrous oxide (N_2O) emissions (direct) from the process, in particular:
  - In the production of nitric acid, N_2O emissions from the catalytic oxidation of ammonia and/or from the NO_X/N_2O abatement units (but not from combustion); and
  - Under certain conditions CO_2 transferred from the production process for ammonia to other installations. However, CO_2 consumed in the production of urea has to be considered as being emitted at the installation, as it does not comply with the requirements for permanently chemically bound CO_2.
- Carbon dioxide emissions (direct) resulting from the production of measurable heating (e.g. steam) and cooling that is consumed within the system boundaries of the production process, regardless of the location of the production of the heat (i.e. from on-site generation or from imports from off-site).
- Carbon dioxide emissions (direct) resulting from emissions control (e.g. from carbonate raw materials such as soda ash used for acidic flue gas cleaning). This is included for any good where this is applicable.

Direct emissions from the different source streams above are not reported separately but are added together to result in the total direct emissions for the installation or production process.

Indirect emissions from electricity consumed must be reported separately from direct emissions. In accordance with section 3.1 of Annex I to the Methodology Act, indirect emissions of precursors do not have to be included if those precursors are listed in Annex II to the CBAM Regulation, i.e. if indirect emissions are excluded for those precursors. This is relevant for ammonia production, where hydrogen can be a precursor. Hydrogen's indirect emissions are not counted even though ammonia as a good has to take into account indirect emissions. However, this needs to be understood to apply **only where hydrogen from external installations or separate production processes is used** in the synthesis of ammonia. In cases of generic Haber-Bosch processes, where the production of hydrogen is only a highly integrated intermediate step of the overall production process, the indirect emissions of the complete process are to be included.

Note that other N_2O emissions resulting from the combustion of fuels are excluded from the system boundaries.

3.1.2 Additional rules

Functional unit and Attribution of emissions for mixed fertilisers

For fertiliser goods whose **functional units** are **kilograms of nitrogen content** and that are sold in different ranges of composition, you as the operator will need to calculate the specific embedded emissions of the goods according to the nitrogen contained in the goods averaged for each range of composition, using the following equation.

$$SEE_{g(Ni)} = SEE_g \cdot N_i \qquad \text{(Equation 65)}$$

Where:

$SEE_{g(Ni)}$ is the specific embedded emissions of the good with nitrogen content N_i expressed as t CO_2e per tonne of good;

SEE_g is the specific embedded emissions calculated in Equation 59 or 62, i.e. expressed as t CO_2e per kg N, and

N_i is the average nitrogen content of the goods within a range of composition in kilograms of nitrogen per tonnes of goods.

Note that for goods whose functional units are kg of nitrogen content, and that are sold in custom-made compositions at the request of the client, you as the operator are required to issue a declaration of nitrogen content for each consignment and with the calculation of specific embedded emissions according to the correspondent Equation 65, where N_i will be the specific nitrogen content of the consignment[8].

Measurable heat produced from exothermic chemical processes

Where an installation consumes measurable heat produced/recovered from an exothermic chemical process other than combustion, such as in the production of ammonia or nitric acid, the amount of recovered heat consumed is determined separately from other measurable heat, and is assigned zero CO_2 emissions.

Production of electricity

If electricity is produced within the production process, a correction to the attributed emissions has to be made. Where the electricity stems from processes without combustion (e.g. expansion turbines in ammonia production), the emission factor of that electricity is considered zero.

Measurement-based approach for monitoring N_2O emissions

If you, as an operator, produce nitric acid, you must monitor N_2O emissions from the process (not from combustion) using a Continuous Emission Measurement System (CEMS) installed at a suitable measurement point[9]..

---

8 In mixed fertiliser production European fertiliser legislation requires the content of N (in its different forms, as ammonium (NH_4^+) or nitrate (NO_3^-), urea or other (organic) forms) to be clearly indicated on the packaging or in accompanying sales documentation in case of bulk deliveries. These content values may be used to determine embedded emissions of any mixed fertiliser.

9 If there are multiple emissions points that cannot be monitored from a single location, emissions from these various points must be separately monitored and the results combined for reporting purposes.

N_2O emissions are only regarded relevant for monitoring in the production of nitric acid. However, where nitric acid or the resulting nitrates (mixed fertilisers) are used as precursor, the related N_2O emissions form an integral part of the embedded emissions, which are expressed as t CO_2e:

$$CO_{2(e)}\ [t] = N_2O_{annual}[t] \times GWP_{N2O} \text{ (Equation 18)}$$

Where:

N_2O_{annual} … total annual N_2O emissions.

GWP_{N2O} … Global Worming Potential of N_2O (t CO_2e / t N_2O). Please see Annex II point G to the Methodology Act for relevant GWP values as shown in Table 3-1.

Table 3-1: Global warming potentials

Gas	Global warming potential
N_2O	265 t CO_2e / t N_2O
CF_4	6 630 t CO_2e / t CF_4
C_2F_6	11 100 t CO_2e / t C_2F_6

For determining the flow rate of the flue gas, the Methodology Act states that the mass balance method is preferred over continuous emissions flow measurements.

3.1.3 Additional reporting requirements

Table 3-2 lists out the additional information that needs to be provided by you as an operator to importers or operators using your goods as precursors, in your verified emissions report which you provide to them.

Table 3-2: Additional fertiliser sector parameters requested in the CBAM declaration

Aggregated good category	Reporting requirement in the annual report
Ammonia[10]	– Concentration, if hydrous solution. – Content of nitrogen (N).
Nitric acid[11]	– Concentration (mass %).

[10] Both hydrous and anhydrous ammonia shall be reported jointly as 100% ammonia.

[11] Amounts of nitric acid produced shall be monitored and reported as 100% nitric acid.

Aggregated good category	Reporting requirement in the annual report
	– Content of N.
Urea	- Purity (mass % urea contained, % N contained). - Content of N.

Mixed fertilisers[12,13]	- Information required anyway under Regulation (EU) 2019/1009:
	    - Content of N as ammonium (NH_4^+);
	    - Content of N as nitrate (NO_3^-);
	    - Content of N as urea;
	    - Content of N in other (organic) forms.
	- Content of N total.

You need to ensure that you collect all the parameters necessary for your CBAM goods and communicate them to the importers of your goods. The importer will need to report the additional parameters in their annual CBAM declaration for the relevant reporting period.

4 WORKED EXAMPLE FOR THE FERTILISER SECTOR

The following worked example shows how specific embedded emissions are derived for a particular mixed fertiliser grade, NPK 15-15-15, produced by mixing and granulation.

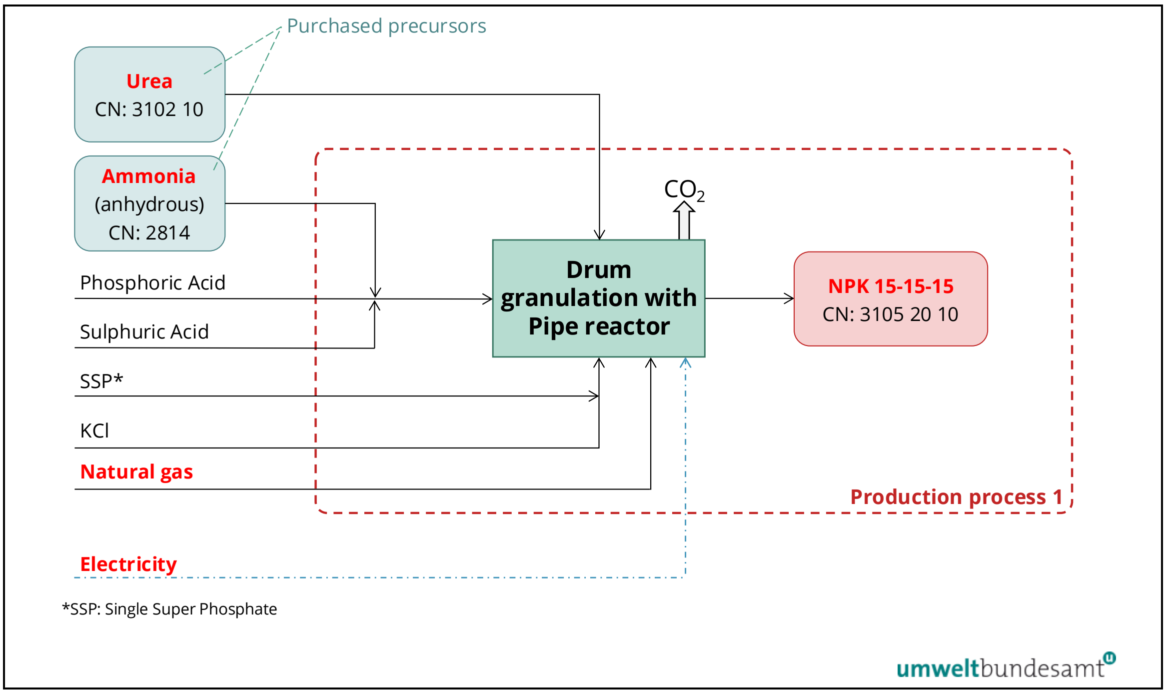
The resulting embedded emissions of imports into the EU are then calculated at the end of the example for reporting in the definitive period.

Figure 4-1 gives an outline view of the installation and shows the system boundaries as a hatched line for the single production process. The physical units carrying out the production process have been grouped under ‘Granulation with Pipe reactor’ (including an assumed dryer using natural gas) and the inputs and outputs and sources of emissions have been identified.

12 The amounts of different nitrogen compounds contained in the final product must be recorded in accordance with Regulation (EU) 2019/1009 laying down rules on the making available on the market of EU fertilizing products.

13 Regulation (EU) 2019/1009 of the European Parliament and of the Council laying down rules on the making available on the market of EU fertilizing products.
See: http://data.europa.eu/eli/reg/2019/1009/2025-12-30

Figure 4-1: Fertiliser example – Overview and complete monitoring approach for the production of a mixed fertiliser grade.



Inputs into the production process are raw materials, precursor goods urea and ammonia (anhydrous), and electrical energy. Outputs are mixed fertiliser product.

The inputs and outputs highlighted in red text above are the parameters that would need to be monitored by the operator in order to attribute emissions and determine direct and indirect specific embedded emissions for the production process.

The direct and indirect emissions that are monitored in this example result from:

- Direct emissions from natural gas used in the dryer.
- Indirect emissions from the electrical energy consumed by the production process.

The inputs of precursors (with embedded emissions) and the activity level of the mixed fertiliser goods produced also need to be monitored.

Note that a single mixed fertiliser production process can make a wide range of different fertiliser grades (or formulations) using different quantities of precursor. However, this issue was resolved in the rules for the definitive phase by introduction of the ‘functional unit’. In this way, the specific embedded emissions for each fertiliser grade can be determined easily.

The following needs to be monitored:

- The relevant mass of each precursor used over the reporting period;
- The production ‘recipe’ of each mixed fertiliser grade (or an analysis of the final product); and
- The specific embedded emissions of the precursors used to make a given mixed fertiliser grade.

- Assuming that the granulation and drying process is similar for all produced fertiliser grades, the direct and indirect emissions of the production process can be monitored over the full reporting period and then divided by the total activity level of the process, i.e. the total amount of all fertilisers produced in the reporting period. This gives a value of energy per tonne of fertiliser as used in the calculation in Table 4-1.

- The embedded emissions are first calculated per functional unit (kg N used in the reporting period) and then converted into embedded emissions per tonne of (mixed) fertiliser using equation 65 (see section 3.1.2).

For the example, it is assumed that the installation is situated in Türkiye. The electricity grid emission factor as found in Annex II to the default Values Act is used for the calculation of indirect embedded emissions. The precursors ammonia and urea are assumed to be sourced from Azerbaijan. Production year both for the precursors and the actual production are assumed to be 2026. Default values including mark-up are taken from Annex I to the Default Values Act. Table 4-1 sets out the process by which total direct and indirect specific embedded emissions for mixed fertiliser product NPK 15-15-15, are determined.

Total direct and indirect specific embedded emissions for the mixed fertiliser product are calculated by combining the default SEE values for precursors (which cover both direct and indirect emissions) and for energy needed for granulation, per tonne product, as above

Precursor goods are NH_3 and Urea. In order to determine the total embedded emissions of the mixed fertiliser product, the amount (kg) of each precursor used per tonne of mixed fertiliser product is taken into account, e.g. for urea the total input mass of precursor per tonne of product is 160 kg:

- Ammonia total embedded emissions: 0,093 t / t × 2,273 t CO_2 / t = **0,211 t CO_2 / t** mixed fertiliser product.

- Urea total embedded emissions: 0,160 t / t × 1,545 t CO_2 / t = **0,247 t CO_2 / t** mixed fertiliser product.

Table 4-1: Example calculation of total direct and indirect specific embedded emissions for NPK mixed fertiliser.

Inputs	**Input mass**	**Precursor embedded emissions (t CO_2/t)**		**Embedded emissions (t CO_2/t)**	
	(kg / t)	Direct / total	indirect	Direct / total	indirect
KCl	251,3	n.a.	n.a.	n.a.	n.a.
SSP[14] 17% P_2O_5	200,0	n.a.	n.a.	n.a.	n.a.
Phosphoric acid (40% P_2O_5)	300,0	n.a.	n.a.	n.a.	n.a.
Sulphuric acid (96 wt-%)	116,0	n.a.	n.a.	n.a.	n.a.
NH_3[15]	93,0	2,273	(included)[16]	0,211	--
Urea[17]	160,0	1,545	(included)[16]	0,247	--
Emissions from energy needed for granulation (average of reporting period)				0,018	**0,0126**
Total SEE for mixed fertiliser product NPK 15-15-15				**0,489**	
Total SEE expressed per functional unit, i.e. t CO_2e/kg N				0,00326	

Direct and indirect emissions arising from the mixing and granulation production process must also be included, as is done in Table 4-1 above per tonne of product.

Other chemical raw material inputs (KCl, SSP, Phosphoric and Sulphuric acids) do not have embedded emissions and do not need to be taken into account.

Note on calculation pathway: In the example above, only a single NPK formulation is produced. Therefore, it is simple to make all calculations per tonne of final fertiliser as presented above. However, if the installation produces many different NPK grades, the approach would be different:

- Instead of the specific input of each fertiliser component (precursor and other inputs) expressed as kg/t, the table would have to contain the total amount of each component (in tonnes) used during the production year.
- As the activity level, the total amount of nitrogen contained in all produced NPKs would be calculated (expressed as kg N, not differentiating between ammonia and urea inputs).
- Then an average level of embedded emissions per NPK would be calculated, expressed as t CO_2e/ kg N.

[14] Single Super Phosphate

[15] CN 2814 10 00 – Anhydrous ammonia

[16] The default values include the indirect embedded emissions, where relevant. This is the case for ammonia and urea.

[17] CN 3102 10 19 – Urea, whether or not in aqueous solution, containing >45% nitrogen in relation to the weight of the dry product

- Finally, for each NPK the embedded emissions per t would be calculated from the value per kg N and the N content.

Using the above approach, the CBAM reporting obligation due for the import of mixed fertiliser product into the EU during the definitive period may then be determined; for example, for the import of 100 tonnes of NPK 15-15-15 product:

- **Definitive period:**
    - Total embedded emissions = 100 t × 0,489 t CO_2 / t = 48,9 t CO_2

Annex A List of definitions

Term	Definition
‘Accuracy’	means the closeness of the agreement between the result of a measurement and the true value of the particular quantity or a reference value determined empirically using internationally accepted and traceable calibration materials and standard methods, taking into account both random and systematic factors
‘Activity data’	means the amount of fuels or materials consumed or produced by a process relevant for the calculation-based methodology, expressed in terajoules (TJ), mass in tonnes or (for gases) volume in normal cubic metres, as appropriate
‘Actual emissions’	means the emissions calculated based on primary data from the production processes of goods and from the production of electricity consumed during those processes as determined in accordance with the methods set out in Annex IV [to the Methodology Act]
‘Activity level’	means the quantity of goods to which the same functional unit applies that are produced within the system boundaries of a production process during a reporting period
‘Aggregated goods categories’	means aggregated goods categories pursuant to Table 1 of point 2 of Annex I. A group of CBAM goods with their CN codes, used for the purpose of defining system boundaries of production processes.
‘Agricultural, aquaculture, fisheries and forestry residues’	means residues that are directly generated by agriculture, aquaculture, fisheries and forestry and that do not include residues from related industries or processing
‘Authorised CBAM declarant’	means a person authorised by the competent authority in accordance with Article 17 [of the CBAM Regulation]. The ‘authorised CBAM declarant’ [which replaces the term ‘reporting declarant’ from the transitional period] may be importers of CBAM goods, or their indirect customs representatives, who have applied for and been granted the status of authorised CBAM declarant.
‘Batch’	means an amount of fuel or material representatively sampled and characterised, and transferred as one shipment or continuously over a specific period of time
‘Biomass’	means biomass as defined in Article 2, point (24) of the Renewable Energy Directive (RED II)[18]; it includes bioliquids and biofuels as defined in Article 2, point (32) and (33), biomass fuels as defined in Article 2, point (27) and biogas as defined in Article 2 point (28) of the RED II;

[18] Directive (EU) 2018/2001

Term	Definition
'Biomass fraction'	means the ratio of carbon stemming from biomass to the total carbon content of a fuel or material, expressed as a fraction
'Calculation factors'	means net calorific value, emission factor, preliminary emission factor, oxidation factor, conversion factor, carbon content or biomass fraction
'Calibration'	means the set of operations, which establishes, under specified conditions, the relations between values indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material and the corresponding values of a quantity realised by a reference standard
'Carbon price'	means the monetary amount paid in a third country, under a carbon emissions reduction scheme, in the form of a tax, levy or fee or in the form of emission allowances under a greenhouse gas emissions trading system, calculated on greenhouse gases covered by such a measure, and released during the production of goods
'CBAM certificate'	means a certificate in electronic format corresponding to one tonne of CO_2e of embedded emissions in goods
'CO_2 emission factor'	means the weighted average of the CO_2 intensity of electricity produced from fossil fuels within a geographic area. The CO_2 emission factor is the result of the division of the CO_2 emission data of the electricity sector by the gross electricity generation based on fossil fuels in the relevant geographic area. It is expressed in tonnes of CO_2 per megawatt-hour
'Combined nomenclature' (CN)	means the classification of goods, designed to meet the needs of: i) the Common customs tariff, setting import duties for products imported into the European Union (EU), as well as the Integrated tariff of the European Communities (Taric), incorporating all EU and trade measures applied to goods imported into and exported out of the EU; ii) the international trade statistics of the EU. The CN provides the means of collecting, exchanging and publishing data on EU international trade statistics. It is also used for the collection and publication of international trade statistics in intra-EU trade.[19]
'Combustion emissions'	means greenhouse gas emissions occurring during the exothermic reaction of a fuel with oxygen
'Competent authority'	means the authority designated by each Member State in accordance with Article 11 [of the CBAM Regulation]

[19] For definition see: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Combined_nomenclature_(CN)

Term	Definition
'Continuous emission measurement' (CEM)	means a set of operations having the objective of determining the value of a quantity by means of periodic measurements, applying either measurements in the stack or extractive procedures with a measuring instrument located close to the stack, whilst excluding measurement methodologies based on the collection of individual samples from the stack
'Control system'	means the operator's risk assessment and entire set of control activities, including the continuous management thereof, that an operator has established, documented, implemented and maintained pursuant to point A.2. of Annex II
'Complex goods'	means goods other than simple goods
'Conservative'	means that a set of assumptions is defined in order to ensure that no under-estimation of reported emissions or over-estimation of production of heat, electricity or goods occurs
'Conversion factor'	means the ratio of carbon emitted as CO_2 to the total carbon contained in the source stream before the emitting process takes place, expressed as a fraction, considering CO emitted to the atmosphere as the molar equivalent amount of CO_2
'Co-product'	means any of two or more products resulting from the same production process
'Customs declarant'	means a declarant as defined in Article 5, point (15) of Regulation (EU) No 952/2013 lodging a customs declaration for release for free circulation of goods in its own name or the person in whose name such a declaration is lodged
'CCUS system'	means a group of economic operators with technically connected installations and transport equipment for CO_2 capture, transport, use in production of goods, or geological storage
'Data flow activities'	mean activities related to the acquisition, processing and handling of data that are needed to draft an emissions report from primary source data
'Data set'	means one type of data, either at installation level or production process level as relevant in the circumstances, as any of the following: (a) the amount of fuels or materials consumed or produced by a production process as relevant for the calculation-based methodology, expressed in terajoules, mass in tonnes, or for gases as volume in normal cubic metres, as appropriate, including for waste gases; (b) a calculation factor;

Term	Definition
	(c) net quantity of measurable heat, and the relevant parameters required for determining this quantity, in particular: i) mass flow of heat transfer medium; and ii) enthalpy of transmitted and returned heat transfer medium, as specified by composition, temperature, pressure and saturation; (d) quantities of non-measurable heat, specified by the relevant quantities of fuels used for producing the heat, and the net calorific value (NCV) of the fuel mix; (e) quantities of electricity; (f) quantities of CO_2 transferred between installations; (g) quantities of precursors received from outside the production process, and their relevant parameters, such as country of origin, used production route, specific direct and indirect emissions;
'Default value'	means a value, which is calculated or drawn from secondary data, which represents the embedded emissions in goods
'Direct emissions'	means emissions from the production processes of goods including emissions from the production of heating and cooling that is consumed during the production processes, irrespective of the location of the production of the heating or cooling
'Embedded emissions'	means direct emissions released during the production of goods and indirect emissions from the production of electricity that is consumed during the production processes, calculated in accordance with the methods set out in Annex IV and further specified in the implementing acts adopted pursuant to Article 7(7)
'Emissions'	mean the release of greenhouse gases into the atmosphere from the production of goods
'Emission factor'	means the average emission rate of a greenhouse gas relative to the activity data of a source stream assuming complete oxidation for combustion and complete conversion for all other chemical reactions
'Emission factor' for electricity	means the default value, expressed in CO_2e, representing the emission intensity of electricity consumed in production of goods.
'Emission source'	means a separately identifiable part of an installation or a process within an installation, from which relevant greenhouse gases are emitted
EU ETS	means the system for greenhouse gas emissions allowance trading within the Union in respect of activities listed in Annex I to Directive 2003/87/EC other than aviation activities

Term	Definition
‘EU ETS allowance’	means an allowance as defined in Article 3, point (a), of Directive 2003/87/EC in respect of activities listed in Annex I to that Directive other than aviation activities
‘Fossil carbon’	means inorganic and organic carbon that is not biomass
‘Fossil fraction’	means the ratio of fossil carbon to the total carbon content of a fuel or material, expressed as a fraction
‘Fugitive emissions’	means irregular or unintended emissions from sources that are not localised, or too diverse or too small to be monitored individually
‘Functional unit’	means the reference unit used for the calculation of embedded emissions in goods
‘Goods’	means goods listed in Annex I [to the CBAM the CBAM Regulation]
‘Greenhouse gases’	mean greenhouse gases as specified in Annex I [to the CBAM the CBAM Regulation] in relation to each of the goods listed in that Annex
‘Heat meter’	means a thermal energy meter or any other device to measure and record the amount of thermal energy produced based upon flow volumes and temperatures
‘Importer’	means either the person lodging a customs declaration for release for free circulation of goods or a bill of discharge in accordance with Article 175(5) of Delegated Regulation (EU) 2015/2446 in its own name and on its own behalf or, where the customs declaration is lodged by an indirect customs representative in accordance with Article 18 of Regulation (EU) No 952/2013, the person on whose behalf such a declaration is lodged
‘Importation’	means release for free circulation as provided for in Article 201 of Regulation (EU) No 952/2013
‘Indirect customs Representative’	A customs representative appointed by an importer established in a Member State. If the importer appoints an indirect customs representative and they agree, they can act as an authorised CBAM declarant and submit the application for an authorisation on behalf of the importer. The indirect customs representative is liable for all operations made for the importers it represents
‘Indirect emissions’	means emissions from the production of electricity which is consumed during the production processes of goods, irrespective of the location of the production of the consumed electricity
‘Inherent CO_2’	means CO_2 which is part of a source stream.
‘Installation’	means a stationary technical unit where a production process is carried out

Term	Definition
‘Legal metrological control’	means the control exercised by a public authority or regulator of the measurement tasks intended for the field of application of a measuring instrument, for reasons of public interest, public health, public safety, public order, protection of the environment, the levying of taxes and duties, the protection of consumers and fair trading
‘Measurable heat’	means a net heat flow transported through identifiable pipelines or ducts using a heat transfer medium, such as, in particular, steam, hot air, water, oil, liquid metals and salts, for which a heat meter is or could be installed
‘Measurement point’	means the emission source for which continuous emission measurement systems (CEMS) are used for emission measurement, or the cross-section of a pipeline system for which the CO_2 flow is determined using continuous measurement systems
‘Measurement system’	means a complete set of measuring instruments and other equipment used to determine variables for the monitoring and calculation of emissions
‘Minimum requirements’	means monitoring methods using the minimum efforts allowed for determining data in order to result in emission data acceptable for the purpose of the CBAM Regulation.
‘Mixed fuel’	means a fuel which contains both biomass and fossil carbon
‘Mixed material’	means a material which contains both biomass and fossil carbon
‘Multifunctional process’	means a process that delivers multiple outputs or whose outputs feed into several production processes
‘Net calorific value’ (NCV)	means the specific amount of energy released as heat when a fuel or material undergoes complete combustion with oxygen under standard conditions, less the heat of vaporisation of any water formed
‘Non-CBAM good’	means any good produced in the installation that is not included in Annex I to the CBAM Regulation
‘Non-measurable heat’	means all heat other than measurable heat
‘Operator’	means any person who operates or controls an installation in a third country, including a parent company that controls an installation in a third country
‘Oxidation factor’	means the ratio of carbon oxidised to CO_2 as a consequence of combustion to the total carbon contained in the fuel, expressed as a fraction, considering carbon monoxide (CO) emitted to the atmosphere as the molar equivalent amount of carbon dioxide (CO_2)
‘Power purchase agreement’	means a contract under which a person agrees to purchase electricity directly from an electricity producer

Term	Definition
'Precursor'	means any input material into a production process included in the list of goods set out in Annex I to the CBAM Regulation;
'Preliminary emission factor'	means the assumed total emission factor of a fuel or material based on the carbon content of its biomass fraction and its fossil fraction before multiplying it by the fossil fraction to produce the emission factor
'Production process'	means the chemical and physical processes carried out to produce goods in an installation
'Production route' [20]	means a specific technology used in a production process to produce goods
'Process emissions'	means greenhouse gas emissions other than combustion emissions occurring as a result of intentional and unintentional reactions between substances or their transformation, for a primary purpose other than the generation of heat, including from the following processes: (a) the chemical, electrolytic or pyrometallurgical reduction of metal compounds in ores, concentrates and secondary materials; (b) the removal of impurities from metals and metal compounds; (c) the decomposition of carbonates, including those used for flue gas cleaning; (d) chemical syntheses of products and intermediate products where the carbon bearing material participates in the reaction; (e) the use of carbon containing additives or raw materials; (f) the chemical or electrolytic reduction of metalloid oxides or non-metal oxides such as silicon oxides and phosphates.
'Proxy data'	means annual values which are empirically substantiated or derived from accepted sources and which an operator uses to substitute a data set[21] for the purpose of ensuring complete reporting
'Rebate'	means any amount that reduces the amount due or paid by a person liable for the payment of a carbon price, before its payment or after, in a monetary form or in any other form.
'Recommended improvements'	means monitoring methods which are proven means to ensure that data are more accurate or less prone to mistakes than by mere application of minimum requirements
'Related emissions'	means: – the direct emissions caused by the source stream or emission source concerned; – emissions attributed to a quantity of measurable heat; – the indirect emissions related to the quantity of electricity concerned; – embedded emissions of a material produced or of a precursor consumed.

[20] Note that different production routes can fall within the same production process.

[21] Refers to the activity data or the calculation factors.

Term	Definition
'Reporting period'	means the period corresponding to the calendar year during which the good was produced and used by the authorised CBAM declarant as reference for the determination of embedded emissions
'Residue'	means a substance that is not the end product that a production process directly seeks to produce; it is not a primary aim of the production process and the process has not been deliberately modified to produce it
'Simple goods'	means goods produced in a production process requiring exclusively input materials (precursors) and fuels having zero embedded emissions
'Source stream'	means either of the following: (a) a specific fuel type, raw material or product giving rise to emissions of relevant greenhouse gases at one or more emission sources as a result of its consumption or production; (b) a specific fuel type, raw material or product containing carbon and included in the calculation of greenhouse gas emissions using a mass-balance method
'Specific embedded emissions'	means the embedded emissions of one tonne of goods, expressed as tonnes of CO_2e emissions per tonne of goods
'Standard conditions'	means temperature of 273,15 K and pressure conditions of 101 325 Pa defining normal cubic metres (Nm^3)
'System boundary'	means the group of chemical or physical processes included in the calculation of embedded emissions of goods under the same aggregated goods category. The system boundaries shall cover direct emissions, indirect emissions for goods not listed in Annex II to the CBAM Regulation, and the embedded emissions of any precursor.
'Third country'	means a country or territory outside the customs territory of the [European] Union
'Tonne of $CO_{2(e)}$'	means one metric tonne of carbon dioxide ('CO_2'), or an amount of any other greenhouse gas listed in Annex I [to the CBAM Regulation] with an equivalent global warming potential ['CO_2e']
'Transmission system operator'	means an operator as defined in Article 2, point (35) of Directive (EU) 2019/944 of the European Parliament and of the Council ([22]).

[22] Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity and amending Directive 2012/27/EU (OJ L 158, 14.6.2019, p. 125).

Term	Definition
'Uncertainty'	means a parameter, associated with the result of the determination of a quantity, that characterises the dispersion of the values that could reasonably be attributed to the particular quantity, including the effects of systematic as well as of random factors, expressed in percent, and describes a confidence interval around the mean value comprising 95% of inferred values taking into account any asymmetry of the distribution of values
'Waste'	means any substance or object which the holder discards or intends or is required to discard, excluding substances that have been intentionally modified or contaminated in order to meet this definition
'Waste gas'	means a gas containing incompletely oxidised carbon in a gaseous state under standard conditions which is a result of any of the processes listed under 'process emissions'

Annex B List of abbreviations

Abbreviation	Full term
AD	Activity Data
AEM	Anode Effect Minutes
AEO	Anode Effect Overvoltage
AL	Activity Level
AOD	Argon Oxygen Decarburisation.
BAT	Best Available Techniques
BF	Biomass Fraction
BFG	Blast Furnace Gas
BM	Benchmark
BOF	Basic Oxygen Furnace
BOFG	Basic Oxygen Furnace Gas
BREFs	Best Available Techniques Reference documents
CA	Competent Authority
CBAM	Carbon Border Adjustment Mechanism, the
CCR	Clinker to Cement Ratio
CCS	Carbon Capture and Storage
CCU(S)	Carbon Capture and Utilisation (and Storage)
CEMS	Continuous Emission Measurement Systems
CF	Conversion Factor
CFP	Carbon footprint of products
CHP	Combined Heat and Power
CKD	Cement Kiln Dust
CN	Combined nomenclature
COG	Coke Oven Gas
DRI	Direct Reduced Iron
EAF	Electric Arc Furnace
EEA	European Economic Area (EU-27, Iceland, Norway, Liechtenstein)
EF	Emission Factor
EFTA	European Free Trade Area
EORI	Economic Operator Registration and Identification
ETS	Emissions Trading System
EU ETS	EU Emissions Trading System
EUA	EU Allowances (used in the EU ETS)
EUR	Euro (currency)

Abbreviation	Full term
FAR	Free Allocation Rules (Regulation 2019/331)[23]
FIFO	First-In-First-Out principle
GHG	Greenhouse Gas
GWP	Global Warming Potential
HBI	Hot Briquetted Iron
HS	Harmonised System (for international trade)
IEA	International Energy Agency
ISO	International Organization for Standardization
LULUCF	Land-use, land change and forestry (criteria)
MP	Monitoring Plan
MRR	Monitoring and Reporting Regulation (Regulation 2018/2066)[24]
MRV	Monitoring, Reporting and Verification
MS	Member State(s)
MWh	Megawatt-hour
NCV	Net Calorific Value
NPI	Nickel pig iron
OF	Oxidation Factor
PCI	Pulverised Coal Injection
PEMS	Predictive Emission Monitoring System
PFC	Perfluoro-carbon
PoS	Proofs of Sustainability
RED II	Renewable Energy Directive, re-cast
SEE	Specific embedded emissions
SEFA	Specific embedded free allocation
TARIC	Integrated Tariff of the European Union database
TJ	Terajoules
TSO	Transmission System Operator
UCC	Union Custom Code
UN/LOCODE	United Nations Code for Trade and Transport Location

[23] Free Allocation Rules (Commission Delegated Regulation (EU) 2019/331 of 19 December 2018 determining transitional Union-wide rules for harmonised free allocation of emission allowances pursuant to Article 10a of Directive 2003/87/EC of the European Parliament and of the Council)

[24] Monitoring and Reporting Regulation (Commission Implementing Regulation (EU) 2018/2066 of 19 December 2018 on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council and amending Commission Regulation (EU) No 601/2012

EUROPEAN COMMISSION
DIRECTORATE-GENERAL
TAXATION AND CUSTOMS UNION
Indirect Taxation and Tax Administration
CBAM, Energy and Green Taxation

Brussels, 14 August 2026

GUIDANCE DOCUMENT 5D: SECTOR-SPECIFIC GUIDANCE DOCUMENT ON IRON AND STEEL

Disclaimer: This guidance document is not legally binding and it is of an explanatory nature. Legal provisions of Union law take precedence over the contents of this document and should always be consulted. The authentic texts of the EU legal instruments are those published in the Official Journal of the European Union. This guidance was prepared by Commission services and does not represent an official position of the Commission. Only the Court of Justice of the European Union is competent to authoritatively interpret Union law.

VERSION HISTORY

Date	Version notes
14.08.2026	First Publication of this document for the definitive period.

CONTENTS

1 PREFACE

1.1 Structure and content of the guidance documents

This series of documents has been written to support stakeholders by explaining the requirements of the CBAM Regulation in a non-legislative language. This series of guidance documents should benefit a variety of stakeholders. A specific focus has been put on clarifying the **requirements for operators of installations producing CBAM goods outside of the EU for the definitive period**.

- **Guidance 1** provides an overview of the main changes to the CBAM methodology between the definitive period and the concluded transitional period. It also introduces the CBAM and an overview of the compliance cycle, roles and responsibilities, as well as milestones and deadlines for operators of installations outside the EU during the definitive period and explains the general exemptions from the CBAM.

- **Guidance 2** provides a quick guidance for the intended reader of this document, the operator of an installation producing CBAM goods. It provides a roadmap of the most important concepts of CBAM emissions monitoring and where to find more information in this series of documents.

- **Guidance 3** sets out the monitoring and reporting obligations and recommendations which are potentially applicable to any affected producer of CBAM goods.

- **Guidance 4** provides an overview of how the adjustment for free allocation is to be determined and what information is needed.

- **Guidance documents 5a, 5b, 5c, 5d, 5e and 5f** present an overview per sector of the production processes and value chains for goods that are included in the scope of the CBAM, as well as sector-specific monitoring and reporting considerations for each CBAM good where this is relevant. These sections are supplemented by examples for each sector.

The series of guidance documents is accompanied by an electronic template for information that should be used by installation operators to communicate information to the authorised CBAM declarants and CBAM Registry.

Presentation of numbers in EU documents

To align with EU legal documents, this guidance document uses the following convention when presenting numbers.

The decimal separator used to separate the integral part of a number from its fractional part is a comma, e.g.: 0,890

Thousands, and powers of 10^{3n} thereafter, are separated by a space, e.g.:

- fifteen thousand is written as 15 000
- fifteen million is written as 15 000 000

1.2 Reference regulations and legal acts

Several regulations and legal acts are referred to throughout this series of guidance documents. For ease of reading and to avoid ambiguity, simplified references are used when citing these acts.

- **CBAM Regulation**: Regulation (EU) 2023/956 and Regulation (EU) 2025/2083 amending Regulation (EU) 2023/956. Notably, where article numbers are given in this document without further specification, they always refer to the CBAM Regulation.

  It can be accessed at the following link (consolidated version): **http://data.europa.eu/eli/reg/2023/956/2025-10-20**

- **Methodology Act:** Commission Implementing Regulation (EU) 2025/2547, in legal texts referred to as "Implementing act pursuant to Article 7(7) of the CBAM Regulation".

  It can be accessed at the following link: **http://data.europa.eu/eli/reg_impl/2025/2547/oj**

- **Default Values Act**: Commission Implementing Regulation (EU) 2025/2621, in legal texts referred to as "Implementing act pursuant to Article 7(7) of the CBAM Regulation", also referred to as "default values determined in accordance with Annex IV to the CBAM Regulation".

  It can be accessed at the following link: **http://data.europa.eu/eli/reg_impl/2025/2621/oj**

- **Verification Principles Act**: Commission Implementing Regulation (EU) 2025/2546, in legal texts referred to as "Implementing act pursuant to Article 8(3) of the CBAM Regulation".

  It can be accessed at the following link: **http://data.europa.eu/eli/reg_impl/2025/2546/oj**

- **Accreditation & Verification Requirements Act**: Commission Delegated Regulation (EU) 2025/2551, in legal texts referred to as "Delegated act pursuant to Article 18(3) of the CBAM Regulation".

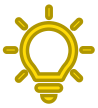
  It can be accessed at the following link: **http://data.europa.eu/eli/reg_del/2025/2551/oj**

- **Free Allocation Adjustment Act**: Commission Implementing Regulation (EU) 2025/2620, in legal texts referred to as "Implementing act pursuant to Article 31(2) of the CBAM Regulation".

  It can be accessed at the following link: **http://data.europa.eu/eli/reg_impl/2025/2620/oj**

For acronyms and definitions used in this document, please see **Annex B** and **Annex A**.

A series of icons are used throughout to help guide the reader:

Icon	Description of use
	Points to information of particular importance for operators of installations producing CBAM goods.
Simplified!	Highlights simplified approaches of the general requirements of the CBAM.
	Used where recommended improvements are presented.
	Used where other documents, templates or electronic tools are available from other sources.
	Points to examples given for the topics discussed in the surrounding text.

2 CBAM Goods and Production Routes

This section provides guidance on industry-sector-specific rules that apply for the definitive period (from 2026 onwards), for iron and steel sector. It deals with the specification of products covered by the CBAM and the relevant production routes.

2.1 Foreword to sector-specific sections

The following sections provide an overview of the different production routes for the goods under the iron and steel sector in CBAM and provide sector specific guidance. Where goods to which the same functional unit applies are produced in one installation via different production routes, the embedded emissions shall be determined in accordance with the averaging rules applicable in the definitive period.

Additional information on the production processes of the goods can also be found in the BREF[1] documents for best available techniques (BAT).

Diagrams used in the following sections.

For the system boundary graphics presented in the sections below, the **following conventions** are applied:

- **Production processes** (for which monitoring of the direct emissions would take place) are shown as **rectangles with white background**.
- **Optional** processes (e.g. CCS/CCU) are shown in **blue** boxes. In particular, CCS/CCU would not be taken into account for developing default values, but where you (as an operator) use them, the related emissions or emission savings should be taken into account for determining actual embedded emissions in line with the CBAM Regulation and the Methodology Act.
- **Materials** which are considered to have no embedded emissions are shown in **pink** boxes, materials with embedded emissions (precursor materials and final products, i.e. goods under the CBAM) in **green** boxes. Simple goods are shown in **normal** font, complex goods in **bold** font. Materials which are **optional** are shown in boxes with a **blue dashed** outline and must be included where actually used at the installation.
- Input materials are presented without trying to be complete. This means that the focus is on materials which are relevant for demonstrating the differences between different production routes. As a consequence, less important input materials and in particular fuels are usually omitted in order to keep graphs simple.
- **Electricity** as input is shown only in cases where it is the main "precursor" of the process (i.e. in particular for electric arc furnaces and electrolysis processes). Electricity is shown in **light grey** boxes.

[1] BAT Reference document (BREF), BAT being "Best Available Techniques" as defined by the IED (Industrial Emissions Directive). Relevant BREF documents are those for: the production of cement; for iron and steel production; large volume inorganic chemicals (which includes fertilisers); for Chlor-alkali; and for non-ferrous metals (which includes both aluminium and ferro-alloys). All BREFs can be found at the European IPPC Bureau, under https://eippcb.jrc.ec.europa.eu/reference.

2.2 Iron and Steel sector goods and production routes

The textbox below signposts sector-specific sections in the Methodology Act, relevant for the CBAM definitive period (2026 onwards).

Methodology Act references:

- **Annex I** ("Mapping of CN codes to aggregated goods categories") to the Methodology Act
- **Annex I**, points 3.11 (Sintered ore), 3.12 (Ferro-manganese, Ferro-chromium, Ferro-nickel), 3.13 (Pig iron), 3.14 (DRI), 3.15 (Crude steel) and 3.16 (Iron or steel products), which define the functional unt, system boundaries and possible precursors for iron and steel sector goods.

2.2.1 Unit of production and embedded emissions

The quantity of declared iron and steel sector goods imported into the EU must be expressed in metric tonnes. As an operator, you must record the quantity of CBAM goods produced by your installation in each production process, for the purposes of reporting. For the purposes of determining embedded emissions on the basis of actual values, the 'reporting period' corresponds to the calendar year during which the good was produced. By default, the reporting period for goods imported into the EU is the calendar year of import (with the possibility to rebut this presumption where there is sufficient evidence of the actual time of production).

Industrial sector	**Iron and steel**
Production unit of goods	Tonnes (metric), reported separately for each type of sector goods, by installation or production process in the country of origin
Associated activities	Producing, melting or refining iron or steel or ferrous alloys; manufacture of semi-finished and basic steel products.
Relevant greenhouse gas	Carbon dioxide (CO_2)
Direct Emissions	Tonnes (metric) of CO_2e
Indirect Emissions	Quantity of electricity consumed (MWh), source and emissions factor used to calculate the indirect emissions in tonnes (metric) of CO_2 or CO_2e where relevant (i.e. for goods not listed in Annex II to the CBAM Regulation and/or for precursors whose embedded emissions include indirect emissions).

	During the transitional period, indirect emissions from electricity consumption were monitored and reported separately. In the definitive period, for iron and steel CBAM goods listed in Annex II (“Goods for which only direct emissions are taken into account”) to the CBAM Regulation, only direct emissions are taken into account in their embedded emissions; indirect emissions of electricity are not included. For sintered ore (CN 2601 12 00) – not listed in Annex II to the CBAM Regulation, indirect emissions are to be included.
Unit for embedded emissions	Tonnes CO_2e emissions per tonne of goods, reported separately for each type of goods, by installation in the country of origin

During the transitional period, the iron and steel sector reported both direct and indirect emissions, with indirect emissions reported separately. In the definitive period, in line with Article 7(1) and Annex II (“List of goods for which only direct emissions are to be taken into account”) to the CBAM Regulation and Article 3(2) of the Methodology Act, only direct emissions are taken into account when determining the embedded emissions of iron and steel CBAM goods (except for sintered ore). Where iron and steel goods listed in Annex II are used as precursors in the production of other CBAM goods, their indirect emissions are likewise not included in the embedded emissions of those complex goods, in accordance with the cross-sectoral rules in the Methodology Act.

Where iron and steel CBAM goods are complex goods produced using precursors (such as sintered ore, pig iron, DRI or ferro-alloys), the embedded emissions of the iron and steel goods must include the full embedded emissions of those precursors, including any indirect emissions of electricity associated with the precursors where relevant (i.e. where the precursor is not listed in Annex II to the CBAM Regulation), for example, hydrogen where used as a precursor. Where actual data are used for precursors produced outside the installation, such actual data may be used only where they are taken from a verification report. The verification report must be issued by a verifier having an accreditation valid at the time of issuing the verification report and for the sectoral scope required for the aggregated goods category of the precursor under consideration. The verification report must cover the reporting period during which the precursor was produced, otherwise, the relevant default values shall be used.

The following sections set out how the system boundaries of iron and steel sector goods should be defined and identify elements of the production process that must be included for the purposes of monitoring and reporting. Operators shall design and implement a monitoring plan and submit it in English. Records supporting monitoring and reporting shall be retained for at least 6 years. Where a claim is made that applying a specific determination methodology incurs unreasonable costs, the justification shall be set out in the monitoring plan and assessed against the reference price of EUR 80 per tonne of CO_2e and the accumulated limit of EUR 4 000 per year.

2.2.2 *Definition and explanation of sector CBAM goods covered*

The following Table 2-1 lists the relevant goods in scope for the CBAM definitive period in the iron and steel industry sector. The CN codes in the central column are the starting point for which 'production processes' are to be defined for the purpose of monitoring in line with Annex I to the CBAM Regulation and Annex I ("Mapping of CN codes to aggregated goods categories") to the Methodology Act. Where goods with different CN codes to which the same functional unit applies are produced using different production routes within an installation, a single production process shall be used encompassing all production routes.

Table 2-1: CBAM goods in the iron and steel sector[2]

Aggregated goods category	**Product CN Code**[3]	**Description**
Sintered Ore[4]	2601 12 00	Agglomerated iron ores and concentrates, other than roasted iron pyrites
Pig iron	7201	Pig iron and spiegeleisen[5] in pigs, blocks or other primary forms
	7205[6]	Some products under 7205 (Granules and powders, of pig iron, spiegeleisen, iron, or steel) may be covered here
Ferro-alloy: FeMn	7202 1	Ferro-manganese (FeMn)
Ferro-alloy: FeCr	7202 4	Ferro-chromium (FeCr)
Ferro-alloy: FeNi	7202 6	Ferro-nickel (FeNi)
DRI	7203	Ferrous products obtained by direct reduction of iron ore and other spongy ferrous products
Crude steel	7206, 7207, 7218 and 7224	7206 – Iron and non-alloy steel in ingots or other primary forms (excluding iron of heading 7203) 7207 – Semi-finished products of iron or non-alloy steel

2 Source: Annex I to the CBAM Regulation; Annex I ("Mapping of CN codes to aggregated goods categories") to the Methodology Act.

3 Where the CN codes indicated in this table consist of 4, 5 or 6 digits, all 8-digit CN codes sharing the same initial digits shall be considered included, unless otherwise specified.

4 This aggregated goods category includes all kinds of iron ore pellet production (for sale of pellets as well as for direct use in the same installation) and sinter production.

5 Pig iron containing alloy ferro-manganese.

6 Only some products of this CN code will qualify as "pig iron", while other goods of this code are classified as "iron or steel products".

Aggregated goods category	Product CN Code[3]	Description
		7218 – Stainless steel in ingots or other primary forms; semi-finished products of stainless steel 7224 – Other alloy steel in ingots or other primary forms; semi-finished products of other alloy steel
Iron or steel products[7]	Includes: 7205, 7208-7217, 7219-7223, 7225-7229, 7301-7311, 7318 and 7326	7205 – Granules and powders, of pig iron, spiegeleisen, iron or steel (if not covered under category pig iron) 7208 – Flat-rolled products of iron or non-alloy steel, of a width of 600 mm or more, hot-rolled, not clad, plated or coated 7209 – Flat-rolled products of iron or non-alloy steel, of a width of 600 mm or more, cold-rolled (cold-reduced), not clad, plated or coated 7210 – Flat-rolled products of iron or non-alloy steel, of a width of 600 mm or more, clad, plated or coated 7211 – Flat-rolled products of iron or non-alloy steel, of a width of less than 600 mm, not clad, plated or coated 7212 – Flat-rolled products of iron or non-alloy steel, of a width of less than 600 mm, clad, plated or coated 7213 – Bars and rods, hot-rolled, in irregularly wound coils, of iron or non-alloy steel 7214 – Other bars and rods of iron or non-alloy steel, not further worked than forged, hot-rolled, hot-drawn or hot-extruded, but including those twisted after rolling 7215 – Other bars and rods of iron or non-alloy steel 7216 – Angles, shapes and sections of iron or non-alloy steel 7217 – Wire of iron or non-alloy steel 7219 – Flat-rolled products of stainless steel, of a width of 600 mm or more 7220 – Flat-rolled products of stainless steel, of a width of less than 600 mm 7221 – Bars and rods, hot-rolled, in irregularly wound coils, of stainless steel 7222 – Other bars and rods of stainless steel; angles, shapes and sections of stainless steel

[7] This aggregated goods category includes semi-finished and finished products.

Aggregated goods category	Product CN Code[3]	Description
		7223 – Wire of stainless steel
		7225 – Flat-rolled products of other alloy steel, of a width of 600 mm or more
		7226 – Flat-rolled products of other alloy steel, of a width of less than 600 mm
		7227 – Bars and rods, hot-rolled, in irregularly wound coils, of other alloy steel
		7228 – Other bars and rods of other alloy steel; angles, shapes and sections, of other alloy steel; hollow drill bars and rods, of alloy or non-alloy steel
		7229 – Wire of other alloy steel
		7301 – Sheet piling of iron or steel, whether or not drilled, punched or made from assembled elements; welded angles, shapes and sections, of iron or steel
		7302 – Railway or tramway track construction material of iron or steel, the following: rails, check-rails and rack rails, switch blades, crossing frogs, point rods and other crossing pieces, sleepers (cross-ties), fish- plates, chairs, chair wedges, sole plates (base plates), rail clips, bedplates, ties and other material specialised for jointing or fixing rails
		7303 – Tubes, pipes and hollow profiles, of cast iron
		7304 – Tubes, pipes and hollow profiles, seamless, of iron (other than cast iron) or steel
		7305 – Other tubes and pipes (for example, welded, riveted or similarly closed), having circular cross-sections, the external diameter of which exceeds 406,4 mm of iron or steel
		7306 – Other tubes, pipes and hollow profiles (for example, open seam or welded, riveted or similarly closed), of iron or steel
		7307 – Tube or pipe fittings (for example, couplings, elbows, sleeves), of iron or steel
		7308 – Structures (excluding prefabricated buildings of heading 9406) and parts of structures (for example, bridges and bridge-sections, lock- gates, towers, lattice masts, roofs, roofing frameworks, doors and windows and their frames and thresholds for doors, shutters, balustrades, pillars and columns), of iron or steel; plates, rods, angles, shapes, sections, tubes and the like, prepared for use in structures, of iron or steel

Aggregated goods category	Product CN Code[3]	Description
		7309 – Reservoirs, tanks, vats and similar containers for any material (other than compressed or liquefied gas), of iron or steel, of a capacity exceeding 300 l, whether or not lined or heat-insulated, but not fitted with mechanical or thermal equipment
		7310 – Tanks, casks, drums, cans, boxes and similar containers, for any material (other than compressed or liquefied gas), of iron or steel, of a capacity not exceeding 300 l, whether or not lined or heat-insulated, but not fitted with mechanical or thermal equipment
		7311 – Containers for compressed or liquefied gas, of iron or steel
		7318 – Screws, bolts, nuts, coach screws, screw hooks, rivets, cotters, cotter pins, washers (including spring washers) and similar articles, of iron or steel
		7326 – Other articles of iron or steel

The aggregated goods categories listed in Table 2-1 include both finished goods and precursor goods (intermediate products) that are consumed in the production of iron or steel products. The system boundaries specified in the Methodology Act do not mention explicitly which precursors are relevant for the production process. Therefore, Table 2-2 should help to identify the possible precursors by aggregated goods category and production route.

Table 2-2: Aggregated goods categories, their production routes and possible precursors

Aggregated Goods Category ***Production route***	**Precursors**
Sintered Ore	None
Ferro alloys (FeMn, FeCr, FeNi)	Sintered ore, if used in the process.
Pig iron *Blast furnace route* *Smelting reduction*	Hydrogen, sintered ore, ferro alloys, pig iron/DRI (the latter if obtained from other installations or production processes and used in the process).
Direct Reduced Iron (DRI)	Hydrogen, sintered ore, ferro alloys, pig iron/DRI (the latter if obtained from other installations or production processes and used in the process).
Crude steel *Basic oxygen steelmaking*	Ferro alloys, pig iron, DRI, crude steel (the latter if obtained from other installations or production processes and used in the process).

Aggregated Goods Category *Production route*	Precursors
Electric arc furnace	
Iron or steel products	Ferro alloys, pig iron, DRI, crude steel, iron or steel products (if used in the process).

Not all precursors will apply in every case. For example, hydrogen may only become relevant in the future.

Note in particular that in some cases an aggregated goods category may be precursor for its own category. This is best explained by an example:

> **Example**: If an installation produces screws and nuts from steel rods, then the rods are the precursor, but both rods and screws and nuts are included in the same aggregated goods category (iron or steel products).
>
> The embedded emissions of the screws and nuts (whose CN codes share the first four digits, 7318) will be composed of the emissions of the production process (heat applied for making the rods workable, and for annealing of the final product) plus the embedded emissions of the steel rods. Note that this is important because the mass of the precursor rods and the mass of the final product screws and nuts will not be the same – if e.g. 20% of the original mass are cut away (and disposed of as scrap), 100 t precursor are required for 80 t of final product.

Some types of iron or steel product have been excluded from the scope of the CBAM. In particular, these include certain other types of ferro alloys under CN 7202[8] and CN 7204 – ferrous waste and scrap.

The production of iron and steel sector goods is by a number of different production processes and routes, outlined below.

2.2.3 Definition and explanation of relevant production processes and emissions covered

The system boundaries of precursors and basic iron and steel finished goods are distinct and may, under certain conditions, be added together to include all processes directly or indirectly linked to the production processes for these goods, including input activities to the process, and output activities from the process in line with the definitions of functional units, system boundaries and precursors for the iron and steel aggregated goods categories in Annex I, points 3.11 to 3.16, and the rules on attributing emissions to goods in Annex III of the Methodology Act. For the goods under the aggregated goods categories crude steel and iron or steel products, where different functional units that only differ in size or shape are produced with the same precursors in types, quantities and proportions, a single

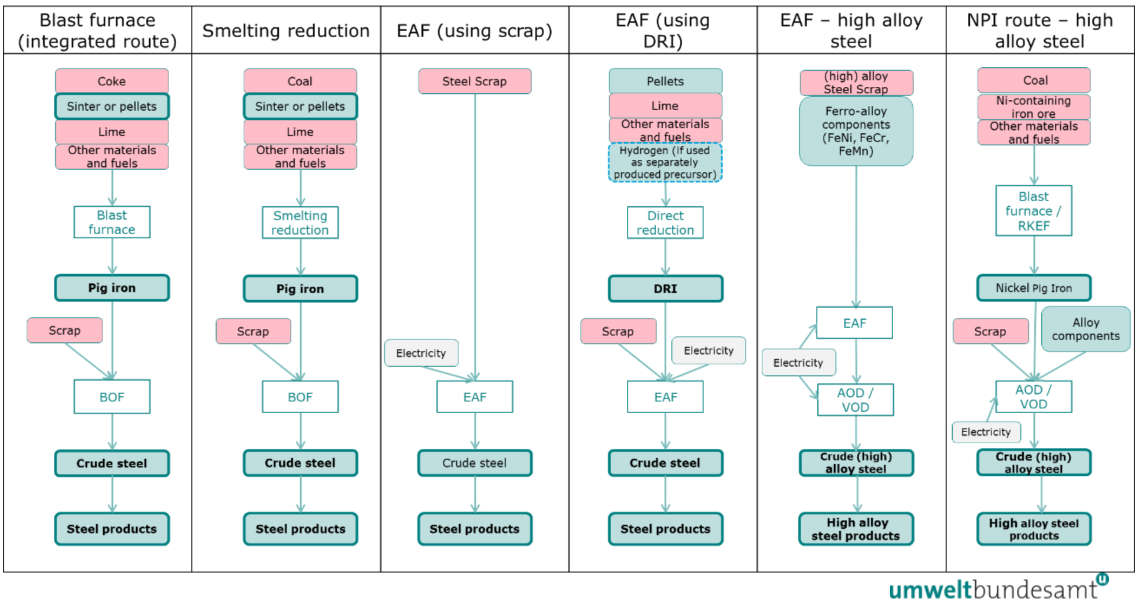
8 Other ferro-alloys not covered by CBAM include ferro-silicon, ferro-silico-manganese, ferro-silico-chromium, ferro-molybdenum, ferro-tungsten and ferro-silico-tungsten etc.

multifunctional production process shall be defined for that group of goods and the relevant attribution rules shall apply.

Where iron and steel CBAM goods are complex goods and precursors are received (i) under a given CN code produced during different reporting periods and/or (ii) from multiple installations, embedded emissions shall, by default, be determined using the weighted-average rules, with deviation from the default allowed only where sufficient evidence supports more granular attribution to a specific installation or subset of installations.

In addition (where indirect emissions are relevant to precursors or other non-Annex II goods produced at the installation), where electricity is received from multiple sources, indirect emissions shall be determined, by default, using a weighted average of the emission factors of each electricity source (with a limited possibility to determine indirect emissions for a production process based only on one source or a subset of sources, where sufficient evidence is provided).

Figure 2-1: System boundaries and value chain for the production of iron or steel products.



Notes to figure:

- In this figure, the green boxes with a blue dashed outline (e.g. Hydrogen (if used as separately produced precursor)) represent optional precursors or process steps that are only included where they are actually used at the installation.
- Functional unit for iron and steel goods: tonnes of goods under the same CN code.
- Electricity (shown as a system-boundary input only in some cases in this figure): Electricity may be consumed in several production steps (e.g. EAF-based routes). Indirect emissions from electricity are not included in embedded emissions for iron and steel goods listed in Annex II to the CBAM Regulation (direct emissions only).
- Averaging across routes: Where goods with the same functional unit are produced via more than one production route within an installation, specific embedded emissions shall be determined using a weighted average across those routes.
- Precursors: Where iron and steel goods are complex goods, embedded emissions include the embedded emissions of precursors; where indirect emissions are relevant to a precursor (e.g., sintered ore), those indirect emissions are included in the final goods' embedded emissions even if the final iron/steel good is direct-only.

Where actual embedded emissions are calculated, the operator shall prepare an operator's emissions report and a summary thereof, and, where embedded emissions of electricity are calculated based on actual emissions, a declarant-specific addendum. The operator's emissions report shall be submitted in English.

The following Figure 2-1 provides an overview of the different production processes and process routes by which iron or steel CBAM goods are produced.

The production of precursor and finished goods is by a number of different process routes, outlined in the following sections. The relevant emissions that must be monitored for the iron and steel sector are detailed in section 3.1.1 of this document.

2.2.3.1 Sintered ore production process

This aggregated goods category includes all kinds of iron ore pellet production (for sale of pellets as well as for direct use in the same installation) and sinter production. Pelletisation and sintering are complementary process routes for preparing and agglomerating iron oxide raw materials for use in iron and steel making. In pelletisation, iron oxide raw materials are ground and combined with additives to form pellets, which are then thermally treated. In sintered ore production, iron oxide raw materials are mixed with coke breeze and other additives before the mixture is sintered together in a kiln, forming a porous material similar to clinker, called 'sinter'. Sinter is typically produced and used at the steelworks. Pellets may be produced at the steelworks or at a distance at mine sites.

Note that to the extent covered by CN code 2601 12 00, iron ores used as precursors for ferro-chromium (FeCr), ferro-manganese (FeMn) or ferro-nickel (FeNi) may also be covered by this aggregated goods category.

The Methodology Act (Annex I, point 3.11.2)) defines the system boundaries for direct emissions monitoring for the sintered ore production route, as encompassing:

> *" – All processes emitting CO_2 from process materials such as limestone and other carbonates or carbonate ores.*
>
> *– All processes emitting CO_2 from all fuels including coke, waste gases such as coke oven gas, blast furnace gas or converter gas; directly or indirectly linked to the production process, and materials used for flue gas cleaning."*

There are no other CBAM goods commonly used as precursors for this production process. Note that the system boundaries for sintered ore includes indirect emissions that result from electricity consumed by the production process for this good.

In line with the above definition of systems boundaries, the following production steps may be regarded as being within the system boundaries of iron ore pellet and sinter production:

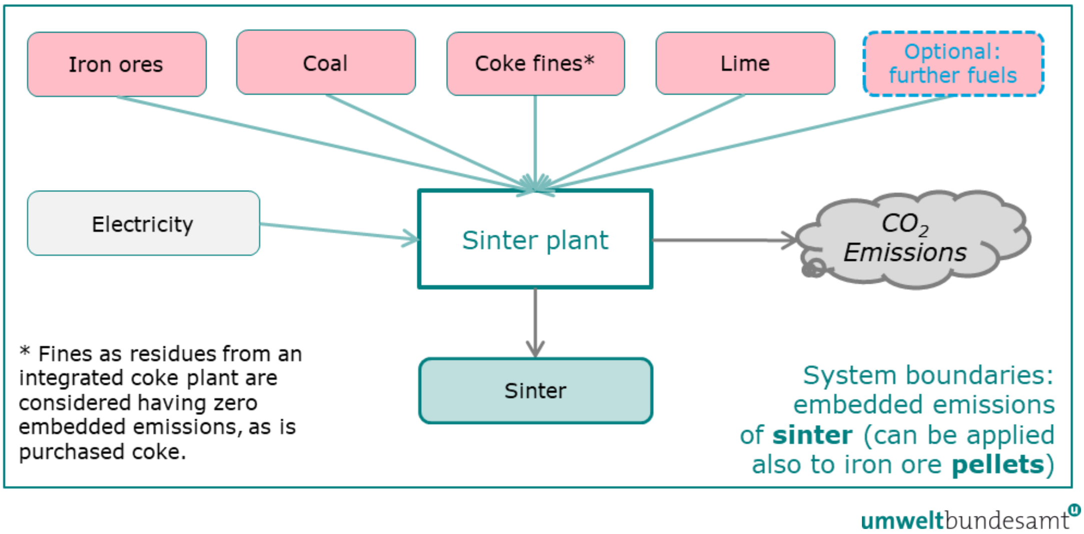
- Raw material handling and pre-treatment – drying and grinding of iron ore raw materials.
- Blending and mixing of raw materials – preparation of raw mixture for pellets and for sinter. Storage of raw mix in bunkers or hoppers at the start of the process.
- Iron ore pellets only – forming into pellets and thermal treatment, screening.

- Sintered ore only – raw material preparation, sintering in a furnace, followed by crushing, screening, conveying and cooling.

- Emissions control – in particular waste gas treatment.

The following *Figure 2-2* shows the system boundaries of the sinter (or iron ore pellets) production process.

Figure 2-2: System boundaries: embedded emissions of sintered ore (sinter and pellets)



Notes to figure:

- Electricity consumed by the production process is included in embedded emissions for this good.

2.2.3.2 Ferro-alloy FeMn, FeCr, and FeNi production processes

This process covers the production of the alloys ferro-manganese (FeMn), ferro-chromium (FeCr), ferro-nickel (FeNi), identified under CN codes 7202 1, 7202 4 and 7202 6. Other iron materials with significant alloy content such as spiegeleisen are not covered here. However, nickel pig iron (NPI) is included if the nickel content is greater than 10%; if nickel content is less than 10% then NPI is covered by the pig iron – blast furnace production route.

The different ferro-alloys are produced by reductive smelting with the addition of a reducing agent such as coke to the EAF, along with other additives. Different types of EAF may be used, depending on the ferro-alloy production process; Ferro-nickel has an additional calcination and pre-reduction production step prior to smelting. Following EAF smelting, liquid metal alloy is tapped and cast in moulds and the solidified metal is then crushed or granulated, depending on customer requirements.

The Methodology Act (Annex I, point 3.12.2) defines the system boundaries for direct emissions monitoring for ferro-alloys FeMn, FeCr and FeNi production processes, as encompassing:

> *" – All processes directly or indirectly linked to the production processes emitting CO_2 emissions caused by fuel inputs, irrespective of whether they are used for energetic or non-energetic use.*

– All processes directly or indirectly linked to the production processes emitting CO_2 emissions from process inputs such as limestone and from flue gas cleaning.

– All processes directly or indirectly linked to the production processes emitting CO_2 emissions from the consumption of electrodes or electrode pastes.

– Carbon remaining in the product or in slags or wastes is taken into account by using a mass balance method in accordance with point B.3.2 of Annex II to the Methodology Act."

No precursors are specified for this production process in Annex I, point 3.12 of the Methodology Act adopted under Article 7(7) of the CBAM Regulation.

Indirect emissions that result from electricity consumed by the production process were required to be monitored and reported during the transitional period. In the definitive period, indirect emissions are not taken into account in the embedded emissions of ferro-alloys for CBAM purposes, as indirect emissions are taken into account only for goods not listed in Annex II to the CBAM Regulation (Article 3(2) of the Methodology Act). Electricity may still be consumed in the production process and recorded for operational/energy balance purposes but is not included in embedded emissions for these goods where only direct emissions apply.

In line with the above definition of systems boundaries, the following production steps may be regarded as being within the system boundaries of ferro-alloy installations:

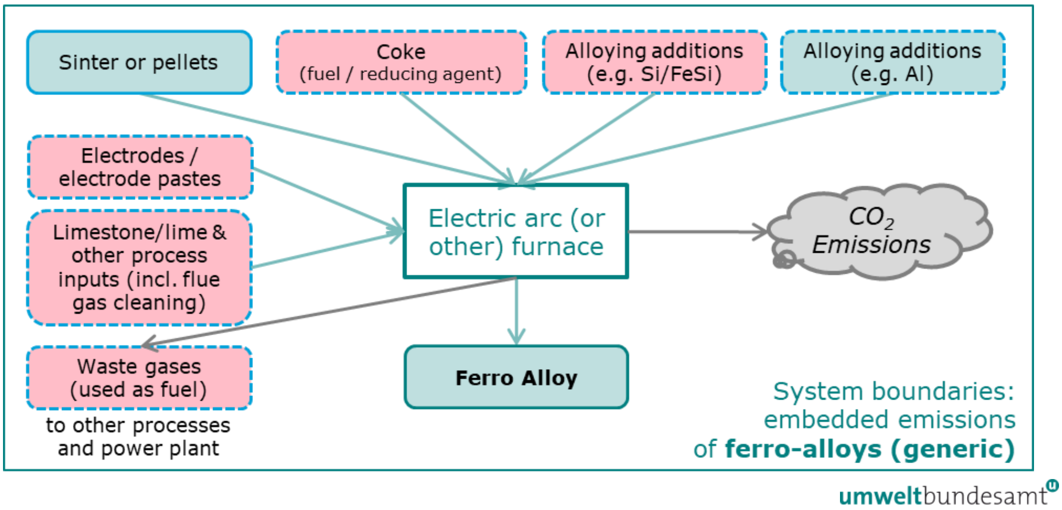
- Raw material handling and pre-treatment – pellets and sinter for FeMn and FeCr, calcination and pre-reduction in a rotary kiln for FeNi.
- EAF process – all steps for the EAF process, including charging, melting, primary refining and tapping of the primary furnace.
- Decarburisation and secondary metallurgy – if required to produce ferro-alloys with different carbon contents.
- Casting plant – including casting and cutting, casting ingots pre-heating stands.
- Crushing and granulation.
- Emissions control – for treating releases to air, water or ground, including dedusting units, post-combustion unit, slag handling.

The following *Figure 2-3* shows the system boundaries of the relevant ferro-alloy production processes.

The mass balance method is to be used to give a complete balance of the amount of carbon entering or leaving the EAF production process (carbon remaining in the ferro-alloy product, in wastes or in slag) in line with point B.3.2 of Annex II to the Methodology Act. For ferro-alloy CBAM goods listed in Annex II to the CBAM Regulation, only direct emissions are included in embedded emissions; indirect emissions from electricity consumption are not included.

Figure 2-3: System boundaries of Ferro-alloy production processes.

Ferro-alloy production process – EAF reductive smelting



Notes to figure:

- CO_2/CO in waste gases: Where waste gases contain CO and are emitted without abatement, the CO component is treated as the molar equivalent of CO_2 for the purpose of determining direct emissions (i.e. counted as CO_2e on a molar basis), in line with the Methodology Act's rules for fuel/waste-gas streams.
- Indirect emissions/electricity: Ferro-alloy goods are treated as "direct emissions only" goods for CBAM purposes (Annex II to the CBAM Regulation). Accordingly, electricity may be consumed by the process, but indirect emissions from electricity are not included in embedded emissions for these goods; any electricity references in the figure should be read as operational inputs rather than system-boundary components for embedded emissions.
- Optional inputs: Inputs shown with blue dashed outlines are illustrative/optional (used only where they are actually applied in the installation's process route) and do not introduce any standalone "threshold" rule for inclusion. Materials in green boxes have embedded emissions (precursor materials and final products, i.e. goods under the CBAM). Materials which are considered to have no embedded emissions are shown in pink boxes.
- System-boundary reminder: Direct-emissions system boundaries include (as applicable) fuel inputs (energetic and non-energetic use), process inputs such as limestone/carbonates and flue-gas cleaning materials, and emissions from consumption of electrodes/electrode pastes, with carbon retained in products/slag/wastes accounted for via mass balance where required.

2.2.3.3 Pig iron – Blast furnace production route

The blast furnace production route produces liquid pig iron ("hot metal") that may be alloyed (e.g. spiegeleisen and nickel pig iron or NPI[9]) or non-alloyed. The main production unit for this production process is the blast furnace. Inputs into the blast furnace include iron ore pellets or sintered ore, fuels and other raw materials including those used as reducing agents. Inside the blast furnace iron oxide is reduced to iron metal. The hot metal produced is then tapped and is either cast or is directly converted to crude steel in a sequential step by the basic oxygen converter. This step is covered under a different production process, the crude steel – basic oxygen steelmaking production route.

The Methodology Act (Annex II, point 3.13.2.1, in conjunction with points B.3.2 and B.3.3 of Annex III) defines the system boundaries for direct emissions monitoring for the pig iron – Blast furnace production route, as encompassing:

[9] NPI is covered by this production process if the nickel content is lower than 10%, otherwise if more than 10% it is covered under the ferro-alloy production process.

“ – All processes directly or indirectly linked to the production processes emitting CO_2 from fuels and reducing agents such as coke, coke dust, coal, fuel oils, plastic wastes, natural gas, wood wastes, charcoal, as well as from waste gases such as coke oven gas, blast furnace gas or converter gas.

– Where biomass is used, the provisions of Section B.3.3 of Annex II shall be taken into account.

– All processes directly or indirectly linked to the production processes emitting CO_2 from process materials such as limestone, magnesite, and other carbonates, carbonate ores; materials for flue gas cleaning.

– Carbon remaining in the product or in slags or wastes is taken into account by using a mass balance method in accordance with Section B.3.2 of Annex II.”

Precursors (if used in the process) are: sintered ore; pig iron or DRI from other installations or production processes; ferro-alloys FeMn, FeCr, FeNi; and hydrogen, if used. Indirect emissions that result from electricity consumed by the production process were monitored and reported separately during the transitional period but are not taken into account in the embedded emissions of pig iron under the definitive-period CBAM rules.

In line with the above definition of systems boundaries, the following production steps may be regarded as being within the system boundaries of blast furnace installations:

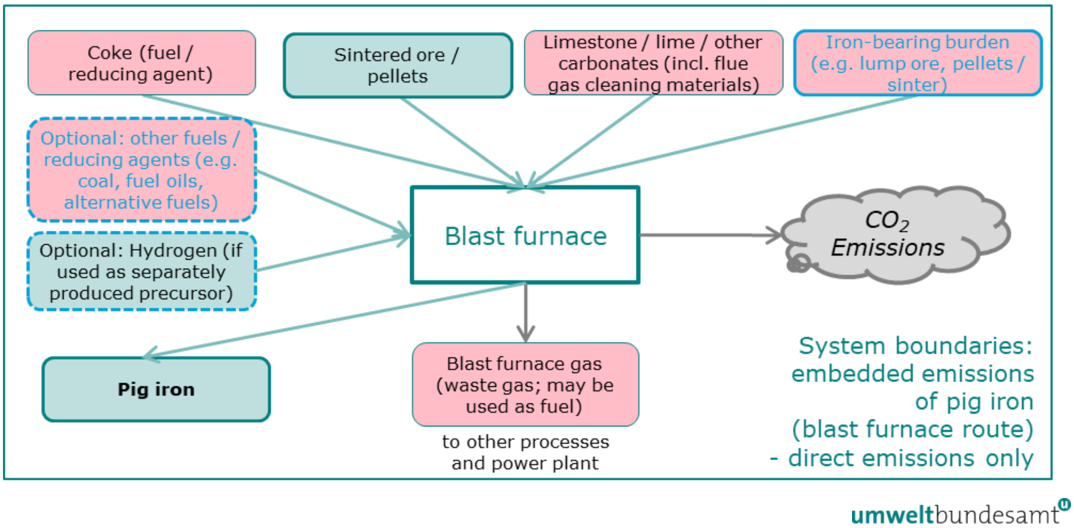
- Raw material handling and pre-treatment.
- Fuel storage and preparation – e.g. coal drying and preparation for pulverized coal injection (PCI), vessels preheating stands.
- Hot metal production – all steps for the blast furnace process resulting in liquid pig iron, the main unit being the Blast furnace, along with hot metal treatment units, blast furnace blowers, blast furnace hot stoves, compressed air production, steam injection in the blast furnace unit, steam generation plant, etc.
- Emissions control – for treating releases to air, water or ground, including slag treatment, waste gas treatment, dedusting units, dust briquetting.
- Miscellaneous not covered above.

The following *Figure 2-4* shows the system boundary for the blast furnace production route.

If all the liquid pig iron from the blast furnace is used by the oxygen steelmaking process to produce crude steel, the Methodology Act (Annex I, point 3.13.1) allows the operator to define a joint production process including crude steel, subject to the rules of Article 4, rather than monitoring pig iron production as a separate production process.

The mass balance method is to be used to give a complete balance of the amount of carbon entering or leaving the production process (carbon remaining in the product, or in wastes or slags). This method is defined in point B.3.2 of Annex II to the Methodology Act.

Figure 2-4: System boundaries of the Pig iron – Blast furnace production route.



Note to figure:

- Hydrogen is shown as an optional input where hydrogen is used as a reducing agent and is treated as a precursor in line with Annex I, point 3.13.2.1 of the Methodology Act.
- Indirect emissions from electricity are not included in embedded emissions for pig iron (direct emissions only), as pig iron is listed in Annex II to the CBAM Regulation; electricity may nevertheless be consumed and recorded for operational/energy balance purposes.
- Where blast furnace gas or other waste gases are used as fuels, the associated CO_2 emissions fall within the system boundaries as fuel-related emissions.

2.2.3.4 Pig iron – Smelting reduction production route

Smelting reduction produces pig iron from precursor sintered ore, iron ore pellets, or ironmaking residues, using different fuels and reducing agents. The process comprises two steps, the reduction of iron ore followed by melting to produce liquid pig iron / hot metal.

The Methodology Act (Annex I, point 3.13.2.2 ("Smelting reduction") to the Methodology Act) defines the system boundaries for direct emissions monitoring for the pig iron – smelting reduction production route, as encompassing:

> *" – All processes directly or indirectly linked to the production processes emitting CO_2 from fuels and reducing agents such as coke, coke dust, coal, fuel oils, plastic wastes, natural gas, wood wastes, charcoal, waste gases from the process or converter gas.*
>
> *– Where biomass is used, the provisions of point B.3.3 of Annex II shall be taken into account.*
>
> *– All processes directly or indirectly linked to the production processes emitting CO_2 from process materials such as limestone, magnesite, and other carbonates, carbonate ores; materials for flue gas cleaning.*
>
> *– Carbon remaining in the product or in slags or wastes is taken into account by using a mass balance method in accordance with point B.3.2 of Annex II."*

Precursors (if used in the process) are: sintered ore; pig iron or DRI from other installations or production processes; ferro-alloys FeMn, FeCr, FeNi; and hydrogen, if used. During the transitional period, indirect emissions that result from electricity consumed by the production process also had to be monitored and reported. In the definitive period, indirect emissions are not taken into account for the calculation of embedded emissions of iron and steel CBAM goods listed in Annex II ("List of goods for which only direct emissions are to be taken into account") to the CBAM Regulation.

The mass balance method referred to above is used to give a complete balance of the amount of carbon entering or leaving the production process (including carbon remaining in the product, or in wastes or slags), in accordance with point B.3.2 of Annex III to the Methodology Act.

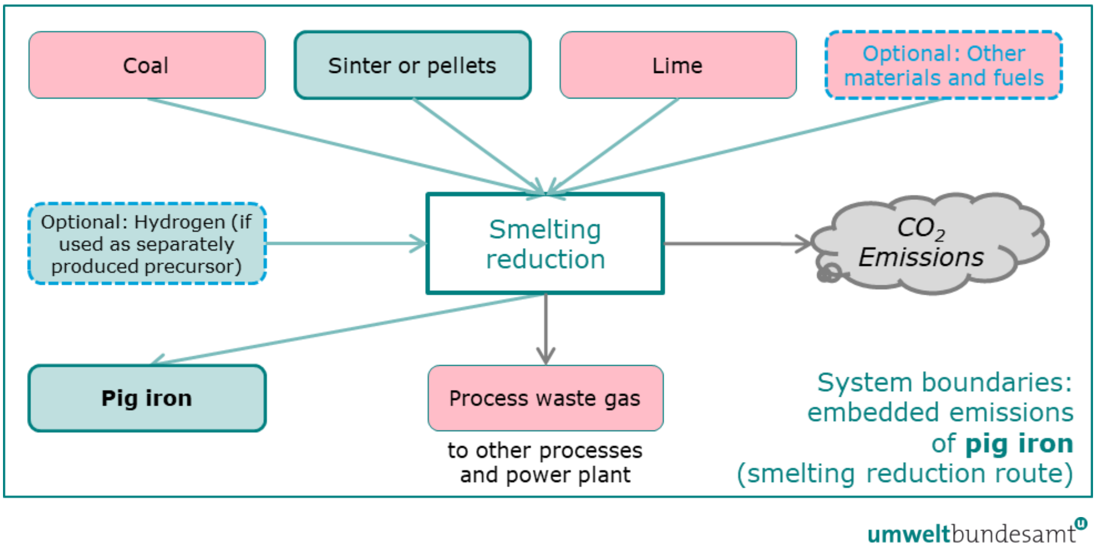
In line with the above definition of systems boundaries, the following production steps may be regarded as being within the system boundaries of smelting reduction installations:

- Raw material handling and pre-treatment.
- Fuel storage and preparation.
- Smelting reduction process – all steps for the smelting process, resulting in hot metal.
- Casting plant.
- Emissions control – in particular flue gas cleaning.

The following *Figure 2-5* shows the system boundaries of the smelting reduction process for producing pig iron.

The mass balance method is to be used to give a complete balance of the amount of carbon entering or leaving the production process (as carbon remaining in the product, or in wastes or slags) in accordance with point B.3.2 of Annex II to the Methodology Act.

Figure 2-5: System boundaries of the Pig iron – smelting reduction production route.



Note to figure:

- In this figure, the boxes with a blue dashed outline (e.g. Hydrogen (if used as separately produced precursor) and Optional: other materials and fuels) represent optional inputs that are included only where they are actually used at the installation.
- Functional unit for iron and steel goods: tonnes of goods under the same CN code.
- Electricity: Electricity may be consumed in smelting reduction operations (e.g. for auxiliaries) and may be recorded for energy balance; indirect emissions from electricity are not included in the embedded emissions for iron and steel goods listed in Annex II to the CBAM Regulation (direct emissions only).
- Precursors: Where pig iron is produced as a complex good using precursors, embedded emissions include the embedded emissions of those precursors in accordance with the rules on precursors in the Methodology Act; where indirect emissions are relevant to a precursor, those indirect emissions are included in the precursor's embedded emissions even if pig iron is direct-only.

2.2.3.5 Direct Reduced Iron (DRI) production process

Direct reduction involves the production of solid primary iron from high grade iron ores (pellets, sinter or concentrates). There are different technologies that may use different qualities of ores (which may require pelletisation or sintering) and different fuels and reducing agents (natural gas, diverse fossil fuels or biomass, hydrogen). The solid product is called direct reduced iron (DRI). Different types of DRI are produced, for example 'iron sponge' and hot briquetted iron (HBI). Some DRI is used directly as a feedstock in EAFs or for other downstream processes. It is expected that production routes using hydrogen will play a major role in decarbonising the steel industry in coming years.

The Methodology Act (Annex I, point 3.14 ("DRI (Direct Reduced Iron)") defines the system boundaries for direct emissions monitoring for the DRI production route, as encompassing:

> *" – All processes directly or indirectly linked to the production processes emitting CO_2 from fuels and reducing agents such as natural gas, fuel oils, waste gases from the process or converter gas, etc.*
>
> *– Where biogas or other forms of biomass are used, the provisions of point B.3.3 of Annex II shall be taken into account.*

– All processes directly or indirectly linked to the production processes emitting CO_2 from process materials such as limestone, magnesite, and other carbonates, carbonate ores; materials for flue gas cleaning.

– Carbon remaining in the product or in slags or wastes is taken into account by using a mass balance method in accordance with point B.3.2 of Annex II."

Precursors (if used in the process) are: sintered ore; hydrogen; pig iron or DRI from other installations or production processes; and ferro-alloys FeMn, FeCr, FeNi, if used. During the transitional period, indirect emissions that result from electricity consumed by the production process also had to be monitored and reported. In the definitive period, indirect emissions are not taken into account for the calculation of embedded emissions of iron and steel CBAM goods listed in Annex II to the CBAM Regulation.

In line with the above definition of systems boundaries, the following production steps may be regarded as being within the system boundaries of DRI installations:

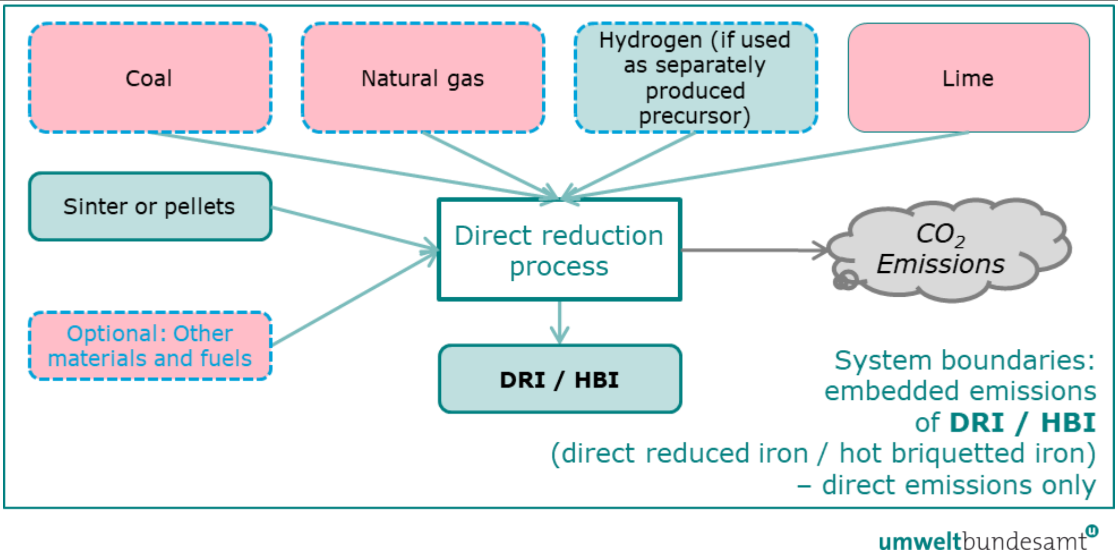
- Raw material handling and pre-treatment.
- Fuel storage and preparation – coal, natural gas or hydrogen etc.
- Direct reduction process for iron production – all steps for the DRI process, forming into hot briquetted iron (HBI) if applicable.
- Emissions control – in particular flue gas cleaning.

The following *Figure 2-6* shows the system boundaries of the relevant processes for DRI production. Although there are several different processes used in practice, the high-level system boundaries are very similar and can therefore be represented on a single diagram.

Note that where an installation does not sell or transfer DRI produced to other installations, a common production process including steelmaking may be defined, in line with Annex I, point 3.14.1 of the Methodology Act, so that emissions are monitored at the level of the joint production process rather than for DRI separately.

The mass balance method is to be used to give a complete balance of the amount of carbon entering or leaving the production process (as carbon remaining in the product, or in wastes or slags).

Figure 2-6: System boundaries of the DRI production process



Note to figure:

- Boxes with a blue dashed outline represent optional inputs that are only included where they are actually used at the installation (e.g. hydrogen where it is used as a reducing agent/precursor).
- Electricity may be consumed in the process (recorded for energy balance); indirect emissions from electricity are not included in embedded emissions for iron and steel goods listed in Annex II to the CBAM Regulation (direct emissions only).

2.2.3.6 Crude steel – Basic oxygen steelmaking production route

If the basic oxygen steelmaking production route starts with hot metal (liquid pig iron); the hot metal is directly converted to crude steel by the basic oxygen converter or furnace (BOF) as part of a continuous process. Following the converter, a steel decarburisation process by argon oxygen decarburisation (AOD) or vacuum oxygen decarburisation (VOD) may be performed, followed by various secondary metallurgical processes such as vacuum degassing to remove dissolved gases. Crude steel is then cast into its primary forms by continuous casting or ingot casting, which may be followed by hot-rolling or forging to obtain the semi-finished crude steel products (under CN codes 7207, 7218 and 7224).

The Methodology Act (Annex I, point 3.15.2.1) defines the system boundaries for direct emissions monitoring for the Crude steel – basic oxygen production route, as encompassing:

> *" – All processes directly or indirectly linked to the production processes emitting CO_2 from fuels such as coal, natural gas, fuel oils, waste gases such as blast furnace gas, coke oven gas or converter gas.*
>
> *– All processes directly or indirectly linked to the production processes emitting CO_2 from process materials such as limestone, magnesite, and other carbonates, carbonate ores; materials for flue gas cleaning."*
>
> *– Carbon entering the process in scrap, alloys, graphite etc. and carbon remaining in the product or in slags or wastes is taken into account by using a mass balance method in accordance with point B.3.2 of Annex II to the Methodology Act."*

Precursors (if used in the process) are: pig iron, DRI; ferro-alloys FeMn, FeCr, FeNi; and crude steel from other installations or production processes, if used. During the transitional period, indirect emissions that result from electricity consumed by the production process also had to be monitored and reported. In the definitive period, indirect emissions are not taken into account for the calculation of embedded emissions of iron and steel CBAM goods listed in Annex II to the CBAM Regulation.

In line with the above definition of systems boundaries, the following production steps may be regarded as being within the system boundaries of basic oxygen steelmaking installations:

- Basic oxygen converter or furnace (BOF).
- Decarburisation – AOD or VOD processes, where relevant.
- Secondary metallurgy and vacuum degassing.
- Casting plant – continuous casting or ingot casting, preheating equipment.
- Hot rolling or forging – where relevant, only primary hot-rolling and rough shaping by forging to obtain the semi-finished products.
- All necessary auxiliary activities – such as transfers, re-heating.
- Emissions control – in particular flue gas cleaning, dedusting units, slag handling.

Note that only primary hot-rolling and rough shaping by forging to obtain the semi-finished products under CN codes 7207, 7218 and 7224 are included in this aggregated goods category. All other rolling and forging processes are included in the aggregated goods category “iron or steel products”.

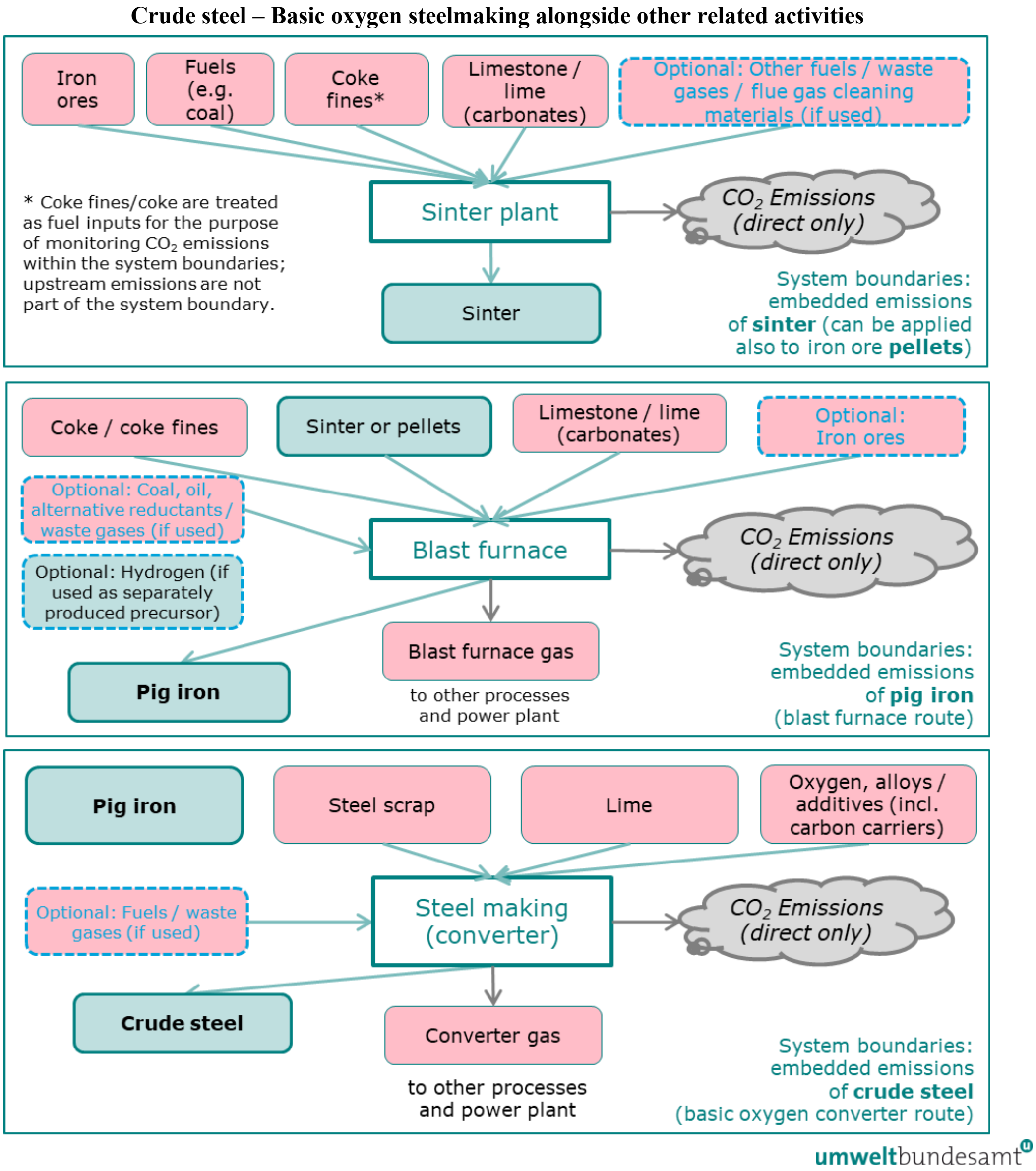
Where goods with the same functional unit are produced via more than one production route within an installation, specific embedded emissions shall be determined using a weighted average across those routes, in accordance with Article 4(6) of the Methodology Act.

In integrated steel plants, liquid pig iron that is directly charged to the oxygen converter is the product which separates the production process for pig iron (bottom left in *Figure 2-7* above) from the production process of crude steel (bottom right, above).

The integrated blast furnace / basic oxygen furnace (BF/BOF) steelmaking process is by far the most complex steel making process and is characterised by networks of interdependent material and energy flows between the various production units. Note that coke (top left) is treated as a raw material with no embedded emissions as a CBAM precursor (as coke is not a CBAM good) under the CBAM methodology; however, its use contributes to the installation’s direct CO_2 emissions within the system boundaries.

When all the liquid pig iron from the blast furnace is used by the oxygen steelmaking process to produce crude steel, the Methodology Act allows the operator to define a joint production process for crude steel making, rather than monitoring the blast furnace production route as a separate production process, provided that the requirements of Article 4 and Annex III of the Methodology Act are met (see also Annex I, point 3.13.1, as applicable).

Figure 2-7: System boundaries of basic oxygen steelmaking and related processes.



Notes to the figure:

- For iron and steel CBAM goods listed in Annex II to the CBAM Regulation, embedded emissions are direct emissions only; indirect emissions from electricity are not included in embedded emissions for these goods. Electricity may be consumed operationally (e.g. for plant operation and energy balance) but is not part of the embedded emissions boundary where the good is direct-only.
- Optional inputs / steps (blue dashed outline): Boxes with a blue dashed outline represent optional inputs or process elements that are included only where they are actually used at the installation.
- Hydrogen as an optional precursor (where shown): Where "Hydrogen" is shown, it indicates that hydrogen, if used as a reducing agent/input in the relevant route at the installation, must be treated as a precursor for embedded-emissions accounting in line with the applicable sector-specific system boundary provisions in Annex I to the Methodology Act.
- Waste gases: Streams such as blast furnace gas and converter gas are shown as process waste gases. Where such gases are used as fuels, they fall within the fuel input boundary for direct emissions monitoring for the relevant production process.
- Functional unit: Functional unit for iron and steel goods is tonnes of goods under the same CN code.
- *BOF (mass balance): BOF indicates that, for the basic oxygen furnace route, carbon entering and leaving the process (including carbon in scrap and alloying/carbon-bearing additions, and carbon remaining in product, slags or wastes) is accounted for using a mass balance method as required by the applicable monitoring rules for the route.

- Averaging across routes within an installation: Where goods with the same functional unit are produced via more than one production route within an installation, specific embedded emissions are determined using a weighted average across those routes (to avoid selective reporting).
- Precursors and embedded emissions: Where iron and steel goods are complex goods, embedded emissions include the embedded emissions of precursors used. Where a precursor's embedded emissions include indirect emissions (only where indirect emissions are applicable to that precursor under the CBAM rules), those are included at the precursor level even if the final iron/steel good itself is direct-only.

The mass balance method is to be used to give a complete balance of the amount of carbon entering or leaving the production process (carbon remaining in steel product, or in wastes and slags). This method is defined in point B.3.2 of Annex III to that Methodology Act.

2.2.3.7 Crude steel – Electric Arc Furnace steelmaking production route

The direct smelting of materials which contain iron is usually performed in an electric arc furnace (EAF). Feedstocks for EAF routes are metallic iron; in particular ferrous scrap[10] and/or Direct Reduced Iron (DRI). Where significant amounts of DRI are used, one of the various EAF-DRI routes applies. Following EAF smelting, a steel decarburisation process by argon oxygen decarburisation (AOD) or vacuum oxygen decarburisation (VOD) may be performed, followed by various secondary metallurgical processes such as desulphurisation and vacuum degassing to remove dissolved gases. Electricity is the main energy input to the EAF.

The Methodology Act (Annex I, point 3.15.2.2 "Electric arc furnace") defines the system boundaries for direct emissions monitoring for the Crude steel – EAF production route, as encompassing:

> *" – All processes directly or indirectly linked to the production processes emitting CO_2 from fuels such as coal, natural gas, fuel oils, as well as from waste gases such as blast furnace gas, coke oven gas or converter gas.*
>
> *– All processes directly or indirectly linked to the production processes emitting CO_2 from the consumption of electrodes and electrode pastes.*
>
> *– All processes directly or indirectly linked to the production processes emitting CO_2 from process materials such as limestone, magnesite, and other carbonates, carbonate ores; materials for flue gas cleaning.*
>
> *– Carbon entering the process, e.g. in the form of scrap, alloys and graphite, and carbon remaining in the product or in slags or wastes is taken into account by using a mass balance method in accordance with Section B.3.2 of Annex II."*

Precursors (if used in the process) are: pig iron, DRI; ferro-alloys FeMn, FeCr, FeNi; and crude steel from other installations or production processes, if used. Indirect emissions resulting from electricity consumption may be monitored for operational/energy-balance purposes in line with the Methodology Act (see in particular Annex II, point D), but for iron and steel goods listed in Annex II to the CBAM Regulation they are not taken into account when determining embedded emissions for CBAM purposes in the definitive period. Where crude steel goods listed in Annex II to the CBAM Regulation include

[10] Where only post-consumer scrap is used, it is assumed to have zero embedded emissions.

precursors that are not listed in Annex II to that Regulation, the indirect emissions of those precursors are included in the embedded emissions of the crude steel good, in accordance with the cross-sectoral rules (Annex I, point 3.1) and the applicable precursor accounting rules. Where a precursor originates in the Union or in exempted countries/territories, its specific embedded emissions (direct and, where applicable, indirect) shall be counted as zero for the complex good calculation, in accordance with Annex III, Section B.

In line with the above definition of systems boundaries, the following production steps may be regarded as being within the system boundaries of EAF steelmaking installations – all relevant activities and production units, such as:

- Raw material handling and pre-treatment– scrap drying and pre-heating of raw materials.
- EAF process – all steps for the EAF process, including charging, melting, primary refining and steel and slag tapping of the primary furnace.
- Decarburisation – AOD or VOD processes, where relevant.
- Secondary metallurgy and vacuum degassing.
- Casting plant – continuous casting or ingot casting, preheating equipment.
- Hot rolling or forging – where relevant, only primary hot-rolling and rough shaping by forging to obtain the semi-finished products.
- All necessary auxiliary activities – such as transfers, heating of equipment, re-heating.
- Emissions control – in particular flue gas cleaning, dedusting units, slag handling.

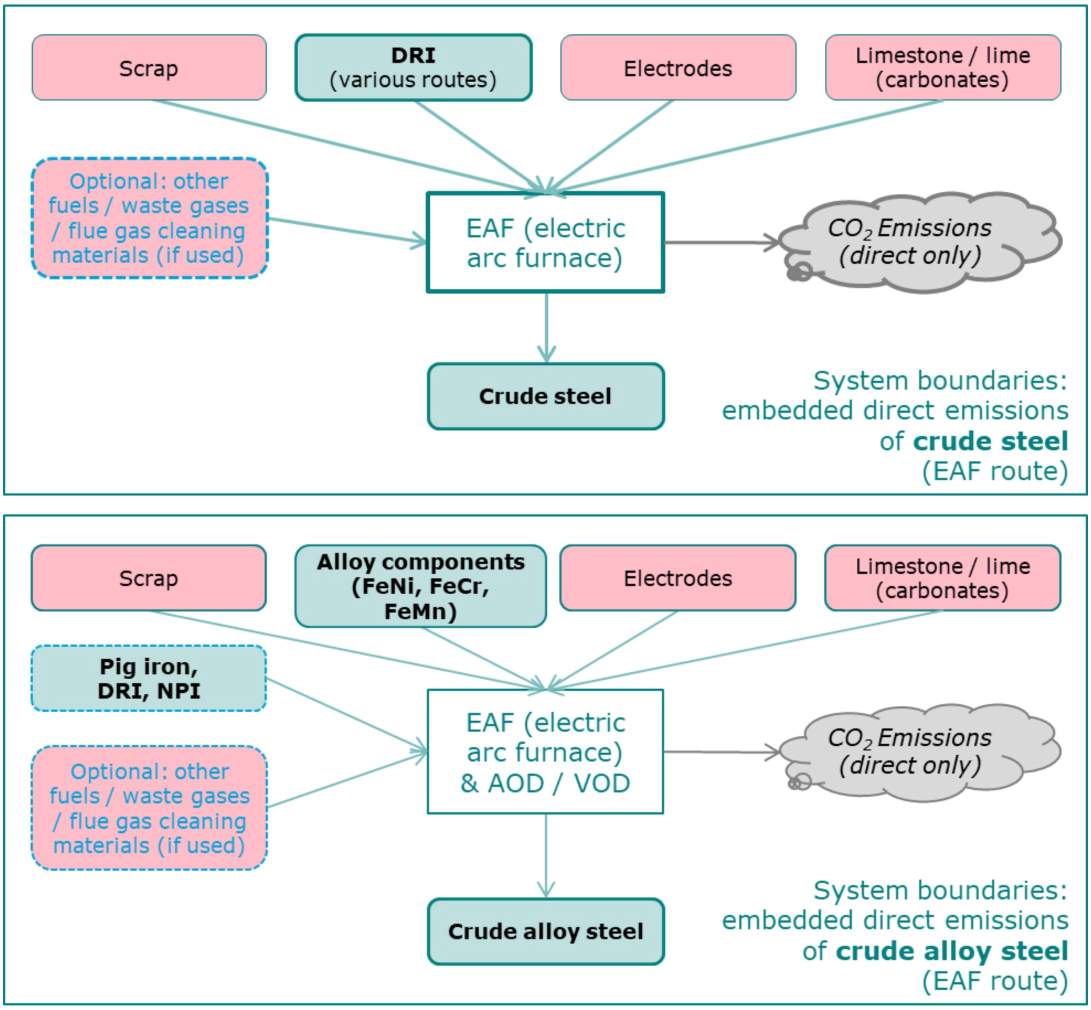
Note that only primary hot-rolling and rough shaping by forging to obtain the semi-finished products under CN codes 7207, 7218 and 7224 are included in this aggregated goods category. All other rolling and forging processes are included in the aggregated goods category “iron or steel products”.

There are several different EAF production routes, for crude steel and crude alloy steel, which are broadly similar and are shown jointly in Figure 2-8**.**

The mass balance method is to be used to give a complete balance of the amount of carbon entering or leaving the EAF production process (carbon remaining in steel, in wastes and in slag). This method is defined in point B.3.2 of Annex III to the Commission Methodology Act.

Figure 2-8: System boundaries: embedded direct emissions of crude steel (EAF route).

Crude steel – EAF alloy and non-alloy steel production route



umweltbundesamt

Footnote to figure:

- Boxes with a blue dashed outline represent optional inputs that are only included where they are actually used at the installation. For iron and steel CBAM goods listed in Annex II to the CBAM Regulation, embedded emissions cover direct emissions only.

2.2.3.8 Iron or steel products production process

Iron or steel products are produced from the further processing of crude steel, semi-finished products, as well as other final steel products by all kinds of forming and finishing steps, including: re-heating, re-melting, casting, hot rolling, cold rolling, forging, pickling, annealing, coating, galvanizing, wire drawing, plating, cutting, welding and finishing.

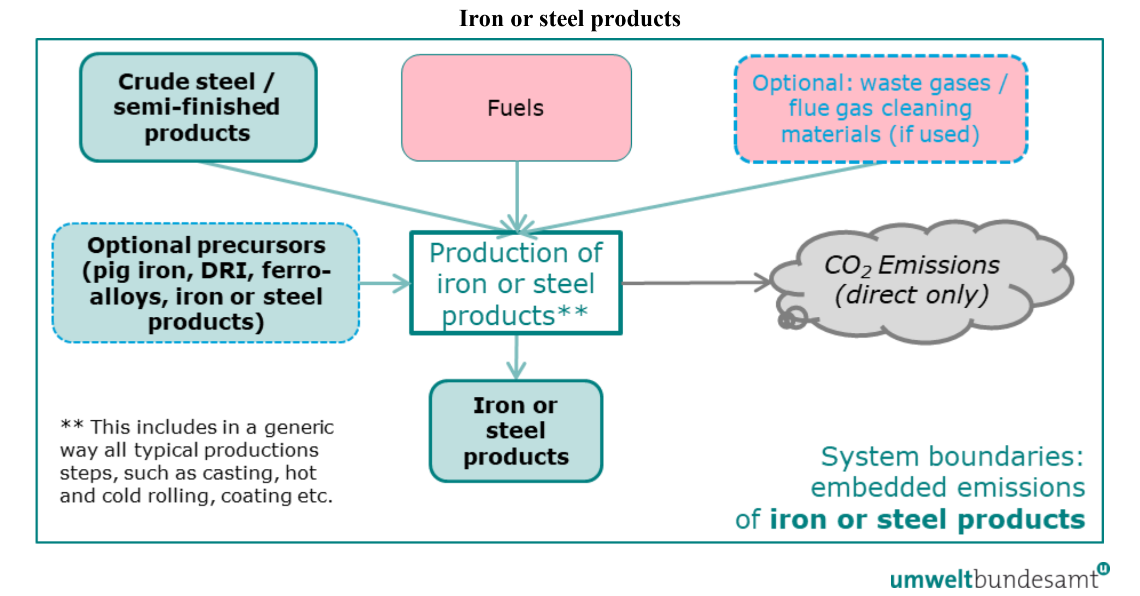
The Methodology Act (Annex I, point 3.16 “Iron or steel products”) defines the system boundaries for direct emissions monitoring for the iron or steel products production route, as encompassing:

> *“ – All processes directly or indirectly linked to the production processes emitting CO_2 emissions from combustion of fuels and process emissions from flue gas treatment, including re-heating, re-melting, casting, hot rolling, cold rolling, forging, annealing, coating, galvanizing, wire drawing, pickling* <u>*and excluding the*</u>

following processes: plating, cutting, welding and finishing of iron or steel products."

Purchase and maintenance of infrastructure and equipment are not included within the system boundaries.

Figure 2-9: System boundaries of the iron or steel products production process (direct emissions)



Note to figure: Boxes with a blue dashed outline represent optional inputs that are only included where they are actually used at the installation. Electricity may be consumed operationally in the production steps shown; for iron and steel goods listed in Annex II to the CBAM Regulation, indirect emissions from electricity are not included in embedded emissions (direct emissions only). The footnote marker on "Production of iron or steel products" indicates that purchase and maintenance of infrastructure and equipment are excluded from the system boundaries

Precursors (if used in the process) are: crude steel; pig iron, DRI; ferro-alloys FeMn, FeCr, FeNi; and other iron or steel products. Indirect emissions resulting from electricity consumption may be monitored in line with the Methodology Act (see in particular Annex II, point D), but for iron and steel goods listed in Annex II to the CBAM Regulation they are not taken into account when determining embedded emissions for CBAM purposes in the definitive period. Where iron or steel products are complex goods produced using precursors, the embedded emissions of the iron or steel products include the embedded emissions of those precursors, including any indirect emissions of electricity associated with the precursors where relevant (i.e. where the precursor is not listed in Annex II to the CBAM Regulation), in line with the cross-sectoral rules.

In line with the above definition of systems boundaries, the following production steps may be regarded as being within the system boundaries of iron or steel products:

- Raw material preparation – including pre-heating, re-melting and alloying.
- Forming processes for iron or steel products – all forming process steps, including casting, hot and cold rolling, shaping by forging, wire drawing.
- Pickling, annealing, coating, galvanizing.
- Emissions control – for treating releases to air, water or ground.

Figure 2-9 shows the system boundaries from crude steel to basic steel products.

3 IRON AND STEEL SECTOR - SPECIFIC REQUIREMENTS

The textbox below signposts sector-specific sections in the Methodology Act, relevant for the CBAM definitive period.

Methodology Act references:

- **Annex I, point 3** – Functional unit and system boundaries. Sub-sections 3.11 to 3.16 (iron and steel sector aggregated goods categories)
- **Annex II, section G** – Standard factors used in the monitoring of direct emissions at installation level, including: Table 1: fuel emission factors related to NCV and net calorific values per mass of fuel, Table 3: stoichiometric emission factor for process emissions from carbonate decomposition, Table 5: Emission factors for process emissions from other process materials (production of iron or steel, and processing of ferrous metals).
- **Annex IV**, **point 2** – Sector-specific parameters to be included in the operator's emissions report.

3.1 Sector-specific requirements for monitoring and reporting

Direct and indirect embedded emissions should be monitored in line with the methodology set out in the Methodology Act.

3.1.1 Emissions monitoring

Relevant emissions that must be monitored and reported for the iron and steel sector are:

- Carbon dioxide emissions (direct) from the fuel combustion process including waste or off-gases such as blast furnace gas (BFG), from stationary units only (excludes emissions from any mobile machinery such as vehicles).

- Carbon dioxide emissions (direct) from the process, resulting from the reduction of iron and steel by reducing agents such as coke or natural gas, from the thermal decomposition of carbonate raw materials[11], from the carbon content of scrap or alloys, graphite[12] or other carbon containing materials entering the process.

- Carbon dioxide emissions (direct) resulting from the production of measurable heating (e.g. steam) and cooling that is consumed within the system boundaries of the production process, regardless of the location of the production of the heat (i.e. from on-site generation or from imports from off-site).

- Carbon dioxide emissions (direct) resulting from emissions control (e.g. from carbonate raw materials such as soda ash used for acidic flue gas cleaning). This is included for any good where this is applicable.

Direct emissions from the different source streams above are not reported separately but are added together to result in the total direct emissions for the installation or production process.

---

[11] Such as limestone, dolomite and carbonatic iron ores, including $FeCO_3$.

[12] Such as graphite blocks used inside the blast furnace, or electrodes or electrode pastes.

In deriving total direct emissions, carbon remaining in aggregated iron and steel goods such as pig iron, DRI, crude steel or iron alloys, or in slags or wastes, is also taken into account by using a mass balance method.

Indirect emissions from electricity consumed must be reported separately from direct emissions. Note that for the iron and steel sector indirect emissions must be reported only for the aggregated good category 'sintered ore', but these have to be included in the embedded emissions of the complex goods for which the sintered ore is used as precursor.

Installations that only carry out excluded processes for iron or steel products

Where the installation only carries out processes excluded from the system boundaries (see section 3.16 of Annex I to the Methodology Act), verification obligations still apply if operators want to use actual values. Notably, the verification process will have to establish the following:

- That the installation only operates within the list of excluded processes
- Whether the production process carried out on the installation changed the specific embedded emissions of the goods:
    - for instance, in an installation where only cutting occurs, to compute embedded emissions of precursors, operators shall use the mass of precursors as **entering the production process** (before cutting), even if emissions from cutting activities will not be accounted for in embedded emissions of the complex good (see point B of Annex III to the Methodology Act). This means that SEE will increase, even if no emissions need to be reported for CBAM purposes.
- That embedded emissions of precursors, whether based on default values or actual values, are correctly calculated. For instance, the origin of precursors needs to be verified (to establish zero-rating if produced in the EU or exempted territories; to justify the use of the appropriate country-specific default values where relevant; to check that verification reports exist for precursors where relevant).

As the installation needs to be verified, the operator will have to establish a monitoring plan. In this case, the monitoring plan might be very concise given the absence of process emissions, combustion emissions, and indirect emissions. Emissions from excluded process steps do not have to be included in the monitoring plan as a source stream and do not have to be reported in the operator's emissions report.

3.1.2 Additional rules

Attribution of emissions

Given the complexity of production processes in the iron and steel sector, **during the definitive period** installations producing two or more goods from the groups sintered ore, pig iron, FeMn, FeCr, FeNi, DRI, crude steel, iron or steel products, may monitor and report embedded emissions defining **one joint production process**, or '**bubble'**, for all the products from these groups covered, if none of the precursors produced within the installation are sold separately.

Simplified!

3.1.3 Additional reporting parameters

The following Table 3-1 lists out the additional information that needs to be provided by you as an operator to importers, in your emissions data communication to them.

Table 3-1: Additional iron and steel sector parameters requested in the CBAM declaration

Aggregated good category	Reporting requirement
Sintered Ore	– N.a. (not applicable)
Pig Iron	– The main reducing agent used. – Mass % of Mn, Cr, Ni, total of other alloy elements.
FeMn Ferro-Manganese	– Mass % of Mn and carbon.
FeCr – Ferro-Chromium	– Mass % of Cr and carbon.
FeNi – Ferro-Nickel	– Mass % of Ni and carbon.
DRI (Direct Reduced Iron)	– The main reducing agent used. – Mass % of Mn, Cr, Ni, total of other alloy elements.
Crude steel	– The main reducing agent of the precursor, if known. – Mass % of Mn, Cr, Ni, total of other alloy elements. – Tonnes scrap used for producing 1 t crude steel. – % of scrap that is pre-consumer scrap.
Iron or steel products	– The main reducing agent used in precursor production, if known. – Mass % of Mn, Cr, Ni, total of other alloy elements. – Tonnes scrap used for producing 1 t of the product. – % of scrap that is pre-consumer scrap.

You need to ensure that you collect all the parameters necessary for your CBAM goods and communicate them to the importers of your goods. The importer will need to report the additional parameters in their annual CBAM declaration for the relevant reporting period.

4 Worked examples for the iron and steel sectors

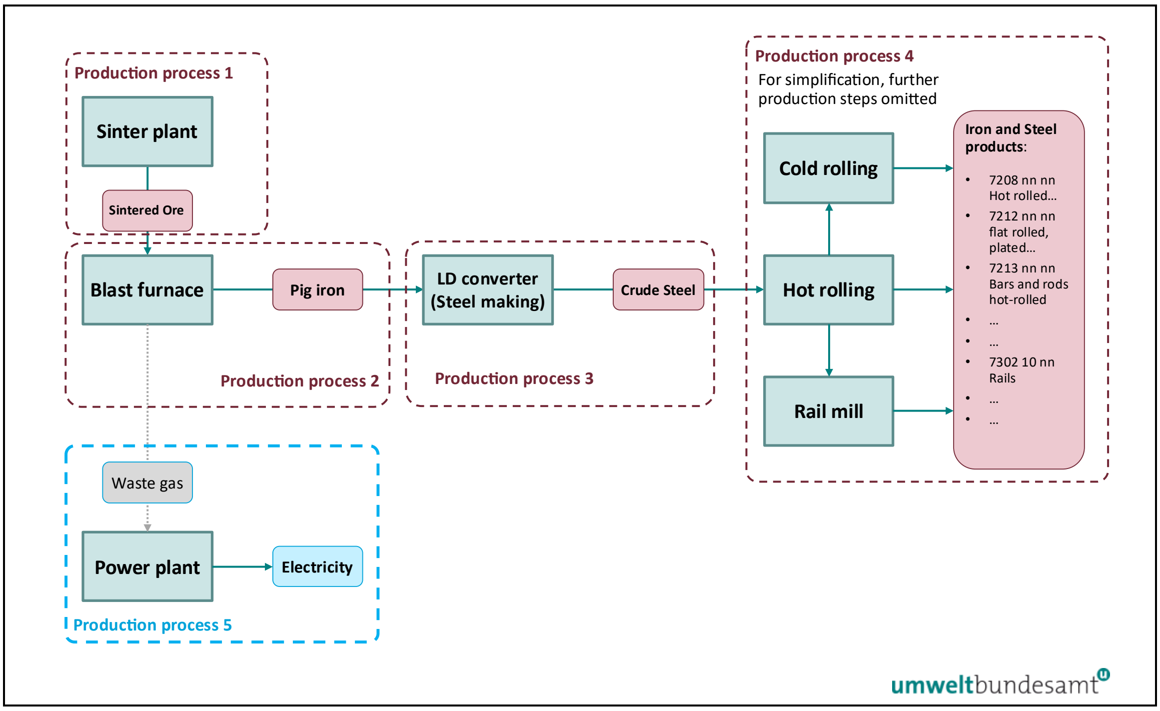
4.1 Example 1 – integrated steel works and conversion to iron or steel products.

The following worked example shows how specific embedded emissions are derived for iron and steel sector goods, produced by the blast furnace/basic oxygen furnace (BOF) route. The resulting embedded emissions of imports into the EU are then calculated at the end of the example for reporting by the importer in their annual CBAM declaration for the relevant reporting period.

In this example for integrated steel making, the installation produces five products, each of which is treated as a separate production process, as each is a separate category of CBAM aggregated good. It is assumed that only CN codes related to carbon steel are produced, which allows limiting the number of production.

The diagram below gives an outline view of the installation and shows the system boundaries as a red (and blue) hatched line for each production process. The physical units carrying out each production process have been grouped under 'Sinter plant', 'Blast furnace', 'LD converter', and under forming as 'Cold rolling, Hot rolling, Rail mill' and 'Power plant'; relevant inputs and outputs have been identified for each production process.

Figure 4-1: Example for carbon steel production, blast furnace route – Overview



The five relevant production processes defined above, and elaborated further in the diagrams below are:

- Production process 1 – sinter[13] (aggregated goods category 'sintered ore') produced in a sinter plant. The system boundaries of this production process have been defined as including inputs of raw materials (iron ore), fuels (coke fines) and electrical energy. The sintered ore output from the process is a precursor for production process 2.

13 CN 26011200 – Agglomerated iron ores and concentrates (excl. roasted iron pyrites)

- Production process 2 – pig iron[14] (hot metal) produced by a blast furnace. The system boundaries of this production process have been defined as including inputs of raw materials lime, coke (which is not a CBAM good, and therefore no precursor, and is treated as having zero embedded emissions for the purposes of this calculation), precursor sintered ore (which has embedded emissions), fuels/reducing agents including coke and plastics waste from households (i.e. a mixed waste fraction containing some biomass). Because indirect emissions are not relevant for pig iron, electrical energy is included only for completeness purposes (its monitoring helps establishing the complete energy balance and is included as 'recommended improvement'). The pig iron output from the process is a precursor for production process 3.

- Production process 3 – crude steel produced by the LD (basic oxygen) converter steelmaking route. The system boundaries of this production process have been defined as including inputs of raw materials lime and steel scrap (which is no CBAM good and therefore treated as having zero embedded emissions for the purposes of this calculation), precursor pig iron (which has embedded emissions), fuels (natural gas), and (like in process 2, only for completeness reasons) electrical energy. The crude steel output from the process is a precursor for production process 4.

- Production process 4 – iron or steel products produced by different forming processes (hot rolling, cold rolling and rail mill)[15] to give basic products such as bars, rods, rails and other rolled products. The system boundaries of this production process have been defined as including inputs of crude steel (which has embedded emissions), fuels (natural gas), and (for completeness purposes only) electrical energy. Outputs from the production process are all within the same aggregated goods category 'iron or steel products' (complex goods produced from the different precursors produced) that are sold.

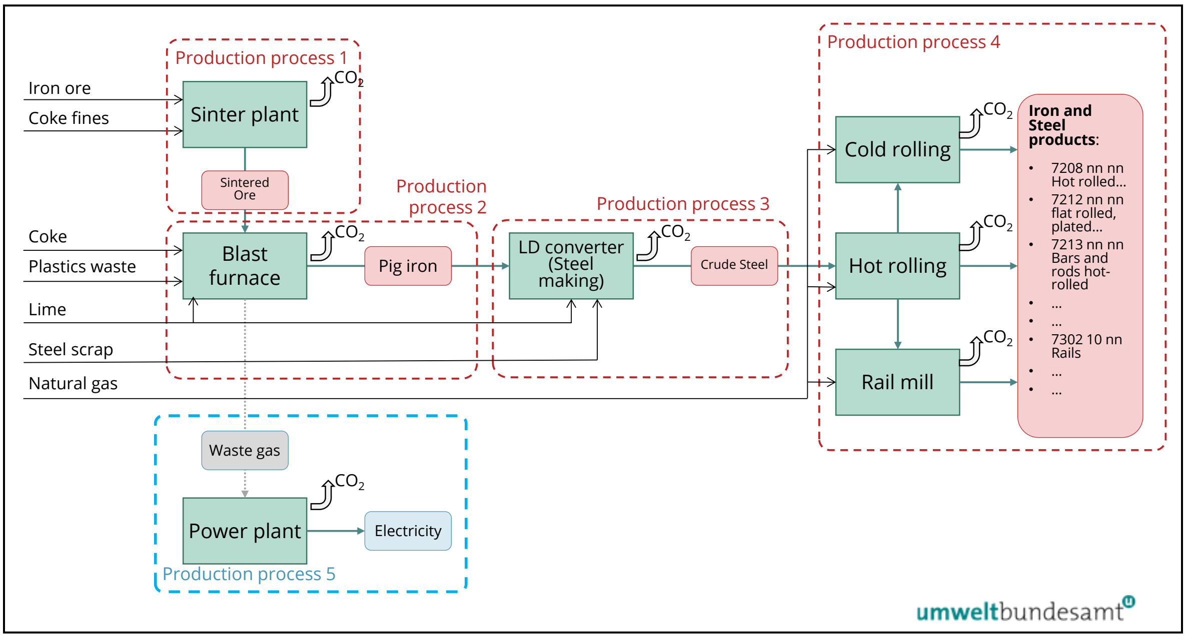
- Production process 5 – electricity produced from waste gas from blast furnace (production process 2). Blast furnace gas is transferred from production process 2 to production process 5 and energy is recovered through the generation of electricity, used for processes 1 to 4, contributing to the indirect emissions of those processes, where relevant.

The *second diagram (Figure 4-2) identifies* the different source streams as inputs into the production processes, giving rise to direct emissions.

[14] CN 7201nnnn (no further distinction seems necessary for the example)

[15] Some of the possible CN codes are given in the graphs. Only carbon steel is produced.

Figure 4-2: *Example for carbon steel production, blast furnace route – Direct emissions and related source streams*

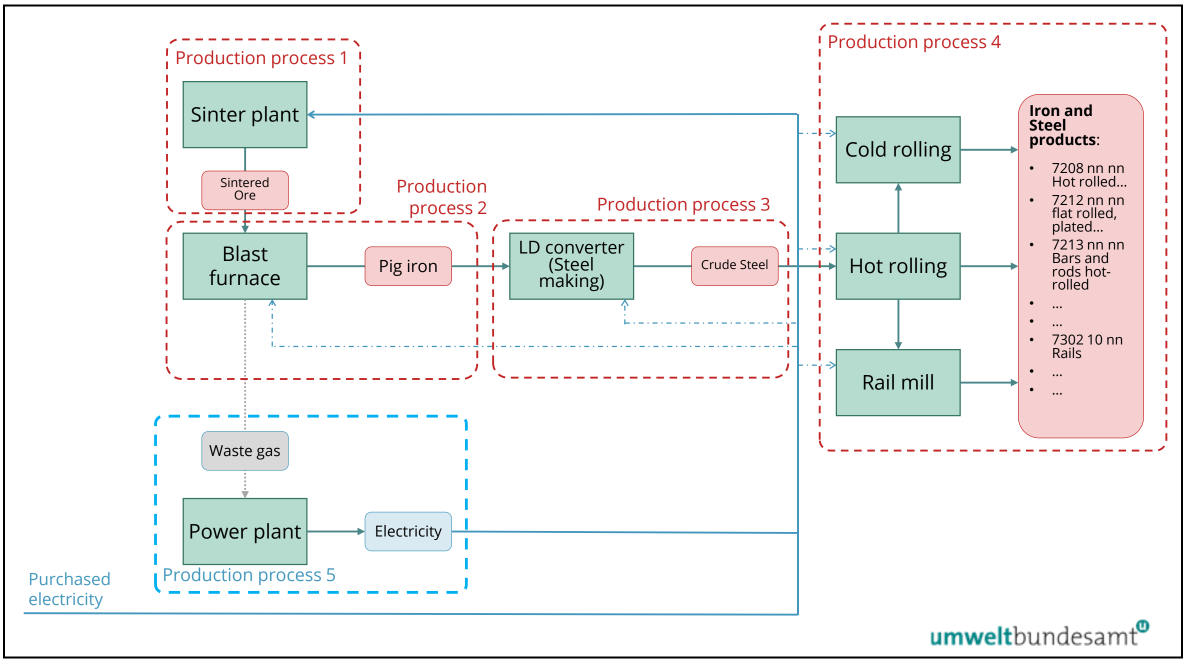


Direct emissions arise from the combustion of fuels (coke fines, plastic wastes, natural gas) and from the waste gas (blast furnace gas) used for power generation, and from process emissions from coke[16] as reducing agent and the thermal decomposition of carbonate-containing materials (such as lime) and from releases of carbon contained within the different iron and steel materials.

The third diagram (Figure 4-3) below shows by the blue line which electricity flows need to be monitored for indirect emissions, resulting from the consumption of electricity produced in the installation and purchased from the grid, consumed by production process 1. The additional electricity monitoring "for completeness only" as outlined above is shown by dashed blue lines.

[16] Coke can also be treated as fuel, although it is primarily used as reducing agent. However, reporting it like a fuel, i.e. including its NCV, has the advantage that it can be included in an energy balance for consistency checking.

Figure 4-3: Example for carbon steel production, blast furnace route – Indirect emissions monitoring (electricity flows) The light blue dashed lines are only monitored for completeness (recommended improvement). The solid blue line represents the essential monitoring requirement for indirect emissions.



Some of the waste gas (blast furnace gas) that is produced by production process 2 is recovered as a fuel for generating electricity through production process 5. This electricity is used within the installation, thereby reducing the amount of imported grid electricity that is required. The assumption in this example is that the produced electricity is 100% consumed within the installation, but does not cover the complete electricity demand of the installation. Therefore, for indirect emissions calculation, a weighted average from the emission factor of the self-produced electricity and the grid electricity has to be calculated. As the indirect emissions have to be monitored only for the production process 'sintered ore', that process could theoretically consume exclusively electricity from own production. However, the operator would have to provide specific evidence to the verifier that this is the case (Article 9 of the Methodology Act). For the example we assume the more realistic case, i.e. the average electricity mix is used evenly across all production processes.

Given the **complexity** of production processes in the iron and steel sector, installations producing complex goods using precursors from their own installation's production (in this example: sintered ore, pig iron, DRI, crude steel and iron or steel products) are permitted to monitor and report embedded emissions by defining one joint production process or **'bubble',** for all the iron and steel aggregated goods categories covered, provided that the precursors produced are wholly used to make the finished iron or steel products.

Figure 4-4: Example for *carbon steel production, blast furnace route – complete monitoring approach. All parameters in red font need to be monitored.*

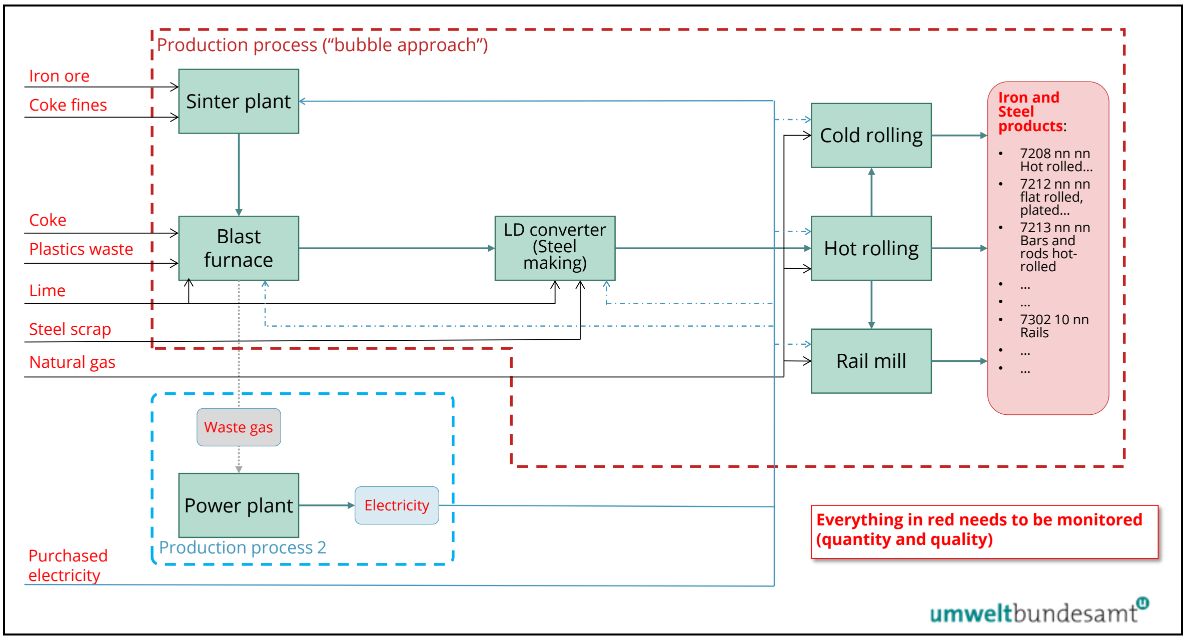


Figure 4-4 provides a complete monitoring approach for all source streams, for the example installation. In this figure a single bubbled system boundary has been drawn around production processes 1 to 4, for iron or steel products. Within the bubble, direct emissions for this production route result from:

- Fuel combustion – direct emissions from the combustion of fossil fuels and waste gases.
- Process emissions – direct emissions resulting from the thermal decomposition of carbonates, reductants (coke) and from the carbon content of iron and steel materials, including scrap.
- Indirect emissions from the electrical energy consumed by the joint production process is monitored, but the amount of electricity for the sinter plant has to be singled out, as it is the only product for which indirect emissions are relevant in this example.

The inputs and outputs highlighted in red text are the parameters that would need to be monitored by the operator in order to attribute emissions and determine direct specific embedded emissions for the bubbled process.

For both direct and indirect emissions, monitoring encompasses both aspects, quantitative (activity data) and qualitative (calculation factors). The activity levels for the different goods produced would also need to be monitored. However, applying the bubble approach, interim products (precursors), in this example sintered ore, pig iron and crude steel, do not have to be monitored. Furthermore, quantities fuels used in more than one of the production processes, do not have to be split by use levels in the production process. The only exception is the monitoring of electricity used in the production of sintered ore.

Given the complexity of the installation with its different source streams and material flows, the mass balance method is used to give a complete balance of the amount of carbon entering and leaving the installation. In applying this method, the CO_2 quantities relevant for each source stream are calculated based on the carbon content (CC) in each material, without distinguishing fuels and process materials. Non-emitted carbon leaving the installation in products and residues instead of being emitted is also taken into account, by defining output source streams, which have negative activity data, highlighted in red text in Table 4-1.

Table 4-1: Example calculation for carbon steel production, blast furnace route – Mass balance for the installation's direct emissions. AD = Activity data, CC = carbon content.

Consumption levels	**AD (t)**	**CC**	**Bio fraction**	**Emissions (t CO_2)[17]**	**Comments**
Coke fines	50 000	88,0%		161 216,0	
Iron ores	5 600 000	0,023%		4 719,2	
Coke	2 200 000	88,0%		7 093 504,0	
Plastic wastes	70 000	68,4%	16%	147 270,8	Biomass fraction[18] = 28 052 t CO_2 (zero-rated)
Scrap (external)	800 000	0,210%		6 155,5	
Scrap (internal)	200 000	0,180%		1 319,0	
Lime calcined	280 000	0,273%		2 800,0	
Natural gas	170 000	75,0%		467 160,0	
Other inputs	40 000	10,0%		14 656,0	
Sum				**7 898 800,6**	
Carbon in outputs	AD (t)	CC		**"Emissions" (negative) (t CO_2)**	
Steel	-4 800 000	0,180%		-31 657,0	
Slags	-1 000 000	0,030%		-1 099,0	
Sum				**-32 756,2**	
Total direct emissions of the installation				**7 866 044,4**	

In Table 4-1 above, the carbon content (CC) of the different input and output source streams is converted into its CO_2 equivalent, including for scrap from different sources. Emissions from biomass in the mixed plastic waste (assuming this is derived from MSW) is zero-rated for emissions. Total direct emissions, net of carbon in outputs, is then calculated.

Total indirect emissions must then be calculated, along with a correction for waste gas from direct emissions that has been used to generate electricity. The following assumptions have been made for the purposes of this example.

---

17 Factor 3,664 t CO_2 / t C

18 Calculated above as 70 000 x 68,4% x 16% x 3,664 t CO_2 / t carbon = 28 052 t CO_2

Table 4-2: Carbon steel, blast furnace route – Calculation of the installation's indirect emissions

Installation's Indirect Emissions
Assumptions: – All electricity in the total plant uses the same average fuel mix consisting of the grid factor (assumption: installation is situated in South Korea) and self-generated electricity from blast furnace waste gas. – 40% of produced waste gas used for electricity production (35% efficiency). – This covers 75% of electricity consumption, the rest comes from the grid. – Emission factor for waste gas is based on equivalent natural gas, but lower efficiency than in other natural gas power plants (EF = 0,576 t CO_2 /MWh). – Grid emission factor = 0,475 t CO_2 / MWh (looked up in the Default Values Act, Annex II for Korea). Weighted emissions factor of consumed electricity at installation: **0,551 t CO_2 / MWh.** Total electricity consumption of installation: 1 658 844 MWh / year. **Total indirect emissions of the installation: 977 059 t CO_2 / year.** However, indirect emissions are relevant **only for the sinter plant**: the electricity consumption for its production is determined to be 241 111 MWh, which translates into indirect emissions of 132 797 t CO_2 / year, or **0,0237 t CO_2 / t sinter.**

Indirect emissions are calculated by multiplying the activity data by the relevant emission factor. As a general principle, the relevant emission factor is the default value for the country where the installation is located, as provided by the Commission. Where the electricity consumed for the production of a specific production process (here: sintered ore) is partially self-generated and partially purchased from the grid, a weighted emission factor shall be calculated based on the sources of electricity. The example above follows this logic, where 75% of the electricity consumed comes from own generation using waste gas, while the remaining 25% is purchased from the grid. Only if the operator can provide evidence to the verifier that all the electricity consumed for a specific the production (like sintered ore) is generated from a selected electricity source (e.g. the power plant using waste gases), the emission factor for that power plant may be used. However, in the example above, the more likely case is applied where the same electricity mix applies to the whole installation.

To avoid double counting of emissions from waste gas used to generate electricity, it is necessary to make a deduction from direct emissions. The activity data for waste gas is calculated from electricity generated, using the information on fuel input and generation efficiency given above, as follows:

- Electricity generated from waste gas: 1 244 133 MWh (measured)
- Total waste gas fuel input: 1 244 133 / 0,35 efficiency = 3 554 666 MWh
- Converted to TJ: 3 544 666 * 0,0036 = 12 800 TJ

The amount to deduct from direct emissions for waste gas used to generate electricity is calculated in Table 4-3 below.

Table 4-3: Example calculation, carbon steel, blast furnace route – installations' total direct emissions corrected for waste gas deduction

				$t\ CO_2$ / year	Comment
Total direct emissions of the installation				7 866 044	From Table 4-1 above
	AD (TJ)	EF (Nat. Gas) $t\ CO_2$ / GJ	Corr. factor		
Deduction for Waste gases	-12 800	56,1	0,667	– 478 959	Deduction for waste gas used to generate electricity
Total direct emissions of the production process for crude steel products				**7 387 085**	**Revised total direct emissions**

Next, Table 4-4 gives example activity level data for goods produced in the example installation during the reporting period.

Table 4-4: Example activity levels for goods produced in the reporting period

Products	Activity Level (AL)	Units
Precursors		
Sintered ore	5 600 000	t / year ([19])
Pig Iron	4 000 000	t / year
Crude steel	5 000 000	t / year
Iron or steel products		
Sheets	3 500 000	t / year
Bars	800 000	t / year
Rails	500 000	t / year
Total goods produced	**4 800 000**	**t / year**
Internal scrap	200 000	t / year

Using the total direct and indirect emissions data from Table 4-2 and Table 4-3, and production data from Table 4-4, direct and indirect specific embedded emissions are then calculated for iron or steel products, as follows (Table 4-5).

Table 4-5: Example calculation, specific embedded emissions SEE under the simplified / "bubble" approach for iron or steel products

Total amount of goods produced (steel products)	4 800 000	t / year
Total direct emissions of the production process for steel products	7 387 085	$t\ CO_2$ / year
Total indirect emissions of the 'sintered ore' process	132 797	$t\ CO_2$ / year
Specific direct embedded emissions	1,539	$t\ CO_2$ / steel product
Specific indirect embedded emissions	0,028	$t\ CO_2$ / t steel product
Specific total embedded emissions	**1,567**	**$t\ CO_2$ / t steel product**

[19] For a simplified calculation in the example, it is assumed that 1 t ore is used for 1 t of sinter. In reality, additives (lime, etc.) and returned fines from other process of the installation would result in a different value.

Note: The whole 'bubble' production process is formally a 'multifunctional process', with the goods under the different CN codes being 'co-products' (i.e. simultaneously produced in the same process). This means that formally, a 'per mass' attribution approach to the different goods (with functional units being tonnes of each separate good) would have to be carried out at the end of the calculation. However, as all tonnes of good per CN code are weighted with the same factor (the physical unit 'tonne'), there is nothing more to calculate.

Calculation of free allocation adjustments

Table 4-6 presents the step-by-step calculation of the (year-independent preliminary) SEFA values. For this purpose, for each of the complex goods, M_i are determined for each precursor using the production data determined in the course of the monitoring of embedded emissions, as given in the example above. Secondly, the CBAM benchmark (BM) values applicable for each production process have to be determined in Column A in section 5 of the Annex to the Free Allocation Adjustment Act. The 'remarks' column in Table 4-6 clarifies which corresponding CN code was used for the look-up. The SEFA values printed in bold font are the results of the calculation. Only for comparison, the CBAM BM value from column B in the Free Allocation Adjustment Act is given. It is the default value that would have to be used by the authorised CBAM declarant if the operator did not report actual data.

Table 4-6: Calculation of the specific free allocation of each product of the example installation (carbon steel, blast furnace route). "BM Col.A" means the value from column A in section 5 of the Annex to the Free Allocation Adjustment Act.

Product / precursor	BM col. A t CO_2 / t	M_i t / t	SEFA t CO_2 / t	BM Col. B t CO_2 / t	Remarks
Sinter	0,086				CN 2601 12 00
Pig Iron	1,089				CN 7201 10 19
Sinter	0,086	1,400			
Pig Iron			**1,209**	1,210	
Crude steel	0,188				CN 7207 11 11
Pig iron	1,209	0,800			
Crude steel			**1,156**	1,364	(C) = blast furnace route
Sheets	0,044				CN 7208 nn nn
Crude steel	1,156	1,042			
Sheets			**1,248**	1,370	(C)
Bars	0,038				CN 7213 nn nn
Crude steel	1,156	1,042			
Bars			**1,242**	1,364	(C)
Rails	0,057				CN 7302 10 nn
Crude steel	1,156	1,042			
Rails			**1,261**	1,383	(C)

Note: The SEFA values still need adjustment for the reporting. For the example, it is assumed that the import takes place in **year 2027** (CBAM factor = 95,0%, CSCF = 1).

Therefore, the calculation gives. E.g. for the rails:
$SEFA_{g,2027} = CBAM_y \cdot CSCF_y \cdot SEFA_g$ = 0,95 × 1,00 × 1,261 = 1,198 t CO_2 / t

As a last step, the **CBAM reporting obligation** for these iron or steel products into the EU can then be determined. For example, for the import of **10 000 tonnes** of iron or steel products e.g. **rails,** taking place **in 2027**:

- **Definitive period:**
  - Direct embedded emissions = 10 000 t × 1,539 t CO_2 / t = 15 390 t CO_2
  - Indirect embedded emissions = 10 000 t × 0,028 t CO_2 / t = 280 t CO_2

  Total: 15 670 t CO_2

  Minus Free Allocation adjustment: = 10 000 t × 1,198 t CO_2 / t = **11 980 t CO_2**

  (Further deduction could be made if a carbon price was paid in the country of production – outside the scope of this guidance).

  Total CBAM obligation to be covered by the authorised declarant with CBAM certificates: 15 670 – 11 980 = **3 690 certificates**

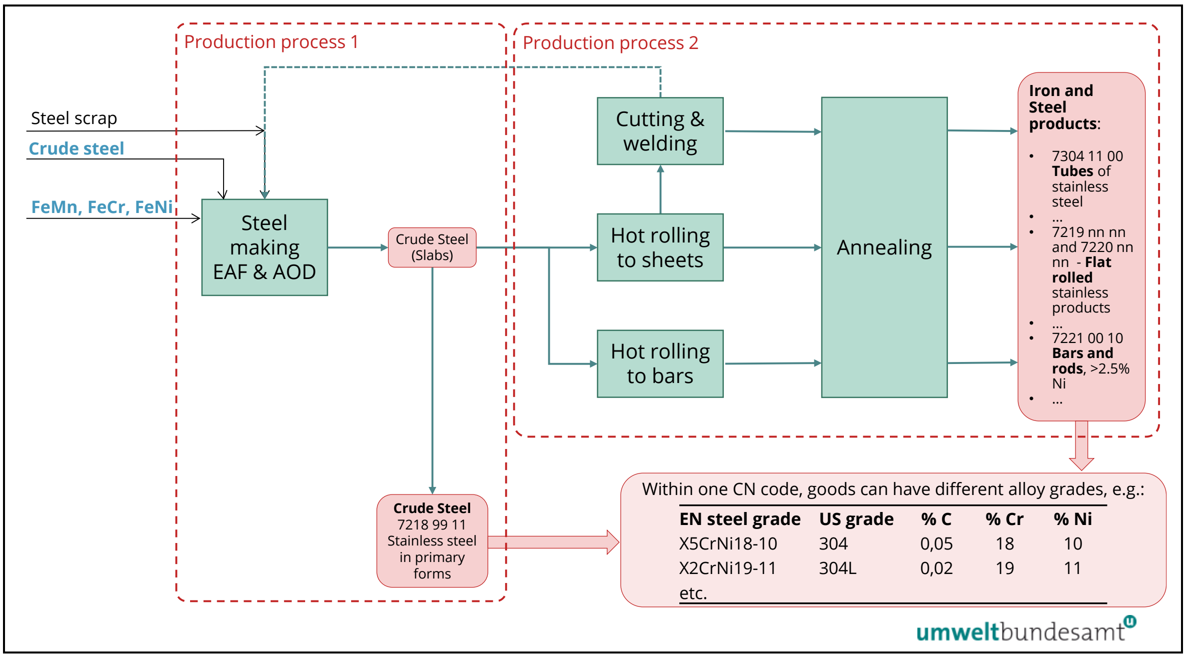
4.2 Example 2 – EAF and conversion to iron or steel products

The following example shows how specific embedded emissions are derived for crude steel and iron or steel products, produced by the EAF route. The resulting embedded emissions of imports into the EU are then calculated at the end of the example for reporting by the importer in their annual CBAM declaration for the relevant reporting period.

In this example for the EAF steel making route, the installation produces products falling under two aggregated goods categories, each of which is treated as a separate production process. It is assumed that only stainless steel of Nickel content >2,5% is produced, although some variation of alloy grades is observed. Nevertheless, all CN codes within each of steel type may be aggregated into joint production processes.

Figure 4-5 gives an outline view of the installation and shows the system boundaries as a red hatched line for each production process. The physical units carrying out each production process have been grouped under ‘Steel making EAF & AOD’, and under forming as ‘Cutting and welding’, ‘hot rolling to sheets, to bars and annealing’; and relevant inputs and outputs have been identified for each production process.

Figure 4-5: Example installation producing stainless steel from EAF route – Overview



The two relevant production processes defined above, and elaborated further in the diagrams below are:

- Production process 1 – crude steel produced by the EAF/AOD steel making route as slabs, of different alloy grades. The system boundaries of this production process have been defined as including inputs of steel scrap from production process 2 (steel that is cut off during the production of pipes), precursors crude steel and alloys, fuels (natural gas), graphite electrodes and other additives. The crude steel output from the process is both sold and is a precursor for production process 2. Due to the sale of precursor, the bubble approach is not allowed for this example installation.

- Production process 2 – iron or steel products, of different alloy grades, produced by different forming processes giving basic products such as tubes (cutting, rolling and welding), bars and rods (hot rolling and annealing) and sheets. The system boundaries of this production process have been defined as including inputs of crude steel (which has embedded emissions) and fuels (natural gas)[20]. Outputs from the production process are finished iron or steel products that are sold.

The second diagram (Figure 4-6) identifies the different source streams as inputs into the production processes, giving rise to direct emissions. There is no need to monitor electricity consumption / indirect emissions. However, if any precursors have been produced using sintered ore, the respective indirect emissions are carried over into the final products (this is not displayed in the example here separately, as default values are used

[20] In line with point 3.16 of Annex I to the Methodology Act, "*plating, cutting, welding and finishing of iron or steel products*" are excluded regarding their emissions. However, as such steps may be part of the actual way of making the listed steel goods, they are first to be included in the consideration of system boundaries, and only the respective emissions to be omitted.

for the purchased precursors, and only "total" embedded emissions are used as default values).

Direct emissions arise from the combustion of fuels (natural gas) and from process emissions from graphite electrodes, other additives and from releases of carbon contained within the different iron and steel materials.

Figure 4-6: Example installation producing stainless steel from EAF route – source streams relevant for direct emissions monitoring with a calculation-based approach

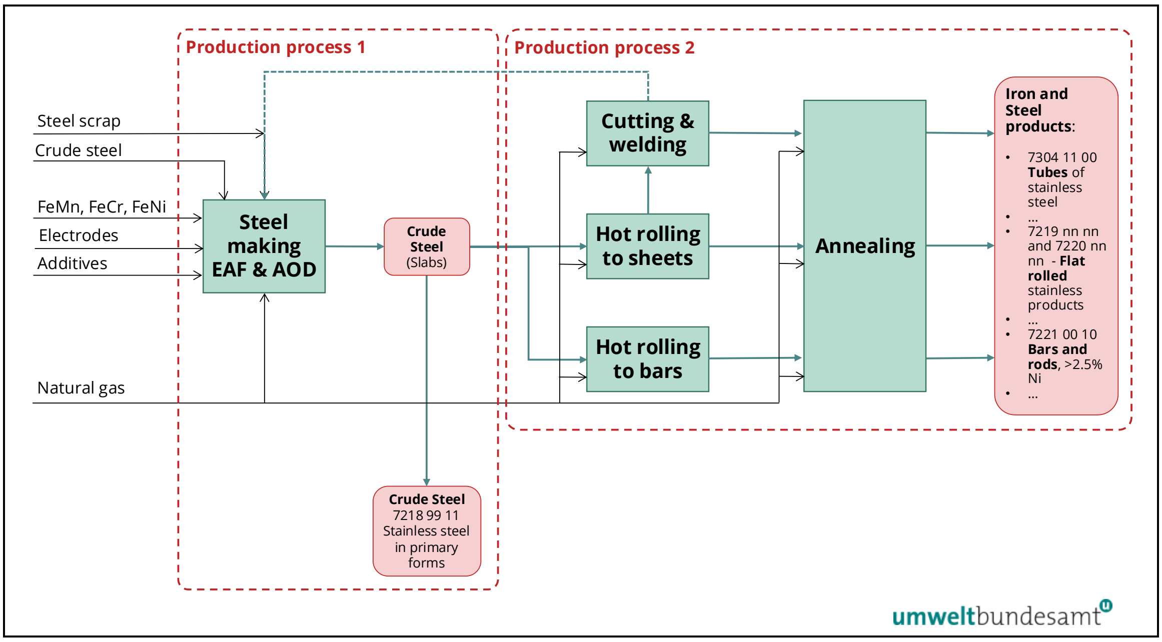
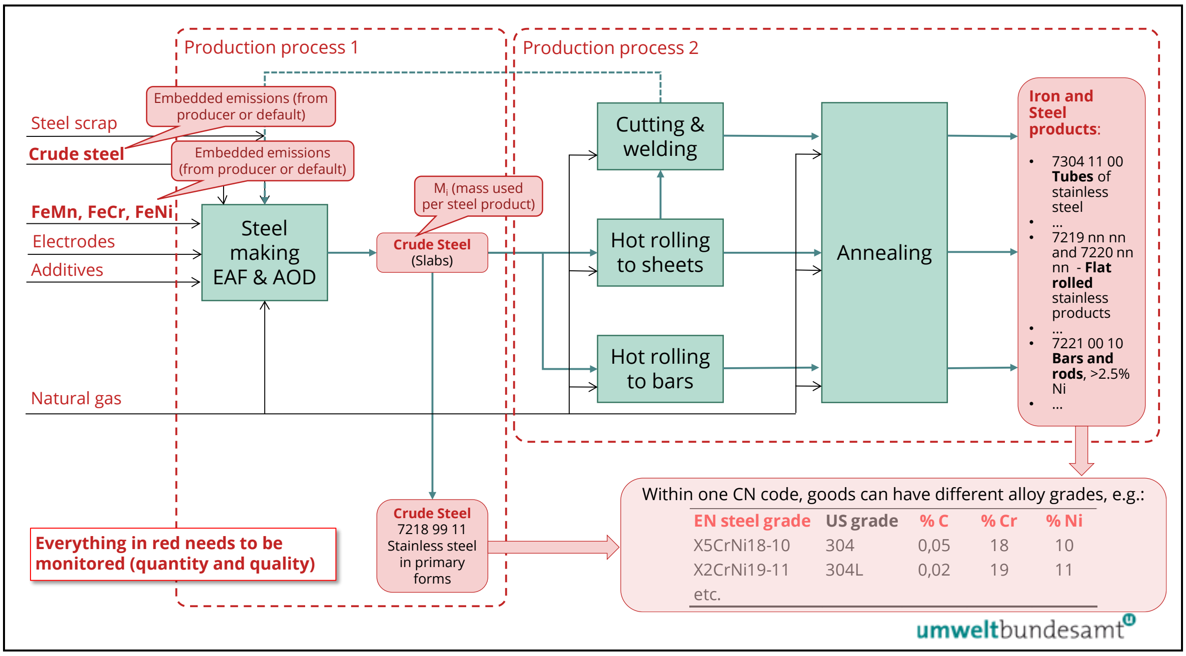


Figure 4-7: Example installation producing stainless steel via the EAF route – complete monitoring approach. All information in red font needs monitoring.



The third diagram (Figure 4-7), provides a complete monitoring approach for all source streams, for the example installation.

In the first example for iron and steel, a 'bubble' approach was used, as all precursors produced by the installation are wholly used in the production of the finished iron and steel goods. However, this approach is not available to the operator in this example, as some of the crude stainless steel precursor produced by production process 1 is diverted and is sold before it reaches production process 2. Therefore, specific embedded emissions have to be separately derived for each production process at this installation.

The inputs and outputs highlighted in red text in Table 4-7 are the parameters that should be monitored by the operator in order to attribute emissions and determine direct specific embedded emissions for both processes. Monitoring encompasses both aspects, quantitative (activity data) and qualitative (calculation factors). In case of purchased precursors it includes the specific embedded emissions.

Like in example 1, given the complexity of the installation and different source streams and material flows, the mass balance method is used to give a complete balance of the amount of carbon entering and leaving the installation. In applying this method, the CO_2 quantities relevant for each source stream are calculated based on the carbon content (CC) in each material, without distinguishing fuels and process materials. Non-emitted carbon leaving the installation in products instead of being emitted is also taken into account by defining output source streams, which have negative activity data, highlighted in red text in Table 4-7.

Table 4-7: EAF installation, example consumption levels – mass balance method

Consumption levels	**AD (t)**	**CC**	**EF**	**NCV (GJ/t)**	**Emissions (t CO_2)** [21]	**Assumptions / comments**
Steel scrap (market)	1 345 000	0,08%			3 942,5	Converted to CO_2
Natural gas	163 806		56,1	48	441 096.9	IPCC values; EF as t CO_2 / TJ
Graphite electrodes	4 468	81,9%			13 407,6	IPCC values
Various additives	89 360		0,45		40 212,0	Limestone, others omitted; EF [t CO_2/t]
Crude steel (purchased)	80 540	0,15%			442,6	
FeNi (28% Ni)	346 773	1,5%			19 058,6	
FeCr (52% Cr)	331 213	5,2%			63 105,4	
FeMn (65% Mn)	60 595	2,8%			6 216,6	
Sum					**587 482,3**	
Carbon in outputs	AD	CC			**Emissions (negative)**	
Steel	-2 140 000	0,180%			-14 114	Steel AL is net of scrap[22]
Slags	-107 232	0,030%			-118	
Sum					**-14 232**	
Total direct emissions of the installation					**573 251**	**t CO_2 / year**

[21] Factor 3,664 t CO_2 / t carbon

[22] i.e. after deduction of scrap amounts

In Table 4-7, the carbon content (CC) of different input and output source streams is converted to the CO_2 equivalent and total direct emissions, net of carbon contained in the outputs (steel and slag from the process) is calculated.

The next Table 4-8 summarises firstly the activity levels of the two production processes. Secondly, it shows how natural gas and emissions are attributed to process 2. Energy and emissions data are calculated using the specific energy consumption (SEC) values for bars, sheets and pipes. The balance of direct emissions is then attributed to production process 1, in the lower part of the table.

Table 4-8: EAF installation, example calculation of embedded emissions by production process and product (Note: SEC = Specific energy consumption)

Production levels	Tonnes	EAF/AOD and (Hot) rolling energy consumption Natural gas GJ / t	Comment
Slabs	2 234 000	0,31	**Process 1** – tonnes produced, EAF
Slabs to market	1 007 000		
Bars to market	456 000	5,4	**Process 2** – SEC values used to attribute energy and emissions.
Sheets	771 000	4,45	**Process 2** – SEC values used to attribute energy and emissions.
Sheets to market	221 000		
Sheets to pipes	550 000		
Pipes	456 000	2,8	**Process 2** – SEC values used to attribute energy and emissions.
Scrap (internal recycling)	94 000		Scrap from sheet to pipe conversion (cut-off steel).
Split of emissions		**Direct Emissions (t CO_2)**	
Process 1 (EAF / AOD)		171 005	
Process 2 (rolling etc.)		402 245	
Total		**573 251**	

No embedded emissions are attributed to steel scrap from production process 2, which is used internally to process 1.

Using the data on the allocation of attributed emissions between the two production processes, in Table 4-8, specific embedded emissions are then calculated for each CBAM product in the following two tables, for direct emissions. At this stage, the embedded emissions of precursors (purchased steel and alloys in process 1, crude steel in process 2) have to be added.

Table 4-9 calculates direct specific embedded emissions for crude steel slabs. At this point, embedded emissions of precursors are required. In the example it is assumed that the installation is situated in the United States (USA), and the production takes place in the year 2027. All precursors are assumed to be received from US installations, but no verified emissions reports are available. Consequently, the default values listed in Annex I to the Default Values Act with the mark-up for the year 2027 need to be looked up. Data used in these calculations are:

- Emissions at the installation for process 1 – determined above.
- Embedded emissions of precursors consumed by process 1 – calculated below, for precursors crude steel and alloys purchased.
- The Activity Level for crude steel slabs in the reporting period. The activity level is the sum of sold slabs and slabs used in process 2.

Table 4-9: EAF installation, example calculation of total embedded emission – Process 1 (Crude steel / slabs)

Precursors	**SEE (t CO_2/t)**	**Consumption (t)**	**direct em. (t CO_2)**
Crude steel[23]	3,864	80 540	311 207
FeNi (28% Ni)[24]	4,176	346 773	1 448 124
FeCr (52% Cr)[25]	2,280	331 213	934 021
FeMn (65% Mn)[26]	2,028	60 595	122 887
Calculation of Total Embedded Emissions of Slabs (process 1)			
Activity Level for process 1 (slabs)		2 234 000	
Emissions at installation			171 005
Embedded emissions of precursors consumed (from totals above)			2 816 238
Total embedded emissions			2 987 243
Specific embedded emissions (t CO_2 / t slab)			**1,337**

The calculation for process 2 could be done in a similar way as for process 1. However, for the sake of guidance, Table 4-10 presents the calculation of specific embedded emissions for complex goods (iron or steel products) by way of using only specific embedded emissions and specific attributed emissions of the 2nd process, i.e. by omitting the activity level and total emissions of the 2nd production process.

Table 4-10: EAF installation, example calculation of embedded emissions of complex goods. Process 2 – steel products

Total tonnes produced:		
Bars to market	456 000	t
Sheets to market	221 000	t
Pipes	456 000	t

---

23 CN 72189110 – Semi-finished products of stainless steel, of rectangular "other than square" cross-section, containing by weight >= 2,5% nickel

24 CN 720260 – Ferro-nickel

25 CN 72024110 – Ferro-chromium, containing by weight > 4% but <= 6% carbon

26 CN 72021120 – Ferro-manganese, containing by weight > 2% carbon, with a granulometry <= 5 mm and a manganese content by weight > 65%

Total steel products	**1 133 000**	t
Consumption precursor (slabs)	**1 227 000**	t
Mass slabs (crude steel) consumed per t:	**1,083**	t / t
		Direct (t CO_2)
Mass ratio (M_i) precursor	1,083	
SEE_i of precursor		1,337
Emissions per tonne product process 2		0,355
Specific embedded emissions SEE (t CO_2 / t steel product)		**1,783**

When calculating the total embedded emissions of final steel products in process 2 above, the **mass ratio (*M_i*)** of the precursor is taken account. This is the mass of crude steel slabs consumed per tonne of steel products produced, and is calculated as:

- Mass slabs / mass steel products: 1 227 000 / 1 133 000 = **1,083** (as above). The *SEE_i* values of the precursor are then adjusted by this ratio i.e.:

- For *SEE_i* (precursor): 1,337 x 1,083 = 1,448.

Total direct specific embedded emissions of the complex steel product are then calculated, as presented in the table above.

Calculation of free allocation adjustments

Table 4-11 presents the step-by-step calculation of the (year-independent preliminary) SEFA values. For this purpose, for each of the complex goods, M_i are determined for each precursor using the production data determined in the curse of the monitoring of embedded emissions, as given in the example above. Secondly, the CBAM benchmark (BM) values applicable for each production process have to be determined in Column A in section 5 of the Annex to the Free Allocation Adjustment Act. For purchased precursors for which the producer does not provide actual data (as is the case in this example), values have to be taken from column B of that Annex in order to ensure that the precursors' precursors are correctly accounted for. In line with the example of calculating embedded emissions, the assumption is that the production takes place in the year 2027. Therefore, if there is a choice between values with note "(1)" or "(2)", the look-up must take the value for "(1)", which refers to the period 2026-27. For later years, the value with "(2)" would have to be chosen.

The remark column in Table 4-11 clarifies which corresponding CN code was used for the look-up. The SEFA values printed in bold font are the results of the calculation. Only for comparison, the CBAM BM value from column B in the Free Allocation Adjustment Act is given. It is the default value that would have to be used by the authorised CBAM declarant if the operator did not report actual data.

Table 4-11: Calculation of the specific free allocation of each product of the example installation (stainless steel, EAF/scrap route). "BM Col.A" means the value from column A in section 5 of the Annex to the Free Allocation Adjustment Act.

Product / precursor	**BM col. A** **$t\ CO_2$ / t**	***M_i*** **t / t**	**SEFA** **$t\ CO_2$ / t**	**BM Col. B** **$t\ CO_2$ / t**	**Remarks**
Production process	0,128				CN 72189110
Precursors:					
Crude steel purchased	1,189	0,036			CN 72189110
FeNi (28% Ni)	2,390	0,155			CN 72026000
FeCr (52% Cr)	1,142	0,148			CN 72024110
FeMn (65% Mn)	1,361	0,027			CN 72021120
Crude steel slabs to market			**0,748**	1,189	CN 72189110
production process	0,057				CN 7304 11 00
Precursor:					
Crude steel slabs	0,748	1,083			
Steel products (e.g. pipes)			**0,867**	1,173	CN 7304 11 00

Note: The SEFA values still need adjustment for the reporting period For the example, it is assumed that the import takes place in **year 2027** (CBAM factor = 95,0%, CSCF = 1).

Therefore, the calculation gives. E.g. for the stainless pipes:
$SEFA_{g,2027} = CBAM_y \cdot CSCF_y \cdot SEFA_g = 0{,}95 \times 1{,}00 \times 0{,}867 = 0{,}824\ t\ CO_2 / t$

Using the above approach, the CBAM reporting obligation for the import of crude steel slabs and other steel products into the EU during the definitive period may then be determined; for example, for the import of 100 tonnes of product e.g. steel pipe:

- **Definitive period:**
  - Direct embedded emissions = 100 × 1,783 = 178,3 t CO_2

    Minus Free Allocation adjustment: = 100 t × 0,824 t CO_2 / t = 82,4 t CO_2

    (Further deduction could be made if a carbon price was paid in the country of production – outside the scope of this guidance)
  - **Total CBAM obligation** to be covered by the authorised declarant with CBAM certificates: 178,3 – 82,4 = **95,9 certificates**

4.3 Example 3 – production of screws and nuts from purchased steel rods

This is an example typical for many non-integrated manufacturing of steel products, which may be similarly applicable in other sectors such as aluminium production. In this example, the installation purchases precursors that contribute the majority of the embedded emissions, while its own process contributes little to the total embedded emissions.

For the example it is assumed that the installation purchases steel rods of two qualities (both covered by the CBAM themselves):

- Carbon steel rods with the embedded emissions as determined in Example 1; and
- Stainless steel rods with embedded emissions as determined in Example 2.

The production process involves:

- Hot rolling of the rods to wires of different diameters;
- Cutting and forging of the wires to screws;
- Cutting and forging of wires following by drilling / machining to nuts.

These processes consume natural gas and electricity, although the latter does not need to be monitored and reported in the definitive period of CBAM. Therefore, the installation itself has only direct emissions. However, the majority of the embedded emissions stem from the precursors. As the process involves cutting and machining, significant amounts of scrap are produced. In line with the rules of the Methodology Act, the scrap is attributed zero embedded emissions. Because of the production of scrap, the weight of the precursor used exceeds the weight of the final products. The factor m_i is > 1.

In the example installation, only one aggregated goods category is produced (screws and nuts of different alloy grades), but due to the different steel grades, the products fall under different CN codes and, therefore, have to be reported separately. The following two groups of products can be addressed in separate production processes:

Process	CN code	Descriptions
1	73181290	Wood screws of iron or steel other than stainless (excl. coach screws)
	73181491	Spaced-thread screws of iron or steel other than stainless
	73181499	Self-tapping screws of iron or steel other than stainless (excl. spaced-thread screws and wood screws)
	73181558	Screws and bolts, of iron or steel other than stainless "whether or not with their nuts and washers", with slotted or cross-recessed heads (excl. wood screws and self-tapping screws)
	73181568	Hexagonal-socket head screws and bolts, of iron or steel other than stainless "whether or not with their nuts and washers" (excl. wood screws, self-tapping screws and screws and bolts for fixing railway track construction material)
2	73181210	Wood screws of stainless steel (excl. coach screws)
	73181410	Self-tapping screws, of stainless steel (excl. wood screws)
	73181552	Screws and bolts, of stainless steel "whether or not with their nuts and washers", with slotted or cross-recessed heads (excl. wood screws and self-tapping screws)
	73181562	Hexagonal-socket head screws and bolts, of stainless steel "whether or not with their nuts and washers" (excl. wood screws, self-tapping screws and screws and bolts for fixing railway track construction material)

Therefore, the operator must determine two separate average values for annual direct emissions (i.e. for each of the two production processes). This is aligned with the fact that the percentages of scrap are different for the two main product groups, and because the quantities produced are different.

Table 4-12 shows the data that the operator has to monitor (input and output quantities, energy consumption (excluding electricity), consumption of precursors, specific embedded emissions of the precursors obtained from their producers).

Table 4-13 presents the calculation of specific embedded emissions of the two product groups, where the installation's own specific emissions are added to the embedded emissions of the precursors. To calculate the specific embedded emissions, Equation 62 is used. Therefore, the emissions embedded in precursor carbon steel (1,567 t CO_2/t in the example) are multiplied by the specific mass consumption of precursor carbon steel, m_i (1,176 in the example, as calculated in Table 4-12). The same approach is used for precursor high-alloy steel.

Table 4-12: Example installation No.3, main inputs and outputs

Precursors:	SEE direct (t CO_2 / t)			
Carbon Steel (see Example 1)	1,567			
High alloy steel (see Example 2)	1,783			
Products:	Activity level (t product / yr)	consumed quantity (t steel / yr)	scrap produced (t / yr)	m_i (t precursor / t product)
Carbon steel screws and nuts	17 000,00	20 000,00	3 000,00	1,176
High alloy steel screws and nuts	8 200,00	10 000,00	1 800,00	1,220
Energy consumed (average for both products)			Emission factor	
Natural gas (heating, forging,…)	3,5	GJ / t product	56,1	t CO_2 / TJ

Table 4-13: Example installation No.3, Calculation of specific embedded emissions (SEE)

Direct specific emissions	**SEE (t CO_2 / t)**	**m_i (t/t)**	**SEE (t CO_2 / t product)**
Precursor: carbon steel	1,567	1,176	1,843
Direct emissions (natural gas)			0,196
total SEE (carbon steel screws and nuts)			**2,039**
Precursor: High alloy steel	1,783	1,220	2,175
Direct emissions (natural gas)			0,196
total SEE (high alloy steel screws and nuts)			**2,371**

Finally, the specific free allocation levels are calculated like in the previous examples. Note, however, that the SEFA values of the precursors are taken here to be "actual data", i.e. taken from the operators of examples 1 and 2 above (same approach as used for the specific embedded emissions). Only the CBAM benchmark for the installation's own production process needs to be taken from Column A in section 5 of the Annex to the Free Allocation Adjustment Act. The M_i values are taken from the monitoring of embedded emissions. The results are presented in Table 4-14, using the same presentation method as explained in the previous examples.

Table 4-14: Calculation of the specific free allocation of each product of the example installation (screws and nuts from precursors received from installations in examples 1 and 2). "BM_g^* Col.A" means the value from column A in section 5 of the Annex to the Free Allocation Adjustment Act.

Product / precursor	BM_g^* col. A t CO_2 / t	M_i t / t	SEFA t CO_2 / t	BM_g Col. B t CO_2 / t	Remarks
Production process	0,038				CN 73181290
Precursor: carbon steel	1,242	1,176			SEFA calculated in Example 1 (bars and rods)
Carbon steel screws and nuts			**1,499**	1,364	(C) = carbon steel
Production process	0,038				CN 73181210
Precursor: stainless steel bars & rods	0,919	1,220			SEFA calculated in Example 2 (bars and rods)
Stainless steel screws and nuts			**1,159**	1,154	stainless steel (1)

Annex A List of definitions

Term	Definition
'Accuracy'	means the closeness of the agreement between the result of a measurement and the true value of the particular quantity or a reference value determined empirically using internationally accepted and traceable calibration materials and standard methods, taking into account both random and systematic factors
'Activity data'	means the amount of fuels or materials consumed or produced by a process relevant for the calculation-based methodology, expressed in terajoules (TJ), mass in tonnes or (for gases) volume in normal cubic metres, as appropriate
'Actual emissions'	means the emissions calculated based on primary data from the production processes of goods and from the production of electricity consumed during those processes as determined in accordance with the methods set out in Annex IV [to the Methodology Act]
'Activity level'	means the quantity of goods to which the same functional unit applies that are produced within the system boundaries of a production process during a reporting period
'Aggregated goods categories'	means aggregated goods categories pursuant to Table 1 of point 2 of Annex I. A group of CBAM goods with their CN codes, used for the purpose of defining system boundaries of production processes.
'Agricultural, aquaculture, fisheries and forestry residues'	means residues that are directly generated by agriculture, aquaculture, fisheries and forestry and that do not include residues from related industries or processing
'Authorised CBAM declarant'	means a person authorised by the competent authority in accordance with Article 17 [of the CBAM Regulation]. The 'authorised CBAM declarant' [which replaces the term 'reporting declarant' from the transitional period] may be importers of CBAM goods, or their indirect customs representatives, who have applied for and been granted the status of authorised CBAM declarant.
'Batch'	means an amount of fuel or material representatively sampled and characterised, and transferred as one shipment or continuously over a specific period of time
'Biomass'	means biomass as defined in Article 2, point (24) of the Renewable Energy Directive (RED II)[27]; it includes bioliquids and biofuels as defined in Article 2, point (32) and (33), biomass fuels as defined in Article 2, point (27) and biogas as defined in Article 2 point (28) of the RED II;

[27] Directive (EU) 2018/2001

Term	Definition
'Biomass fraction'	means the ratio of carbon stemming from biomass to the total carbon content of a fuel or material, expressed as a fraction
'Calculation factors'	means net calorific value, emission factor, preliminary emission factor, oxidation factor, conversion factor, carbon content or biomass fraction
'Calibration'	means the set of operations, which establishes, under specified conditions, the relations between values indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material and the corresponding values of a quantity realised by a reference standard
'Carbon price'	means the monetary amount paid in a third country, under a carbon emissions reduction scheme, in the form of a tax, levy or fee or in the form of emission allowances under a greenhouse gas emissions trading system, calculated on greenhouse gases covered by such a measure, and released during the production of goods
'CBAM certificate'	means a certificate in electronic format corresponding to one tonne of CO_2e of embedded emissions in goods
'CO_2 emission factor'	means the weighted average of the CO_2 intensity of electricity produced from fossil fuels within a geographic area. The CO_2 emission factor is the result of the division of the CO_2 emission data of the electricity sector by the gross electricity generation based on fossil fuels in the relevant geographic area. It is expressed in tonnes of CO_2 per megawatt-hour
'Combined nomenclature' (CN)	means the classification of goods, designed to meet the needs of: i) the Common customs tariff, setting import duties for products imported into the European Union (EU), as well as the Integrated tariff of the European Communities (Taric), incorporating all EU and trade measures applied to goods imported into and exported out of the EU; ii) the international trade statistics of the EU. The CN provides the means of collecting, exchanging and publishing data on EU international trade statistics. It is also used for the collection and publication of international trade statistics in intra-EU trade.[28]
'Combustion emissions'	means greenhouse gas emissions occurring during the exothermic reaction of a fuel with oxygen
'Competent authority'	means the authority designated by each Member State in accordance with Article 11 [of the CBAM Regulation]

[28] For definition see: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Combined_nomenclature_(CN)

Term	Definition
‘Continuous emission measurement’ (CEM)	means a set of operations having the objective of determining the value of a quantity by means of periodic measurements, applying either measurements in the stack or extractive procedures with a measuring instrument located close to the stack, whilst excluding measurement methodologies based on the collection of individual samples from the stack
‘Control system’	means the operator’s risk assessment and entire set of control activities, including the continuous management thereof, that an operator has established, documented, implemented and maintained pursuant to point A.2. of Annex II
‘Complex goods’	means goods other than simple goods
‘Conservative’	means that a set of assumptions is defined in order to ensure that no under-estimation of reported emissions or over-estimation of production of heat, electricity or goods occurs
‘Conversion factor’	means the ratio of carbon emitted as CO_2 to the total carbon contained in the source stream before the emitting process takes place, expressed as a fraction, considering CO emitted to the atmosphere as the molar equivalent amount of CO_2
‘Co-product’	means any of two or more products resulting from the same production process
‘Customs declarant’	means a declarant as defined in Article 5, point (15) of Regulation (EU) No 952/2013 lodging a customs declaration for release for free circulation of goods in its own name or the person in whose name such a declaration is lodged
‘CCUS system’	means a group of economic operators with technically connected installations and transport equipment for CO_2 capture, transport, use in production of goods, or geological storage
‘Data flow activities’	mean activities related to the acquisition, processing and handling of data that are needed to draft an emissions report from primary source data
‘Data set’	means one type of data, either at installation level or production process level as relevant in the circumstances, as any of the following: (a) the amount of fuels or materials consumed or produced by a production process as relevant for the calculation-based methodology, expressed in terajoules, mass in tonnes, or for gases as volume in normal cubic metres, as appropriate, including for waste gases; (b) a calculation factor;

Term	Definition
	(c) net quantity of measurable heat, and the relevant parameters required for determining this quantity, in particular: i) mass flow of heat transfer medium; and ii) enthalpy of transmitted and returned heat transfer medium, as specified by composition, temperature, pressure and saturation; (d) quantities of non-measurable heat, specified by the relevant quantities of fuels used for producing the heat, and the net calorific value (NCV) of the fuel mix; (e) quantities of electricity; (f) quantities of CO_2 transferred between installations; (g) quantities of precursors received from outside the production process, and their relevant parameters, such as country of origin, used production route, specific direct and indirect emissions;
'Default value'	means a value, which is calculated or drawn from secondary data, which represents the embedded emissions in goods
'Direct emissions'	means emissions from the production processes of goods including emissions from the production of heating and cooling that is consumed during the production processes, irrespective of the location of the production of the heating or cooling
'Embedded emissions'	means direct emissions released during the production of goods and indirect emissions from the production of electricity that is consumed during the production processes, calculated in accordance with the methods set out in Annex IV and further specified in the implementing acts adopted pursuant to Article 7(7)
'Emissions'	mean the release of greenhouse gases into the atmosphere from the production of goods
'Emission factor'	means the average emission rate of a greenhouse gas relative to the activity data of a source stream assuming complete oxidation for combustion and complete conversion for all other chemical reactions
'Emission factor' for electricity	means the default value, expressed in CO_2e, representing the emission intensity of electricity consumed in production of goods.
'Emission source'	means a separately identifiable part of an installation or a process within an installation, from which relevant greenhouse gases are emitted
EU ETS	means the system for greenhouse gas emissions allowance trading within the Union in respect of activities listed in Annex I to Directive 2003/87/EC other than aviation activities

Term	Definition
'EU ETS allowance'	means an allowance as defined in Article 3, point (a), of Directive 2003/87/EC in respect of activities listed in Annex I to that Directive other than aviation activities
'Fossil carbon'	means inorganic and organic carbon that is not biomass
'Fossil fraction'	means the ratio of fossil carbon to the total carbon content of a fuel or material, expressed as a fraction
'Fugitive emissions'	means irregular or unintended emissions from sources that are not localised, or too diverse or too small to be monitored individually
'Functional unit'	means the reference unit used for the calculation of embedded emissions in goods
'Goods'	means goods listed in Annex I [to the CBAM the CBAM Regulation]
'Greenhouse gases'	mean greenhouse gases as specified in Annex I [to the CBAM the CBAM Regulation] in relation to each of the goods listed in that Annex
'Heat meter'	means a thermal energy meter or any other device to measure and record the amount of thermal energy produced based upon flow volumes and temperatures
'Importer'	means either the person lodging a customs declaration for release for free circulation of goods or a bill of discharge in accordance with Article 175(5) of Delegated Regulation (EU) 2015/2446 in its own name and on its own behalf or, where the customs declaration is lodged by an indirect customs representative in accordance with Article 18 of Regulation (EU) No 952/2013, the person on whose behalf such a declaration is lodged
'Importation'	means release for free circulation as provided for in Article 201 of Regulation (EU) No 952/2013
'Indirect customs Representative'	A customs representative appointed by an importer established in a Member State. If the importer appoints an indirect customs representative and they agree, they can act as an authorised CBAM declarant and submit the application for an authorisation on behalf of the importer. The indirect customs representative is liable for all operations made for the importers it represents
'Indirect emissions'	means emissions from the production of electricity which is consumed during the production processes of goods, irrespective of the location of the production of the consumed electricity
'Inherent CO_2'	means CO_2 which is part of a source stream.
'Installation'	means a stationary technical unit where a production process is carried out

Term	Definition
'Legal metrological control'	means the control exercised by a public authority or regulator of the measurement tasks intended for the field of application of a measuring instrument, for reasons of public interest, public health, public safety, public order, protection of the environment, the levying of taxes and duties, the protection of consumers and fair trading
'Measurable heat'	means a net heat flow transported through identifiable pipelines or ducts using a heat transfer medium, such as, in particular, steam, hot air, water, oil, liquid metals and salts, for which a heat meter is or could be installed
'Measurement point'	means the emission source for which continuous emission measurement systems (CEMS) are used for emission measurement, or the cross-section of a pipeline system for which the CO_2 flow is determined using continuous measurement systems
'Measurement system'	means a complete set of measuring instruments and other equipment used to determine variables for the monitoring and calculation of emissions
'Minimum requirements'	means monitoring methods using the minimum efforts allowed for determining data in order to result in emission data acceptable for the purpose of the CBAM Regulation.
'Mixed fuel'	means a fuel which contains both biomass and fossil carbon
'Mixed material'	means a material which contains both biomass and fossil carbon
'Multifunctional process'	means a process that delivers multiple outputs or whose outputs feed into several production processes
'Net calorific value' (NCV)	means the specific amount of energy released as heat when a fuel or material undergoes complete combustion with oxygen under standard conditions, less the heat of vaporisation of any water formed
'Non-CBAM good'	means any good produced in the installation that is not included in Annex I to the CBAM Regulation
'Non-measurable heat'	means all heat other than measurable heat
'Operator'	means any person who operates or controls an installation in a third country, including a parent company that controls an installation in a third country
'Oxidation factor'	means the ratio of carbon oxidised to CO_2 as a consequence of combustion to the total carbon contained in the fuel, expressed as a fraction, considering carbon monoxide (CO) emitted to the atmosphere as the molar equivalent amount of carbon dioxide (CO_2)
'Power purchase agreement'	means a contract under which a person agrees to purchase electricity directly from an electricity producer

Term	Definition
'Precursor'	means any input material into a production process included in the list of goods set out in Annex I to the CBAM Regulation;
'Preliminary emission factor'	means the assumed total emission factor of a fuel or material based on the carbon content of its biomass fraction and its fossil fraction before multiplying it by the fossil fraction to produce the emission factor
'Production process'	means the chemical and physical processes carried out to produce goods in an installation
'Production route' [29]	means a specific technology used in a production process to produce goods
'Process emissions'	means greenhouse gas emissions other than combustion emissions occurring as a result of intentional and unintentional reactions between substances or their transformation, for a primary purpose other than the generation of heat, including from the following processes: (a) the chemical, electrolytic or pyrometallurgical reduction of metal compounds in ores, concentrates and secondary materials; (b) the removal of impurities from metals and metal compounds; (c) the decomposition of carbonates, including those used for flue gas cleaning; (d) chemical syntheses of products and intermediate products where the carbon bearing material participates in the reaction; (e) the use of carbon containing additives or raw materials; (f) the chemical or electrolytic reduction of metalloid oxides or non-metal oxides such as silicon oxides and phosphates.
'Proxy data'	means annual values which are empirically substantiated or derived from accepted sources and which an operator uses to substitute a data set[30] for the purpose of ensuring complete reporting
'Rebate'	means any amount that reduces the amount due or paid by a person liable for the payment of a carbon price, before its payment or after, in a monetary form or in any other form.
'Recommended improvements'	means monitoring methods which are proven means to ensure that data are more accurate or less prone to mistakes than by mere application of minimum requirements
'Related emissions'	means: – the direct emissions caused by the source stream or emission source concerned; – emissions attributed to a quantity of measurable heat; – the indirect emissions related to the quantity of electricity concerned; – embedded emissions of a material produced or of a precursor consumed.

[29] Note that different production routes can fall within the same production process.

[30] Refers to the activity data or the calculation factors.

Term	Definition
'Reporting period'	means the period corresponding to the calendar year during which the good was produced and used by the authorised CBAM declarant as reference for the determination of embedded emissions
'Residue'	means a substance that is not the end product that a production process directly seeks to produce; it is not a primary aim of the production process and the process has not been deliberately modified to produce it
'Simple goods'	means goods produced in a production process requiring exclusively input materials (precursors) and fuels having zero embedded emissions
'Source stream'	means either of the following: (a) a specific fuel type, raw material or product giving rise to emissions of relevant greenhouse gases at one or more emission sources as a result of its consumption or production; (b) a specific fuel type, raw material or product containing carbon and included in the calculation of greenhouse gas emissions using a mass-balance method
'Specific embedded emissions'	means the embedded emissions of one tonne of goods, expressed as tonnes of CO_2e emissions per tonne of goods
'Standard conditions'	means temperature of 273,15 K and pressure conditions of 101 325 Pa defining normal cubic metres (Nm^3)
'System boundary'	means the group of chemical or physical processes included in the calculation of embedded emissions of goods under the same aggregated goods category. The system boundaries shall cover direct emissions, indirect emissions for goods not listed in Annex II to the CBAM Regulation, and the embedded emissions of any precursor.
'Third country'	means a country or territory outside the customs territory of the [European] Union
'Tonne of CO_{2}(e)'	means one metric tonne of carbon dioxide ('CO_2'), or an amount of any other greenhouse gas listed in Annex I [to the CBAM Regulation] with an equivalent global warming potential ['CO_2e']
'Transmission system operator'	means an operator as defined in Article 2, point (35) of Directive (EU) 2019/944 of the European Parliament and of the Council ([31]).

[31] Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity and amending Directive 2012/27/EU (OJ L 158, 14.6.2019, p. 125).

Term	Definition
'Uncertainty'	means a parameter, associated with the result of the determination of a quantity, that characterises the dispersion of the values that could reasonably be attributed to the particular quantity, including the effects of systematic as well as of random factors, expressed in percent, and describes a confidence interval around the mean value comprising 95% of inferred values taking into account any asymmetry of the distribution of values
'Waste'	means any substance or object which the holder discards or intends or is required to discard, excluding substances that have been intentionally modified or contaminated in order to meet this definition
'Waste gas'	means a gas containing incompletely oxidised carbon in a gaseous state under standard conditions which is a result of any of the processes listed under 'process emissions'

Annex B List of abbreviations

Abbreviation	Full term
AD	Activity Data
AEM	Anode Effect Minutes
AEO	Anode Effect Overvoltage
AL	Activity Level
AOD	Argon Oxygen Decarburisation.
BAT	Best Available Techniques
BF	Biomass Fraction
BFG	Blast Furnace Gas
BM	Benchmark
BOF	Basic Oxygen Furnace
BOFG	Basic Oxygen Furnace Gas
BREFs	Best Available Techniques Reference documents
CA	Competent Authority
CBAM	Carbon Border Adjustment Mechanism, the
CCR	Clinker to Cement Ratio
CCS	Carbon Capture and Storage
CCU(S)	Carbon Capture and Utilisation (and Storage)
CEMS	Continuous Emission Measurement Systems
CF	Conversion Factor
CFP	Carbon footprint of products
CHP	Combined Heat and Power
CKD	Cement Kiln Dust
CN	Combined nomenclature
COG	Coke Oven Gas
DRI	Direct Reduced Iron
EAF	Electric Arc Furnace
EEA	European Economic Area (EU-27, Iceland, Norway, Liechtenstein)
EF	Emission Factor
EFTA	European Free Trade Area
EORI	Economic Operator Registration and Identification
ETS	Emissions Trading System
EU ETS	EU Emissions Trading System
EUA	EU Allowances (used in the EU ETS)
EUR	Euro (currency)

Abbreviation	Full term
FAR	Free Allocation Rules (Regulation 2019/331)[32]
FIFO	First-In-First-Out principle
GHG	Greenhouse Gas
GWP	Global Warming Potential
HBI	Hot Briquetted Iron
HS	Harmonised System (for international trade)
IEA	International Energy Agency
ISO	International Organization for Standardization
LULUCF	Land-use, land change and forestry (criteria)
MP	Monitoring Plan
MRR	Monitoring and Reporting Regulation (Regulation 2018/2066)[33]
MRV	Monitoring, Reporting and Verification
MS	Member State(s)
MWh	Megawatt-hour
NCV	Net Calorific Value
NPI	Nickel pig iron
OF	Oxidation Factor
PCI	Pulverised Coal Injection
PEMS	Predictive Emission Monitoring System
PFC	Perfluoro-carbon
PoS	Proofs of Sustainability
RED II	Renewable Energy Directive, re-cast
SEE	Specific embedded emissions
SEFA	Specific embedded free allocation
TARIC	Integrated Tariff of the European Union database
TJ	Terajoules
TSO	Transmission System Operator
UCC	Union Custom Code
UN/LOCODE	United Nations Code for Trade and Transport Location

[32] Free Allocation Rules (Commission Delegated Regulation (EU) 2019/331 of 19 December 2018 determining transitional Union-wide rules for harmonised free allocation of emission allowances pursuant to Article 10a of Directive 2003/87/EC of the European Parliament and of the Council)

[33] Monitoring and Reporting Regulation (Commission Implementing Regulation (EU) 2018/2066 of 19 December 2018 on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council and amending Commission Regulation (EU) No 601/2012

EUROPEAN COMMISSION
DIRECTORATE-GENERAL
TAXATION AND CUSTOMS UNION
Indirect Taxation and Tax Administration
CBAM, Energy and Green Taxation

Brussels, 14 August 2026

GUIDANCE DOCUMENT 5E: SECTOR-SPECIFIC GUIDANCE DOCUMENT ON ALUMINIUM

Disclaimer: This guidance document is not legally binding and it is of an explanatory nature. Legal provisions of Union law take precedence over the contents of this document and should always be consulted. The authentic texts of the EU legal instruments are those published in the Official Journal of the European Union. This guidance was prepared by Commission services and does not represent an official position of the Commission. Only the Court of Justice of the European Union is competent to authoritatively interpret Union law.

Commission européenne/Europese Commissie, 1049 Bruxelles/Brussel, BELGIQUE/BELGIË – Tel. +32 22991111

VERSION HISTORY

Date	Version notes
14.08.2026	First Publication of this document for the definitive period.

CONTENTS

1 PREFACE

1.1 Structure and content of the guidance documents

This series of documents has been written to support stakeholders by explaining the requirements of the CBAM Regulation in a non-legislative language. This series of guidance documents should benefit a variety of stakeholders. A specific focus has been put on clarifying the **requirements for operators of installations producing CBAM goods outside of the EU for the definitive period**.

- **Guidance 1** provides an overview of the main changes to the CBAM methodology between the definitive period and the concluded transitional period. It also introduces the CBAM and an overview of the compliance cycle, roles and responsibilities, as well as milestones and deadlines for operators of installations outside the EU during the definitive period and explains the general exemptions from the CBAM.

- **Guidance 2** provides a quick guidance for the intended reader of this document, the operator of an installation producing CBAM goods. It provides a roadmap of the most important concepts of CBAM emissions monitoring and where to find more information in this series of documents.

- **Guidance 3** sets out the monitoring and reporting obligations and recommendations which are potentially applicable to any affected producer of CBAM goods.

- **Guidance 4** provides an overview of how the adjustment for free allocation is to be determined and what information is needed.

- **Guidance documents 5a, 5b, 5c, 5d, 5e and 5f** present an overview per sector of the production processes and value chains for goods that are included in the scope of the CBAM, as well as sector-specific monitoring and reporting considerations for each CBAM good where this is relevant. These sections are supplemented by examples for each sector.

The series of guidance documents is accompanied by an electronic template for information that should be used by installation operators to communicate information to the authorised CBAM declarants and CBAM Registry.

Presentation of numbers in EU documents

To align with EU legal documents, this guidance document uses the following convention when presenting numbers.

The decimal separator used to separate the integral part of a number from its fractional part is a comma, e.g.: 0,890

Thousands, and powers of 10^{3n} thereafter, are separated by a space, e.g.:

- fifteen thousand is written as 15 000
- fifteen million is written as 15 000 000

1.2 Reference regulations and legal acts

Several regulations and legal acts are referred to throughout this series of guidance documents. For ease of reading and to avoid ambiguity, simplified references are used when citing these acts.

- **CBAM Regulation**: Regulation (EU) 2023/956 and Regulation (EU) 2025/2083 amending Regulation (EU) 2023/956. Notably, where article numbers are given in this document without further specification, they always refer to the CBAM Regulation.

  It can be accessed at the following link (consolidated version): **http://data.europa.eu/eli/reg/2023/956/2025-10-20**

- **Methodology Act:** Commission Implementing Regulation (EU) 2025/2547, in legal texts referred to as "Implementing act pursuant to Article 7(7) of the CBAM Regulation".

  It can be accessed at the following link: **http://data.europa.eu/eli/reg_impl/2025/2547/oj**

- **Default Values Act**: Commission Implementing Regulation (EU) 2025/2621, in legal texts referred to as "Implementing act pursuant to Article 7(7) of the CBAM Regulation", also referred to as "default values determined in accordance with Annex IV to the CBAM Regulation".

  It can be accessed at the following link: **http://data.europa.eu/eli/reg_impl/2025/2621/oj**

- **Verification Principles Act**: Commission Implementing Regulation (EU) 2025/2546, in legal texts referred to as "Implementing act pursuant to Article 8(3) of the CBAM Regulation".

  It can be accessed at the following link: **http://data.europa.eu/eli/reg_impl/2025/2546/oj**

- **Accreditation & Verification Requirements Act**: Commission Delegated Regulation (EU) 2025/2551, in legal texts referred to as "Delegated act pursuant to Article 18(3) of the CBAM Regulation".

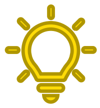
  It can be accessed at the following link: **http://data.europa.eu/eli/reg_del/2025/2551/oj**

- **Free Allocation Adjustment Act**: Commission Implementing Regulation (EU) 2025/2620, in legal texts referred to as "Implementing act pursuant to Article 31(2) of the CBAM Regulation".

  It can be accessed at the following link: **http://data.europa.eu/eli/reg_impl/2025/2620/oj**

For acronyms and definitions used in this document, please see **Annex B** and **Annex A**.

A series of icons are used throughout to help guide the reader:

Icon	Description of use
	Points to information of particular importance for operators of installations producing CBAM goods.
Simplified!	Highlights simplified approaches of the general requirements of the CBAM.
	Used where recommended improvements are presented.
	Used where other documents, templates or electronic tools are available from other sources.
	Points to examples given for the topics discussed in the surrounding text.

2 CBAM Goods and Production Routes

This section provides guidance on industry-sector-specific rules that apply for the definitive period (from 2026 onwards), for aluminium sector. It deals with the specification of products covered by the CBAM and the relevant production routes.

2.1 Foreword to sector-specific sections

The following sections provide an overview of the different production routes for the goods under aluminium sector in CBAM and provide sector specific guidance. Where goods to which the same functional unit applies are produced in one installation via different production routes, the embedded emissions shall be determined in accordance with the averaging rules applicable in the definitive period.

Additional information on the production processes of the goods can also be found in the BREF[1] documents for best available techniques (BAT).

Diagrams used in the following sections.

For the system boundary graphics presented in the sections below, the **following conventions** are applied:

- **Production processes** (for which monitoring of the direct emissions would take place) are shown as **rectangles with white background**.
- **Optional** processes (e.g. CCS/CCU) are shown in **blue** boxes. In particular, CCS/CCU would not be taken into account for developing default values, but where you (as an operator) use them, the related emissions or emission savings should be taken into account for determining actual embedded emissions in line with the CBAM Regulation and the Methodology Act.
- **Materials** which are considered to have no embedded emissions are shown in **pink** boxes, materials with embedded emissions (precursor materials and final products, i.e. goods under the CBAM) in **green** boxes. Simple goods are shown in **normal** font, complex goods in **bold** font. Materials which are **optional** are shown in boxes with a **blue dashed** outline and must be included where actually used at the installation.
- Input materials are presented without trying to be complete. This means that the focus is on materials which are relevant for demonstrating the differences between different production routes. As a consequence, less important input materials and in particular fuels are usually omitted in order to keep graphs simple.
- **Electricity** as input is shown only in cases where it is the main "precursor" of the process (i.e. in particular for electric arc furnaces and electrolysis processes). Electricity is shown in **light grey** boxes.

[1] BAT Reference document (BREF), BAT being "Best Available Techniques" as defined by the IED (Industrial Emissions Directive). Relevant BREF documents are those for: the production of cement; for iron and steel production; large volume inorganic chemicals (which includes fertilisers); for Chlor-alkali; and for non-ferrous metals (which includes both aluminium and ferro-alloys). All BREFs can be found at the European IPPC Bureau, under https://eippcb.jrc.ec.europa.eu/reference.

2.2 Aluminium sector

The textbox below signposts the sector-specific sections in the Methodology Act, relevant for the CBAM definitive period.

Methodology Act references:

- **Annex I** (“Mapping of CN codes to aggregated goods categories”) to the Methodology Act.
- **Annex I,** points 3.17 (“Unwrought aluminium”) and 3.18 (“Aluminium products”) which define the functional unit, system boundaries and possible precursors for aluminium sector goods.

2.2.1 Unit of production and embedded emissions

The quantity of declared aluminium goods imported into the EU must be expressed in metric tonnes. As an operator, you must record the quantity of CBAM good(s) produced by the installation or production process, for the purposes of reporting. In the definitive period, the reporting period corresponds to the calendar year of production, in accordance with Article 1(5) of the Methodology Act.

Industrial sector	**Aluminium**
Production unit of goods	Tonnes (metric), reported separately for each type of sector goods, by installation or production process in the country of origin.
Associated activities	Producing unwrought aluminium from alumina, or secondary raw materials (aluminium scrap), by metallurgical, chemical or electrolytic means; manufacture of semi-processed and finished aluminium products.
Relevant greenhouse gases	Carbon dioxide (CO_2) and perfluorocarbons (CF_4 and C_2F_6)
Direct Emissions	Tonnes (metric) of CO_2e
Indirect Emissions	Quantity of electricity consumed (MWh), source and emission factor used to calculate the indirect emissions in tonnes (metric) of CO_2 or CO_2e. During the transitional period, indirect emissions resulting from electricity consumption were monitored and reported separately. In the definitive period, for aluminium CBAM goods which are listed in Annex II (“Goods for which only direct emissions are taken into account”) to the CBAM Regulation, only direct emissions are taken into account in their embedded emissions under the CBAM; indirect emissions of electricity are not included.
Unit for embedded emissions	Tonnes CO_2e emissions per tonne of goods, reported separately for each type of good, by installation in the country of origin.

During the transitional period, the aluminium sector reported both direct emissions and indirect emissions, with indirect emissions monitored and reported separately. For the definitive period, aluminium CBAM goods are listed in Annex II to the CBAM Regulation ("List of goods for which only direct emissions are to be taken into account, pursuant to Article 7(1)"). For those goods, only direct emissions are taken into account when determining embedded emissions for CBAM purposes; indirect emissions of electricity are not included, in line with Article 7(1) and Annex II of the CBAM Regulation and the cross-sectoral rules on system boundaries and precursors in the Methodology Act. Emissions must be reported in metric tonnes CO_2 equivalent (t CO_2e) emissions per tonne of output. This figure must be calculated for the specific installation or production process in your country of origin.

The following sections set out how the system boundaries of aluminium sector goods should be defined and identify elements of the production process that must be included for the purposes of monitoring and reporting.

2.2.2 Definition and explanation of sector goods covered

The following Table 2-1 lists the relevant goods in scope for the CBAM definitive period in the aluminium industry sector. The CN codes in the central column are the starting point for which 'production processes' are to be defined are to be defined for the purpose of monitoring in line with Annex I to the CBAM Regulation and Annex I ("Mapping of CN codes to aggregated goods categories") to the Methodology Act. Where goods with different CN codes to which the same functional unit applies are produced using different production routes within an installation, a single production process shall be used encompassing all production routes.

Table 2-1: CBAM goods in the aluminium sector[2]

Aggregated goods category	Product CN Code[3]	Description
Unwrought aluminium	7601	Unwrought aluminium

2 Source: Annex I to the CBAM Regulation; Annex I ("Mapping of CN codes to aggregated goods categories") and points 3.17 ("Unwrought aluminium") and 3.18 ("Aluminium products") of Annex I to the Methodology Act.

3 Where the CN codes indicated in this table consist of 4, 5 or 6 digits, all 8-digit CN codes sharing the same initial digits shall be considered included, unless otherwise specified.

Aggregated goods category	Product CN Code[3]	Description
Aluminium products	7603 – 7608, 7609 00 00, 7610, 7611 00 00, 7612, 7613 00 00, 7614, 7616	7603 – Aluminium powders and flakes 7604 – Aluminium bars, rods and profiles 7605 – Aluminium wire 7606 – Aluminium plates, sheets and strip, of a thickness exceeding 0,2 mm 7607 – Aluminium foil (whether or not printed or backed with paper, paper-board, plastics or similar backing materials) of a thickness (excluding any backing) not exceeding 0,2 mm 7608 – Aluminium tubes and pipes 7609 00 00 – Aluminium tube or pipe fittings (for example, couplings, elbows, sleeves) 7610 – Aluminium structures (excluding prefabricated buildings of heading 9406) and parts of structures (for example, bridges and bridge-sections, towers, lattice masts, roofs, roofing frameworks, doors and windows and their frames and thresholds for doors, balustrades, pillars and columns); aluminium plates, rods, profiles, tubes and the like, prepared for use in structures 7611 00 00 – Aluminium reservoirs, tanks, vats and similar containers, for any material (other than compressed or liquefied gas), of a capacity exceeding 300 litres, whether or not lined or heat-insulated, but not fitted with mechanical or thermal equipment 7612 – Aluminium casks, drums, cans, boxes and similar containers (including rigid or collapsible tubular containers), for any material (other than compressed or liquefied gas), of a capacity not exceeding 300 litres, whether or not lined or heat-insulated, but not fitted with mechanical or thermal equipment 7613 00 00 – Aluminium containers for compressed or liquefied gas 7614 – Stranded wire, cables, plaited bands and the like, of aluminium, not electrically insulated 7616 – Other articles of aluminium

The aggregated goods categories listed in Table 2-1 include both finished aluminium products and a precursor ‘unwrought aluminium’ that is itself used in the production of aluminium goods. The system boundaries specified in the Methodology Act do not mention explicitly which precursors are relevant for the production process. Therefore, Table 2-2 should help to identify the possible precursors by aggregated goods category and production route.

Table 2-2: Aggregated goods categories, their production routes and possible precursors

Aggregated Goods Category ***Production route***	**Precursors**
Unwrought aluminium *Primary aluminium* *Secondary aluminium*	None for primary aluminium For secondary aluminium – unwrought aluminium from other sources, if used in the process[4]
Aluminium products	Unwrought aluminium (differentiated between primary and secondary aluminium, if known), other aluminium products (if used in the production process).

Unwrought aluminium is produced by several production routes (‘primary aluminium’ for electrolytic smelting, ‘secondary aluminium’ for melting/recycling of scrap) as metal ingots, blocks, billets, slabs or similar. It is defined as a ‘simple good’, as the raw materials (carbon anodes and alumina for primary aluminium, scrap for secondary aluminium) used in its manufacture are themselves not treated as precursors (i.e. their upstream embedded emissions are not included).

The aluminium goods listed above include most types of aluminium product manufactured[5]. Aluminium products are defined as complex goods as they include the embedded emissions from the precursor unwrought aluminium.

The production of aluminium sector goods is by a number of different process routes, outlined below.

2.2.3 Definition and explanation of relevant production processes and routes

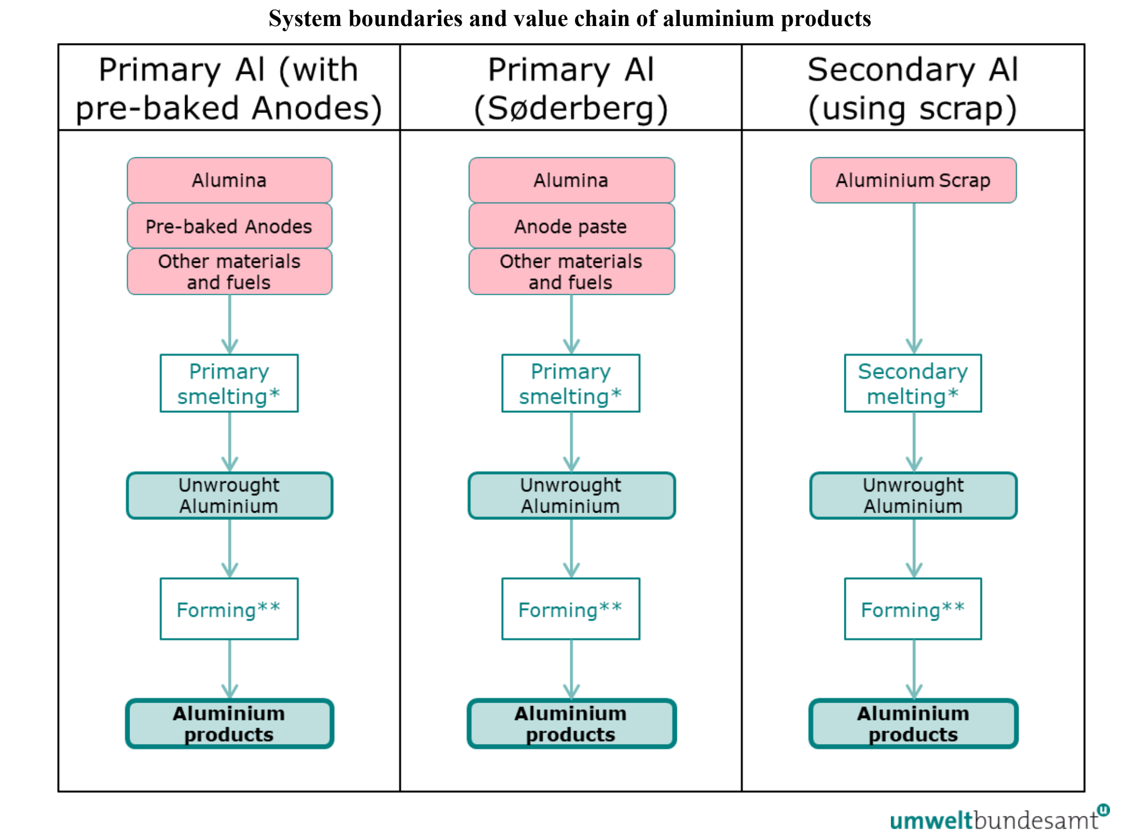
The system boundaries of the precursor unwrought aluminium and of aluminium products are distinct and may, under certain conditions, be added together to include all processes directly or indirectly linked to the production processes for these goods, including input activities to, and output activities from the process. In line with Annex I, point 3.1 (cross-sectoral rules) of the Methodology Act, the purchase and maintenance of infrastructure and equipment are excluded from the system boundaries.

---

[4] Note that any alloying elements contained in unwrought aluminium, that are not defined as CBAM precursor goods, must be excluded from the determination of mass and embedded emissions of the aluminium good.

[5] Excludes CN 7615 (certain household articles) and CN 7602 00 (aluminium waste and scrap).

Figure 2-1: System boundaries and value chain for unwrought aluminium and aluminium products



Note to figure:

- The differences between the aluminium production routes shown in the diagram are as follows: the two primary aluminium smelting routes differ in the electrode materials used (pre-baked versus Søderberg anodes), while the secondary aluminium route uses aluminium scrap instead of alumina as input. Boxes with a blue dashed outline represent optional inputs that are only included where they are actually used at the installation.
- ***Primary smelting / Secondary melting** denotes the unwrought aluminium production step(s) as defined in the system boundaries for "Unwrought aluminium" in Section 3.17 of Annex I to the Act. Electricity may be consumed operationally in the steps shown; for aluminium goods listed in Annex II to the CBAM Regulation, indirect emissions from electricity are not included in embedded emissions (direct emissions only). Purchase and maintenance of infrastructure and equipment are excluded from the system boundaries.
- ****Forming*** covers all processes directly or indirectly linked to the production of aluminium products, excluding cutting, welding and finishing of aluminium products, in line with point 2 ("System boundary") of Section 3.18 "Aluminium products" of Annex I to the Methodology Act

The differences between the aluminium production routes shown in the diagram are as follows: the two primary aluminium smelting routes differ in the electrode materials used (pre-baked anodes versus anode paste (Søderberg)), while the secondary aluminium route uses aluminium scrap instead of alumina as input.

The relevant emissions that must be monitored for the aluminium sector are detailed in section 3.1.1 of this document.

2.2.3.1 Unwrought aluminium – Primary (electrolytic) smelting production route

Primary aluminium is produced by the electrolysis of alumina[6] in electrolytic cells. During electrolysis, aluminium is reduced and oxygen from the alumina is liberated and combines with the carbon anode to form carbon dioxide and carbon monoxide – the carbon anodes in the primary aluminium process are therefore continuously consumed during the process.

Primary aluminium cell systems vary according to the type of anode used. The 'Pre-baked' electrolytic cell uses multiple pre-baked carbon anodes that must be regularly replaced. The 'Søderberg' electrolytic cell uses a single continuous carbon anode, which is self-baked in situ within the cell by means of the heat released during the electrolytic process within the smelter; 'green' anode paste briquettes are added at the top while the anode is consumed at the bottom. Molten aluminium is deposited at the cathode and collects at the bottom of the cell, where it is periodically withdrawn by vacuum siphons into crucibles before being transported to the casting plant. At the casting plant molten aluminium is held in holding furnaces for further processing prior to casting metal ingots, blocks, billets, slabs or similar; small quantities of clean commercial scrap may also be added at this stage.

Annex I, point 3.17.2 ("Unwrought aluminium – primary aluminium from electrolytic reduction") to the Methodology Act defines the system boundaries for direct emissions monitoring for the primary (electrolytic) smelting production route, as encompassing:

> *" – All processes directly or indirectly linked to the production processes emitting CO_2 emissions from the consumption of electrodes or electrode pastes.*
>
> *– All processes directly or indirectly linked to the production processes emitting CO_2 emissions from any fuels used (e.g. for drying and pre-heating of raw materials, heating of electrolysis cells, heating required for casting).*
>
> *– All processes directly or indirectly linked to the production processes emitting CO_2 emissions from any flue gas treatment, from soda ash or limestone if relevant.*
>
> *– Perfluorocarbon emissions caused by anode effects monitored in accordance with Section B.7 of Annex II."*

There are no precursors for this production process. Indirect emissions resulting from electricity consumed by the production process are not taken into account in the embedded emissions of unwrought aluminium CBAM goods, in line with Article 7(1) and Annex II ("List of goods for which only direct emissions are to be taken into account") to the CBAM Regulation. Operators may nevertheless monitor electricity consumption and related indirect emissions, for example for internal purposes or under other monitoring and reporting schemes. In addition, in line with Annex I, point 3.1 (cross-sectoral rules), the system boundaries exclude the purchase and maintenance of infrastructure and equipment.

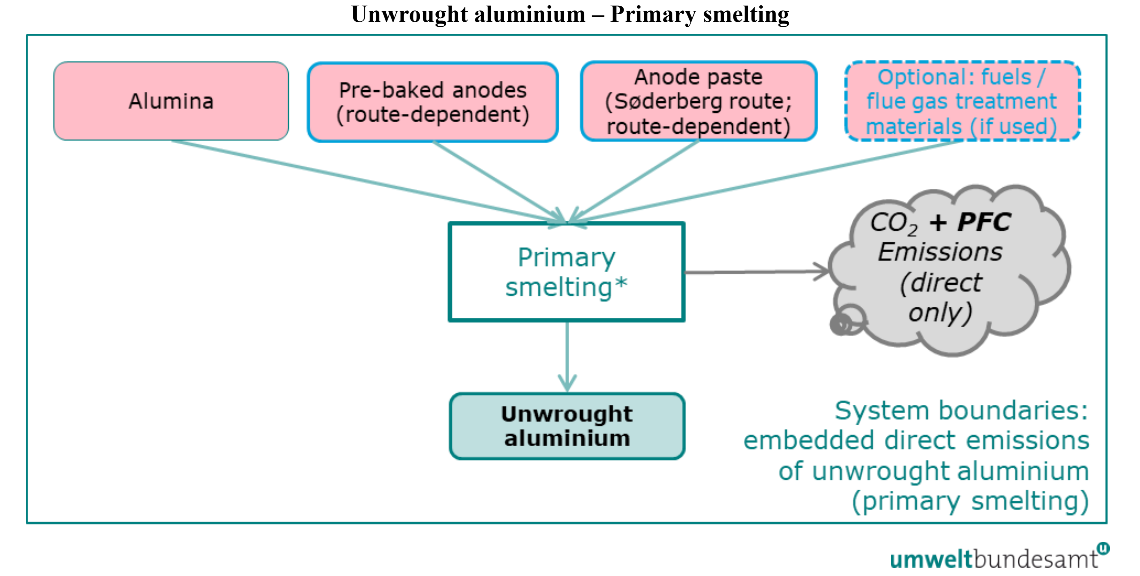
In line with the above definition of systems boundaries, the following production steps may be regarded as being within the system boundaries of primary aluminium installations:

- Raw material preparation – including storage of various additive constituents.

[6] Alumina is purified aluminium oxide produced by beneficiation of bauxite ore via the Bayer process. Production of alumina usually takes place at a different site to primary aluminium production for logistical and power supply reasons

- Electrolytic cell system for aluminium production process – all steps.
- Casting plant – all steps including holding furnaces, conveying systems, further metal processing (metal treatment, alloying and homogenisation) and casting.
- Emissions control – for treating releases to air, water or ground.
- The process materials consumed by the primary aluminium production route – alumina, pre-baked carbon anodes, ‘green’ anode paste briquettes, cryolite and other additives – are treated as raw materials and so have zero embedded emissions.

Figure 2-2: System boundaries of the unwrought aluminium – primary smelting production route



Note to figure:

- Boxes with a blue dashed outline represent optional inputs that are only included where they are actually used at the installation. The “Pre-baked anodes” and “Anode paste (Søderberg route)” boxes represent alternative anode systems (route-dependent), not additional optional inputs. Electricity is consumed operationally in primary smelting; for aluminium goods listed in Annex II to the CBAM Regulation, indirect emissions from electricity are not included in embedded emissions (direct emissions only).
- *Purchase and maintenance of infrastructure and equipment are excluded from the system boundaries.

2.2.3.2 Unwrought aluminium – Secondary melting (recycling) production route

Secondary aluminium is produced mainly from post-consumer aluminium scrap collected for recycling (although unwrought aluminium may also be separately added). Scrap is sorted according to type (cast or wrought alloy) and the sort of pre-treatment measures required (e.g. de-coating, de-oiling), and is then re-melted in the appropriate type of furnace (typically rotary or reverberatory, but induction furnaces may also be used) before further processing including: alloying, melt treatment (addition of salt or chlorination) and finally casting metal ingots, blocks, billets, slabs or similar. Typical fuels used are natural gas, LPG or fuel oil.

The Methodology Act (Annex I, point 3.17.3 ("Unwrought aluminium – secondary aluminium from melting) defines the system boundaries for direct emissions monitoring for the secondary melting (recycling) production route, as encompassing:

> *" – All processes directly or indirectly linked to the production processes emitting CO_2 emissions from any fuels used for drying and pre-heating of raw materials, used in melting furnaces, in pre-treatment of scrap such as de-coating and de-oiling, and combustion of the related residues, and fuels required for casting of ingots, billets or slabs.*
>
> *– All processes directly or indirectly linked to the production processes emitting CO_2 emissions from any fuels used in associated activities such as treatment of skimmings and slag recovery.*
>
> *– All processes directly or indirectly linked to the production processes emitting CO_2 emissions from any flue gas treatment, from soda ash or limestone if relevant."*

A precursor is unwrought aluminium from other sources, if used in the process. During the transitional period, indirect emissions resulting from electricity consumption were monitored and reported separately. In the definitive period, for aluminium CBAM goods listed in Annex II to the CBAM Regulation, indirect emissions from electricity are not included in embedded emissions (direct emissions only); operators may nevertheless monitor electricity consumption and related indirect emissions for internal purposes or under other monitoring and reporting schemes.

In line with the above definition of systems boundaries, the following production steps should be regarded as being within the system boundaries of secondary aluminium:

- Raw material preparation – including sorting, pre-treatment (de-coating, de-oiling), drying and pre-heating of scrap.
- Furnace system for aluminium production process – all steps, including furnace charging, melting and holding furnaces.
- Casting plant – all steps including holding furnaces, conveying systems, further metal processing (metal treatment, alloying and homogenisation) and casting.
- Emissions control – for treating releases to air, water or ground.

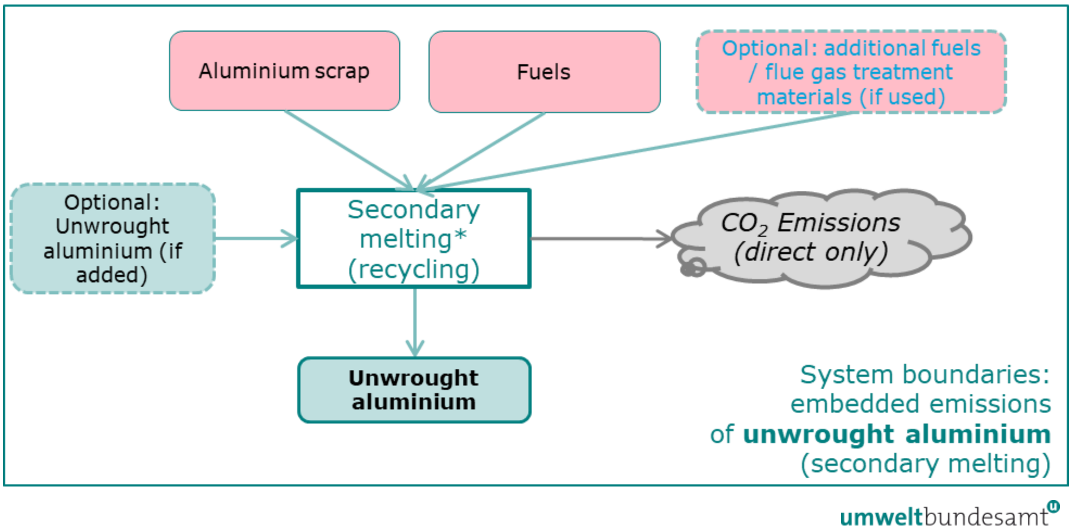
The following *Figure 2-3* shows the system boundaries of the relevant processes for secondary aluminium production.

There are no PFC emissions from the secondary aluminium process.

Aluminium scrap is the main material input to the secondary melting production route. Scrap (whether pre-consumer or post-consumer) is treated as a raw material and so has zero embedded emissions.

.

Figure 2-3: System boundaries of the Unwrought aluminium – secondary melting production route



Note to figure

- Boxes with a blue dashed outline represent optional inputs that are only included where they are actually used at the installation.
- Electricity may be consumed operationally in the production steps shown; for aluminium goods listed in Annex II to the CBAM Regulation, indirect emissions from electricity are not included in embedded emissions (direct emissions only).
- *Purchase and maintenance of infrastructure and equipment are excluded from the system boundaries.

2.2.3.3 Aluminium products production process

Aluminium products are produced by the further processing of precursor unwrought aluminium (alloyed or un-alloyed). Aluminium products are produced by a variety of forming processes including extrusion, casting, hot and cold rolling, forging and drawing. Extrusion is a common process used to produce aluminium profiles. Hot and cold rolling may be used to produce plate, sheet and foil. Casting may be used to produce complex forms.

The Methodology Act (Annex I, point 3.18 ("Aluminium products") defines the system boundaries for direct emissions monitoring for the aluminium products production route, as encompassing:

> *" – All processes directly or indirectly linked to the production processes emitting CO_2 emissions from combustion of fuels and process emissions from flue gas treatment, excluding the following processes: cutting, welding and finishing of aluminium products."*

Precursors are unwrought aluminium, if used in the production process (note that primary and secondary aluminium must be treated separately, if data is known, as each has different embedded emissions), and aluminium products, if used in the production process. Electricity consumption and related indirect emissions may be monitored (e.g. for internal purposes or under other monitoring and reporting schemes), but are not taken into account in embedded emissions for aluminium CBAM goods listed in Annex II to the CBAM Regulation (direct emissions only).

In line with the above definition of systems boundaries, the following production steps should be regarded as being within the system boundaries of basic aluminium products installations:

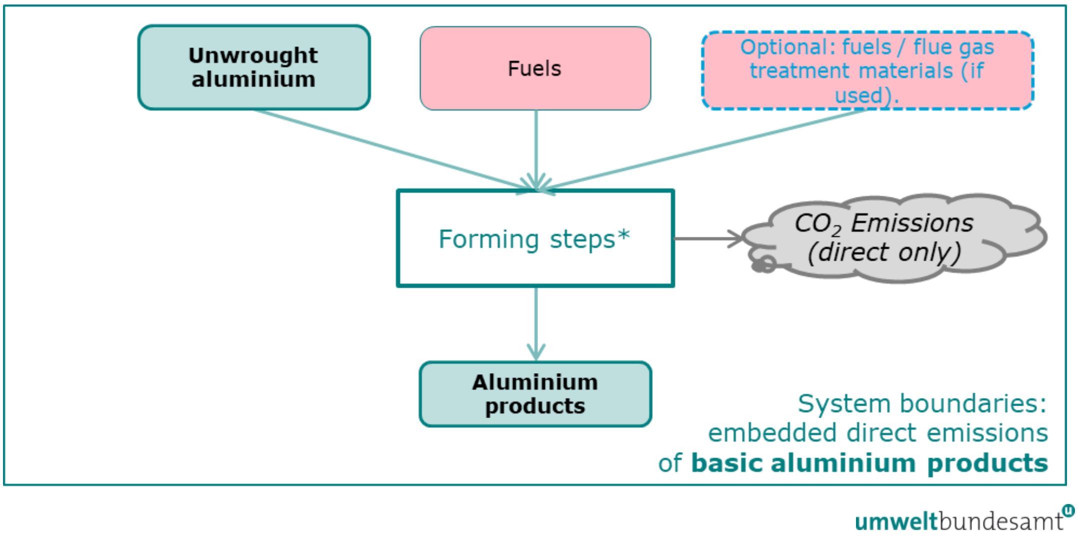
- Raw material preparation – including pre-heating, re-melting and alloying.
- Forming processes – all forming process steps for basic aluminium products, including (but not limited to): extrusion, casting, hot and cold rolling, forging, drawing.
- Annealing, surface preparation and treatment
- Emissions control – for treating releases to air, water or ground.

Purchase and maintenance of infrastructure and equipment are excluded from the system boundaries, in accordance with Annex I, point 3.1 (cross-sectoral rules) of the Methodology Act.

The following *Figure 2-4* shows the system boundaries of the relevant processes for aluminium products.

Figure 2-4: System boundaries of Aluminium products production process

Aluminium products production process



Note to figure:

- Boxes with a blue dashed outline represent optional inputs that are only included where they are actually used at the installation. *"Forming steps"* covers all processes directly or indirectly linked to the production of aluminium products, excluding cutting, welding and finishing of aluminium products, in line with point 2 ("System boundary") of Section 3.18 ("Aluminium products") of Annex I to the Act. Electricity may be consumed operationally; for aluminium goods listed in Annex II to the CBAM Regulation, indirect emissions from electricity are not included in embedded emissions (direct emissions only).
- Purchase and maintenance of infrastructure and equipment are excluded from the system boundaries.

There are no PFC emissions resulting from aluminium products forming processes.

Also note that the quantity of aluminium products shall be reported in accordance with the applicable CN code and the functional unit (tonnes), without applying a standalone mass-threshold adjustment for non-aluminium components (e.g. lining or insulation).

3 ALUMINIUM SECTOR-SPECIFIC REQUIREMENTS

The textbox below signposts the sector-specific sections in the Methodology Act, relevant for the CBAM definitive period.

Methodology Act references:

- **Annex II, point 3** – Functional unit and system boundaries. Sub-sections 3.17 to 3.18 (aluminium sector aggregated goods categories).
- **Annex II, section G** – Global warming potentials for non-CO2 greenhouse gases.
- **Annex III, Section A** – Principles and general requirements, sub-section **A.4** Specific provisions of division of installations into production processes**.**
- **Annex III, Section B** – Monitoring of direct emissions at installation level, sub-section B.7. Requirements for determining perfluorocarbon emissions, covering: **B.7.1** Calculation method A – Slope Method; **B.7.2** Calculation method B – Overvoltage Method; **B.7.3** Determination of CO_2e emissions.

  Annex IV, point 2 – Sector-specific parameters to be included in the operator's emissions report.

3.1 Sector-specific requirements for monitoring and reporting

Direct embedded emissions should be monitored in line with the methodology set out in the Methodology Act.

3.1.1 Emissions monitoring

Relevant emissions that must be monitored and reported for the aluminium sector are:

- Carbon dioxide emissions (direct) resulting from the consumption of pre-baked carbon anodes or green anode paste during electrolysis – emissions result from the reaction of the carbon electrode with oxygen from the alumina or from other sources of oxygen such as from air[7]. There are also emissions associated with the self-baking (coking) of green anode paste in situ in the Søderberg process.

- Carbon dioxide emissions (direct) resulting from furnaces (e.g. holding, pre-heating, re-melting and annealing), where heated by the combustion of fuels used for the furnaces, from stationary plant only (excludes emissions from any mobile units such as vehicles).

- Carbon dioxide emissions (direct) resulting from the production of measurable heating (e.g. steam) and cooling, that is consumed within the system boundaries of the production process, regardless of the location of the production of the heating and cooling (i.e. from on-site generation or from imports from off-site).

---

[7] All formed carbon monoxide (CO) is assumed to be converted to CO_2.

- PFC (perfluorocarbon) emissions (direct) for CF_4 and C_2F_6 only, formed during brief upset conditions known as the 'Anode Effect', when alumina concentration levels drop too low and the electrolytic bath itself undergoes electrolysis.

- Carbon dioxide emissions (direct) resulting from emissions control (e.g. from carbonate raw materials such as soda ash used for acidic flue gas cleaning).

Note that emissions related to the production of pre-baked carbon anodes (even if produced on the same site) and alumina are excluded from the system boundary, i.e. they are not CBAM goods themselves and therefore no precursors with embedded emissions.

Direct emissions from the different source streams above are not reported separately but are added together to result in the total direct emissions for the installation or production process.

Installations that only carry out excluded processes for aluminium products

Where the installation only carries out processes excluded from the system boundaries (see section 3.18 of Annex I to the Methodology Act), verification obligations still apply if operators want to use actual values. Notably, the verification process will have to establish the following:

- That the installation only operates within the list of excluded processes
- Whether the production process carried out on the installation changed the specific embedded emissions of the goods:
    - for instance, in an installation where only cutting occurs, to compute embedded emissions of precursors, operators shall use the mass of precursors as **entering the production process** (before cutting), even if emissions from cutting activities will not be accounted for in embedded emissions of the complex good (see point B of Annex III to the Methodology Act). This means that SEE will increase, even if no emissions need to be reported for CBAM purposes.
- That embedded emissions of precursors, whether based on default values or actual values, are correctly calculated. For instance, the origin of precursors needs to be verified (to establish zero-rating if produced in the EU or exempted territories; to justify the use of the appropriate country-specific default values where relevant; to check that verification reports exist for precursors where relevant).

As the installation needs to be verified, the operator will have to establish a monitoring plan. In this case, the monitoring plan might be very concise given the absence of process emissions, combustion emissions, and indirect emissions. Emissions from excluded process steps do not have to be included in the monitoring plan as a source stream and do not have to be reported in the operator's emissions report.

3.1.2 Additional rules

Attribution of emissions

Given the complexity of production processes in the aluminium sector, installations producing two or more goods from the aggregated goods categories 'unwrought aluminium' or 'aluminium products', may be monitored and reported defining one joint production process for all the products from these groups covered, provided no intermediate product (i.e. precursor to the second processes) is sold or otherwise transferred out of the installation.

Simplified!

Determining PFC process emissions

Additional rules also apply for determining PFC emissions (CF_4 and C_2F_6 only) from primary aluminium production. However, where primary aluminium is used as a precursor, the related PFC emissions form part of the embedded emissions of the final product.

Two different calculation-based methods are available in accordance with Methodology Act, Annex II, section B.7. Both methods are considered equivalent, but as each requires different data, you should choose the method that is most appropriate for your installation's process control equipment:

- '**Slope method'** (**Method A**) – where the 'anode effect minutes per cell-day' (AEM) are recorded. The AEM expresses the frequency of anode effects (number of anode effects / cell-day) multiplied by the average duration of anode effects (anode effect minutes / occurrence).
- '**Overvoltage method'** (**Method B)** – where the 'anode effect overvoltage' (AEO) per cell [mV] is recorded. The AEO is determined as the integral of (time × voltage above the target voltage) divided by the time (duration) of data collection.

Calculation Method A – Slope Method

The following equations for determining PFC emissions shall be used under method A:

$$CF_4\ emissions\ [t] = AEM \times (SEF_{CF4}/1\ 000) \times Pr_{Al} \quad \text{(Equation 21)}$$

$$C_2F_6\ emissions\ [t] = CF_4\ emissions \times F_{C2F6} \quad \text{(Equation 22)}$$

Where:

AEM is the anode effect minutes / cell-day;

SEF_{CF4} is the slope emission factor expressed in (kg CF_4 / t Al produced) / (anode effect minutes / cell-day)]. Where different cell-types are used, different *SEF* may be applied as appropriate;

Pr_{Al} is the production of primary aluminium [t] during the reporting period, and

F_{C2F6} is the weight fraction of C_2F_6 [t C_2F_6 / t CF_4].

The anode effect minutes per cell-day expresses the frequency of anode effects (number anode effects / cell-day) multiplied by the average duration of anode effects (anode effect minutes / occurrence):

$$AEM = frequency \times average\ duration \quad \text{(Equation 23)}$$

Emission factor: the emission factor for CF_4 (slope emission factor, SEF_{CF4}) expresses the amount [kg] of CF_4 emitted per tonne of aluminium produced per anode effect minute per cell-day. The emission factor (weight fraction F_{C2F6}) of C_2F_6 expresses the amount [kg] of C_2F_6 emitted proportionate to the amount [kg] of CF_4 emitted.

Table 3-1: Technology-specific emission factors related to activity data for the slope method.

Technology	**Emission factor for CF_4 (SEF_{CF4})** **[(kg CF_4/t Al) / (AE-min/cell-day)]**	**Emission factor for C_2F_6 (F_{C2F6})** **[t C_2F_6/ t CF_4]**
Legacy Point Feed Pre Bake (PFPB L)	0,122	0,097
Modern Point Feed Pre Bake (PFPB M)	0,104	0,057
Modern Point-Fed Prebake without fully automated anode effect intervention strategies for PFC emissions (PFPB MW)	– (*)	– (*)
Centre Worked Prebake (CWPB)	0,143	0,121
Side Worked Prebake (SWPB)	0,233	0,280
Vertical Stud Søderberg (VSS)	0,058	0,086
Horizontal Stud Søderberg (HSS)	0,165	0,077

(*) The installation has to determine the factor by own measurements. If this is technically not feasible or involves unreasonable costs, the values for CWPB methodology shall be used.

Calculation Method B – Overvoltage Method

For the overvoltage method, the following equations shall be used:

$$CF_4 \text{ emissions } [t] = OVC \times (AEO/CE) \times Pr_{Al} \times 0{,}001 \quad \text{(Equation 24)}$$

$$C_2F_6 \text{ emissions } [t] = CF_4 \text{ emissions} \times F_{C2F6} \quad \text{(Equation 25)}$$

Where:

OVC is the overvoltage coefficient ('emission factor') expressed in kg CF_4 per tonne of aluminium produced per mV overvoltage;

AEO is the anode effect overvoltage per cell [mV] determined as the integral of (time × voltage above the target voltage) divided by the time (duration) of data collection;

CE is the average current efficiency of aluminium production [%];

Pr_{Al} is the annual production of primary aluminium [t], and

F_{C2F6} is the weight fraction of C_2F_6 [t C_2F_6 / t CF_4].

The term *AEO/CE* (Anode effect overvoltage / current efficiency) expresses the time-integrated average anode effect overvoltage [mV overvoltage] per average current efficiency [%].

Table 3-2: Technology-specific emission factors related to overvoltage activity data.

Technology	**Emission factor for CF_4** **[(kg CF_4/t Al) / mV]**	**Emission factor for C_2F_6** **[t C_2F_6/ t CF_4]**
Centre Worked Prebake (CWPB)	1,16	0,121

Technology	Emission factor for CF_4 [(kg CF_4/t Al) / mV]	Emission factor for C_2F_6 [t C_2F_6/ t CF_4]
Side Worked Prebake (SWPB)	3,65	0,252

- **Minimum requirement** for both methods: technology-specific emission factors given in the Methodology Act, Annex II, section B.7 are used.
- **Recommended improvement** for both methods**:** Installation-specific emission factors for CF_4 and C_2F_6 are established through continuous or intermittent field measurements at least every 3 years or after significant changes[8] in the installation, taking into account industry best practice guidelines[9]. *The emission factors shall be determined with a maximum uncertainty of ±15% each.*

Calculating CO_2(e) emissions from PFC emissions

The following formula (Equation 26) may be used to calculate CO_2(e) from CF_4 and C_2F_6 emissions, using the global warming potential (GWP) for these gases:

$$PFC\ emissions\ [t\ CO_{2(e)}] = CF_4\ emissions\ [t] \times GWP_{CF4} + C_2F_6\ emissions\ [t] \times GWP_{C2F6}$$

Please see Table 6 in section G of Annex II to the Methodology Act for relevant GWP values as shown in *Table 3-3*.

Table 3-3: Global warming potentials

Gas	Global warming potential
N_2O	265 t CO_2e / t N_2O
CF_4	6 630 t CO_2e / t CF_4
C_2F_6	11 100 t CO_2e / t C_2F_6

Furthermore, fugitive emissions of PFC are taken into account calculated from the emissions measurable in a duct or stack ('point source emissions') using the collection efficiency of the duct:

$$PFC\ emissions\ (total) = PFC\ emissions\ (duct) / collection\ efficiency \quad \text{(Equation 20)}$$

The collection efficiency shall be measured when the installation-specific emission factors are determined.

8 Relevant changes shall include a change in the distribution of anode effect duration, or a change in the control algorithm affecting the mix of the types of anode effects or the nature of the anode effect termination routine.

9 In particular, the most recent best practice guidelines provided by the International Aluminium Institute.

3.1.3 Additional reporting requirements

The following Table 3-4 lists out the additional information that needs to be provided by you as an operator to importers, in your emissions data communication to them.

Table 3-4: Additional aluminium sector parameters requested in the CBAM declaration

Aggregated good category	Reporting requirement in the annual report
Unwrought aluminium	– Tonnes of scrap used for producing one tonne of the unwrought aluminium product. – % of scrap that is pre-consumer scrap. – Content of alloys in aluminium: If the total content of elements other than aluminium exceeds 1%, the total percentage of such elements.
Aluminium products	– Tonnes of scrap used for producing one tonne of the aluminium product. – % of scrap that is pre-consumer scrap. – Content of alloys in aluminium: If the total content of elements other than aluminium exceeds 1%, the total percentage of such elements.

These parameters depend on the goods produced. Alloying elements play a minor role and are not reflected in the CN classification of aluminium goods. Note that any alloying elements contained in unwrought aluminium, that are not defined as CBAM precursor goods, are excluded from the determination of mass and embedded emissions of the unwrought aluminium or resulting aluminium product good.

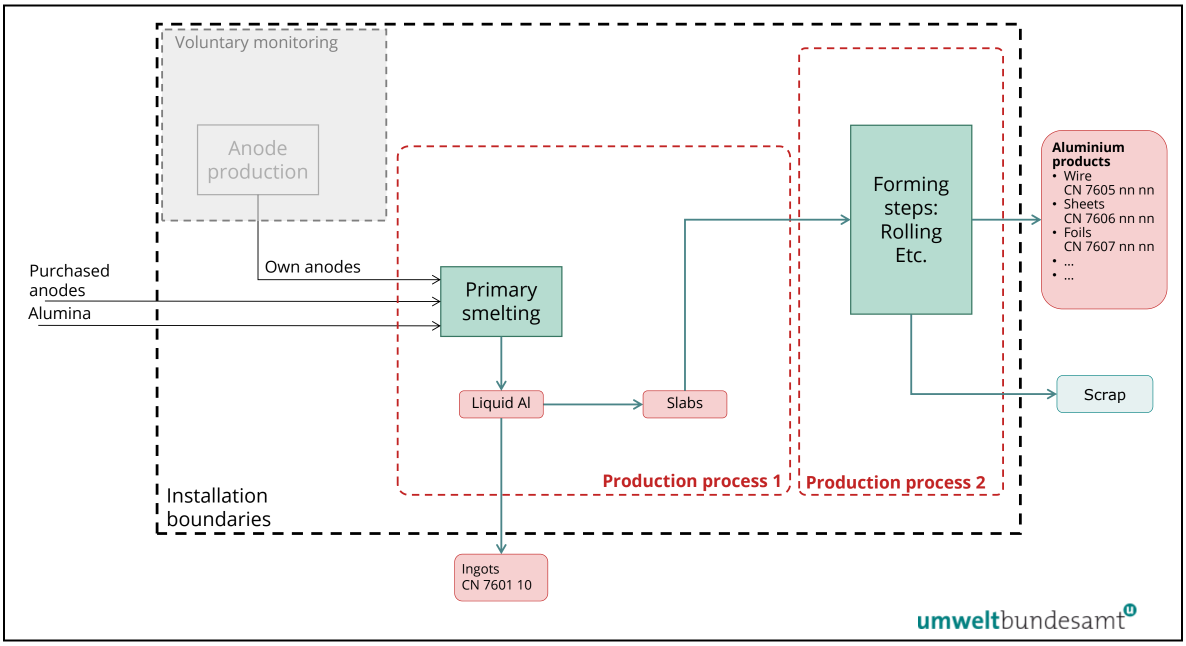
You need to ensure that you collect all the parameters necessary for your CBAM goods and communicate them to the importers of your goods. The importer will need to report the additional parameters when the goods are imported to the EU under the CBAM.

4 WORKED EXAMPLE FOR THE ALUMINIUM SECTOR

The following worked example shows how specific embedded emissions are derived for aluminium sector goods. The resulting embedded emissions of imports into the EU are then calculated at the end of the example for reporting in the definitive period. In this example the installation produces products from two aggregated goods categories, unwrought aluminium and aluminium products, each of which is defined as a single production process, as the intermediate product is sold. Therefore, a 'bubble approach' is not possible. All goods produced from the category "Aluminium products" belong to CN codes that comply with the criterion to differ only in size or shape, but having the same composition. Therefore, these CN codes may be grouped into one production process, as in this example.

Figure 4-1 gives an outline view of the installation and shows the system boundaries as a hatched line for each production process. The physical units carrying out each production process have been grouped under 'Primary smelting' and 'Forming steps' and the different inputs and outputs and sources of emissions have been identified for each production process.

Figure 4-1: Aluminium example – overview



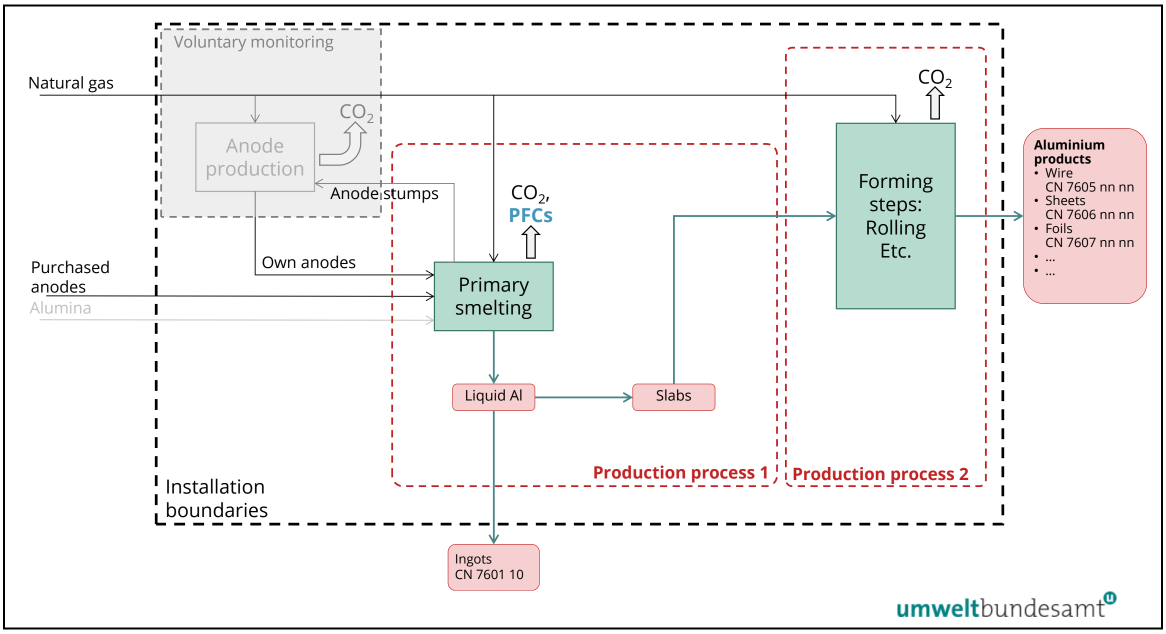
The two production processes defined above are:

- Production process 1 – primary smelting process route producing unwrought aluminium as ingots (which may be sold) and slabs, which are transferred to production process 2. Raw material inputs are anodes, both manufactured on site and purchased from elsewhere, and alumina.

- Production process 2 – different forming processes producing a range of aluminium products, such as wire, sheets and foils. Raw material inputs are unwrought aluminium slabs transferred from production process 1. There is also scrap from this process. This is sent off-site for recycling.

The second diagram (Figure 4-2) identifies sources of direct emissions from the installation.

Figure 4-2: Aluminium example – Identification of source streams for monitoring of direct emissions



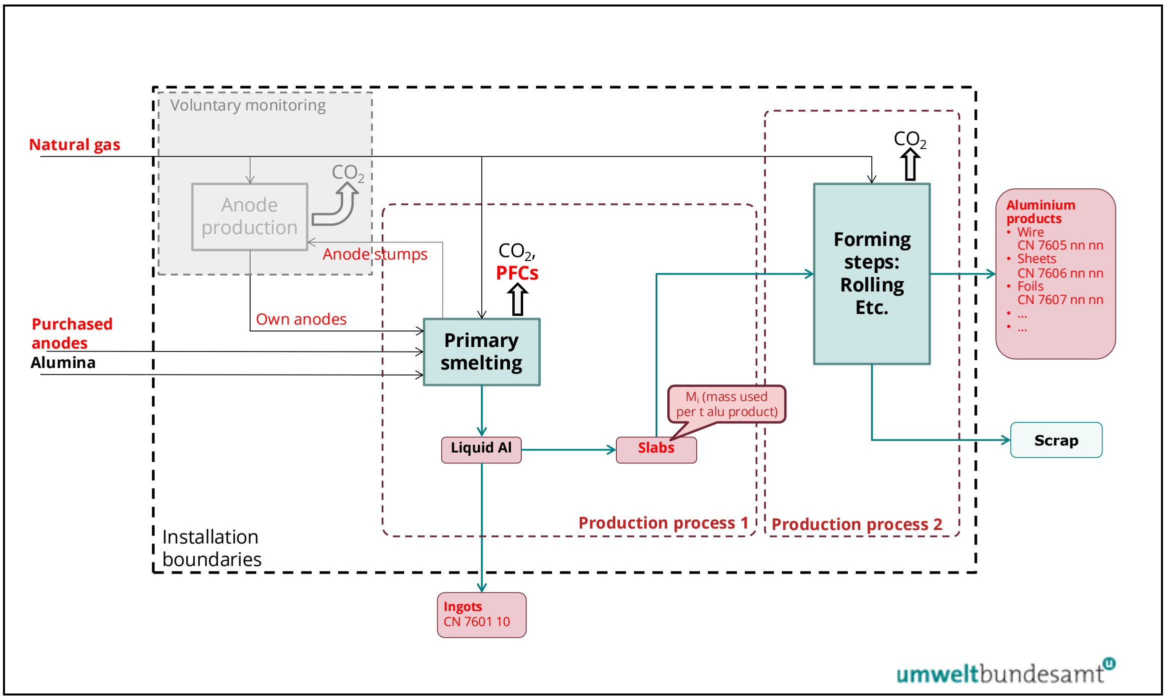
Direct emissions above result from fuel combustion in both production processes, and from the primary smelting process – from the consumption of carbon anodes and from the formation of PFCs.

Note that on-site anode production is omitted from monitoring, as anodes are raw materials and are therefore considered to have zero embedded emissions. For monitoring the anode consumption, the difference of anode input and anode stumps recycled result in the activity data of anode consumption.

However, for completeness you may wish on a voluntary basis to fully monitor all sources of direct and indirect emissions, which in this case would include a full mass balance of raw materials and additional fuels consumed in the anode production. Alumina consumption does not need monitoring, as it neither contributes to the direct emissions nor to embedded emissions.

The third diagram (Figure 4-3) provides a complete monitoring approach for all source streams, for the example installation.

Figure 4-3: Aluminium example – complete monitoring approach. All elements highlighted in red need to be monitored.



The inputs and outputs highlighted in red text in Figure 4-3 are the parameters that need to be monitored by the operator in order to attribute emissions and determine direct specific embedded emissions for both production processes.

The direct emissions that are monitored in this example result from:

- Direct CO_2 emissions from fuel (natural gas) combustion, and from the process resulting from the consumption of carbon anodes.
- Direct emissions of PFCs formed during the electrolysis process.
- In the case of production process 2, embedded emissions in precursors (the slabs produced in process 1).

The inputs of precursors (with embedded emissions) and the activity level of the aluminium goods produced by each production process also need to be monitored. There is no need to monitor the electricity consumption, as no indirect emissions are included for aluminium goods.

Table 4-1 summarises the inputs and outputs from the two production processes that are monitored in order to determine total direct specific embedded emissions.

Table 4-1: Input & production levels of the aluminium example

Production:	**Ingots & liquid aluminium, total**	**200 000 t**
	Ingots (sale):	80 000 t
	Primary aluminium into process 2 (slabs)	120 000 t
	Aluminium products (process 2)	
	Wire (CN 7605)	45 000 t
	Sheets (CN 7606)	60 000 t
	Foils (CN 7607)	8 000 t
	Total Aluminium products (process 2)	**113 000 t**
	Scrap[10] sold	7 000 t
Inputs:	Alumina	380 000 t
	Electrodes (sum self-produced and purchased, minus stumps)	69 000 t
	Natural gas (12 219 t for process 1, 1 962 t for process 2)	14 181 t

Whilst some unwrought aluminium is sold off site in the form of ingots (80 000 tonnes), 120 000 tonnes is used as a precursor in production process 2, and there is scrap of 7 000 tonnes at the end. No emissions are attributed to aluminium scrap, which therefore has zero embedded emissions.

Table 4-2 summarises the calculation of direct emissions and their attribution to each production process.

Table 4-2: Aluminium example – Installation's total direct emissions

Direct emissions CO_2e	**Emissions**	**Units**
From electrodes (using factor 3,664 t CO_2 / t C):	252 816	t CO_2
From natural gas (NCV = 48 GJ/t, EF=56,1 t CO_2 / TJ):	32 902	t CO_2
From PFCs (using a method described in section 3.1.2)	25 282	t CO_2e
Total Process 1 (primary aluminium)	**311 000**	**t CO_2e**
Total process 2 (final aluminium products), emissions from natural gas	5 283	t CO_2
Total direct emissions of the installation	**316 283**	**t CO_2**

Using the data in the tables above, direct specific embedded emissions are then calculated separately for each production process as shown in Table 4-3.

[10] Not a CBAM good

Table 4-3: Example calculation of specific embedded emissions of complex final aluminium goods

		Production levels (t)	**Process total emissions (t CO_2e)**	**Mass ratio (M_i) of precursor (t / t)**	**SEE dir. (t CO_2e / t)**
Process 1 (unwrought aluminium – ingots and slabs)					
	Product				
	Ingots	80 000			
	Slabs	120 000			
	Total	**200 000**	**311 000**		**1,555**
Process 2 (final aluminium products)					
Precursor	Slabs	120 000		1,062	1,651
Aluminium products		113 000	5 283		0,047
Total embedded emissions of final aluminium products					**1,698**

When calculating the total embedded emissions of final aluminium products above, the **mass ratio (*M_i*)** of the precursor is taken into. This is the mass of unwrought aluminium slabs consumed per tonne of aluminium products, and is calculated as:

- Mass slabs / mass aluminium products: 120 000 t / 113 000 t = 1,062 t / t (as above).

The direct *SEE_i* values of the precursor are then adjusted by this ratio i.e.:

- For *SEE_i* direct (precursor): 1,555 t CO_2 / t × 1,062 t / t = 1,651 t CO_2 / t.

Total direct specific embedded emissions of the final complex aluminium product are calculated by **adding** the *SEE* values of the precursor (adjusted by the *M_i*) to the emissions of the production process for aluminium products, as above.

Using the above approach, the CBAM reporting obligation due for the import of final aluminium product into the EU during the definitive period may then be determined; for example, for the import of 100 tonnes of basic aluminium product e.g. sheets:

- **Definitive period (report only):**
  - Direct embedded emissions = 100 t × 1,698 t CO_2 / t = 169,8 t CO_2

  Total: 169,8 t CO_2

Annex A List of definitions

Term	Definition
‘Accuracy’	means the closeness of the agreement between the result of a measurement and the true value of the particular quantity or a reference value determined empirically using internationally accepted and traceable calibration materials and standard methods, taking into account both random and systematic factors
‘Activity data’	means the amount of fuels or materials consumed or produced by a process relevant for the calculation-based methodology, expressed in terajoules (TJ), mass in tonnes or (for gases) volume in normal cubic metres, as appropriate
‘Actual emissions’	means the emissions calculated based on primary data from the production processes of goods and from the production of electricity consumed during those processes as determined in accordance with the methods set out in Annex IV [to the Methodology Act]
‘Activity level’	means the quantity of goods to which the same functional unit applies that are produced within the system boundaries of a production process during a reporting period
‘Aggregated goods categories’	means aggregated goods categories pursuant to Table 1 of point 2 of Annex I. A group of CBAM goods with their CN codes, used for the purpose of defining system boundaries of production processes.
‘Agricultural, aquaculture, fisheries and forestry residues’	means residues that are directly generated by agriculture, aquaculture, fisheries and forestry and that do not include residues from related industries or processing
‘Authorised CBAM declarant’	means a person authorised by the competent authority in accordance with Article 17 [of the CBAM Regulation]. The ‘authorised CBAM declarant’ [which replaces the term ‘reporting declarant’ from the transitional period] may be importers of CBAM goods, or their indirect customs representatives, who have applied for and been granted the status of authorised CBAM declarant.
‘Batch’	means an amount of fuel or material representatively sampled and characterised, and transferred as one shipment or continuously over a specific period of time
‘Biomass’	means biomass as defined in Article 2, point (24) of the Renewable Energy Directive (RED II)[11]; it includes bioliquids and biofuels as defined in Article 2, point (32) and (33), biomass fuels as defined in Article 2, point (27) and biogas as defined in Article 2 point (28) of the RED II;

[11] Directive (EU) 2018/2001

Term	Definition
'Biomass fraction'	means the ratio of carbon stemming from biomass to the total carbon content of a fuel or material, expressed as a fraction
'Calculation factors'	means net calorific value, emission factor, preliminary emission factor, oxidation factor, conversion factor, carbon content or biomass fraction
'Calibration'	means the set of operations, which establishes, under specified conditions, the relations between values indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material and the corresponding values of a quantity realised by a reference standard
'Carbon price'	means the monetary amount paid in a third country, under a carbon emissions reduction scheme, in the form of a tax, levy or fee or in the form of emission allowances under a greenhouse gas emissions trading system, calculated on greenhouse gases covered by such a measure, and released during the production of goods
'CBAM certificate'	means a certificate in electronic format corresponding to one tonne of CO_2e of embedded emissions in goods
'CO_2 emission factor'	means the weighted average of the CO_2 intensity of electricity produced from fossil fuels within a geographic area. The CO_2 emission factor is the result of the division of the CO_2 emission data of the electricity sector by the gross electricity generation based on fossil fuels in the relevant geographic area. It is expressed in tonnes of CO_2 per megawatt-hour
'Combined nomenclature' (CN)	means the classification of goods, designed to meet the needs of: i) the Common customs tariff, setting import duties for products imported into the European Union (EU), as well as the Integrated tariff of the European Communities (Taric), incorporating all EU and trade measures applied to goods imported into and exported out of the EU; ii) the international trade statistics of the EU. The CN provides the means of collecting, exchanging and publishing data on EU international trade statistics. It is also used for the collection and publication of international trade statistics in intra-EU trade.[12]
'Combustion emissions'	means greenhouse gas emissions occurring during the exothermic reaction of a fuel with oxygen
'Competent authority'	means the authority designated by each Member State in accordance with Article 11 [of the CBAM Regulation]

[12] For definition see: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Combined_nomenclature_(CN)

Term	Definition
'Continuous emission measurement' (CEM)	means a set of operations having the objective of determining the value of a quantity by means of periodic measurements, applying either measurements in the stack or extractive procedures with a measuring instrument located close to the stack, whilst excluding measurement methodologies based on the collection of individual samples from the stack
'Control system'	means the operator's risk assessment and entire set of control activities, including the continuous management thereof, that an operator has established, documented, implemented and maintained pursuant to point A.2. of Annex II
'Complex goods'	means goods other than simple goods
'Conservative'	means that a set of assumptions is defined in order to ensure that no under-estimation of reported emissions or over-estimation of production of heat, electricity or goods occurs
'Conversion factor'	means the ratio of carbon emitted as CO_2 to the total carbon contained in the source stream before the emitting process takes place, expressed as a fraction, considering CO emitted to the atmosphere as the molar equivalent amount of CO_2
'Co-product'	means any of two or more products resulting from the same production process
'Customs declarant'	means a declarant as defined in Article 5, point (15) of Regulation (EU) No 952/2013 lodging a customs declaration for release for free circulation of goods in its own name or the person in whose name such a declaration is lodged
'CCUS system'	means a group of economic operators with technically connected installations and transport equipment for CO_2 capture, transport, use in production of goods, or geological storage
'Data flow activities'	mean activities related to the acquisition, processing and handling of data that are needed to draft an emissions report from primary source data
'Data set'	means one type of data, either at installation level or production process level as relevant in the circumstances, as any of the following: (a) the amount of fuels or materials consumed or produced by a production process as relevant for the calculation-based methodology, expressed in terajoules, mass in tonnes, or for gases as volume in normal cubic metres, as appropriate, including for waste gases; (b) a calculation factor;

Term	Definition
	(c) net quantity of measurable heat, and the relevant parameters required for determining this quantity, in particular: i) mass flow of heat transfer medium; and ii) enthalpy of transmitted and returned heat transfer medium, as specified by composition, temperature, pressure and saturation; (d) quantities of non-measurable heat, specified by the relevant quantities of fuels used for producing the heat, and the net calorific value (NCV) of the fuel mix; (e) quantities of electricity; (f) quantities of CO_2 transferred between installations; (g) quantities of precursors received from outside the production process, and their relevant parameters, such as country of origin, used production route, specific direct and indirect emissions;
'Default value'	means a value, which is calculated or drawn from secondary data, which represents the embedded emissions in goods
'Direct emissions'	means emissions from the production processes of goods including emissions from the production of heating and cooling that is consumed during the production processes, irrespective of the location of the production of the heating or cooling
'Embedded emissions'	means direct emissions released during the production of goods and indirect emissions from the production of electricity that is consumed during the production processes, calculated in accordance with the methods set out in Annex IV and further specified in the implementing acts adopted pursuant to Article 7(7)
'Emissions'	mean the release of greenhouse gases into the atmosphere from the production of goods
'Emission factor'	means the average emission rate of a greenhouse gas relative to the activity data of a source stream assuming complete oxidation for combustion and complete conversion for all other chemical reactions
'Emission factor' for electricity	means the default value, expressed in CO_2e, representing the emission intensity of electricity consumed in production of goods.
'Emission source'	means a separately identifiable part of an installation or a process within an installation, from which relevant greenhouse gases are emitted
EU ETS	means the system for greenhouse gas emissions allowance trading within the Union in respect of activities listed in Annex I to Directive 2003/87/EC other than aviation activities

Term	Definition
‘EU ETS allowance’	means an allowance as defined in Article 3, point (a), of Directive 2003/87/EC in respect of activities listed in Annex I to that Directive other than aviation activities
‘Fossil carbon’	means inorganic and organic carbon that is not biomass
‘Fossil fraction’	means the ratio of fossil carbon to the total carbon content of a fuel or material, expressed as a fraction
‘Fugitive emissions’	means irregular or unintended emissions from sources that are not localised, or too diverse or too small to be monitored individually
‘Functional unit’	means the reference unit used for the calculation of embedded emissions in goods
‘Goods’	means goods listed in Annex I [to the CBAM the CBAM Regulation]
‘Greenhouse gases’	mean greenhouse gases as specified in Annex I [to the CBAM the CBAM Regulation] in relation to each of the goods listed in that Annex
‘Heat meter’	means a thermal energy meter or any other device to measure and record the amount of thermal energy produced based upon flow volumes and temperatures
‘Importer’	means either the person lodging a customs declaration for release for free circulation of goods or a bill of discharge in accordance with Article 175(5) of Delegated Regulation (EU) 2015/2446 in its own name and on its own behalf or, where the customs declaration is lodged by an indirect customs representative in accordance with Article 18 of Regulation (EU) No 952/2013, the person on whose behalf such a declaration is lodged
‘Importation’	means release for free circulation as provided for in Article 201 of Regulation (EU) No 952/2013
‘Indirect customs Representative’	A customs representative appointed by an importer established in a Member State. If the importer appoints an indirect customs representative and they agree, they can act as an authorised CBAM declarant and submit the application for an authorisation on behalf of the importer. The indirect customs representative is liable for all operations made for the importers it represents
‘Indirect emissions’	means emissions from the production of electricity which is consumed during the production processes of goods, irrespective of the location of the production of the consumed electricity
‘Inherent CO_2’	means CO_2 which is part of a source stream.
‘Installation’	means a stationary technical unit where a production process is carried out

Term	Definition
'Legal metrological control'	means the control exercised by a public authority or regulator of the measurement tasks intended for the field of application of a measuring instrument, for reasons of public interest, public health, public safety, public order, protection of the environment, the levying of taxes and duties, the protection of consumers and fair trading
'Measurable heat'	means a net heat flow transported through identifiable pipelines or ducts using a heat transfer medium, such as, in particular, steam, hot air, water, oil, liquid metals and salts, for which a heat meter is or could be installed
'Measurement point'	means the emission source for which continuous emission measurement systems (CEMS) are used for emission measurement, or the cross-section of a pipeline system for which the CO_2 flow is determined using continuous measurement systems
'Measurement system'	means a complete set of measuring instruments and other equipment used to determine variables for the monitoring and calculation of emissions
'Minimum requirements'	means monitoring methods using the minimum efforts allowed for determining data in order to result in emission data acceptable for the purpose of the CBAM Regulation.
'Mixed fuel'	means a fuel which contains both biomass and fossil carbon
'Mixed material'	means a material which contains both biomass and fossil carbon
'Multifunctional process'	means a process that delivers multiple outputs or whose outputs feed into several production processes
'Net calorific value' (NCV)	means the specific amount of energy released as heat when a fuel or material undergoes complete combustion with oxygen under standard conditions, less the heat of vaporisation of any water formed
'Non-CBAM good'	means any good produced in the installation that is not included in Annex I to the CBAM Regulation
'Non-measurable heat'	means all heat other than measurable heat
'Operator'	means any person who operates or controls an installation in a third country, including a parent company that controls an installation in a third country
'Oxidation factor'	means the ratio of carbon oxidised to CO_2 as a consequence of combustion to the total carbon contained in the fuel, expressed as a fraction, considering carbon monoxide (CO) emitted to the atmosphere as the molar equivalent amount of carbon dioxide (CO_2)
'Power purchase agreement'	means a contract under which a person agrees to purchase electricity directly from an electricity producer

Term	Definition
'Precursor'	means any input material into a production process included in the list of goods set out in Annex I to the CBAM Regulation;
'Preliminary emission factor'	means the assumed total emission factor of a fuel or material based on the carbon content of its biomass fraction and its fossil fraction before multiplying it by the fossil fraction to produce the emission factor
'Production process'	means the chemical and physical processes carried out to produce goods in an installation
'Production route' [13]	means a specific technology used in a production process to produce goods
'Process emissions'	means greenhouse gas emissions other than combustion emissions occurring as a result of intentional and unintentional reactions between substances or their transformation, for a primary purpose other than the generation of heat, including from the following processes: (a) the chemical, electrolytic or pyrometallurgical reduction of metal compounds in ores, concentrates and secondary materials; (b) the removal of impurities from metals and metal compounds; (c) the decomposition of carbonates, including those used for flue gas cleaning; (d) chemical syntheses of products and intermediate products where the carbon bearing material participates in the reaction; (e) the use of carbon containing additives or raw materials; (f) the chemical or electrolytic reduction of metalloid oxides or non-metal oxides such as silicon oxides and phosphates.
'Proxy data'	means annual values which are empirically substantiated or derived from accepted sources and which an operator uses to substitute a data set[14] for the purpose of ensuring complete reporting
'Rebate'	means any amount that reduces the amount due or paid by a person liable for the payment of a carbon price, before its payment or after, in a monetary form or in any other form.
'Recommended improvements'	means monitoring methods which are proven means to ensure that data are more accurate or less prone to mistakes than by mere application of minimum requirements
'Related emissions'	means: – the direct emissions caused by the source stream or emission source concerned; – emissions attributed to a quantity of measurable heat; – the indirect emissions related to the quantity of electricity concerned; – embedded emissions of a material produced or of a precursor consumed.

[13] Note that different production routes can fall within the same production process.

[14] Refers to the activity data or the calculation factors.

Term	Definition
'Reporting period'	means the period corresponding to the calendar year during which the good was produced and used by the authorised CBAM declarant as reference for the determination of embedded emissions
'Residue'	means a substance that is not the end product that a production process directly seeks to produce; it is not a primary aim of the production process and the process has not been deliberately modified to produce it
'Simple goods'	means goods produced in a production process requiring exclusively input materials (precursors) and fuels having zero embedded emissions
'Source stream'	means either of the following: (a) a specific fuel type, raw material or product giving rise to emissions of relevant greenhouse gases at one or more emission sources as a result of its consumption or production; (b) a specific fuel type, raw material or product containing carbon and included in the calculation of greenhouse gas emissions using a mass-balance method
'Specific embedded emissions'	means the embedded emissions of one tonne of goods, expressed as tonnes of CO_2e emissions per tonne of goods
'Standard conditions'	means temperature of 273,15 K and pressure conditions of 101 325 Pa defining normal cubic metres (Nm^3)
'System boundary'	means the group of chemical or physical processes included in the calculation of embedded emissions of goods under the same aggregated goods category. The system boundaries shall cover direct emissions, indirect emissions for goods not listed in Annex II to the CBAM Regulation, and the embedded emissions of any precursor.
'Third country'	means a country or territory outside the customs territory of the [European] Union
'Tonne of $CO_{2(e)}$'	means one metric tonne of carbon dioxide ('CO_2'), or an amount of any other greenhouse gas listed in Annex I [to the CBAM Regulation] with an equivalent global warming potential ['CO_2e']
'Transmission system operator'	means an operator as defined in Article 2, point (35) of Directive (EU) 2019/944 of the European Parliament and of the Council ([15]).

[15] Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity and amending Directive 2012/27/EU (OJ L 158, 14.6.2019, p. 125).

Term	Definition
'Uncertainty'	means a parameter, associated with the result of the determination of a quantity, that characterises the dispersion of the values that could reasonably be attributed to the particular quantity, including the effects of systematic as well as of random factors, expressed in percent, and describes a confidence interval around the mean value comprising 95% of inferred values taking into account any asymmetry of the distribution of values
'Waste'	means any substance or object which the holder discards or intends or is required to discard, excluding substances that have been intentionally modified or contaminated in order to meet this definition
'Waste gas'	means a gas containing incompletely oxidised carbon in a gaseous state under standard conditions which is a result of any of the processes listed under 'process emissions'

Annex B List of abbreviations

Abbreviation	Full term
AD	Activity Data
AEM	Anode Effect Minutes
AEO	Anode Effect Overvoltage
AL	Activity Level
AOD	Argon Oxygen Decarburisation.
BAT	Best Available Techniques
BF	Biomass Fraction
BFG	Blast Furnace Gas
BM	Benchmark
BOF	Basic Oxygen Furnace
BOFG	Basic Oxygen Furnace Gas
BREFs	Best Available Techniques Reference documents
CA	Competent Authority
CBAM	Carbon Border Adjustment Mechanism, the
CCR	Clinker to Cement Ratio
CCS	Carbon Capture and Storage
CCU(S)	Carbon Capture and Utilisation (and Storage)
CEMS	Continuous Emission Measurement Systems
CF	Conversion Factor
CFP	Carbon footprint of products
CHP	Combined Heat and Power
CKD	Cement Kiln Dust
CN	Combined nomenclature
COG	Coke Oven Gas
DRI	Direct Reduced Iron
EAF	Electric Arc Furnace
EEA	European Economic Area (EU-27, Iceland, Norway, Liechtenstein)
EF	Emission Factor
EFTA	European Free Trade Area
EORI	Economic Operator Registration and Identification
ETS	Emissions Trading System
EU ETS	EU Emissions Trading System
EUA	EU Allowances (used in the EU ETS)
EUR	Euro (currency)

Abbreviation	Full term
FAR	Free Allocation Rules (Regulation 2019/331)[16]
FIFO	First-In-First-Out principle
GHG	Greenhouse Gas
GWP	Global Warming Potential
HBI	Hot Briquetted Iron
HS	Harmonised System (for international trade)
IEA	International Energy Agency
ISO	International Organization for Standardization
LULUCF	Land-use, land change and forestry (criteria)
MP	Monitoring Plan
MRR	Monitoring and Reporting Regulation (Regulation 2018/2066)[17]
MRV	Monitoring, Reporting and Verification
MS	Member State(s)
MWh	Megawatt-hour
NCV	Net Calorific Value
NPI	Nickel pig iron
OF	Oxidation Factor
PCI	Pulverised Coal Injection
PEMS	Predictive Emission Monitoring System
PFC	Perfluoro-carbon
PoS	Proofs of Sustainability
RED II	Renewable Energy Directive, re-cast
SEE	Specific embedded emissions
SEFA	Specific embedded free allocation
TARIC	Integrated Tariff of the European Union database
TJ	Terajoules
TSO	Transmission System Operator
UCC	Union Custom Code
UN/LOCODE	United Nations Code for Trade and Transport Location

[16] Free Allocation Rules (Commission Delegated Regulation (EU) 2019/331 of 19 December 2018 determining transitional Union-wide rules for harmonised free allocation of emission allowances pursuant to Article 10a of Directive 2003/87/EC of the European Parliament and of the Council)

[17] Monitoring and Reporting Regulation (Commission Implementing Regulation (EU) 2018/2066 of 19 December 2018 on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council and amending Commission Regulation (EU) No 601/2012

EUROPEAN COMMISSION
DIRECTORATE-GENERAL
TAXATION AND CUSTOMS UNION
Indirect Taxation and Tax Administration
CBAM, Energy and Green Taxation

Brussels, 14 August 2026

GUIDANCE DOCUMENT 5F: SECTOR-SPECIFIC GUIDANCE DOCUMENT ON ELECTRICITY AS A GOOD

Disclaimer: This guidance document is not legally binding and it is of an explanatory nature. Legal provisions of Union law take precedence over the contents of this document and should always be consulted. The authentic texts of the EU legal instruments are those published in the Official Journal of the European Union. This guidance was prepared by Commission services and does not represent an official position of the Commission. Only the Court of Justice of the European Union is competent to authoritatively interpret Union law.

VERSION HISTORY

Date	Version notes
14.08.2026	First Publication of this document for the definitive period.

CONTENTS

1 PREFACE

1.1 Structure and content of the guidance documents

This series of documents has been written to support stakeholders by explaining the requirements of the CBAM Regulation in a non-legislative language. This series of guidance documents should benefit a variety of stakeholders. A specific focus has been put on clarifying the **requirements for operators of installations producing CBAM goods outside of the EU for the definitive period**.

- **Guidance 1** provides an overview of the main changes to the CBAM methodology between the definitive period and the concluded transitional period. It also introduces the CBAM and an overview of the compliance cycle, roles and responsibilities, as well as milestones and deadlines for operators of installations outside the EU during the definitive period and explains the general exemptions from the CBAM.

- **Guidance 2** provides a quick guidance for the intended reader of this document, the operator of an installation producing CBAM goods. It provides a roadmap of the most important concepts of CBAM emissions monitoring and where to find more information in this series of documents.

- **Guidance 3** sets out the monitoring and reporting obligations and recommendations which are potentially applicable to any affected producer of CBAM goods.

- **Guidance 4** provides an overview of how the adjustment for free allocation is to be determined and what information is needed.

- **Guidance documents 5a, 5b, 5c, 5d, 5e and 5f** present an overview per sector of the production processes and value chains for goods that are included in the scope of the CBAM, as well as sector-specific monitoring and reporting considerations for each CBAM good where this is relevant. These sections are supplemented by examples for each sector.

The series of guidance documents is accompanied by an electronic template for information that should be used by installation operators to communicate information to the authorised CBAM declarants and CBAM Registry.

Presentation of numbers in EU documents

To align with EU legal documents, this guidance document uses the following convention when presenting numbers.

The decimal separator used to separate the integral part of a number from its fractional part is a comma, e.g.: 0,890

Thousands, and powers of 10^{3n} thereafter, are separated by a space, e.g.:

- fifteen thousand is written as 15 000
- fifteen million is written as 15 000 000

1.2 Reference regulations and legal acts

Several regulations and legal acts are referred to throughout this series of guidance documents. For ease of reading and to avoid ambiguity, simplified references are used when citing these acts.

- **CBAM Regulation**: Regulation (EU) 2023/956 and Regulation (EU) 2025/2083 amending Regulation (EU) 2023/956. Notably, where article numbers are given in this document without further specification, they always refer to the CBAM Regulation.

  It can be accessed at the following link (consolidated version): **http://data.europa.eu/eli/reg/2023/956/2025-10-20**

- **Methodology Act:** Commission Implementing Regulation (EU) 2025/2547, in legal texts referred to as "Implementing act pursuant to Article 7(7) of the CBAM Regulation".

  It can be accessed at the following link: **http://data.europa.eu/eli/reg_impl/2025/2547/oj**

- **Default Values Act**: Commission Implementing Regulation (EU) 2025/2621, in legal texts referred to as "Implementing act pursuant to Article 7(7) of the CBAM Regulation", also referred to as "default values determined in accordance with Annex IV to the CBAM Regulation".

  It can be accessed at the following link: **http://data.europa.eu/eli/reg_impl/2025/2621/oj**

- **Verification Principles Act**: Commission Implementing Regulation (EU) 2025/2546, in legal texts referred to as "Implementing act pursuant to Article 8(3) of the CBAM Regulation".

  It can be accessed at the following link: **http://data.europa.eu/eli/reg_impl/2025/2546/oj**

- **Accreditation & Verification Requirements Act**: Commission Delegated Regulation (EU) 2025/2551, in legal texts referred to as "Delegated act pursuant to Article 18(3) of the CBAM Regulation".

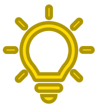
  It can be accessed at the following link: **http://data.europa.eu/eli/reg_del/2025/2551/oj**

- **Free Allocation Adjustment Act**: Commission Implementing Regulation (EU) 2025/2620, in legal texts referred to as "Implementing act pursuant to Article 31(2) of the CBAM Regulation".

  It can be accessed at the following link: **http://data.europa.eu/eli/reg_impl/2025/2620/oj**

For acronyms and definitions used in this document, please see **Annex C** and **Annex B**.

A series of icons are used throughout to help guide the reader:

Icon	Description of use
	Points to information of particular importance for operators of installations producing CBAM goods.
Simplified!	Highlights simplified approaches of the general requirements of the CBAM.
	Used where recommended improvements are presented.
	Used where other documents, templates or electronic tools are available from other sources.
	Points to examples given for the topics discussed in the surrounding text.

2 ELECTRICITY "AS A GOOD" (I.E. IMPORTED INTO THE EU)

Note*: The Commission's proposal*[1] *of 17 December 2025 to amend the CBAM Regulation includes proposed changes on the rules for electricity as CBAM good. However, at the time of writing this guidance document, the legislative discussion process is still ongoing. Therefore, this proposal is not reflected in this guidance document.*

The textbox below signposts sector-specific sections in the Methodology Act, relevant for the CBAM definitive period.

Methodology Act references:

- **Annex I, point 3** – Functional unit and system boundaries Sub-section **3.19** (Electricity)
- **Annex II, Section D** –Electricity, sub-sections **D.1** to **D.2**

Where electricity is imported into the EU as a good on its own, i.e. is not considered in the context of the indirect emissions of a (tangible) good, specific rules apply. Firstly, electricity is listed in Annex II to the CBAM Regulation and therefore only direct emissions are taken into account. Secondly, it is the exception from the rule that actual emissions are monitored instead of using a default value for the embedded emissions. For calculating those emissions, the following formula is used:

$$Em_{el} = E_{el} \cdot EF_{el} \qquad \text{(Equation 35)}$$

Where:

Em_{el} are the emissions related to electricity, expressed in t CO_2 ;

E_{el} is the electricity produced, expressed in MWh; and

EF_{el} is the emission factor for electricity applied, expressed in t CO_2/MWh.

For the emission factor of electricity, the rules given in section D.2 of Annex II to the Methodology Act have to be applied, which are explained below.

The following options for determining the emission factor of electricity apply:

(a) As the default case, the specific default value for a third country, group of third countries or region within a third country shall be used. That value is determined by the Commission based on the best data available to them. These **CO_2 emission factors** are based on data from the International Energy Agency (IEA) and are provided in Annex III to the Default Values Act.

(b) Where no specific default value is available pursuant to point (a), the CO_2 emission factor in the EU as set out in section D.2.2 of Annex II to the Methodology Act shall be used. It is also based on IEA data and provided in Annex III to the Default Values Act.

(c) Where a country, or group of third countries, submits sufficient evidence to demonstrate that the CO_2 emission factor in the third country, group of countries

[1] Proposal for a Regulation of the European Parliament and of the Council amending Regulation (EU) 2023/956 as regards the extension of its scope to downstream goods and anti-circumvention measures, COM/2025/989 final, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52025PC0989

or region within the third country from where the electricity is imported is lower than the values outlined in points (a) and (b), and where conditions provided in section D.2.3 of Annex II to the Methodology Act are met, the alternative default value will be used. However, as such an alternative value will be published by way of amendment of the Default Values Act, in practice there is no difference in approach for the authorised CBAM declarant.

(d) An authorised CBAM declarant may apply actual embedded emissions instead of default values, if it can be demonstrated that specific requirements provided in section 2.2 are met, and the calculation is based on data determined according to points D.4.1 or D.4.2 of Annex II to the Methodology Act.

2.1 CO_2 emission factor based on alternative reliable data

For the purpose of point (c) mentioned above, the third country, or group of third countries may propose the use of alternative default values for a given year if they provide, by 30 June of that year, the datasets from reliable alternative **official sources**, including national statistics, demonstrating that the CO_2 emission factor calculated as per equations 36 and 37 are lower than the default values laid down in the Default Values Act. If the Commission considers the alternative official sources to be reliable, it shall, where feasible, update the relevant default values by 30 June of the subsequent year. The Methodology Act contains the relevant calculation formulae (equations 36 and 37), building a five-year weighted average of all fossil electricity producers. The updated default values shall apply to electricity imports for the year in which the data from those sources were provided.

2.2 Elements of evidence for using actual embedded emissions for electricity imported into the Union.

Pursuant to point 5 of Annex IV to the CBAM Regulation, for allowing an authorised CBAM declarant to use actual emissions data of a specific electricity producing installation, all of the criteria (a) to (e) provided in section 5 of Annex IV to the CBAM Regulation have to be fulfilled, which are:

(a) The amount of electricity for which the use of actual embedded emissions is claimed is covered by a **power purchase agreement (PPA)** between the authorised CBAM declarant and a producer of electricity located in a third country;

(b) The installation producing electricity is **either directly connected to the Union transmission system or** it can be demonstrated that at the time of export there was **no physical network congestion** at any point in the network between the installation and the Union transmission system;

(c) The installation producing electricity **does not emit more than 550 grammes of CO_2** of fossil fuel origin **per kWh** of electricity;

(d) The amount of electricity for which the use of actual embedded emissions is claimed has been **firmly nominated to the allocated interconnection capacity** by all responsible transmission system operators in the country of origin, the country of destination and, if relevant, each country of transit, and the nominated capacity and the production of electricity by the installation refer to the same period of time, which shall not be longer than one hour.

(e) The fulfilment of the above criteria is certified by an accredited verifier, who shall receive at least monthly interim reports demonstrating how those criteria are fulfilled.

Furthermore, the said installation must determine the emission factor of electricity in line with Annex II to the Methodology

As clarified in section D.2.4 of Annex II to the Methodology Act, the following elements of evidence shall be provided to justify the use of actual emissions.

- For criterion (a):
    i. There must be contractual evidence demonstrating the existence of a power purchase agreement (PPA) concluded directly between the authorised CBAM declarant and a producer of electricity located in a third country for the physical delivery of electricity. The PPA shall be applicable at the time of electricity import for which actual emissions are claimed and shall cover at least the amount of electricity for which actual emissions are claimed. Where the PPA was concluded through an intermediary, the contractual evidence shall demonstrate that only one single contract was concluded between the three contracting parties.
- For criterion (b), one of the following:
    i. A single line diagram demonstrating the existence of a direct connection between the installation producing electricity and the Union transmission system;
    ii. Written documentation, either from the transmission system operator or from another entity with access to relevant information, attesting that at the time of export, determined on an hourly basis, there was no physical network congestion at any point in the network between the installation and the Union transmission system.
- For criterion (c):
    i. Data showing that the installation producing electricity does not emit more than 550 grammes of CO_2 of fossil fuel origin per kilowatt-hour of electricity.
- For criterion (d):
    i. Written documentation, either from the person who nominated the relevant capacity at the interconnector or from the relevant transmission system operator, demonstrating that a given quantity of electricity has been nominated in the country of origin, the country of destination and, if relevant, each country of transit, and demonstrating the period of time to which the nomination of capacity refers; and
    ii. Data from a smart metering system demonstrating that the production of a corresponding amount of electricity by the installation occurred within the same measurement period as the nomination of the capacity. This period shall not exceed one hour.
- For criterion (e):

i. Monthly interim reports containing the elements of evidence laid down in this point demonstrating how criteria (a) to (d) as laid down in point 5 of Annex IV to the CBAM Regulation are fulfilled.

The evidence for these criteria is to be provided to the verifier of the installation producing the electricity for which actual data are to be used. For making the evidence (or the verification thereof) accessible to the declarants importing electricity, the installation's emission report must be supplemented by "*Declarant-specific addendums*" as specified in section 1.1.1 of Annex IV to the Methodology Act, which have to contain:

1. The EORI number of the authorised CBAM declarant to whom the declarant-specific addendum refers;
2. An indication that the criteria for the use of actual values laid down in point 5, first subparagraph, points (a) and (d) of Annex IV to Regulation (EU) 2023/956, as well as, where relevant, laid down in point 5 first subparagraph, point (b) of Annex IV to that Regulation in relation to the lack of physical network congestion, are met, and a confirmation that the related elements of evidence laid down in point D.2.4 of Annex II were submitted to the verifier;
3. The quantity of electricity imported by that authorised CBAM declarant from the relevant installation for which the criteria laid down in point 5 of Annex IV to Regulation (EU) 2023/956 are met.

3 WORKED EXAMPLE FOR ELECTRICITY

The following example demonstrates how an installation that exports electricity to the EU can determine the electricity emissions factor. The example installation consists of two blocks: Block 1 is a relatively old coal-fired baseload power plant, which produces only electricity. It is assumed that after 2016 a modern gas-fired cogeneration (CHP) plant was added as Block 2. As Block 2 can react more easily to market demand for heat (district heating) and electricity, it runs for a smaller number of full-load hours, but still for a significant part of the year. Both blocks are monitored separately, but for CBAM purposes, the weighted average of the electricity emission factor is determined. The emissions then need to be verified and provided to the authorised CBAM declarant who imports the electricity into the EU.

For simplicity, standard values are used for the properties of fuels and emissions from flue gas cleaning are omitted in this example. Below, the separate calculations for each block, and thereafter for the whole installation are demonstrated.

1. Coal-fired baseload power plant

Capacity:		500	MW thermal input		
Electrical Efficiency:		35%			
Full-load operating hours:		7 800	h/year		
Coal:	Emission factor =	96,1	t CO_2 / TJ		
	NCV =	25,8	GJ/t		
Coal input:				544 186	t coal / year
Energy input from fuels:				14 040	TJ / year

Emissions:	1 349 244	t CO_2 / year
Electricity production:	1 365 000	MWh
EF electricity Block 1:	**0,988**	**t CO_2 / MWh**

2. Natural-gas-fired Cogeneration plant

Capacity:		850	MW thermal input	
Full load hours:		6 000	h/year	
Actual efficiency electricity:			49%	
Actual efficiency heat:			31%	
Natural gas	EF =	56,1	t CO2 / TJ	
	NCV =	48,0	GJ/t	
Natural gas input:			382 500	t / year
Energy input from fuels:			18 360	TJ / year
Emissions:			1 029 996	t CO2 / year
Electricity production:			2 499 000	MWh

For applying the CHP-related calculations (point A.2.2 of Annex III to the Methodology Act), the operator needs to determine the applicable reference efficiencies for separate heat and electricity production. Those are given in section C of Annex III to the Methodology Act, and in **Annex A** of this document. It is assumed that this CHP was built after 2015. Therefore, the following values for natural gas are determined:

Reference efficiency electricity	53%
Reference efficiency heat (hot water)	92%

The following calculation is required:

$$F_{CHP,El} = \frac{\eta_{el}/\eta_{ref,el}}{\eta_{heat}/\eta_{ref,heat}+\eta_{el}/\eta_{ref,el}} = \frac{0{,}49/0{,}53}{0{,}31/0{,}92+0{,}49/0{,}53} = 73{,}3\%$$

$$EF_{CHP,El} = Em_{CHP} \cdot F_{CHP,El} / E_{El,prod} = 1\ 029\ 996 \text{ t } CO_2 \times 0{,}733 / 2\ 499\ 000 \text{ MWh} = \\ = 0{,}3021 \text{ t } CO_2 / \text{MWh}$$

3. Calculation of the weighted average

The specific embedded (direct) emissions of electricity, which is the emission factor of electricity, of the whole installation is calculated as the weighted average of the emission factors of the two power plant blocks, as follows:

	Electricity produced (MWh)	**Emission factor (EF) [t CO_2 / MWh]**
Block 1	1 365 000	0,988
Block 2	2 499 000	0,302
Total installation:	3 864 000	**0,545**

Therefore, the emission factor to be used by an authorised declarant for electricity from this specific installation will be 0,545 t CO_2 / MWh. Note that this at the same time provided evidence for meeting criterion (c) of point 5 of Annex IV to the CBAM Regulation (see section 2.2).

Annex A Harmonised efficiency reference values for separate production of electricity and heat

Methodology Act: Annex III.

In the tables below the harmonised efficiency reference values for separate production of electricity and heat are based on net calorific value and standard atmospheric ISO conditions (15 °C ambient temperature, 1,013 bar, 60 % relative humidity).

Table 3-1: Reference efficiency factors for electricity production

Category		Type of fuel	Year of construction		
			Before 2012	**2012-2015**	**From 2016**
Solids	S1	Hard coal including anthracite, bituminous coal, sub-bituminous coal, coke, semi-coke, pet coke	44,2	44,2	44,2
	S2	Lignite, lignite briquettes, shale oil	41,8	41,8	41,8
	S3	Peat, peat briquettes	39,0	39,0	39,0
	S4	Dry biomass including wood and other solid biomass including wood pellets and briquettes, dried woodchips, clean and dry waste wood, nut shells and olive and other stones	33,0	33,0	37,0
	S5	Other solid biomass including all wood not included under S4 and black and brown liquor	25,0	25,0	30,0
	S6	Municipal and industrial waste (non-renewable) and renewable/bio-degradable waste	25,0	25,0	25,0
Liquids	L7	Heavy fuel oil, gas/diesel oil, other oil products	44,2	44,2	44,2
	L8	Bio-liquids including bio-methanol, bioethanol, bio-butanol, biodiesel, and other bio-liquids	44,2	44,2	44,2
	L9	Waste liquids including biodegradable and non-renewable waste (including tallow, fat and spent grain)	25,0	25,0	29,0
Gaseous	G10	Natural gas, LPG, LNG and biomethane	52,5	52,5	53,0
	G11	Refinery gases hydrogen and synthesis gas	44,2	44,2	44,2
	G12	Biogas produced from anaerobic digestion, landfill, and sewage treatment	42,0	42,0	42,0
	G13	Coke oven gas, blast furnace gas, mining gas, and other recovered gases (excluding refinery gas)	35,0	35,0	35,0
Other	O14	Waste heat (including high temperature process exhaust gases, product from exothermic chemical reactions)			30,0

Table 3-2: Reference efficiency factors for heat production

Category		Type of fuel	Year of construction					
			Before 2016			From 2016		
			Hot water	Steam (2)	Direct use of exhaust gases (3)	Hot water	Steam (2)	Direct use of exhaust gases (3)
Solids	S1	Hard coal including anthracite, bituminous coal, sub-bituminous coal, coke, semi-coke, pet coke	88	83	80	88	83	80
	S2	Lignite, lignite briquettes, shale oil	86	81	78	86	81	78
	S3	Peat, peat briquettes	86	81	78	86	81	78
	S4	Dry biomass including wood and other solid biomass including wood pellets and briquettes, dried woodchips, clean and dry waste wood, nut shells and olive and other stones	86	81	78	86	81	78
	S5	Other solid biomass including all wood not included under S4 and black and brown liquor	80	75	72	80	75	72
	S6	Municipal and industrial waste (non-renewable) and renewable/bio-degradable waste	80	75	72	80	75	72
Liquids	L7	Heavy fuel oil, gas/diesel oil, other oil products	89	84	81	85	80	77

(2) If steam plants do not account for the condensate return in their calculation of CHP (combined heat and power) heat efficiencies, the steam efficiencies shown in the table above shall be increased by 5 percentage points.

(3) Values for direct use of exhaust gases shall be used if the temperature is 250 °C or higher.

Category		Type of fuel	Year of construction					
			Before 2016			From 2016		
			Hot water	Steam (2)	Direct use of exhaust gases (3)	Hot water	Steam (2)	Direct use of exhaust gases (3)
	L8	Bio-liquids including bio-methanol, bioethanol, bio-butanol, biodiesel, and other bio-liquids	89	84	81	85	80	77
	L9	Waste liquids including biodegradable and non-renewable waste (including tallow, fat and spent grain)	80	75	72	75	70	67
Gaseous	G10	Natural gas, LPG, LNG and biomethane	90	85	82	92	87	84
	G11	Refinery gases hydrogen and synthesis gas	89	84	81	90	85	82
	G12	Biogas produced from anaerobic digestion, landfill, and sewage treatment	70	65	62	80	75	72
	G13	Coke oven gas, blast furnace gas, mining gas, and other recovered gases (excluding refinery gas)	80	75	72	80	75	72
Other	O14	Waste heat (including high temperature process exhaust gases, product from exothermic chemical reactions)	—	—	—	92	87	—

Annex B List of definitions

Term	Definition
'Accuracy'	means the closeness of the agreement between the result of a measurement and the true value of the particular quantity or a reference value determined empirically using internationally accepted and traceable calibration materials and standard methods, taking into account both random and systematic factors
'Activity data'	means the amount of fuels or materials consumed or produced by a process relevant for the calculation-based methodology, expressed in terajoules (TJ), mass in tonnes or (for gases) volume in normal cubic metres, as appropriate
'Actual emissions'	means the emissions calculated based on primary data from the production processes of goods and from the production of electricity consumed during those processes as determined in accordance with the methods set out in Annex IV [to the Methodology Act]
'Activity level'	means the quantity of goods to which the same functional unit applies that are produced within the system boundaries of a production process during a reporting period
'Aggregated goods categories'	means aggregated goods categories pursuant to Table 1 of point 2 of Annex I. A group of CBAM goods with their CN codes, used for the purpose of defining system boundaries of production processes.
'Agricultural, aquaculture, fisheries and forestry residues'	means residues that are directly generated by agriculture, aquaculture, fisheries and forestry and that do not include residues from related industries or processing
'Authorised CBAM declarant'	means a person authorised by the competent authority in accordance with Article 17 [of the CBAM Regulation]. The 'authorised CBAM declarant' [which replaces the term 'reporting declarant' from the transitional period] may be importers of CBAM goods, or their indirect customs representatives, who have applied for and been granted the status of authorised CBAM declarant.
'Batch'	means an amount of fuel or material representatively sampled and characterised, and transferred as one shipment or continuously over a specific period of time
'Biomass'	means biomass as defined in Article 2, point (24) of the Renewable Energy Directive (RED II)[4]; it includes bioliquids and biofuels as defined in Article 2, point (32) and (33), biomass fuels as defined in Article 2, point (27) and biogas as defined in Article 2 point (28) of the RED II;

[4] Directive (EU) 2018/2001

Term	Definition
'Biomass fraction'	means the ratio of carbon stemming from biomass to the total carbon content of a fuel or material, expressed as a fraction
'Calculation factors'	means net calorific value, emission factor, preliminary emission factor, oxidation factor, conversion factor, carbon content or biomass fraction
'Calibration'	means the set of operations, which establishes, under specified conditions, the relations between values indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material and the corresponding values of a quantity realised by a reference standard
'Carbon price'	means the monetary amount paid in a third country, under a carbon emissions reduction scheme, in the form of a tax, levy or fee or in the form of emission allowances under a greenhouse gas emissions trading system, calculated on greenhouse gases covered by such a measure, and released during the production of goods
'CBAM certificate'	means a certificate in electronic format corresponding to one tonne of CO_2e of embedded emissions in goods
'CO_2 emission factor'	means the weighted average of the CO_2 intensity of electricity produced from fossil fuels within a geographic area. The CO_2 emission factor is the result of the division of the CO_2 emission data of the electricity sector by the gross electricity generation based on fossil fuels in the relevant geographic area. It is expressed in tonnes of CO_2 per megawatt-hour
'Combined nomenclature' (CN)	means the classification of goods, designed to meet the needs of: i) the Common customs tariff, setting import duties for products imported into the European Union (EU), as well as the Integrated tariff of the European Communities (Taric), incorporating all EU and trade measures applied to goods imported into and exported out of the EU; ii) the international trade statistics of the EU. The CN provides the means of collecting, exchanging and publishing data on EU international trade statistics. It is also used for the collection and publication of international trade statistics in intra-EU trade.[5]
'Combustion emissions'	means greenhouse gas emissions occurring during the exothermic reaction of a fuel with oxygen
'Competent authority'	means the authority designated by each Member State in accordance with Article 11 [of the CBAM Regulation]

[5] For definition see: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Combined_nomenclature_(CN)

Term	Definition
‘Continuous emission measurement’ (CEM)	means a set of operations having the objective of determining the value of a quantity by means of periodic measurements, applying either measurements in the stack or extractive procedures with a measuring instrument located close to the stack, whilst excluding measurement methodologies based on the collection of individual samples from the stack
‘Control system’	means the operator’s risk assessment and entire set of control activities, including the continuous management thereof, that an operator has established, documented, implemented and maintained pursuant to point A.2. of Annex II
‘Complex goods’	means goods other than simple goods
‘Conservative’	means that a set of assumptions is defined in order to ensure that no under-estimation of reported emissions or over-estimation of production of heat, electricity or goods occurs
‘Conversion factor’	means the ratio of carbon emitted as CO_2 to the total carbon contained in the source stream before the emitting process takes place, expressed as a fraction, considering CO emitted to the atmosphere as the molar equivalent amount of CO_2
‘Co-product’	means any of two or more products resulting from the same production process
‘Customs declarant’	means a declarant as defined in Article 5, point (15) of Regulation (EU) No 952/2013 lodging a customs declaration for release for free circulation of goods in its own name or the person in whose name such a declaration is lodged
‘CCUS system’	means a group of economic operators with technically connected installations and transport equipment for CO_2 capture, transport, use in production of goods, or geological storage
‘Data flow activities’	mean activities related to the acquisition, processing and handling of data that are needed to draft an emissions report from primary source data
‘Data set’	means one type of data, either at installation level or production process level as relevant in the circumstances, as any of the following: (a) the amount of fuels or materials consumed or produced by a production process as relevant for the calculation-based methodology, expressed in terajoules, mass in tonnes, or for gases as volume in normal cubic metres, as appropriate, including for waste gases; (b) a calculation factor;

Term	Definition
	(c) net quantity of measurable heat, and the relevant parameters required for determining this quantity, in particular: i) mass flow of heat transfer medium; and ii) enthalpy of transmitted and returned heat transfer medium, as specified by composition, temperature, pressure and saturation; (d) quantities of non-measurable heat, specified by the relevant quantities of fuels used for producing the heat, and the net calorific value (NCV) of the fuel mix; (e) quantities of electricity; (f) quantities of CO_2 transferred between installations; (g) quantities of precursors received from outside the production process, and their relevant parameters, such as country of origin, used production route, specific direct and indirect emissions;
'Default value'	means a value, which is calculated or drawn from secondary data, which represents the embedded emissions in goods
'Direct emissions'	means emissions from the production processes of goods including emissions from the production of heating and cooling that is consumed during the production processes, irrespective of the location of the production of the heating or cooling
'Embedded emissions'	means direct emissions released during the production of goods and indirect emissions from the production of electricity that is consumed during the production processes, calculated in accordance with the methods set out in Annex IV and further specified in the implementing acts adopted pursuant to Article 7(7)
'Emissions'	mean the release of greenhouse gases into the atmosphere from the production of goods
'Emission factor'	means the average emission rate of a greenhouse gas relative to the activity data of a source stream assuming complete oxidation for combustion and complete conversion for all other chemical reactions
'Emission factor' for electricity	means the default value, expressed in CO_2e, representing the emission intensity of electricity consumed in production of goods.
'Emission source'	means a separately identifiable part of an installation or a process within an installation, from which relevant greenhouse gases are emitted
EU ETS	means the system for greenhouse gas emissions allowance trading within the Union in respect of activities listed in Annex I to Directive 2003/87/EC other than aviation activities

Term	Definition
‘EU ETS allowance’	means an allowance as defined in Article 3, point (a), of Directive 2003/87/EC in respect of activities listed in Annex I to that Directive other than aviation activities
‘Fossil carbon’	means inorganic and organic carbon that is not biomass
‘Fossil fraction’	means the ratio of fossil carbon to the total carbon content of a fuel or material, expressed as a fraction
‘Fugitive emissions’	means irregular or unintended emissions from sources that are not localised, or too diverse or too small to be monitored individually
‘Functional unit’	means the reference unit used for the calculation of embedded emissions in goods
‘Goods’	means goods listed in Annex I [to the CBAM the CBAM Regulation]
‘Greenhouse gases’	mean greenhouse gases as specified in Annex I [to the CBAM the CBAM Regulation] in relation to each of the goods listed in that Annex
‘Heat meter’	means a thermal energy meter or any other device to measure and record the amount of thermal energy produced based upon flow volumes and temperatures
‘Importer’	means either the person lodging a customs declaration for release for free circulation of goods or a bill of discharge in accordance with Article 175(5) of Delegated Regulation (EU) 2015/2446 in its own name and on its own behalf or, where the customs declaration is lodged by an indirect customs representative in accordance with Article 18 of Regulation (EU) No 952/2013, the person on whose behalf such a declaration is lodged
‘Importation’	means release for free circulation as provided for in Article 201 of Regulation (EU) No 952/2013
‘Indirect customs Representative’	A customs representative appointed by an importer established in a Member State. If the importer appoints an indirect customs representative and they agree, they can act as an authorised CBAM declarant and submit the application for an authorisation on behalf of the importer. The indirect customs representative is liable for all operations made for the importers it represents
‘Indirect emissions’	means emissions from the production of electricity which is consumed during the production processes of goods, irrespective of the location of the production of the consumed electricity
‘Inherent CO_2’	means CO_2 which is part of a source stream.
‘Installation’	means a stationary technical unit where a production process is carried out

Term	Definition
‘Legal metrological control’	means the control exercised by a public authority or regulator of the measurement tasks intended for the field of application of a measuring instrument, for reasons of public interest, public health, public safety, public order, protection of the environment, the levying of taxes and duties, the protection of consumers and fair trading
‘Measurable heat’	means a net heat flow transported through identifiable pipelines or ducts using a heat transfer medium, such as, in particular, steam, hot air, water, oil, liquid metals and salts, for which a heat meter is or could be installed
‘Measurement point’	means the emission source for which continuous emission measurement systems (CEMS) are used for emission measurement, or the cross-section of a pipeline system for which the CO_2 flow is determined using continuous measurement systems
‘Measurement system’	means a complete set of measuring instruments and other equipment used to determine variables for the monitoring and calculation of emissions
‘Minimum requirements’	means monitoring methods using the minimum efforts allowed for determining data in order to result in emission data acceptable for the purpose of the CBAM Regulation.
‘Mixed fuel’	means a fuel which contains both biomass and fossil carbon
‘Mixed material’	means a material which contains both biomass and fossil carbon
‘Multifunctional process’	means a process that delivers multiple outputs or whose outputs feed into several production processes
‘Net calorific value’ (NCV)	means the specific amount of energy released as heat when a fuel or material undergoes complete combustion with oxygen under standard conditions, less the heat of vaporisation of any water formed
‘Non-CBAM good’	means any good produced in the installation that is not included in Annex I to the CBAM Regulation
‘Non-measurable heat’	means all heat other than measurable heat
‘Operator’	means any person who operates or controls an installation in a third country, including a parent company that controls an installation in a third country
‘Oxidation factor’	means the ratio of carbon oxidised to CO_2 as a consequence of combustion to the total carbon contained in the fuel, expressed as a fraction, considering carbon monoxide (CO) emitted to the atmosphere as the molar equivalent amount of carbon dioxide (CO_2)
‘Power purchase agreement’	means a contract under which a person agrees to purchase electricity directly from an electricity producer

Term	Definition
'Precursor'	means any input material into a production process included in the list of goods set out in Annex I to the CBAM Regulation;
'Preliminary emission factor'	means the assumed total emission factor of a fuel or material based on the carbon content of its biomass fraction and its fossil fraction before multiplying it by the fossil fraction to produce the emission factor
'Production process'	means the chemical and physical processes carried out to produce goods in an installation
'Production route' [6]	means a specific technology used in a production process to produce goods
'Process emissions'	means greenhouse gas emissions other than combustion emissions occurring as a result of intentional and unintentional reactions between substances or their transformation, for a primary purpose other than the generation of heat, including from the following processes: (a) the chemical, electrolytic or pyrometallurgical reduction of metal compounds in ores, concentrates and secondary materials; (b) the removal of impurities from metals and metal compounds; (c) the decomposition of carbonates, including those used for flue gas cleaning; (d) chemical syntheses of products and intermediate products where the carbon bearing material participates in the reaction; (e) the use of carbon containing additives or raw materials; (f) the chemical or electrolytic reduction of metalloid oxides or non-metal oxides such as silicon oxides and phosphates.
'Proxy data'	means annual values which are empirically substantiated or derived from accepted sources and which an operator uses to substitute a data set[7] for the purpose of ensuring complete reporting
'Rebate'	means any amount that reduces the amount due or paid by a person liable for the payment of a carbon price, before its payment or after, in a monetary form or in any other form.
'Recommended improvements'	means monitoring methods which are proven means to ensure that data are more accurate or less prone to mistakes than by mere application of minimum requirements
'Related emissions'	means: – the direct emissions caused by the source stream or emission source concerned; – emissions attributed to a quantity of measurable heat; – the indirect emissions related to the quantity of electricity concerned; – embedded emissions of a material produced or of a precursor consumed.

[6] Note that different production routes can fall within the same production process.

[7] Refers to the activity data or the calculation factors.

Term	Definition
'Reporting period'	means the period corresponding to the calendar year during which the good was produced and used by the authorised CBAM declarant as reference for the determination of embedded emissions
'Residue'	means a substance that is not the end product that a production process directly seeks to produce; it is not a primary aim of the production process and the process has not been deliberately modified to produce it
'Simple goods'	means goods produced in a production process requiring exclusively input materials (precursors) and fuels having zero embedded emissions
'Source stream'	means either of the following: (a) a specific fuel type, raw material or product giving rise to emissions of relevant greenhouse gases at one or more emission sources as a result of its consumption or production; (b) a specific fuel type, raw material or product containing carbon and included in the calculation of greenhouse gas emissions using a mass-balance method
'Specific embedded emissions'	means the embedded emissions of one tonne of goods, expressed as tonnes of CO_2e emissions per tonne of goods
'Standard conditions'	means temperature of 273,15 K and pressure conditions of 101 325 Pa defining normal cubic metres (Nm^3)
'System boundary'	means the group of chemical or physical processes included in the calculation of embedded emissions of goods under the same aggregated goods category. The system boundaries shall cover direct emissions, indirect emissions for goods not listed in Annex II to the CBAM Regulation, and the embedded emissions of any precursor.
'Third country'	means a country or territory outside the customs territory of the [European] Union
'Tonne of $CO_{2}(e)$'	means one metric tonne of carbon dioxide ('CO_2'), or an amount of any other greenhouse gas listed in Annex I [to the CBAM Regulation] with an equivalent global warming potential ['CO_2e']
'Transmission system operator'	means an operator as defined in Article 2, point (35) of Directive (EU) 2019/944 of the European Parliament and of the Council ([8]).

[8] Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity and amending Directive 2012/27/EU (OJ L 158, 14.6.2019, p. 125).

Term	Definition
'Uncertainty'	means a parameter, associated with the result of the determination of a quantity, that characterises the dispersion of the values that could reasonably be attributed to the particular quantity, including the effects of systematic as well as of random factors, expressed in percent, and describes a confidence interval around the mean value comprising 95% of inferred values taking into account any asymmetry of the distribution of values
'Waste'	means any substance or object which the holder discards or intends or is required to discard, excluding substances that have been intentionally modified or contaminated in order to meet this definition
'Waste gas'	means a gas containing incompletely oxidised carbon in a gaseous state under standard conditions which is a result of any of the processes listed under 'process emissions'

Annex C List of abbreviations

Abbreviation	Full term
AD	Activity Data
AEM	Anode Effect Minutes
AEO	Anode Effect Overvoltage
AL	Activity Level
AOD	Argon Oxygen Decarburisation.
BAT	Best Available Techniques
BF	Biomass Fraction
BFG	Blast Furnace Gas
BM	Benchmark
BOF	Basic Oxygen Furnace
BOFG	Basic Oxygen Furnace Gas
BREFs	Best Available Techniques Reference documents
CA	Competent Authority
CBAM	Carbon Border Adjustment Mechanism, the
CCR	Clinker to Cement Ratio
CCS	Carbon Capture and Storage
CCU(S)	Carbon Capture and Utilisation (and Storage)
CEMS	Continuous Emission Measurement Systems
CF	Conversion Factor
CFP	Carbon footprint of products
CHP	Combined Heat and Power
CKD	Cement Kiln Dust
CN	Combined nomenclature
COG	Coke Oven Gas
DRI	Direct Reduced Iron
EAF	Electric Arc Furnace
EEA	European Economic Area (EU-27, Iceland, Norway, Liechtenstein)
EF	Emission Factor
EFTA	European Free Trade Area
EORI	Economic Operator Registration and Identification
ETS	Emissions Trading System
EU ETS	EU Emissions Trading System
EUA	EU Allowances (used in the EU ETS)
EUR	Euro (currency)

Abbreviation	Full term
FAR	Free Allocation Rules (Regulation 2019/331)[9]
FIFO	First-In-First-Out principle
GHG	Greenhouse Gas
GWP	Global Warming Potential
HBI	Hot Briquetted Iron
HS	Harmonised System (for international trade)
IEA	International Energy Agency
ISO	International Organization for Standardization
LULUCF	Land-use, land change and forestry (criteria)
MP	Monitoring Plan
MRR	Monitoring and Reporting Regulation (Regulation 2018/2066)[10]
MRV	Monitoring, Reporting and Verification
MS	Member State(s)
MWh	Megawatt-hour
NCV	Net Calorific Value
NPI	Nickel pig iron
OF	Oxidation Factor
PCI	Pulverised Coal Injection
PEMS	Predictive Emission Monitoring System
PFC	Perfluoro-carbon
PoS	Proofs of Sustainability
RED II	Renewable Energy Directive, re-cast
SEE	Specific embedded emissions
SEFA	Specific embedded free allocation
TARIC	Integrated Tariff of the European Union database
TJ	Terajoules
TSO	Transmission System Operator
UCC	Union Custom Code
UN/LOCODE	United Nations Code for Trade and Transport Location

[9] Free Allocation Rules (Commission Delegated Regulation (EU) 2019/331 of 19 December 2018 determining transitional Union-wide rules for harmonised free allocation of emission allowances pursuant to Article 10a of Directive 2003/87/EC of the European Parliament and of the Council)

[10] Monitoring and Reporting Regulation (Commission Implementing Regulation (EU) 2018/2066 of 19 December 2018 on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council and amending Commission Regulation (EU) No 601/2012