The Carbon Border Adjustment Mechanism eLearning module

CBAM in the hydrogen sector

Course takeaways

This eLearning course on CBAM in the hydrogen sector offers a comprehensive exploration of the Carbon Border Adjustment Mechanism (CBAM) specifically within the context of the hydrogen industry.

By the end of this course, the learner will understand CBAM's general aspects, the criteria specific to the hydrogen sector, emissions measurement and reporting requirements, and the IT system. They will be well-equipped to navigate the challenges and opportunities presented by CBAM in the hydrogen industry and comply with the legal obligations.

This is a quick and handy summary of the most relevant module information:

1. Introduction

1.1 Did you know?

The Carbon Border Adjustment Mechanism (CBAM) is an instrument implemented by the European Union to address carbon leakage. The EU's ambition is to become climate neutral by 2050, and CBAM will aim to ensure that imported goods are subject to a carbon price equivalent to the carbon price of domestic production in the EU.

CBAM affects the hydrogen sector by putting a price on emissions associated with hydrogen produced in countries outside the EU and **imported into the EU**. It aims to encourage sustainable practices and reduce carbon footprint.

For hydrogen importers, compliance with CBAM initially involves reporting direct and indirect emissions associated with hydrogen production in imported goods from third countries on a quarterly basis, relying on supplier information. However, from 1 January 2026, importers of hydrogen will have to buy CBAM certificates for emissions in imported hydrogen, just like in the Emissions Trading System in the EU.

Nevertheless, these costs can be minimized by choosing suppliers who have implemented sustainable practices and reduced their carbon emissions.

Overall, CBAM provides an opportunity for the hydrogen sector to embrace sustainability and contribute to environmental protection by positioning businesses as socially responsible and environmentally conscious players in the market.

1.2 Learning objectives

This course is addressed to any person who operates or controls production installations in third countries, importers, indirect customs representatives (acting as reporting declarants), trade partners and competent authorities or anyone who needs to understand and work with CBAM obligations in the hydrogen sector.

At the end of this course, you will have achieved the following learning objectives:

- Understand the general aspects of CBAM and rules for reporting declarants.
- Understand the main criteria for CBAM in the hydrogen sector, including relevant emissions and the formula to calculate specific embedded emissions.
- Be able to calculate the formula for specific embedded emissions in the transitional period.

- Understand reporting requirements and how they are applied in the IT system (CBAM Transitional Registry).
- Demonstrate confidence and competence in the use of the CBAM Transitional Registry.

2 General aspects of CBAM

2.1 Overview

The European Union has adopted the Carbon Border Adjustment Mechanism (CBAM) to support the goal of achieving climate neutrality by 2050. CBAM will work alongside other measures in the 'Fit for 55' package and will reduce the risk of carbon leakage as the EU moves towards achieving its climate targets.

Carbon leakage

Carbon leakage occurs when companies move carbon-intensive production from the EU to countries where less stringent climate policies are in place than in the EU, or when EU products get replaced by more carbon-intensive imports. CBAM aims to gradually replace existing measures designed to prevent carbon leakage, particularly the allocation of free emission allowances under the EU Emissions Trading System (ETS). It seeks to establish an equivalent carbon price for both domestic and imported production of specific goods.

Sectors

CBAM will apply to the following sectors: aluminium, cement, electricity, fertilisers, hydrogen, iron and steel. During the transitional period, the reporting for these sectors includes both direct and indirect emissions, except for electricity, which only includes direct emissions.

Certificates

Each year, from 1 January 2026, authorised CBAM declarants (importers or indirect customs representatives) will have to buy and surrender CBAM certificates that correspond to the embedded emissions in the imported goods. The European Commission will calculate the price of CBAM certificates based on the average weekly price of ETS auctions. This ensures that CBAM certificates remain closely aligned with the price of ETS allowances. Additionally, this approach maintains a manageable system for administrative authorities overseeing the process. But for now – you only need to provide information on the emissions.

2.2 Timeline

Transitional phase: October 2023 - December 2025

CBAM focuses on monitoring and reporting only. It does not involve any financial adjustments or the need to purchase certificates. The goal is to ensure a seamless and uninterrupted rollout of the mechanism. Importers of CBAM goods, or their appointed customs representatives, will need to submit a quarterly CBAM report outlining the embedded emissions associated with goods imported, as well as any carbon pricing due. To prepare for the post transitional phase, it is possible to apply to

become an authorized CBAM declarant from 1 January 2025. Applications must be submitted in the Member State of establishment.

Review and scope extension: 2025

The European Commission will use the reported information for general analysis and review of the CBAM. The conclusions will be presented in reports to the European Parliament and the Council before the end of the transitional period. Those reports will look into different topics on the implications, implementation and functioning of the CBAM. This includes the possibility for extension of the scope to other goods, specifying the methodology and progress made in the international discussions.

Post transitional phase: 2026 - 2034

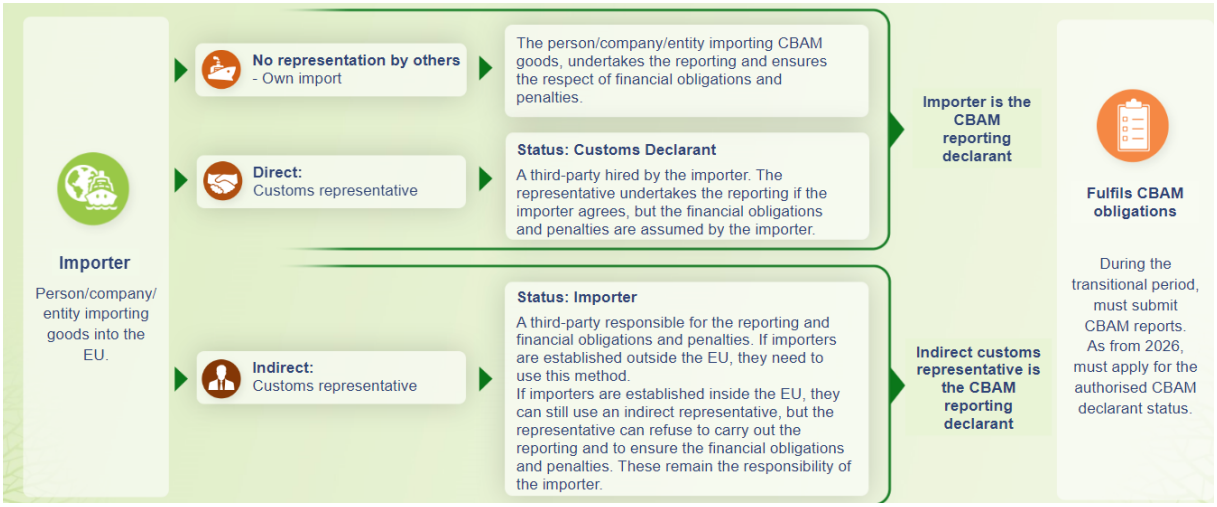
From 1 January 2026, only authorised CBAM declarants will be able to import CBAM goods into the European Union. Authorised CBAM declarants will have to buy CBAM certificates that correspond to the emissions in the goods imported. To ensure coherence with ETS, the CBAM certificates are phased in gradually and in line with the phase out of free allowances in the ETS.

2.3 Rules for representatives

How do importers know who the person responsible for the reporting obligations is?

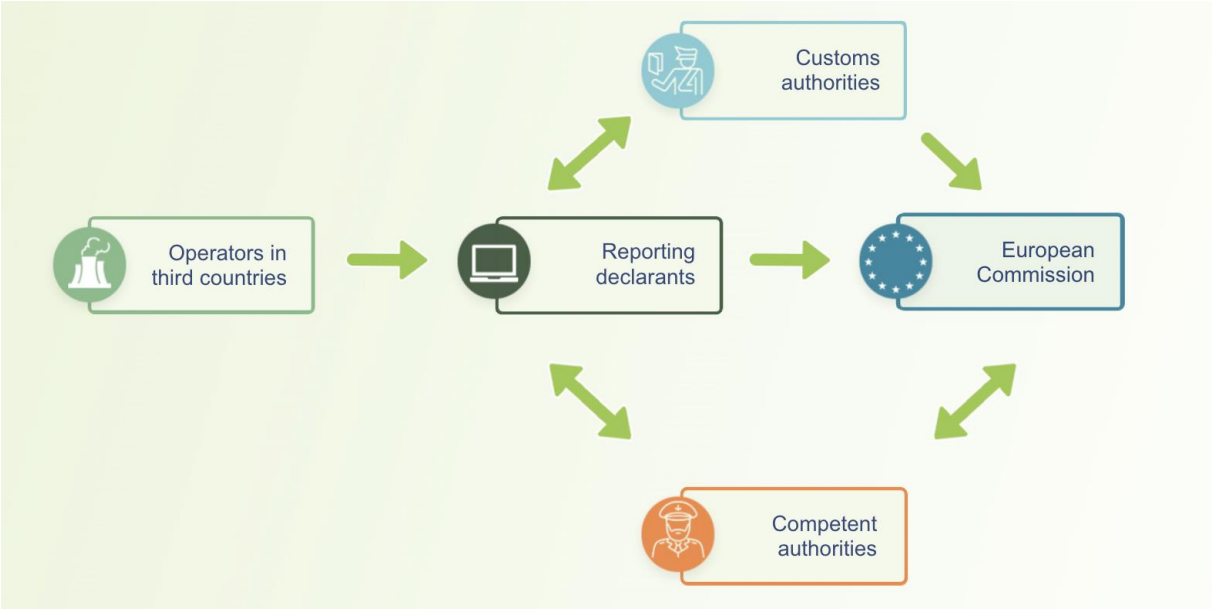
When importers import on their own, that is, with no representation by others, or use a direct representative, then the importer must be the reporting declarant. Note that direct customs representation is not possible if the importer is located outside the EU.

When the importer uses an indirect customs representative, then this representative is the one responsible for the reporting obligations. In this case the indirect customs representative is the reporting declarant.



2.4 Interactions between the reporting declarants and officials

During the transitional phase of CBAM, there is no specific authorisation process in place. Instead, a simplified procedure is applied to facilitate the initial stages of CBAM implementation. This transitional phase is designed to provide time for stakeholders to adjust and prepare for full compliance with CBAM requirements.



Operators in third countries

Operators gather and provide the necessary data related to the direct and indirect emissions associated with the imported goods. This data includes information on the production processes, specific embedded emissions, and other relevant factors.

Reporting declarants

Reporting declarants are responsible for compiling and submitting CBAM reports. They may receive the data from the operators. They analyse and process the data to ensure its accuracy and compliance with CBAM requirements. They then submit the CBAM reports to the European Commission.

Customs authorities

Custom authorities will automatically provide information to the reporting declarants to ensure that these have a clear understanding of their obligations. Additionally, customs authorities collaborate with the European Commission by sharing accurate and detailed information on imports, including customs declarations and associated CBAM-related data.

European Commission

Once the European Commission receives and reviews the CBAM reports submitted by the reporting declarants, a communication process takes place with competent authorities. This process during the transitional period will help improve the implementation of CBAM in the definitive period. Also, data exchanges with customs authorities allows the European Commission to monitor the implementation of CBAM, verify compliance, and assess the effectiveness of CBAM.

Competent authorities

During the transitional period, competent authorities carry out verifications and give feedback to the declarants about the CBAM reports. This serves to clarify any issues, address discrepancies, and ensure

compliance with CBAM requirements. As from 2025 they will deliver the authorisation to become authorised CBAM declarants.

3 CBAM methodology in the hydrogen sector

3.1 Calculating embedded emissions in the hydrogen sector

3.1.1 What types of hydrogen will be included in CBAM

The different CBAM goods in the hydrogen sector can be aggregated in goods categories and have specific greenhouse gases (GHG) associated. In the case of hydrogen there is only one type of good, therefore, only one category and one CN code.

Aggregated goods categories refer to goods that are grouped based on their similar characteristics. These categories are created to simplify the administration and implementation of CBAM. Instead of assessing and monitoring goods individually by their CN codes, goods within the same aggregated goods category are treated and evaluated collectively.

This approach helps to streamline the process while ensuring effective implementation of reporting of embedded emissions for imported goods. However, for several production routes that are used in the same installation for producing goods falling under the same CN code, and where those production routes are assigned separate production processes, the embedded emissions of those goods shall be calculated separately for each production route. However, the emissions of goods falling under the same aggregated goods category shall be calculated separately, if different production routes are applied. Production route means a specific technology used in a production process. Moreover, operators may voluntarily split the aggregated goods category further, for example if this is required by their national system.

The **greenhouse gases** that need to be monitored have been defined according to the activities and emissions of the greenhouse gases listed in Annex I of Directive 2003/87/EC.

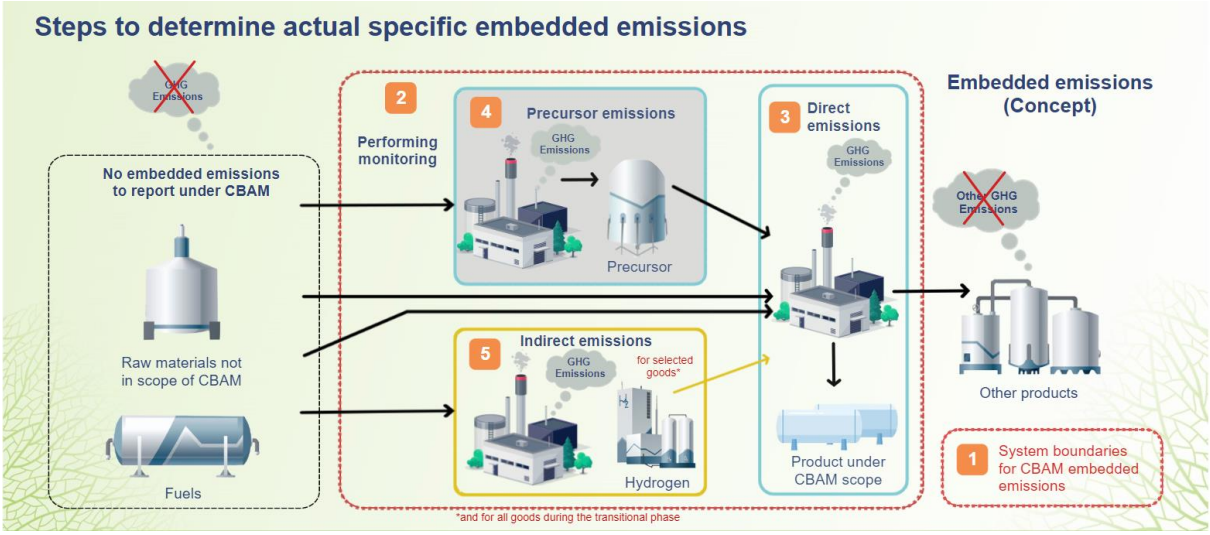
In the hydrogen sector only carbon dioxide (CO2) needs to be monitored as it is the primary greenhouse gas emitted during the production of hydrogen.

The **Combined Nomenclature** (CN) is presented in the form of an organized catalogue that codifies goods which are the subject of trade and takes account on the specific characteristics of the good in question, particularly: the type of product, what is it made of, its function and how it is presented or packaged.

CN Code	Aggregated goods category	Greenhouse gas
Chemicals		
2804 10 000 - Hydrogen	**Hydrogen**	Carbon dioxide

3.1.2 Steps to determine actual specific embedded emissions for hydrogen

Here is an overview of the emissions to monitor and report under CBAM. Emissions to report include the indirect emissions linked to the electricity used in the production process and also the direct emissions to produce hydrogen. Emissions generated by the production of fuel and of raw materials that are not in the scope of CBAM should not be reported.



1 Establishing System Boundaries

As a first step, declarants need to define the installations boundaries, the production processes and routes, which means that there is a need to identify the goods under CBAM scope.

The system boundaries encompass all processes directly or indirectly linked to the production process. The system boundaries depend on the aggregated goods category and may include all processes directly or indirectly linked to hydrogen production, and flue gas cleaning and 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.

The production route refers to the specific technological option used to produce particular goods under an aggregated goods category.

2 Performing monitoring

Performing monitoring in the case of mixed hydrogen means:

- monitoring direct emissions at installation level, originating from fuel combustion and from materials used for flue gas cleaning;
- monitoring flows of net measurable heat;
- monitoring electricity consumption;

3 Attributing emissions to production processes, then to goods

This involves allocating emissions to the production processes responsible for generating them and subsequently attributing those emissions to the specific goods produced within those processes. 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 within refineries or organic chemical installations, where hydrogen is exclusively used within those plants and not used for the production of goods listed in Annex I to Regulation (EU) 2023/956.

4 Embedded emissions of precursors

There are two types of CBAM goods, simple and complex ones. Simple goods are produced from input materials that are considered to have zero embedded emissions under the CBAM. Therefore, the embedded emissions of simple CBAM goods are based entirely on the emissions occurring during their production.

Hydrogen is defined as simple good as the raw materials and fuels used in its manufacture are considered to have zero embedded emissions. There are **no relevant precursors** for hydrogen. However, hydrogen may itself be a relevant 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).

5 Indirect emissions

Monitoring and reporting of indirect emissions in the hydrogen sector requires multiplying the electricity consumption with the relevant emission factor. During the transitional period, these emission factors are generally:

a) The average emission factor of the country of origin of the electricity grid, based on data from the International Energy Agency (IEA) provided by the Commissions or
b) Any other emissions factor of the country of origin of the electricity grid based on publicly available data representing either the average emission factor or the CO_2 emission factor as referred to in Section 4.3 of Annex IV to Regulation (EU) 2023/956.

Actual emission factors for electricity may be used if it can be demonstrated that:

a) A direct technical link exists between the installation in which the imported good is produced and the electricity generation source or
b) The installation has concluded a power purchase agreement with a producer of electricity located in a third country for an amount of electricity that is equivalent to the amount for which the use of a specific factor is claimed.

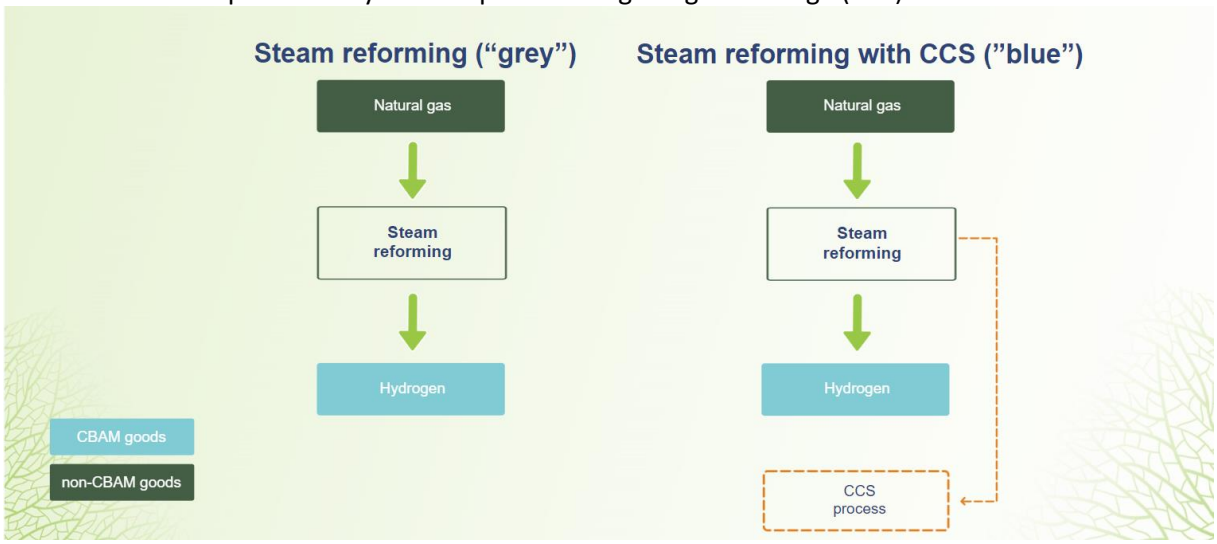
3.1.3 System boundaries embedded emissions of hydrogen sector

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, for example, for an installation producing ammonia.

Steam reforming production route

The natural gas 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 stream of carbon dioxide produced by the steam reforming process is very pure and is separated and captured for further use, for example, for urea production.

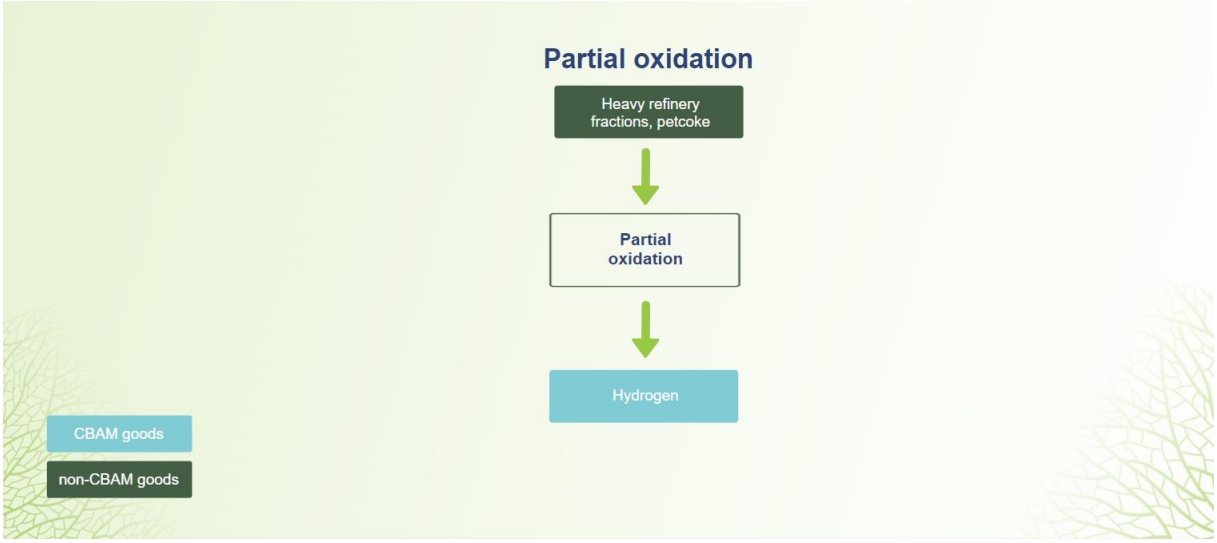
A variation on this process may be with permanent geological storage (CCS).



Partial oxidation of hydrocarbons (gasification) production route

In this case, hydrogen is produced by the partial oxidation (gasification) of hydrocarbons, typically from heavy feedstocks such as residual heavy oils or coal and even waste plastics. Carbon monoxide produced by the process is almost all converted to carbon dioxide.

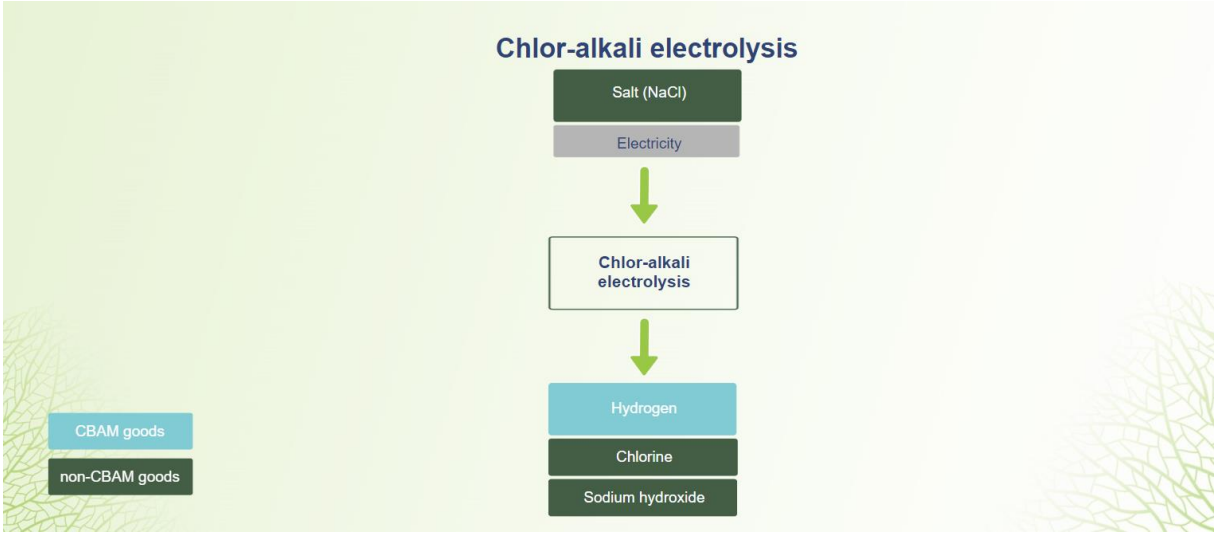
Direct emissions for the steam reforming or partial oxidation production routes result from fuel combustion and from the process materials used for flue gas cleaning. The stream of carbon dioxide produced from the process is of high purity and may be separated and captured for further use. Indirect emissions result from electricity consumed by the process.



Chlor-alkali electrolysis (and production of chlorates) production route

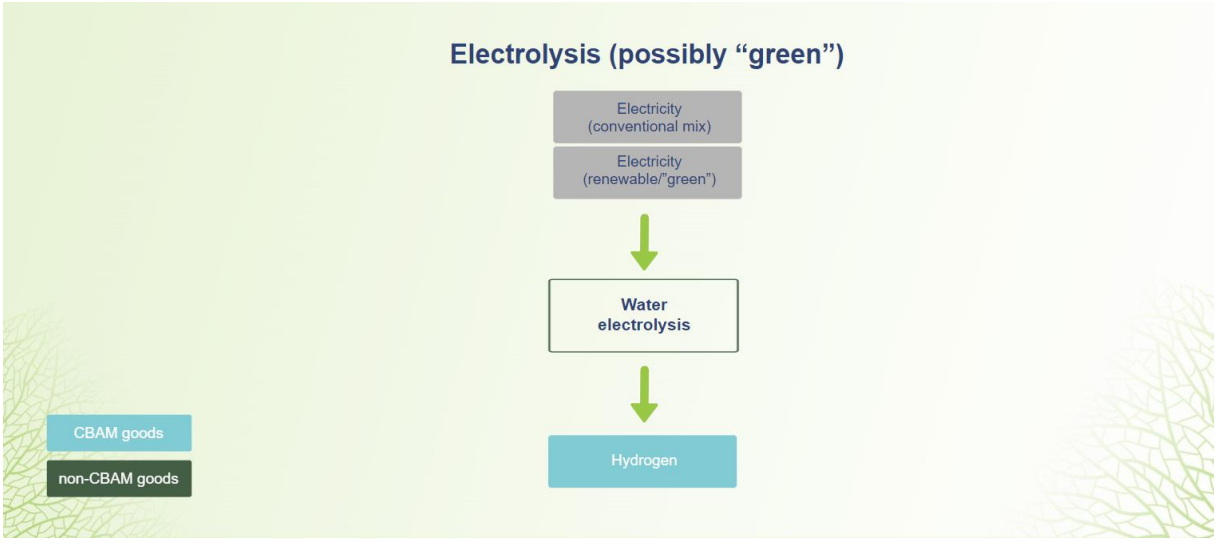
Hydrogen is produced as a by-product of the electrolysis of brine, alongside the simultaneous production of chlorine and sodium hydroxide. There are three basic chlor-alkali process techniques: mercury cell, diaphragm cell and the membrane cell. All three cell techniques produce hydrogen, which is formed 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 including in some cases oxygen, and is then compressed and stored or exported off site.

Direct emissions from the Chlor-Alkali production route result from fuel use directly or indirectly linked to the production process and from the process materials used for flue gas cleaning. Indirect emissions result from electricity consumed by the process.



Electrolysis of water production route

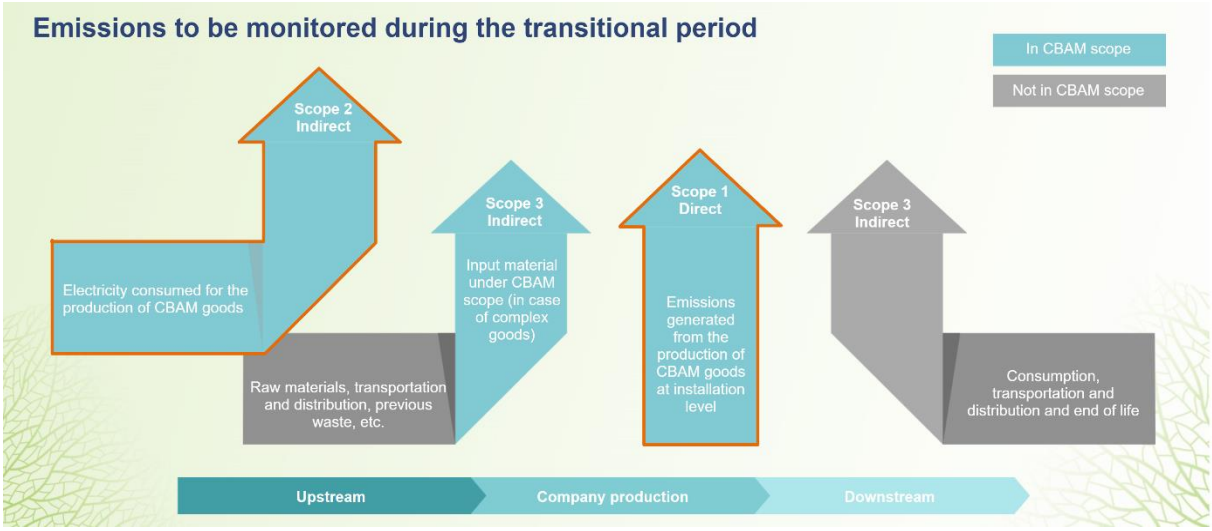
Water electrolysis is a standalone, non-integrated production process that produces a very pure stream of hydrogen gas**.** Direct emissions of carbon dioxide from this process are minimal. Indirect emissions result from electricity consumed by the process. Hydrogen produced by renewable electricity may become relevant in the future.



3.2 Collecting data

3.2.1 Emissions to be monitored during the transitional period

The EU importer or its representative is obliged to report the embedded greenhouse gas emissions of the imported goods. They get the data from the third-country installation, which does the monitoring and calculations in a primary report.



Scope 1 - Direct emissions:

Direct emissions refer to the greenhouse gas emissions released directly during the production at the installation level. The focus is on carbon dioxide (CO2), the most significant greenhouse gas in cement manufacturing. It can be produced from the combustion of fuels and the calcination process, where limestone (calcium carbonate) is heated to produce lime (calcium oxide). Under greenhouse gas accounting standards such as the GHG protocol, direct emissions of CO2 and PFCs would fall under the category of scope 1 emissions.
Under CBAM, direct emissions also include emissions from the production of heating and cooling irrespective of the location where they are produced. For example, emissions related to steam produced in another installation that is then delivered to a cement plant qualify as direct emissions. Under greenhouse gas accounting standards such as the GHG protocol, emissions from heating and cooling produced outside the installation boundaries would fall under the category of scope 2 emissions.

Scope 2 - Indirect emissions due to electricity consumption:

CBAM requires the emissions resulting from the electricity consumed during the manufacturing process to be monitored and accounted for. This includes CO2 emissions associated with the production of electricity, either purchased of produced at the installation. Under greenhouse gas accounting standards such as the GHG protocol, indirect emissions due to electricity consumption would fall under the category of scope 2 emissions.

3.2.2 Methodologies for monitoring and quantifying direct emissions

There are several methods for monitoring and quantifying direct emissions.

Calculation-based methodology

- The **standard method** involves determining quantities of all the fuels and input materials consumed and multiplying those with calculation factors such as the net calorific value and emission factor. These calculation factors are typically determined either based on sampling and analysis or by the use of standard factors.
- The **mass balance method** is typically relevant where carbon remains in the goods produced (e.g. steel). In this case, the carbon quantities of all fuels, input materials as well as output materials are determined. This mass balance will result in a difference between the amount of carbon entering and leaving the installation. This difference will be considered to be converted into CO2 equivalent emissions.

Contrary to what the name suggests, the calculation-based methodology also relies on measurements. However, the emissions are not directly measured. Instead, it is parameters such as the consumption of fuels and materials as well as the carbon contents of fuels and materials that are measured. The emissions are calculated from this data.

Measurement-based methodology

This methodology focuses on continuous measurements of emissions from emission sources at the installation level. Emissions may be measured directly in the stack or using extractive procedures with a measurement instrument located close to the stack. These measurements provide direct data on the amount of greenhouse gases emitted.

Other monitoring systems

The transitional phase allows for some temporary flexibility in using other monitoring, reporting and verification system that are already applied in the installation.
Until 31 December 2024 other monitoring and reporting methods can be used if they lead to similar coverage and accuracy of emissions data.

How can you find out if your installation is covered by an eligible monitoring and reporting system, so you can use its methods during start-up of the CBAM? This is the case if either of the following applies:

- The installation is participating in a ‘carbon pricing scheme’
- The installation is participating in a compulsory GHG reporting scheme
- The installation participates in an emission monitoring scheme at the installation (non-mandatory), which can include verification by an accredited verifier

Besides, for the whole reporting period, up to 20% of the total embedded emissions of complex goods may be based on estimations."

3.3 Calculating the specific embedded emissions in the hydrogen sector

The formula for calculating specific embedded emissions in the hydrogen sector is as follows:

Specific embedded emissions = (Total CO2 Emissions from Hydrogen Production) / (Total Hydrogen Production)

- The numerator, "Total CO2 Emissions from hydrogen production", represents the sum of carbon dioxide (CO2) emissions released during the entire hydrogen production process in tonnes. It encompasses both direct and indirect emissions.
- The denominator, "Total Hydrogen production", refers to the overall amount of hydrogen produced within a specific timeframe. It is usually measured in cubic meters and represents the total quantity of hydrogen manufactured during that period.

By dividing the total CO2 emissions from hydrogen production by the total hydrogen production, the formula provides a measure of specific embedded emissions, which represents the amount of CO2 emitted per unit of hydrogen produced.

It's important to note that the specific calculation of specific embedded emissions may require more comprehensive methodologies that explained in more details in the guidance documentation and communication template.

4 Reporting in the CBAM Transitional Registry

4.1 Relevant reporting requirements during the transitional phase

Information requirements regarding the hydrogen imported into the EU:

- quantity of imported hydrogen
- country of origin
- direct and indirect emissions

Reporting timetable:

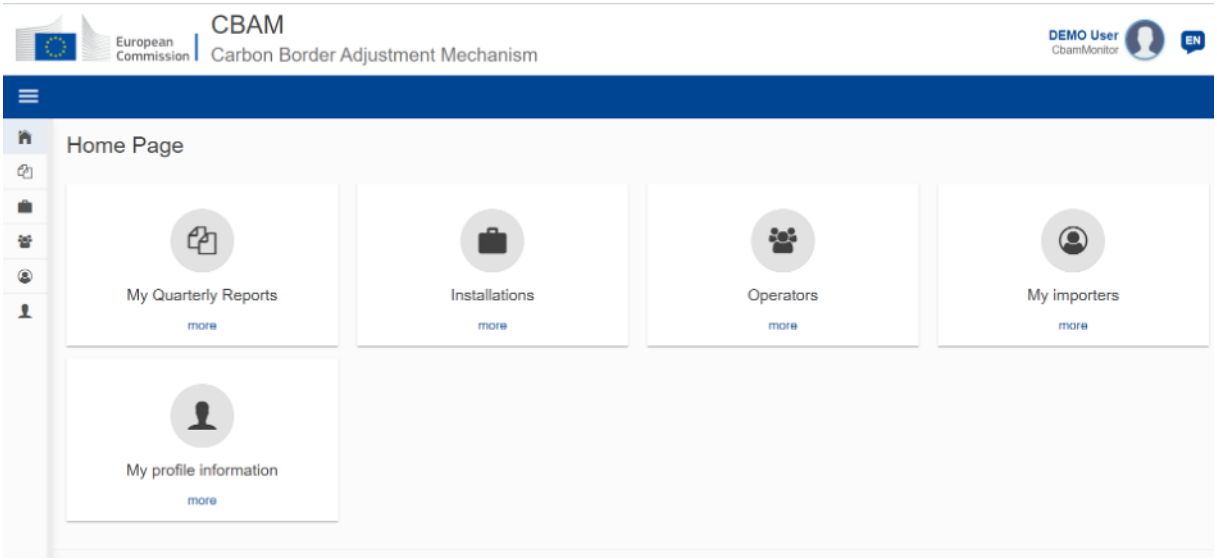
- From October 2023 to December 2025, submit reports quarterly
- First CBAM report is due by 31 January 2024
- First two reports may be modified and corrected until July 2024

Benefits of data collection:

1. helps refine the methodology for reporting and for calculating the default values,
2. integrates the carbon pricing mechanisms being applied in third countries,
3. addresses any difficulty faced by reporting declarants,
4. ensures that the system is as user-friendly as possible.

4.2 Introducing the CBAM Transitional Registry

Please note: to understand how to access the CBAM Transitional Registry, please see course Uniform User Management and Digital Signatures (UUM&DS)



My quarterly reports
All open and closed reports will be displayed on this screen. Here, you can also create new reports or rectify past reports.

Installations
The "Installation" is the physical facility or industrial plant that carries out specific production processes. It can be a manufacturing plant, a power station, or any facility involved in activities covered by CBAM. For example, in the hydrogen sector, an installation would be a hydrogen production facility. On this screen you can create a registry of the Installations you import your goods from, so you can easily look them up when submitting a new report. That way you will save time as most of the information will automatically fill in.

Operators
The "Operator" or "Installation operator" is the entity responsible for operating the installation and carrying out the production processes. They are accountable for complying with emissions monitoring and reporting and other CBAM requirements associated with the production of goods within that installation. In the hydrogen sector, the installation operator would be the company managing the hydrogen production facility. On this screen you can create a registry of the Operators associated with the Installations you import your goods from, so you can easily look them up when submitting a new report. That way you will save time as most of the information will automatically fill in.

My importers
On this screen you can see the list of your importers and access their profiles.

My profile information
On this screen you can see your profile details but cannot edit the information.

4.3 Reporting in the CBAM Transitional Registry

Please refer to the course to see the demo.

Remember, this is a quick and handy summary of the most relevant course information. Only the European Union legislation published in the Official Journal of the European Union is deemed authentic. The Commission accepts no responsibility or liability whatsoever with regard to the training.

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