

Carbon Accounting Frameworks in the EU and Germany

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List of abbreviations

AVR	EU ETS Accreditation and Verification Regulation
BaFin	Federal Financial Supervisory Authority
CA	Competent Authority
CAPEX	Capital expenditures
CBAM	Carbon Border Adjustment Mechanism
CCF	Corporate Carbon Footprint
CDP	Carbon Disclosure Project
CER	Certified Emission Reduction Certificates
CFP	Carbon Footprint of a Product
CGT	Common Ground Taxonomy
CRCF	Carbon Removals Certification Framework
CSDDD	Corporate Sustainability Due Diligence Directive
CSRD	Corporate Sustainability Reporting Directive
DAkks	Deutsche Akkreditierungsstelle
EAC	Energy Attribute Certificates
EFTA	European Free Trade Association
ESMA	European Securities and Markets Authority

ESRS	European Sustainability Reporting Standards
EU	European Union
ETS	Emissions Trading System
EHV	Emissions Trading Ordinance
GHG	Greenhouse Gas
GHGP	Greenhouse Gas Protocol
HGB	German Commercial Code
KPI	Key Performance Indicators
LCA	Life Cycle Assessment
MRR	EU ETS Monitoring and Reporting Regulation
MRV	Monitoring, Reporting, Verification
MS	European Union Member States
NFDR	Non-Financial Reporting Directive
OPEX	Operational Expenditures
PA	Paris Agreement
PCF	Product Carbon Footprint
PPA	Power Purchase Agreement
RTS	Regulatory Technical Standard
SBTi	Science Based Targets Initiative
SEC	Securities and Exchange Commission
SFDR	Sustainable Finance Disclosure Regulation
SME	Small and Mid-sized Enterprises
TEHG	Greenhouse Gas Emissions Trading Act
TIC	Testing, Inspection, and Certification
US	United States of America
VAT	Value Added Tax
VPS	Virtual Post Office
WBCSD	World Business Council for Sustainable Development



Executive summary

High-quality accounting of greenhouse gas (GHG) emissions is pivotal to achieving net-zero emissions targets. In recent years, the proliferation of carbon accounting frameworks has created opportunities and challenges for businesses, regulators, and stakeholders. This report provides a comprehensive overview of these carbon accounting frameworks in the EU and Germany, offering insights into their characteristics, applications, and opportunities for improvement. It explores principles for balancing accuracy and implementation effort, addresses the financial regulation of emission allowances, and discusses fraud prevention measures. In addition, case studies in the steel and cement sectors are given as practical examples. This report aims to inform the ongoing development of China's carbon accounting frameworks and standards.

Rational of the report

China's climate policy, underpinned by its commitments on Dual Carbon Goals, emphasizes the need for building robust carbon accounting frameworks. This report shall help inform that process based on the experiences from the comprehensive set of carbon accounting frameworks in the EU and Germany. It offers a systematic overview for policymakers, real economy actors and accounting consultants alike to learn from the existing ecosystem of carbon accounting in the real economy in Germany and the European Union.

For decisionmakers, the insights from the report can enable the further development of refined policy measures. Businesses can gain actionable guidance to navigate complex compliance requirements and voluntary frameworks, ensuring greater consistency and comparability in corporate emissions reporting. For investors and financial stakeholders, integrating carbon accounting with financial reporting fosters better decision-making and ensures alignment with evolving regulatory and market expectations. By addressing challenges like Scope 3 emissions data collection and encouraging value chain collaboration, the report empowers companies to enhance transparency and align carbon accounting practices with broader sustainability strategies.

Carbon accounting frameworks: categories and standards

Carbon accounting frameworks in the EU have different objectives, target different actors and activities, and reporting requirements. The report describes these differences which are summarized in Table 1. In the report, carbon accounting frameworks are categorized into compliance-driven and voluntary approaches. Compliance-driven frameworks, like the EU Emissions Trading System (EU ETS), Carbon Border Adjustment Mechanism (CBAM), and Corporate Sustainability Reporting Directive (CSRD), mandate reporting and emissions reduction for regulated entities. Meanwhile, voluntary platforms and initiatives, like the Carbon Disclosure Project (CDP), leverage established standards such as the Greenhouse Gas Protocol (GHGP) to drive transparency and corporate responsibility. Both types of frameworks play critical roles in fostering decarbonization, transparency, and alignment with broader climate objectives.

The GHGP and the ISO 14064 standard family are two important non-mandatory standards that define principles and processes for accounting and reporting of GHG emissions. Both standards provide detailed requirements and guidance on quantifying emissions of companies (corporate carbon footprints) or specific products (product carbon footprints). While generally well-aligned, the GHGP and ISO 14064 also differ in focus: The GHGP emphasizes practical methodologies for Scopes 1, 2, and 3 emissions, and ISO 14064 provides rigorous frameworks for validating emissions data. Another difference concerns the requirement for reporting indirect emissions.

Key principles for corporate carbon accounting

The study uses the accounting criteria of the EU ETS as a benchmark for comparison with those in other frameworks. The central piece of legislation for accounting, monitoring, and reporting of greenhouse gas emissions under the EU ETS is the continuously refined Monitoring and Reporting Regulation. It defines six key principles for monitoring, reporting, and verifying GHG emissions: completeness; consistency, comparability, and transparency; accuracy; methodological integrity; continuous improvements; and conservativeness. These principles can also be applied to evaluate compliance and non-compliance frameworks and guide further improvement. If data is not sufficiently aligned with these criteria, investors and consumers will not trust it and the steering of investments into low-carbon activities will fail.

Data quality for emissions from upstream and downstream activities (scope 3) often falls short of these principles. This furthermore highlights the importance of independent third-party auditing and verification as a critical safeguard for better data and legal assurance. In compliance schemes, this validation work improves data quality and supports administrative oversight.

Table 1: Overview of main aspects of EU carbon accounting frameworks.

Regulation	Key aims	Subjects	Main accounting requirements
EU ETS	Cost-effectively phasing down emissions in industry and energy sectors.	Regulated EU producers of CO ₂ -intensive goods, based on activities and relevant thresholds	Relevant scope 1 carbon emissions data.
Carbon Border Adjustment Mechanism (CBAM)	Reduce risks of carbon leakage, international level playing field in carbon pricing, impetus for global decarbonization	Importers of CBAM goods to the EU, operators in supply chain must provide emissions data	Embedded emissions in products belonging to the categories covered by the CBAM
Carbon Removals Certification Framework (CRCF)	Voluntary certification framework for CO ₂ removal projects, defining quality criteria and MRV rules Promote innovation, combat greenwashing.	Operators of removal activities (nature-based, technology-based, products and materials), certification bodies, member states.	QU.A.L.I.T.Y criteria: quantifiability, additionality, long-term storage, sustainability.
Non-financial Reporting Directive (NFRD)	Improve the disclosure of non-financial, environmental and social information by certain large undertakings and groups.	Large corporations with more than 500 employees. Listed companies, banks, insurances and public-interest companies.	Focus on ESG risks regarding climate change.
EU Green Taxonomy	Orients investors towards sustainable activities.	Companies, investors	Emission intensity criteria (scopes 1 and 2) that must be met for an activity to be taxonomy-conform.
Corporate Sustainability Reporting Directive (CSRD)	Corporate disclosure of ESG-related information regarding governance, strategy, impacts, risks, opportunities.	Companies with >250 staff/>€50 million in turnover/ >€25 million in assets	Scopes 1-3
Corporate Sustainability Due Diligence Directive (CSDDD)	Determining responsibility and liability for managing risks and negative impacts regarding human rights and the environment.	Companies above defined annual net turnover thresholds, and their suppliers. Final threshold (2029/30): €450 million.	Develop 1.5°C-aligned plan for climate neutrality by 2050, covering scope 1, 2 and 3 emissions of the company.
Sustainability Finance Disclosure Regulation (SFDR)	Disclosure of information on sustainability in finance products.	Financial market participants and financial advisors.	Adverse sustainability impacts of investments and sustainability risks to investments.

Source: The Climate Desk

Fraud prevention and regulatory oversight

While most covered entities abide by the rules, carbon markets and reporting schemes have not been spared from non-compliance, market abuse, fraud, and other criminal action. Regulators and market actors alike are strongly interested in maintaining environmental integrity, as incidents may undermine trust in the system. In the EU, the supervision of the carbon market is in the hands of financial authorities of Member States, coordinated by the European Securities and Markets Authority as European Regulator.

Compliance checks by competent authorities are an essential measure against fraud. In the EU, the use of electronic reporting systems has improved the efficiency of the compliance system. Known cases of fraud include resale of certificates previously used for compliance, falsified emission reports, VAT fraud, and theft of allowances. They resulted in improvements in regulation. Closing gaps and loopholes and improving security is an ongoing process. Authorities and legislators must stay abreast of evolving challenges and new schemes and develop solutions. Digitalizing processes and introducing measures such as two-factor authentication and stringent verification have already greatly limited the probability of criminal actions, deterring fraudulent action.

Synergies, misalignments, and recommendations

For direct emissions (scope 1), compliance reporting schemes generate reliable and verified emissions data that can be priced via carbon markets. Even in sectors not subject to compliance reporting, frameworks like the GHGP will yield data of decent quality. Scope 1 accounting does not pose a real challenge, and data can be considered relatively comparable. Regarding indirect emissions from electricity or heat purchased from suppliers (scope 2), challenges to comparability become much larger. Considering the entire market, there is a bias to underreport total emissions. Obtaining good emissions data from upstream and downstream activities (scope 3) is most challenging. At present, Scope 3 emission data of companies cannot be considered comparable.

Carbon accounting data can serve different purposes, like inventory accounting (emissions of a company at a certain point of time), consequential accounting (impact of a certain intervention), or performance accounting (comparing climate performance through e.g. benchmarks). When such data that originally serve different purposes are compared or lumped together, problems regarding comparability and consistency do easily result.

Based on the EU situation and experience, the report makes recommendations that also can inform the Chinese discussion: (1) Corporations should acknowledge the inherent challenges of carbon accounting. They should be transparent about the limitations of their approaches and open to feedback for the continuous improvement of their accounting practices. (2) The value of carbon accounting should be seen as extending beyond mere compliance as it is a quintessential basis of companies' strategic development towards net-zero. Thus, companies should prepare adequate resources for carbon accounting that goes beyond the inventory accounting required for compliance purposes only. (3) Regarding reliability and comparability of scope 3 data, companies could aim to move towards a more cooperative approach. Sharing more real scope 1 and 2 emissions data in the supply chain would reduce the need to use imprecise default and replacement values or other work-around solutions in scope 3 emissions accounting.



1 Introduction and scope of the report

The regulatory environment around carbon accounting and sustainable finance has strongly evolved since the Paris Agreement (PA) was adopted in 2015. The legal agreement is fundamental to most climate legislation today. This also applies to the European Union (EU) and Germany which are the focus constituencies in this study.

China, too, has ratified the PA and its climate policy framework is developing rapidly and dynamically. China has committed itself to reaching the peak of its carbon emissions before 2030 and to achieving carbon neutrality before 2060. China has built an increasingly sophisticated climate policy system, including targets, emission trading, and greening the finance system. Reliable, accurate, and transparent carbon accounting systems at the company level are an essential element of such efforts. They enable measuring the status quo and progress of climate action. More and more, financial markets are taking this information into account to align finance flows with long-term climate and sustainability goals.

Relevant climate policy with a focus on reducing greenhouse gas (GHG) emissions was already implemented in the EU well before the PA became the central reference to the core EU legislation. The EU and Germany have repeatedly enhanced their climate policy over time through several rounds of policy making. The primary approach was driving decarbonization based on carbon pricing in its energy and industry sectors. In 2005, the EU launched its Emission Trading System (EU ETS) as a part of its commitments under the Kyoto Protocol (signed in 1997). Since then, it has reduced emissions in covered sectors by 37% below 2005 levels (2022)¹, making its ETS its lead instrument in climate policy.

The EU complemented this market-based regulatory approach through an extensive transparency-driven sustainability agenda that has also become a central element under its comprehensive policy framework, the European Green Deal (2019), working towards making Europe a climate-neutral continent by 2050. Following the publication of its “Action Plan: Financing Sustainable Growth” in 2018², the EU Commission has initiated an agenda with legislative acts to help align financial flows with low carbon and climate-resilient development over the long term. Under the Corporate Sustainability Reporting Directive (CSRD) from 2022, mandatory reporting standards are being developed to address the real economy. These aim to improve the scope and quality of publicly available information on sustainability, including climate-related information. This transparency from real economy players will support ongoing accounting work in the financial sector. Following the Sustainable Finance Disclosure Regulation (SFDR) from 2019³, financial market actors must disclose information on investment risks, financial products, and services. In the end, disclosure requirements shall inform various stakeholders of adverse impacts, and related risks in corporate action and how the negative externalities are dealt with.

This report focuses on evolving accounting requirements for GHG emissions and their impact on corporate reporting in the real economy. These emissions can either be scope 1 and 2 emissions⁴, which are under any company’s direct control or scope 3 emissions⁵ throughout

1 European Commission (2023): REPORT [...] on the functioning of the European carbon market in 2022 pursuant to Articles 10(5) and 21(2) of Directive 2003/87/EC.

2 European Commission. (2018). COM (2018) 97: Action Plan: Financing Sustainable Growth.

3 European Parliament and Council. (2019). Regulation (EU) 2019/2088 on sustainability-related disclosures in the financial services sector.

4 Scope 1 emissions are direct emissions from sources owned or controlled by a company. Scope 2 emissions are indirect emissions from the generation of purchased electricity, steam, heating, and cooling consumed by the company.

5 Scope 3 emissions are upstream and downstream emissions. They are not directly controlled by the company.

the value chain. To that aim, we describe the accounting methods and practices that have been developed over time and helped shape the way German and European companies report emissions and connected metrics today. These metrics can also include emission targets.

The report explains and compares GHG accounting practices under different schemes, thereby informing readers on the spectrum, the rationale, and interplays between requirements and how they can be addressed inside a company. Moreover, the report will also critically discuss the intersection of carbon accounting in the real economy and the reception of such accounts on financial markets as well as in financial reporting. Thus, it provides an assessment of the extent to which carbon accounting approaches are integrated between the real and the financial economy. Beyond the scope of this study are practices regarding further issues like climate-related risk accounting or the aspects of transition planning, which also come to the fore in several of the more prominent legal or voluntary initiatives today.

The first three chapters establish the foundation. Chapter 2 classifies relevant standards and regulations. Chapter 3 provides an overview of the Greenhouse Gas Protocol and ISO 14064, two of the most important standards for corporate carbon accounting. Chapter 4 presents the most important EU regulations and frameworks for carbon accounting. Chapter 5 discusses the main features and elements the accounting follows, starting with principles, actors involved and tasks in a dedicated accounting cycle before explaining the main reporting elements. Chapter 6 looks at the connection of carbon accounting and financial statements. Illustrative case studies in Chapter 7 make the requirements more tangible. Chapter 8 then covers the topic of supervision, fraud, and measures to its prevention, and sanctioning. The report closes with discussing synergies between carbon accounting and financial markets.

The general approach of this report is to take the well-established accounting practices under the EU ETS as a starting point and then compare certain aspects with other accounting practices, discussing differences and weighing sometimes conflicting principles against each other. The primary focus is on accounting practices in Germany. In general, lessons learned, and good practices are shared where possible. By also looking at further emerging and upcoming requirements, e.g., from CSRD, the report also casts light on the evolution of future carbon accounting and reporting.



2 EU corporate carbon accounting requirements and their categorisation in this study

2.1 The rise of corporate carbon accounting in the EU and Germany

Climate change-related metrics, including emissions data, have played a strongly enhanced role in the EU since the implementation of the Kyoto Protocol (1997) and the establishment of the EU Emissions Trading System (EU ETS), launched in 2005.⁶ To support the EU and its Member States with the decarbonization of industry and energy sectors, the EU ETS established a stringent Union-wide system of emissions accounting and control on the corporate level. In monetary terms, this cap-and-trade system is the largest in the world, accounting for around 36% of EU emissions in 2022. It covers 8,640 electricity and heat plants and manufacturing installations as well as 390 aircraft operators throughout the EU⁷. In parallel to the EU ETS, some European countries also use CO₂ taxation schemes to price carbon emissions. Sweden started its carbon tax already in 1991. In Germany, a dedicated ETS for fuel consumption in buildings and transport sectors was launched in 2021. A similar European scheme, the EU ETS II (adopted in 2023), will replace it in the coming years.

On the side of voluntary reporting, other CO₂ related requirements were developed over the years. The EU helped further standardize CSR (corporate social responsibility) reporting through the adoption of its Non-Financial Reporting Directive (NFDR) in 2014. It includes relevant environmental data and defines a clear baseline for transparency and accountability practices in business.

The adoption of the Paris Agreement in 2015, with its central objective of limiting global temperature increase to well below 2 degrees Celsius, while pursuing efforts to limit warming to 1.5 degrees, brought new momentum to carbon reporting in general. To prepare the EU for reaching economy-wide decarbonization and climate neutrality by 2050, the EU Commission published its European Green Deal in 2019. This holistic strategy defines several levers and stepstones that led to groundbreaking changes such as the European Climate Law (2021) which adopted an emissions trajectory for the EU to meet climate neutrality by 2050 (-55% in 2030, -90% in 2040). Considering that, the ambition of the EU ETS was also adjusted, the new Carbon Border Adjustment Mechanism (CBAM) will bring carbon pricing and carbon accounting also to imports of carbon-intensive goods. In 2022 Europe decided to replace its NFDR with the Corporate Sustainability Reporting Directive (CSRD). 2024 is its first reporting year. This directive will further enhance the rigor with view to the reporting of emissions-related data where compliance schemes so far have had limited reach. The EU Corporate Sustainability Due Diligence Directive (CSDDD) requires regulated companies to have climate neutrality plans in place. Reporting here begins in 2027. While all these regulations apply to the management of real economy emissions and emitters, the EU also issued a dedicated regulation to address the need to reorient financial flows to finance a low carbon economy. Its Sustainable Finance Disclosure Regulation (SFDR) from 2019 follows a transparency approach from a risk communications perspective. Its objective is to help omit stranded assets and broader capital market risks in an economy that moves on toward a strong decarbonization pathway. As the CSRD, the SFDR also refers to the EU Taxonomy that defines activities that are eligible and potentially aligned with a 1.5 degrees world.

2.2 How we categorize carbon accounting in this report

In the EU and Germany today, the current ways of GHG emissions accounting in the real economy can be categorized in different ways.

⁶ The EU ETS was established 13 October 2003 through directive 2003/87/EC. It became operative in 2005.

⁷ European Commission (2023): REPORT [...] on the functioning of the European carbon market in 2022 pursuant to Articles 10(5) and 21(2) of Directive 2003/87/EC.

Three conceptual distinctions that are particularly important for this report are outlined below.

Standards, platforms, or frameworks

First, one may distinguish between standards, platforms, and frameworks. Standards set specific requirements for data points, including the rules that must be followed in accounting. Investor-driven platforms like the global CDP initiative refer to and thereby endorse selected existing standards, such as the Greenhouse Gas Protocol, which is the most widely applied carbon accounting standard worldwide. Platforms may do so on different grounds, ultimately considering the selection of standards most appropriate or fit-for-purpose to their defined objectives. For example, for CDP as a voluntary reporting platform there is a focus on rather stringent requirements from standards, which are often also widely applied – as is the case with the EU ETS, a compliance regime or framework.

In this report, we use the term frameworks as an overarching concept. This reflects that virtually all schemes discussed in this report only to some degree establish new standards. Mostly they endorse or adapt preexisting standards or requirements – thus not always reinventing the wheel but rather aligning provisions in a larger, more extensive spectrum of requirements. The authors are aware that the term framework may also refer to the overall environment of standards and platforms. In this report, however, frameworks, as a term in the plural form, refers to the various single initiatives and regimes.

Compliance vs voluntary

This leads to a second reasonable categorization: Frameworks that define reporting requirements may either be binding or non-binding in nature. Compliance regimes like the EU ETS require companies that fall in their scope to follow them. Thus, they automatically have a strong impact on reporting practices within affected companies. For more than 8,640 installations a report was compiled according to EU ETS requirements. In Germany that figure stands at around 1,500 installations (974 small category A installations with <50kt of emissions per year; 396 mid-sized category B emitters with emissions up to 500kt/a; 125 largest category C installations with emissions of >500kt/a⁸), covering major industry sectors and players. As we will show in this report, the scope and type of the entities that must report under a specific framework like the EU ETS is a relevant aspect. Many smaller companies, especially small and mid-sized companies (SME) do not fall under the ETS and thus their reporting practices may follow different requirements. Especially for mid-sized companies, requirements such as those included in the CDP climate change questionnaire may play a large role as many of these smaller players are requested to report through the supply chain program of CDP. The outreach here is global with more than 16,462 suppliers reporting through CDP.⁹ Moreover, in 2022 in total 1,495 companies reported to investors following CDP rules. In Germany this figure stood at 149.¹⁰

By using the compliance vs. voluntary distinction in the structure of the report, we acknowledge and explicitly point out the complementary trends of political regulation and self-regulation in the market. Often private sector initiatives show use-cases that become benchmarks through endorsement in compliance frameworks. Compliance frameworks may drive more principled approaches, where (pragmatic) private initiatives lack rigor or consistency. One example that features in this report is the Carbon Removals Certification Framework (CRCF) that may also help solve some problems in the voluntary carbon market.

Regulation incl. pricing vs transparency frameworks

Frameworks may also be distinguished by the objective(s) they follow. When looking at the EU, there are either frameworks that focus on regulation (incl. through mandatory standards/thresholds e.g. in the building or the transport sector which are beyond the scope of this study) and/or pricing like in the case of the EU ETS or those that are driving transparency in markets, e.g. on ESG data. This distinction is much parallel to the compliance/voluntary divide, though there is some noteworthy overlap now at the demarcation lines.

⁸ European Commission (2023): REPORT [...] on the functioning of the European carbon market in 2022 pursuant to Articles 10(5) and 21(2) of Directive 2003/87/EC.

⁹ CDP (2023a) Global Supply Chain Report 2022.

¹⁰ CDP (2023b): Europe Report 2023-03.

Recently major new compliance requirements have emerged that focus on establishing transparency for investors based on solid requirements for reported information. Starting with requirements for investors’ accounting (SFDR), this also results in a spill-over effect on the real economy as investors request respective data from their investees/corporates. More recently and important also for the real economy, new directly applicable compliance frameworks are being rolled out. Most prominent are the requirements from the European Sustainability Reporting Standards (ESRS) under the CSRD. The current trend in direction of mandatory transparency requirements is global as can be seen from a similar initiative by the US Securities and Exchange Commission (SEC): It will make climate-related disclosure a relevant compliance item for public company filings in the US.

Table 2: Overview of carbon pricing and transparency frameworks.

	Compliance	ESG transparency	Voluntary
	Carbon Pricing		ESG transparency
Main objective and purpose	Create economic incentives to reduce GHG emissions and achieve targets	Increase transparency and accountability on sustainability matters, incl. GHG emissions in corporate supply chains and business models; helping buyers and investors monitor and drive change processes.	Contribute to the proactive initiation of the process of change in a company. Increasingly required by customers and investors as a precondition for business.
Examples in EU and Germany	<ul style="list-style-type: none"> · EU Emissions Trading System (EU ETS) · German National ETS · EU Carbon Border Adjustment Mechanism (CBAM) 	<ul style="list-style-type: none"> · EU Corporate Sustainability Reporting Directive (CSRD) · EU Taxonomy 	<ul style="list-style-type: none"> · CDP Reporting · Greenhouse Gas Protocol and GRI reports

Source: The Climate Desk.

Lessons learned

There are different logical ways to categorize the landscape of emissions reporting requirements in the EU and Germany. Standards set specific requirements for data points. Platforms endorse selected existing standards and do so on different grounds, ultimately considering the selection of standards most appropriate or fit-for-purpose to their defined objectives.

The term frameworks reflects that virtually all schemes discussed in this report establish new standards only to some degree while they mostly tend to endorse or adapt preexisting standards or requirements. Such Frameworks may either be binding, like the EU ETS, or non-binding in nature, like CDP. They may be distinguished by their objective: Some focus rather on regulation through carbon pricing while others drive transparency in the market e.g. on ESG data.

This report distinguishes pricing and transparency frameworks or ESG frameworks to structure the content. Table 2: above illustrates this systematically. A lot of upcoming requirements from the latter type of ESG frameworks (red) will be mandatory in nature – thus they will add to the relevance of information that is put forward to investors and other stakeholders for further purposes than direct use in carbon pricing.



3 Base standards for corporate carbon accounting and footprints

Two important standards: the Greenhouse Gas Protocol and ISO 14064

Existing voluntary and regulatory frameworks for carbon accounting and reporting build on methods and principles defined in international standards – especially when it comes to disclosures for the financial market. This section provides a short overview of the two most important ones: the Greenhouse Gas Protocol (GHGP)¹¹ and ISO 14064.¹²

Basic terms for carbon accounting and footprints

Carbon footprint: a carbon footprint is the total amount of emissions of carbon dioxide (and potentially other greenhouse gas emissions) that are caused directly or indirectly by activities of a company or an organization. It provides the data basis for carbon accounting and disclosure.

Corporate and product carbon footprints: a carbon footprint can be calculated for all activities of an entire company, a single branch office of a company, or a specific business area within a company. In this case, it is referred to as corporate carbon footprint (CCF). A CCF is the total amount of greenhouse gas emissions directly and indirectly caused by a company's activities, typically measured in CO₂ equivalents. Similarly, a carbon footprint can also be calculated as the total amount of emissions embodied in a product, which is referred to as a product carbon footprint. A Product Carbon Footprint (PCF) represents the total greenhouse gas emissions produced throughout a product's entire lifecycle, also measured in CO₂ equivalents. Important metrics for a PCF include emissions from raw material extraction, production, transportation, usage, and disposal of the product. This report will focus on CCFs.

Emission scopes: carbon dioxide and the GHGs defined in the Kyoto Protocol (methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride, and nitrogen trifluoride – all measured in CO₂ equivalents (CO₂e)) are subdivided into three categories – in the GHGP referred as Scopes. Scope 1 includes direct emissions from a company's own installations, buildings, and vehicles. Direct emissions can originate from burning fossil fuels to generate heat or power, or from industrial process emissions. Scope 2 refers to electricity or heat that a company purchases from other suppliers. These so-called indirect emissions can be accounted for by two methods: the location-based method, or the market-based method. The location-based method applies the GHG emissions per unit of power from the grid from where the company receives power on various sites (e.g. based on the national power mix). The market-based method accounts for GHG emissions based on the contractual instruments between the company and its power provider, which also includes green power tariffs based on renewable energy certificates and PPA. Scope 3 refers to emissions from upstream and downstream activities within the value chain of a company but outside its organizational boundaries, i.e. by its suppliers, clients, and consumers.

To support companies in disclosing precise, substantiated, consistent, and comparable carbon footprints, standards have emerged that define certain methods and principles. For example, the Greenhouse Gas Protocol has established itself as the central standard for

¹¹ Greenhouse Gas Protocol: Standards and Guidance.

¹² International Standardisation Organisation (ISO): ISO 14064-1:2018. Part 1: Specification with guidance at the organization level for quantification and reporting of green-house gas emissions and removals.

calculating GHG emissions: it is very user-friendly due to its comprehensive framework, wide acceptance, and collaborative development process. It provides clear, consistent guidelines with practical examples to measure and manage emissions. On the other hand, the ISO 14064 offers an alignment with other ISO management standards and a standardized approach to GHG accounting and verification. This simplifies accounting, makes results more comparable, and reduces associated costs for companies. Transparency standards make the carbon accounting statements of companies more credible and strongly reduce the scope for arbitrariness in accounting. In the following, the GHGP and ISO 14063 are introduced in more detail.

GHG Protocol

The Greenhouse Gas Protocol (GHGP) is the most important global standard for accounting and reporting of GHG emissions. It was published by the World Resources Institute and the World Business Council for Sustainable Development (WBCSD) in 2004. The GHGP has three main parts:

- **Corporate Accounting and Reporting Standard:** Released in 2004, this is the base document of the GHGP. It covers the principles and requirements for measuring and reporting GHG emissions for CCFs, including identifying emission sources, data collection, quantification methods, and reporting frameworks for Scope 1, Scope 2, and Scope 3 emissions.
- **GHG Protocol Scope 2 Guidance:** This document provides rules for improving the comparability of CCFs through clarifying accounting for Scope 2 emissions. This enables companies to capture the environmental impact of their energy consumption completely in their footprint and develop adequate mitigation measures.
- **Corporate Value Chain (Scope 3) Accounting and Reporting Standard:** This standard facilitates companies in measuring indirect emissions along their upstream and downstream value chain, from purchased goods and services down to the utilization and treatment at the end of their life cycle of products.

ISO 14064 and the ISO 14060 family of standards

The ISO 14060 family of standards contains standards concerning GHG neutrality and GHG emission inventories. This section lists the most important ones.

ISO 14064 is an international standard that provides a consistent framework for the measurement, quantification, verification, and reporting of GHG emissions, as well as their abatement and removal. Its aim is to make climate action more comparable and credible by supporting the measurement and management of emissions. ISO 14064 has three main parts:

- **ISO 14064-1:** Quantification and reporting of GHG emissions and their abatement on organization level in companies. It was first published in 2006 and last revised in 2019.
- **ISO 14064-2:** Quantification, monitoring, and reporting of abatement or removal of GHG emissions on project level. It was released in 2019.
- **ISO 14064-3:** Specification and guidance for validating and verifying statements on GHG emissions. It was released in 2019.

Organizations of any size or industry can apply this standard for measuring, reporting, and managing their emissions and for undertaking voluntary climate action. Verification is an important element of this standard and ISO 14064 can be integrated into existing management systems such as ISO 14001 (environmental management).

Further relevant standards in the ISO 14060 group in the context of this report are:

- **ISO 14067:** Quantification and reporting of the carbon footprint of a product (CFP).
- **ISO 14068:** Achieving and demonstrating carbon neutrality (incl. GHG neutrality management plans, target setting and interim targets, carbon offset quality requirements).

Differences between GHGP and ISO 14064

While the GHGP and ISO 14064 are well-aligned in many of their requirements, there are some differences between the two standards. They are summarized in Annex C of ISO 14068:1 (Climate change management). The main differences between both standards are, firstly, the extent to which they require the inclusion of indirect emissions in the quantification of emissions, and, secondly, different requirements on using the location-based versus the market-based approach for reporting indirect energy emissions.

Concerning reporting of indirect emissions (Scope 2), ISO 14064 requires including indirect emissions from purchased energy, transportation, product(s) used by the organization, use of product(s) from the organization, other sources. In contrast, the GHGP requires only the inclusion of indirect emissions from purchased energy, whereas the inclusion of other indirect emissions under Scope 3 is optional.

Regarding methods for reporting indirect energy emissions, ISO 14064 only permits applying the location-based method for the main GHG inventory. A result under the market-based method can be reported separately but it is not permitted to account for renewable energy agreements and certificates as GHG emission reductions. The GHGP allows the market-based method as the main accounting and reporting method as long as the GHG emissions under the location-based method are also reported. The GHGP counts the purchase of renewable energy as an emission reduction.

Following further differences are worth mentioning: (1) GHG emissions and removals: ISO 14064 clearly addresses GHG emissions and removals per category, and removals are inherently included in the GHG quantification. The GHGP is not as clear here in its guidance but allows quantification of GHG removals to be reported separately from GHG emissions. (2) Avoided GHG emissions: ISO 14064 does not address this concept, while the GHGP does and requires reporting avoided GHG emissions separately. Avoided emissions refer to GHG emissions that occur as a result of using a product or service, but that are outside the products lifecycle and value chain. For example, if a company produces a more energy-efficient product, the emissions saved while using the product due to the product's efficiency are avoided emissions.

Despite these differences, GHG emissions reported under the GHGP and ISO 14064 generally conform to each other if significant Scope 3 GHG emissions and removals are included in the quantification.

A further important difference between both standards is that verification and validation of GHG emission statements is defined for ISO 14064 in ISO 14064:3, whereas there is no standard for verification and validation for GHG statements made following the GHGP.

The general process for determining GHG emissions in accordance with the GHGP and ISO 14064

This section briefly explains the process of calculating a carbon footprint for a company (CCF), which is essentially analogous between the GHGP and ISO 14064. Carbon emission accounting is usually based on the following principles: Relevance: Definition of the relevant target group. Completeness: Inclusion of all relevant emission sources within system boundaries and disclosure and justification of

underlying assumptions. Continuity: Recommendation to update accounts every five years, following the same methodology or disclosing and justifying divergence. Transparency: Disclosure of data sources and calculation methods, description of data gaps. Exactness: Avoid insecurities as much as possible and preclude systematic errors. Generally, the process consists of six steps:

- (1) Objective: The objective of a CCF is to disclose which business activities cause emissions, how high total emissions are, and how they are distributed among sources. A CCF can serve different purposes: compliance with legal requirements, risk management, identifying and implementing mitigation potentials, cost savings, developing climate action plans and strategies, or public relations.
- (2) Define system borders: the CCF should cover all direct and indirect emissions resulting from the company's activities. The timeframe of the CCF must be defined and should be kept in the future (typically one year). Organisational system border: all business domains and locations of the company. Operational system border: emission sources to be included (Scope 1, 2, 3).
- (3) Data collection: an essential step for calculating the footprint. Especially for the first footprint, this process may take time as data gaps may have to be closed and data management systems may need to be improved. There are three ways of collecting data: Direct metering of emissions (highest quality); activity data: energy/fuel consumption, travel distance of vehicles, material consumption (moderate to high quality); secondary data, e.g. from studies, general industry data or similar processes.
- (4) Emission factors: Where only activity data are available, emission factors are required to determine an emission value. Emission factors represent the emissions resulting from burning a certain quantity of fuels. Emission factors are also used for the power that a company receives from the grid. Emission factors usually are denominated in ton or kilogram of CO₂ per kWh, MWh, or mass/volume unit of a fuel.
- (5) Certification: Optionally, companies can have an accredited third party certify the calculation results.
- (6) Reporting: The results of the CCF calculation and the underlying process, methods, and assumptions should be documented – both for external communication or potential compliance obligations and as reference for internal use. Within the report, it is crucial to deal transparently with the evaluation of uncertainties and assumptions.

Outlook

Standards for GHG emission accounting are in a process of continuous change. An update of the GHGP is expected for 2025. An important part of that update is a potential change in the GHGP approach to indirect emissions, which may involve a stronger emphasis on the location-based method. It is expected that stating market-based emissions would remain viable at least as a separate statement to the main statement.

Another important development is the emerging requirement for GHG emission statements to undergo verification. The forthcoming EU Green Claims Directive and the Empowering Consumers for the Green Transition Directive, both part of the EU Green Deal Package, require companies to verify their sustainability claims. This also applies to GHG emissions statements. As between GHGP and ISO 14064, only the latter has defined a standard for verification thus far, the ISO may gain in relevance for companies considerably. Under a trend toward mandatory verification of statements, the GHGP may eventually become less relevant in Europe if it does not define a standard for verification. Due to the above-mentioned current developments, we will likely see further assimilation of both standards.

Relevant documents

Greenhouse Gas Protocol Standards (selection):

- Greenhouse Gas Protocol Corporate Standard¹³
- Greenhouse Gas Protocol Product Standard¹⁴
- Greenhouse Gas Protocol Corporate Value Chain (Scope 3 Standard)¹⁵

Greenhouse Gas Protocol Guidance (selection):

- Greenhouse Gas Protocol Scope 2 Guidance¹⁶
- Greenhouse Gas Protocol Scope 3 Calculation Guidance¹⁷

ISO 14064: Greenhouse gases

- ISO 14064-1:2018 - Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals.¹⁸
- ISO 14064-2:2019 - Part 2: Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements.¹⁹
- ISO 14064-3:2019 - Part 3: Specification with guidance for the verification and validation of greenhouse gas statements.²⁰
- ISO 14067:2018 - Carbon footprint of products. Requirements and guidelines for quantification.²¹
- ISO 14068-1:2023 - Climate change management. Transition to net zero.²²

13 Greenhouse Gas Protocol: Corporate Standard.

14 Greenhouse Gas Protocol: Product Standard.

15 Greenhouse Gas Protocol: Corporate Value Chain (Scope 3 Standard).

16 Greenhouse Gas Protocol: Scope 2 Guidance.

17 Greenhouse Gas Protocol: Scope 3 Calculation Guidance.

18 International Standardisation Organisation (2018). ISO 14064-1:2018 – Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals.

19 International Standardisation Organisation (2019). ISO 14064-2:2019 – Part 2: Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements.

20 International Standardisation Organisation (2019). ISO 14064-3:2019 – Part 3: Specification with guidance for the verification and validation of greenhouse gas statements.

21 International Standardisation Organisation (2018). ISO 14067:2018 – Carbon footprint of products

22 International Standardisation Organisation (2023). ISO 14068-1:2023: Achieving and demonstrating carbon neutrality.

4 Relevant regulations in the EU and Germany

In the EU context, there is a set of sophisticated carbon accounting frameworks that have evolved over time. This is further complemented now by various further pieces of legislation. This section introduces the relevant frameworks.

4.1 Carbon pricing schemes

4.1.1 EU Emissions Trading System (EU ETS)

The EU ETS with its roughly 1.3 bn tons of CO₂ coverage is the world's first and, in terms of monetary market volume, largest emissions trading system. The average CO₂ price reached 80.18 EUR per ton of CO₂ in 2020 and has remained in this order of magnitude since. As a tool, it is set to help the EU achieve reductions of 62% from 2005 levels by 2030. This contraction of emissions in covered sectors is driven through an annual decrease in the overall cap. This linear reduction factor will be 4.3% (2024-2027) and 4.4% per year from 2028 onwards. As a compliance instrument, the EU ETS establishes mandatory carbon pricing for the direct CO₂ emissions of regulated companies. It also creates transparency about their CO₂ emissions through a register and, to a limited extent, about their trading activities in the carbon market.

Scope

Through several rounds of review, the sectoral scope of the ETS has repeatedly expanded. Today it covers direct emissions (scope 1) in the energy sector and all major energy-intensive industry sectors, namely oil refineries, iron and steel production, metals, aluminum, cement, lime, glass, ceramics, pulp, paper as well as acids and bulk organic chemicals, and aviation (flights within the European Economic Area). From 2024, it will also include the maritime transport sector. From 2028, municipal waste incineration facilities shall be included.

The EU has also decided in 2023 to launch a separate second ETS in 2027 (EU ETS II). It will cover the fuels emissions from heating of buildings and further combustion emissions in road transportation sectors and additional parts sectors of the industry that are not yet covered by the existing ETS.

The EU ETS covers carbon dioxide (CO₂) emissions as well as the emission of two other GHGs: nitrous oxide (N₂O) emissions from nitric acid, adipic acid, and glyoxylic acid and glyoxal production and perfluorocarbons (PFCs) from aluminum production. From 2026, the EU ETS will also cover emissions of nitrous oxide and methane (CH₄) from maritime transport. The EU has also decided that non-CO₂ effects of aviation will become subject to the EU ETS but implementing regulation is still pending.

Accounting focus

The stationary ETS requires operators of covered industry and energy facilities to monitor and report on their direct emissions. This carbon accounting is the basis for effective emissions control in pricing regimes that drive down emissions as defined by the cap. Emissions under the EU ETS stood at 1,362.1 million tons CO₂ eq in 2022.

Apart from monitoring emissions, the EU ETS requires operators that receive so-called free allocation based on benchmarks also to

regularly monitor and report on their relevant production data. With the phase-in of the Carbon Border Adjustment Mechanism (CBAM, see below) the relevance of this carbon leakage provision will shrink and eventually completely disappear in 2035.

Relevance to Chinese companies

The EU ETS generally does not have high direct relevance for Chinese companies, except if they operate installations in the EU in the covered sectors, and which exceed emission thresholds. However, it has significant indirect relevance. Firstly, the CBAM (see below) will require accounting for carbon emissions on product level based on the ETS accounting. This will also affect Chinese companies that produce goods that are imported into the EU and that are subject to the CBAM. These operators will have to provide data on emissions in line with the ETS accounting system. Secondly, as a long-standing and mature instrument, the EU ETS holds many lessons learned for emission accounting. Moreover, price developments in the EU ETS also will affect the carbon price for imports under the CBAM.

Main legislative acts

EU Monitoring and Reporting Regulation, MRR²³: This regulation is the central piece of legislation on monitoring and reporting, laying down specific rules for application of GHG accounting within the EU ETS. The regulation directly applies to national stakeholders throughout the EU.

The core provisions for accounting as per MRR are embedded in further legislative acts:

EU ETS Directive²⁴: This central Directive establishes the Emissions Trading in the EU (EU ETS), following the objective of promoting cost-effective and economically efficient GHG emissions inside the EU. It helps implement the EU's contributions to combat climate change and is aligned with the EU's international commitments. On MRV it lays down the central provisions and obligations within the scope of the EU ETS. As a directive it addresses Member States that use further national legislative acts to implement their obligations. In Germany these include the Greenhouse Gas Emissions Trading Act (TEHG) and the Emissions Trading Ordinance (EHV), the latter further specifying aspects from the TEHG and further MRV relevant issues.

EU Accreditation and Verification Regulation, AVR²⁵: This regulation lays down specific provisions for the verification of emissions reports and data relevant for the update of benchmarks as well as the determination of free allocation for operators in the ETS. Moreover, it defines requirements for the accreditation and supervision of verifiers. The regulation directly applies to national stakeholders throughout the EU.

4.1.2 Carbon Border Adjustment Mechanism (CBAM)

CBAM is a tool of the EU to reduce the risk of carbon leakage among its industries and to promote global decarbonization by imposing an obligation to surrender CBAM certificates corresponding to carbon emissions embedded in imported CBAM goods and electricity. From 2026 onwards, importers of electricity or goods falling under CBAM must calculate and verify the emissions embedded in their imports, declare them annually, and buy and surrender a corresponding number of CBAM certificates. The newly introduced mechanism thus extends the price signal of the EU ETS to all companies worldwide, provided they produce goods that are covered by the CBAM and find their way into the EU.

23 COMMISSION IMPLEMENTING REGULATION (EU) 2018/2066 of 19 December 2018 on the monitoring and re-ported 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).

24 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

25 COMMISSION IMPLEMENTING REGULATION (EU) 2018/2067 of 19 December 2018 on the verification of data and on the accreditation of verifiers pursuant to Directive 2003/87/EC of the European Parliament and of the Council

CBAM entered into force on 17 May 2023. Its first phase started on 1 October 2023. During the first phase, importers of CBAM goods had to start quarterly reporting on the emissions embedded in their products. Full implementation, including annual CBAM-declarations and the obligation to purchase CBAM certificates, begins on 1 January 2026.

The price of CBAM certificates will be the average weekly price of EU ETS allowances (minus, where applicable, the carbon price in country of origin of imports and current levels of free allowances within ETS). The development period of rules that make CBAM operational is set to last from 2023 to 2025.

Scope

Affected products are identified with CN codes in the following sectors: cement, electricity, fertilizers, iron and steel, aluminum, and chemicals (hydrogen) from all countries not linked with EU ETS. For cement and fertilizers, both direct and indirect emissions are covered.

Accounting focus

Accounting under CBAM is designed to cover the same emissions as the EU ETS does. In this respect, the statements on accounting under the EU ETS are largely analogous here, referring to accounting practices under the MRR and the broader allocation regime for defining benchmarks and reporting respective data by corporates. Rules for reporting during this transitional period were published on 17 August 2023, and the Commission has published several guidance materials to help importers begin with CBAM implementation word during the transitional period. Importers of CBAM goods must submit their first CBAM report on 31 January 2024.

Rigorous accounting under CBAM means that companies in the EU that purchase CBAM goods gain very precise knowledge of their suppliers' product-related emissions. In this respect, CBAM is a mechanism that creates a high degree of transparency amongst non-EU/EFTA suppliers and their European customers.

Relevance to Chinese companies

CBAM has high relevance for Chinese companies. Firstly, their branches in the EU might be obliged to submit CBAM reports for certain imported goods. Secondly, Chinese suppliers of companies with a CBAM reporting obligation, who operate installations in China may need to provide data on embedded emissions for CBAM reports. On the one hand, this may pose a challenge to operators, especially because CBAM reporting requires data on emissions embedded in products rather than on the installation level. On the other hand, the Chinese National ETS (and provincial pilot ETS) have placed MRV obligations on many industrial facilities. This MRV system has been generating emissions data that provide a good foundation for CBAM reporting, also relative to other non-EU countries affected by the CBAM.

Main legislative acts

- CBAM Regulation²⁶
- CBAM Implementing Regulation for the transitional phase²⁷
- Annexes to the CBAM Implementing Regulation for the transitional phase

26 REGULATION (EU) 2023/956 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 10 May 2023 es-tablishing a carbon border adjustment mechanism

27 COMMISSION IMPLEMENTING REGULATION (EU) 2023/1773 of 17 August 2023 laying down the rules for the application of Regulation (EU) 2023/956 of the European Parliament and of the Council as regards reporting obliga-tions for the purposes of the carbon border adjustment mechanism during the transitional period.

4.1.3 Carbon Removals Certification Framework (CRCF)

The Carbon Removals Certification Framework (CRCF) was proposed by the EU Commission on 30 November 2022. It is a voluntary EU-wide framework to certify carbon removals in Europe. It defines quality criteria and approves certification rules for measurement and MRV of removals from industrial and nature-based activities. Supported by this framework, the EU Commission follows the aim to boost innovative carbon removal technologies and sustainable carbon farming solutions, while fighting greenwashing.

Scope

Certification of: (a) nature-based solutions; (b) technologies (e.g. bioenergy with CCS, or direct air carbon capture and storage); (c) long-lasting products and materials (e.g. wood construction).

Accounting focus

Operators of removal activities must apply to a recognized certification scheme. Their activities will be certified by independent bodies to check compliance with EU rules. They will receive certificates of compliance, and the carbon removal units are recorded in registries managed by certification schemes. To receive certification, removals need to be quantified, deliver additional climate benefits, store carbon for a long time, prevent leaks, and contribute to sustainability (= QU.A.L.I.TY criteria). Third party verification and certification are required. Based on the QU.A.L.I.TY criteria, the EU Commission, supported by technical Expert Groups, is developing certification methodologies for the different types of removals. The requirements that are applied in this certification follow established principles (additionality testing, rigorous baseline definition) and best practice approaches from carbon removal measures elsewhere including the EU ETS, and will help the Commission to finance removal action on the ground through its Innovation Fund and other funding programs and schemes.

Relevance to Chinese companies

As the CRCF only applies in Europe, it is unlikely to directly impact Chinese companies, except if Chinese companies develop and operate carbon removal projects in Europe. It also may be relevant for Chinese companies selling carbon removal technologies in Europe. Branch offices of Chinese companies in Europe seeking to purchase carbon removal certificates in Europe should be aware of this framework. Potentially, the CRCF also may inform the evolving framework of legislation and standards for carbon sinks in China.

Main legislative acts

- Proposal for a Carbon Removals Certification Framework, CRCF²⁸

On 10 April 2024, the European Parliament adopted the provisional agreement on the CRCF. It still requires approval by the Council of the EU before being published and entering into force.

4.2 Transparency reporting frameworks

4.2.1 Non-Financial Reporting Directive (NFRD)

The Non-Financial Reporting Directive (NFRD) was adopted in 2014. It aims to improve non-financial and diversity information disclosure by certain large undertakings and groups, encouraging corporates to provide comprehensive details beyond financial information. It focuses on sustainability, social responsibility, and environmental impact. In reporting 2024 the NFRD is replaced by the CSRD and its accounting standards.

²⁸ REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL establishing a Union certification framework for carbon removals, COM(2022) 672 final.

Scope

The NFRD addresses large corporations with more than 500 employees. Since 2017 in Europe around 11.700 companies have fallen under its scope, including listed companies, banks, insurance companies, and other so-called designated public interest companies.

Accounting focus

Corporations under the NFRD are obliged to publish information on social matters including treatment of employees, respect for human rights, anti-corruption, and bribery issues as well as diversity on company boards (age, gender, educational and professional background) as well as environmental issues. Regarding the latter, there is a classical ESG risk focus.

Relevance to Chinese companies

The NFRD has been replaced by the CSRD.

Main legislative acts

- Non-Financial Reporting Directive²⁹

The national German transposition law is:

- CSR Directive Implementation Act³⁰

4.2.2 Corporate Sustainability Reporting Directive (CSRD) and European Sustainability Reporting Standards (ESRS)

The CSRD mandates companies to disclose material impacts, risks, and opportunities related to environmental, social, and governance (ESG) matters. Being part of the European Green Deal, it entered into force on 5 January 2023. It gradually replaces the existing reporting under the NFRD. Under the CSRD, the first accounting standards – the so-called European Sustainability Reporting Standards (ESRS) have been published.

Scope

CSRD applies to all large companies and whether they are listed or not on EU regulated markets (including SMEs and exception of micro-enterprises) if they meet at least two of the following criteria:

- More than 250 employees;
- A turnover of more than €50 million;
- More than €25 million total assets.

Regarding which subsidiaries the companies must report, there is no differentiation between financial or operational control – all parts of the company that are consolidated within the financial reporting of a company must be included, regardless of whether they are within the EU or not. Following a phase-in plan, for all other larger companies the scope of the CSRD will gradually be extended. The directive will be rolled out in four phases through 2024-2029. In each phase, the company size threshold for reporting is reduced: In 2024, the directive covers all listed companies with more than 500 employees – following the scope of the NFRD. From 2025, it is extended to those with more than 250 employees, €50 m turnover, or €25 m total assets. In 2026, listed SMEs will be within the scope. From 2028, non-EU based companies with more than €150 m turnover in the EU must also comply with the obligations, bringing the total number of reporting corporates to around 50,000.

29 DIRECTIVE 2014/95/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 22 October 2014 amending Directive 2013/34/EU as regards disclosure of non-financial and diversity information by certain large undertakings and groups.

30 CSR-Richtlinie-Umsetzungsgesetz: Official publication: Bundesgesetzblatt Teil 1 (BGB 1); Number: 20 ; Publication date: 2017-04-18 ; Page: 00802-00814.

Accounting focus

The ESRS standards provide the rules and requirements by the EU Commission for companies to report on sustainability-related impacts including opportunities and risks related to emissions. They are part of the CSRD and include 12 disclosure standards with 2 cross-cutting standards. These latter standards define the general requirements (ESRS 1) and disclosures (ESRS 2). So far 10 topical standards have been published. One of these (E1) also addresses climate related issues including those on accounting of emissions. The table below shows all these topic-related standards.

Figure 1: Overview of European Sustainability Reporting Standards (as of 2023).

Environmental standards	Social standards	Governance standards
<ul style="list-style-type: none"> •E1: climate change •E2: pollution •E3: water and marine resources •E4: biodiversity and ecosystems •E5: resource use and circular economy 	<ul style="list-style-type: none"> •S1: own workforce •S2: workers in the value chain •S3: affected communities •S4: consumers and end-users 	<ul style="list-style-type: none"> •G1: business conduct

Source: The Climate Desk

Companies subject to the CSRD must adopt the European Sustainability Reporting Standards (ESRS) in their reporting. The principle of double materiality determines whether a company must report on an ESRS domain. The double materiality principles ask two questions about the company:

1. Do the company's activities affect the domain (e.g. climate, biodiversity)?
2. Are the company's activities affected by the domain?

If one or both questions are answered positively for an ESRS domain, the company must report on it. When it comes to climate change, in practice, any companies that are manufacturing goods as part of their operations have to report. Only if a company is a very small service provider with negligible energy use, they may be exempt.

Environmental Standard E1 includes relevant emissions data points as presented below. The information in brackets refers to the number of KPIs and the SFDR reference:

- E1-4: GHG emission reduction targets per paragraph 34 (14 KPIs; SFDR indicator number 4 Table #2 of Annex 1)
- E1-6: Gross scope 1, 2, 3 and total GHG emissions per paragraph 44 (17 KPIs, SFDR indicators number 1 and 2, table #1 of Annex 1); Gross GHG emissions intensity (SFDR indicators number 3, Table #1 of Annex 1)

Regarding E1-6, the key requirements for GHG inventories are as follows:

- Accounting standards to be used: GHG Protocol Corporate Standard (2004) or EN ISO 14064-1:2018. However, E1 strongly refers to the GHG Protocol.
- Disclose methods, key assumptions, and emission factors.
- Include GHG listed in the Kyoto Protocol at least, additional GHG possible, if relevant.
- GHG emissions of fully consolidated associated companies must enter the inventory of the reporting company entirely.
- GHG emissions of non-fully-consolidated companies with operative control by the reporting company must enter the inventory entirely.
- GHG emissions of non-fully-consolidated companies without operative control by the reporting company must be considered under Scope 3

Emissions that an ETS covers must be listed, as well as carbon certificates from the voluntary market. Moreover, companies must disclose natural carbon sinks or technical carbon capture, if relevant for the company. Only the total emissions of the company must be disclosed while emissions per company parts only need to be shared with the verifier. Scope 3 emissions only must be reported every three years or if the company's business model changes fundamentally. As a move to further reduce reporting efforts on the side of SME any undertaking with less than 750 employees must report scope 3 data per E1-6 only in the third year of its mandatory reporting under the CSRD.

Relevance to Chinese companies

Starting from 2028, Chinese companies with a turnover of over € 150 million in the EU will be obliged to report under the CSRD. Reporting in 2028 will cover the year 2027. Therefore, companies should start building up their reporting systems and data collection processes internally already in 2026, or sooner, so that adequate data collection is in place for reporting on the year 2027. As emission reporting includes scope 1, 2, and 3 emissions and other aspects of CSRD reporting also touch upon the value chain, data from suppliers will be required.

Main legislative acts

- Corporate Sustainability Reporting Directive³¹
- Sustainability Reporting Standards Delegated Regulation³²

4.2.3 EU Green Taxonomy

The EU Green Taxonomy ("EU Taxonomy for Sustainable Activities") is a classification system that categorizes economic activities according to the extent to which they contribute to the EU's environmental goals. It entered into force on 12 July 2020. By creating a common language and clear, shared definitions of which investments and economic activities are considered sustainable, the Taxonomy helps inform investor decisions and direct investments towards environmentally friendly activities. The taxonomy, therefore, is a transparency tool providing science-based criteria for determining the sustainability of specific economic activities. Importantly, it has no mandatory character, such as prescribing investors where to invest or placing requirements for environmental performance on companies or products.

The Taxonomy covers six sustainability objectives:

- (1) Climate change mitigation;
- (2) Climate change adaptation;
- (3) Sustainable use and protection of water and marine resources;
- (4) Transition to a circular economy
- (5) Pollution prevention and control;
- (6) Protection and restoration of biodiversity and ecosystems.

In addition, the Taxonomy also defines four conditions that must be met for an investment to qualify as environmentally sustainable.

- (1) Making a substantial contribution to at least one environmental objective;
- (2) Doing no significant harm to any of the other five environmental objectives;
- (3) Complying with minimum safeguards; and,
- (4) Complying with the technical screening criteria set out in the Taxonomy delegated acts.

31 DIRECTIVE (EU) 2022/2464 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 14 December 2022 amending Regulation (EU) No 537/2014, Directive 2004/109/EC, Directive 2006/43/EC and Directive 2013/34/EU, as regards corporate sustainability reporting.

32 COMMISSION DELEGATED REGULATION (EU) 2023/2772 of 31 July 2023 supplementing Directive 2013/34/EU of the European Parliament and of the Council as regards sustainability reporting standards.

There is a distinction between Taxonomy eligibility and Taxonomy alignment. The Taxonomy defines economic activities that are eligible for assessment and provides criteria to assess if they are, ultimately, aligned with the Taxonomy. Eligibility means that the activity can, in principle, be implemented sustainably. The assessment of whether an activity is aligned or not results from applying technical screening criteria given by the Taxonomy for that activity. It is important to note that the Taxonomy is still being developed and additional technical screening criteria for goals 3-6 have been released recently. The ongoing development of the Taxonomy also means that further activities may be added and that screening criteria may be changed. A successive tightening of screening criteria over time is intended.

For many activities, the taxonomy criteria include carbon emission values that the activity may not surpass. The following will elaborate on the relevance of carbon accounting for reporting under taxonomy criteria.

Scope

The Taxonomy applies both to large companies and listed companies that are obliged to report under the CSRD, and to financial market participants that must disclose the sustainability credentials of their financial products under the SFDR. Companies must report the percentage of their current and future revenues from activities aligned with the Taxonomy. Financial market participants must disclose whether their products partially pursue sustainable investment (i.e. they have social or environmental characteristics, “light green”), or can be considered sustainable investment if they are fully aligned with the Taxonomy. Here, companies reporting under the CSRD goes to the financial market actors reporting under the SFDR. Banks must report their green asset ratio under the Taxonomy. This leads to an increasing number of banks tying their loan conditions to taxonomy conformity.

While the Taxonomy involves no obligations about investment policies, those companies with obligations under the CSRD (see above) must report annually how the EU Taxonomy covers their activities and comply with the criteria spelled out in the Taxonomy delegated acts. Currently, the Taxonomy covers over 11,000 companies, already exceeding the number of companies covered by the EU ETS. As the CSRD comes into force, this number is expected to reach 50,000.

Accounting focus

The technical screening criteria for climate change mitigation include emission thresholds or a wide range of economic activities that certain production steps must not exceed to be considered as making a significant contribution to climate change mitigation. Monitoring of emissions and carbon accounting provides data that are required to assess certain economic activities against the technical screening criteria.

Example

Under the Green Taxonomy, production steps in the iron and steel industry must meet the following criteria:

- (i) hot metal = 1.331 tCO₂e/t product;
- (ii) sintered ore = 0.163 tCO₂e/t product;
- (iii) coke (excluding lignite coke) = 0.144 tCO₂e/t product;
- (iv) iron casting = 0.299 tCO₂e/t product;
- (v) electric arc furnace (EAF) high alloy steel = 0.266 tCO₂e/t product;
- (vi) electric arc furnace (EAF) carbon steel = 0.209 tCO₂e/t product.

Relevance to Chinese companies

As the Taxonomy applies to all companies obliged to report under the CSRD and the SFDR, the Taxonomy is relevant to Chinese companies that have reporting obligations there. Any Chinese company already obliged to report under the NFRD must report.

Both, the EU and China have been making efforts to align their respective financial taxonomies more closely, among others on the International Platform on Sustainable Finance (IPSF). The Common Ground Taxonomy (CGT) is a result of this cooperation.³³ In the

33 International Platform on Sustainable Finance (2022). Common Ground Taxonomy – Climate Change Mitigation.

first phase of work, a comparison of commonalities and differences between the green taxonomies of the EU and China was conducted – primarily with the Green Bond Endorsed Projects Catalogue as the Chinese counterpart. (International Platform on Sustainable Finance 2022). Key findings of the comparison are as follows:

- Objectives are generally comparable but more granular in the EU Taxonomy. While the EU Taxonomy lists six objectives (see above), the Chinese counterpart lists three: climate change, environmental improvement, and more efficient resource utilisation.
- Both frameworks have different users. The EU Taxonomy can be used by all entities and is mandatory for some actors, while China's taxonomy is mandatory for green bond issuers, including financial institutions, corporations, and state-owned enterprises.
- The definition of alignment functions differently. The EU Taxonomy combines technical screening criteria, do-no-significant-harm criteria, and minimum safeguard criteria. China's taxonomy includes a detailed white list of eligible activities and projects for various sectors and subsectors and is explicit about technologies for low-emission production. Only activities that are included in the list are eligible.

Main legislative acts

For the EU Green Taxonomy, complementing delegated acts have been adopted by the Commission. These cover screening criteria for evaluating whether activities meet taxonomy criteria as well as the content and methods for disclosing information on activities for different companies to help them translate technical screening criteria into KPIs. A third delegated act approved, under strict conditions, specific nuclear and gas energy activities in the list of economic activities covered by the EU Taxonomy.

- Delegated Regulation as regards economic activities in certain energy sectors and specific public disclosures for those economic activities³⁴

4.2.4 Corporate Sustainability Due Diligence Directive (CSDDD)

The objective of the CSDDD is to regulate how companies deal with potential and actual negative impacts of their economic activities and supply chains on human rights and the environment and to determine responsibility and liability for violations of human rights and negative environmental impacts. Moreover, it includes obligations for adopting and implementing transition plans for climate action in adherence to the 1,5°C target of the Paris Agreement. Importantly, the CSDDD is not a mere reporting obligation. It entails civil liability of management upon wilful and negligent violations of human rights or environmental standards. As the focus of this report is carbon accounting, the following content will focus on climate transition plans.

Scope

The CSDDD will apply to companies that cross certain thresholds for annual net turnover and employees, which are shown in the table below. These thresholds will come into effect three years after the CSDDD enters into force and will be lowered annually in the fourth and fifth years.

While small and medium-sized enterprises (less than 1,000 employees) are excluded from the CSDDD, they are likely to be affected indirectly as suppliers to companies that are in scope.

³⁴ COMMISSION DELEGATED REGULATION (EU) 2022/1214 of 9 March 2022 amending Delegated Regulation (EU) 2021/2139 as regards economic activities in energy and certain sectors and Delegated Regulation (EU) 2021/2178 as regards specific public disclosures for those economic activities.

For non-EU enterprises, the threshold will begin at € 1.5 billion annual net turnover, probably in 2027 or 2028 (depending on when the CSDDD enters into force), then decrease to €900 million in the following year, then to €450 million another year later. At the same time, five years after the CSDDD will have entered into force, a threshold for franchise and license parties will come into action - €22.5 million in contract fees or € 80 million in net turnover. For non-EU enterprises, only turnover within the EU counts towards the threshold.

The CSDDD only applies if thresholds are surpassed in two consecutive business years and applies to the highest-level parent company and its basis of consolidation for financial reporting. If the parent company only holds shares and does not take operative, financial, or other guiding decisions, a subsidiary can fulfill the obligations under the CSDDD on behalf of the entire corporation. Reporting of non-EU companies is due in the EU member state where it has a branch office or achieves the highest net turnover.

Reporting under the CSDDD applies to both upstream and downstream business activities within the immediate business domain of the company as well as activities of its suppliers and business partners. These activities range from the design and development of products and services to extraction and mining, manufacturing (upstream), as well as transport and storage (upstream and downstream). Disposal of products is not included in the CSDDD.

Accounting focus

The CSDDD addresses a wide reporting spectrum of human rights and environmental standards. Therefore, many of its reporting obligations do not touch upon carbon accounting. Nevertheless, carbon accounting is relevant in CSDDD when it comes to climate neutrality plans as required by Article 15 of the CSDDD.

The CSDDD requires companies to adopt climate neutrality plans containing science-based targets for emissions scopes 1, 2, and 3 in accordance with the Paris Agreement and climate neutrality in 2050 as defined in the EU Climate Law. Companies must have a target for 2030 and further targets in five-year increments. They must also describe key measures for decarbonization, incl. changes to products and services and adoption of new technologies. To define targets and mitigation measures adequately, companies will require data on their emissions. This requires corporate, and potentially also product carbon footprints.

The CSDDD does not specify one methodology that companies should follow for carbon accounting. Methodologies such as those defined by ISO 14064 or the GHG Protocol are all permissible.

It should be noted that reporting a climate neutrality plan under the EU Corporate Sustainability Reporting Directive (Environmental Sustainability Reporting Standard, ESRS, E1) is considered as compliance with climate reporting obligations under the CSDDD. Thus, it is not necessary to produce two different reports to meet CSRD and CSDDD climate reporting obligations.

Relevance to Chinese companies

Chinese companies which surpass the turnover thresholds mentioned above within the EU are obliged to report under the CSDDD. As reporting obligations fall on the highest-level parent company, the risk management and reporting structures may have to be built up within China. Reporting and climate and carbon-accounting related requirements may have to be conducted and implemented from China. Moreover, Chinese suppliers to companies with CSDDD obligations also will be affected and will have to improve their capacity to provide the required information, even if they have no direct obligation. Climate and carbon accounting related aspects only make up one part of the reporting, with many other environmental and social aspects to report on.

Main legislative acts

- Corporate Sustainability Due Diligence Directive³⁵

³⁵ DIRECTIVE (EU) 2024/1760 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 13 June 2024 on corporate sustainability due diligence and amending Directive (EU) 2019/1937 and Regulation (EU) 2023/2859.

4.2.5 Sustainable Finance Disclosure Regulation – SFDR

The SFDR is part of the EU Green Deal. It entered into force in March 2021. It aims to improve the transparency of the consideration of sustainability in investment products.

Scope

It applies to financial market participants managing money on behalf of investors. They must make related information available on their websites, in pre-contractual product documents and in their annual reports. This should enable investors to understand how companies are considering sustainability risks.

Accounting focus

Covered financial market actors must disclose how they consider sustainability risks that can affect the value of and return on investments (outside-in effect), and how they consider the adverse effects of investments on environment and society (inside-out effect).

The specific indicators include so-called Principle Adverse Impact (PAI) indicators, which relate to topics such as GHG emissions, biodiversity, water and waste. At product level, the SFDR identifies three categories with different disclosure obligations, with the Regulatory Technical Standard (RTS) outlining standardized comprehensive templates for the product-specific disclosure obligations.

In September 2023, the EU supervisory authorities published an analysis of the extent of voluntary disclosure under the SFDR, indicating that disclosure has improved, but levels of quality and compliance vary. The EU Commission is currently undertaking a public consultation on the implementation of the SFDR.

Relevance to Chinese companies

The SFDR applies to Chinese financial market participants in the EU that manage money on behalf of investors as defined above.

Main legislative acts

- Sustainable Finance Disclosure Regulation³⁶

4.3 Overview of instruments

For the regulations as discussed above the overview table below lists the main aspects of the accounting schemes, starting with legislative status, main objectives, and the targeted subjects with their main accounting duties.

³⁶ REGULATION (EU) 2019/2088 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 November 2019 on sustainability-related disclosures in the financial services sector.

Table 3: Overview of main aspects of EU carbon accounting frameworks.

Regulation	Status	Key aims	Subjects	Main accounting requirements
EU ETS	In force since 2005, currently in phase 4 (since 2020)	Cost-effectively phasing down emissions in industry and energy sectors	EU producers of CO ₂ -intensive goods that are regulated, based on activities and relevant thresholds	MRV of relevant scope 1 carbon emissions data as basis information to the cap & trade regime. Scopes 1,2
Carbon Border Adjustment Mechanism (CBAM)	In force , transitional reporting started on 1 Oct 2023	Reduce risks of carbon leakage, level playing field in carbon pricing, impetus for global decarbonization	Importers of CBAM goods to the EU, operators in supply chain must provide emissions data	Embedded emissions in products belonging to the categories covered by the CBAM
Carbon Removals Certification Framework (CRCF)	Proposal under review by Council and Parliament	Voluntary certification framework for CO ₂ removal projects. Defining quality criteria, approving rules for measurement and MRV of removals from industrial and nature-based activities. Promote innovation, combat greenwashing.	Operators of removal activities, certification bodies, member states. Regulated removals: (a) nature-based solutions; (b) technology-based removals; (c) long-lasting products and materials.	QU.A.L.I.T.Y criteria for carbon removals: quantifiability, additionality, long-term storage, sustainability. Defined by different recognised certification methodologies for different types of removals.
Non-financial Reporting Directive (NFRD)	Replaced by CSRD in reporting from 2024.	Improve the disclosure of non-financial, environmental and social information by certain large undertakings and groups.	Large corporations with more than 500 employees. Listed companies, banks, insurances and public-interest companies.	
EU Green Taxonomy	In force	Orients investors towards sustainable activities	Companies, investors	For certain activities to be taxonomy-conform regarding climate change mitigation, they must meet emission intensity criteria. Scopes 1, 2
Corporate Sustainability Reporting Directive (CSRD)	In force since 5 Jan 2023	Making corporates disclose information on ESG-related information re. governance, strategy, im-pacts/risks / opportunities	Companies with >250 staff/>€50 mn turnover/ >€25 mn assets	Scopes 1-3
Corporate Sustainability Due Diligence Directive (CSDDD)	In force	Determining responsibility and liability for managing risks and negative impacts regarding human rights and the environment.	Companies above defined turnover thresholds, and their suppliers. Definitive threshold (2029/30): € 450 million annual net turnover, (EU companies only: 1,000 employees)	Develop 1.5°C-aligned plan for climate neutrality by 2050, covering scope 1, 2 and 3 emissions of the company. Scopes 1-3
Sustainability Finance Disclosure Regulation (SFDR)	In force	Disclosure of information on sustainability in finance products	Financial market participants and financial advisors	Adverse sustainability impacts of investments ("inside-out") and sustainability risks to investments ("outside-in")

Source: The Climate Desk



5 Key aspects in company-level carbon

This chapter provides an overview of carbon accounting under the EU ETS. This compliance reporting system has been refined continuously and a large expanse of practical experience from implementation does exist. The study uses the EU ETS as a starting and reference point to compare relevant aspects in accounting to those in other frameworks.

After looking at principles, the subsequent subchapters of the report discuss the organizational setting and concrete tasks and requirements for the emissions accounting work. In a dedicated lessons learned section, the report then lays down and discusses prominent special features in other frameworks that vary from the EU ETS case. What are the reasons for that and/or what does this mean for the accounting practice?

5.1 Key principles

The central piece of legislation for accounting, monitoring, and reporting of GHG emissions under the EU ETS is the Monitoring and Reporting Regulation (MRR). This section will introduce a range of key principles for MRV of GHG emissions which the MRR defines.

5.1.1 Completeness (MRR, Art. 5)

The completeness principle requires that reporting covers all relevant emission sources and streams of the installation. Relevant emissions are basically all emissions that can be measured and may lead to measurable effects. Accordingly, all GHG emissions from regulated activities must be monitored and reported, irrespective of their actual size. This means that minor emissions from sources like emergency power generators - which in practice are often used in testing mode only and account for a minimal share in overall emissions - must also be included.

5.1.2 Consistency, comparability, transparency (MRR, Art. 6)

This set of principles requires that all actors follow common standards and provisions when monitoring and reporting data, assuring consistency in the scheme. As a result of that, data shall be comparable. This principle also refers to shared responsibilities among several parties involved in the MRV process. Sharing installation specific monitoring plans with the competent authority for review serves to further eliminate arbitrariness, inconsistencies, and inaccuracies. Transparency among operators, authorities, and verifiers therefore is an important condition for ensuring consistency and comparability.

5.1.3 Accuracy (MRR, Art. 7)

The accuracy principle requires that operators rule out any systematic or knowing errors and biases in their reporting. Accuracy should be on the “highest achievable” level, accepting that there may be limitations imposed by technical constraints or unreasonable costs. The degree of accuracy also depends on the quantity of emissions originating from an installation – usually larger quantities of emissions require

higher accuracy than smaller ones. The EU ETS uses a standardized tier system where different levels of accuracy are defined according to the implementation case.

5.1.4 Integrity of the methodology of the emissions report (MRR, Art. 8)

The integrity principle requires operators to apply their monitoring plans rigorously and keep reporting free of material misstatements. The operator also must maintain solid data management and data evaluation to this end. While the systematic review of the reporting by an independent verifier is an important element in fulfilling this principle, integrity ultimately requires due diligence that goes beyond verification. The correct implementation of MRV processes to emissions accounting is the backbone of the EU ETS.

5.1.5 Continuous improvements (MRR, Art. 9)

The improvement principle reflects the characteristics of emissions trading systems, as well as carbon accounting and reporting systems as learning systems. Rules evolve and are refined and adjusted based on learnings and best practices. In the context of the EU ETS, improvement reports are a systematic tool for improving monitoring systems. In these reports, operators discuss potentials for improving monitoring and reporting, including third-party verifiers' recommendations.

5.1.6 Conservativeness (MRR, Art. 3)

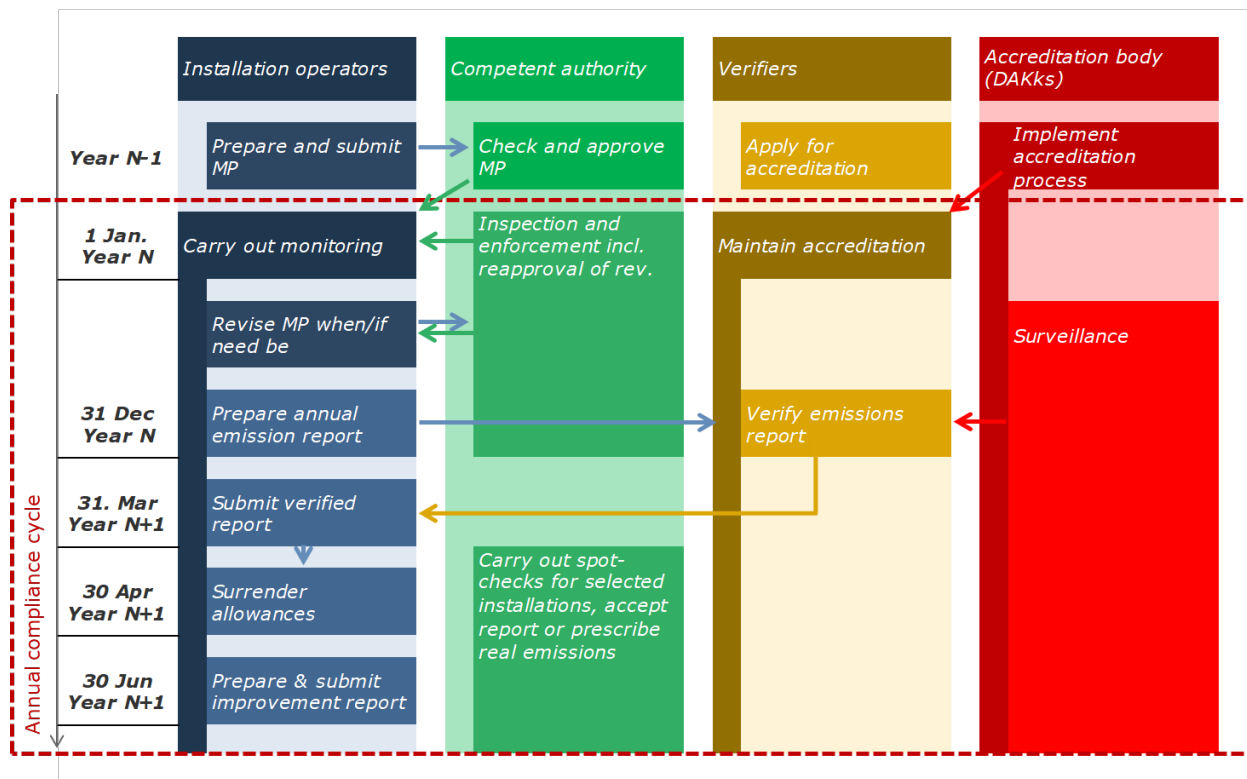
This principle applies when data gaps must be managed. It is not a standard accounting principle but plays an important role. While the principles of accuracy, transparency, and comparability aim for the representation of reality to the best possible degree, the principle of conservativeness diverges from this line: It is about avoiding under-reporting of emissions due to data gaps, even at the cost of introducing inaccuracies.

Operators are to determine and apply conservative replacement or default values that they can use if their emission monitoring experiences data gaps. To this end, operators should apply a "safety margin" when defining replacement values. To arrive at conservative replacement values the MRR defines criteria and best-practice approaches, e.g., an integration based on available values along the use of a 95% confidence interval and a conservative surcharge on that value of twice the standard deviation in the representative sample.

5.2 Organizational setting and the general interplay between actors

Carbon accounting and reporting involves contributions from a range of actors. Besides emitting installation operators, three other actors with important and distinct responsibilities are conspicuous. The flowchart below lays down the situation in the so-called compliance cycle for the EU ETS. It describes the calibrated interplay between the different actors that helps ensure that the scheme's provisions are met.

Figure 2: Interaction of actors on MRV in the EU ETS.



Source: FutureCamp, adjusted from flowchart in DEHSt M&R guidance document.³⁷

This flowchart sums-up main interaction between the different actors in the MRV cycle of the EU ETS. Note: The illustrated workflow includes just the main actions and is thus not exhaustive.

5.2.1 Monitoring and Reporting: Operators of emitting installations

Operators bear the main responsibility for monitoring and reporting – thus the accounting of emissions. They operate and control the installation subject to the reporting. Thus, they are responsible for defining the monitoring and reporting concept and keeping it up to date. They disclose the measurement and monitoring method and explain if and how requirements for monitoring and reporting have been met and justify any deviations. In the EU ETS, operators are liable and subject to penalties if there are misstatements, systematic mistakes in reporting, or underreporting of emissions.

5.2.2 Managing: Competent authorities (CA)

In the EU ETS competent authorities check and approve monitoring plans and inspect emission reports. They also publish guidance or FAQ documents to support operators in fulfilling their obligations. They ensure that reporting meets high standards. Operators are obliged to provide data in response to and accordance with the requests the CAs bring forward. If operators do not submit a report or a report is not verified as required, CAs may apply their own emission estimate using a conservative method. The competent authority in Germany is the DEHSt.

By approving monitoring plans, CAs fulfil a fundamental quality assurance role: At times they translate abstract regulation into concrete

³⁷ Deutsche Emissionshandelsstelle (DEHSt) (2024): Leitfaden zur Erstellung von Überwachungsplänen und Emissionsberichten für stationäre Anlagen. 4. Handelsperiode (2021–2030) des europäischen Emissionshandels, p. 18.

expectations and baselines for accounting practice, helping apply MRR provisions on the ground. Thus, while the CAs do not define the concept itself – which is a core task of the operator – they rigorously check the main parameters of that concept for adequacy.

5.2.3 Auditing: Verifiers and accreditation bodies

Emissions reports must be verified by independent third-party verifiers that are accredited for executing related tasks. The rigorous verification process according to standard rules as defined in the Accreditation and Verification Regulation (AVR) reduces the reporting risks by the operator.

Verifiers execute an independent, professional, and systematic scrutiny of the monitoring processes and the reported data. The verifiers help discover mistakes, establish rigor in accounting and thereby also improve the quality of the reporting. They check whether there are deviations from the approved monitoring plan (so-called “non-conformities”) or further issues of non-compliance with the MRR rules in general. Apart from checking data in a desk review, verifiers usually also carry out on-site inspections. This lays the basis for a good understanding of the applied monitoring practice.

The verification report is part of the emissions reporting. This systematic, integrated documentation of relevant test items is most transparent. It much facilitates the review work by the CA and the accreditation body.

Accreditation bodies are dedicated institutions with dedicated competencies to assure high quality of verification work. In Germany this function is taken over by Deutsche Akkreditierungsstelle (DAkks). It supervises the work of the verifiers and makes sure through a well based accreditation process that only qualified verifiers execute work in the ETS. Main provisions for this are defined by the AVR.

5.3 Tasks and requirements in the MRV process/compliance cycle

The MRR and the AVR define concrete requirements for the MRV based on the principles as discussed above (see 5.1). Both regulations refer in their provisions to “recognized standards” (CEN, ISO, DIN standards, etc.; see chapter 3). These standards define how various relevant aspects of measurement, sampling and analysis must be implemented. The focus in this subchapter is on describing the tasks for operators and (more generally) for the CA and verifiers in the calibrated compliance cycle that is focused on producing high quality data.

5.3.1 Preparation and iterative improvement of the monitoring concept

Based on the MRV rules including further guidance the operator defines all critical information on how the emissions accounting shall be executed in the respective installation. This monitoring plan shall be adjusted once there are technical or methodological changes relevant for the emissions accounting – ideally before these changes are implemented. Moreover, the operator discusses the situation on the implementation of improvements in accounting in dedicated improvement reports that are handed into the CA on a routine basis.

Defining a well-based monitoring plan is a larger task. It is based on and supported by a comprehensive risk analysis as part of the data control system an operator needs to maintain. Documented results of that work feature in the monitoring plan and further supporting documentation. The task is to identify, evaluate, and minimize inherent risks through focused implementation of control activities. Residual risks (risks after mitigation) are to be addressed through additional controls. This reflects that dataflow errors may still happen/cannot be fully eliminated but detecting these can be facilitated. Based on this discussion there is a good understanding of whether the risks for monitoring and reporting (mistakes and deviations from approved methodologies) are acceptable or whether further improvements should be realized. This analysis may not only help increase requirements for the measurement where this is critical. It may also reduce the burden of accounting of minor emissions without compromising on the overall accuracy of emissions accounting in the scheme. In the EU ETS a so-called tier system is used for that, distinguishing between

- de-minimis source streams where all so-classified emissions sources account jointly for less than 2% of all emissions in the installation or less than 1000 t CO₂ – whichever is higher and;
- major source streams for all other emissions sources.

Compared to major source streams, for de-minimis streams facilitations apply.

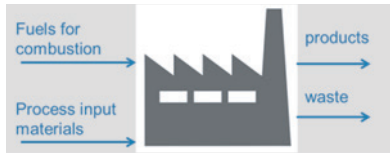

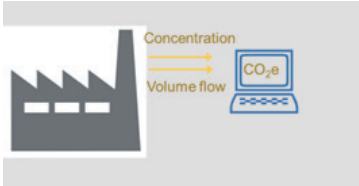
As monitoring problems are usually discovered over time the risk analysis is an iterative process as is the overall improvement of the monitoring concept at large.

The monitoring plan is subject to approval by the CA, to prevent arbitrary changes of monitoring methodologies. In its review work, the CA checks whether the plan is in line with existing MRV rules and provisions. Operators transparently explain the monitoring approach and further justify their choices to the CA. This may also involve review loops where the operator adjusts the plan based on requests by the CA.

5.3.2 Consistent monitoring and reporting of emissions data

The ongoing monitoring agenda is to follow the approved concept. Operators assure that approved monitoring requirements are continuously met. In general, the three different types of monitoring methodologies, displayed in table x below, may be used for the emissions measurement.

Figure 3: Different measurement approaches.

Calculation-based approaches		Direct measurement approach
a) Standard approach	b) Mass balance approach	c) Continuous monitoring
		
<p><i>Emissions = input or output streams * emissions factors * oxidation factor</i></p>	<p><i>Emissions = f * (Σ C_{input} - Σ C_{output})</i></p>	<p><i>Emissions = Concentration * Volume flow</i></p>

Source: FutureCamp, adjusted from flowchart in DEHSt M&R guidance document.

The MRR distinguished between two general calculation-based approaches and continuous monitoring through application of a Continuous Measurement System (CEMS)

Non-approved shifts of the monitoring methodology are not permissible. Relevant failures of the measurement equipment must be reported to the CA in due course. The treatment of eventual data gaps in reports is to follow either pre-defined approaches (per MRR, standard CA guidance, or provision in the monitoring plan) or agreed procedures, obtained through exchange with the CA. In fact, the monitoring process itself is also executed under continuous supervision of the CA.

For drafting the report, the reporting template in the EU ETS is generally based on the monitoring plan. Thus, its structure follows the same approved logic. In case the monitoring concept must change within any reporting year, e.g., due to technical changes in the production process, a report may also follow more than one approved monitoring plan. Typically, the report itself is prepared by the operator based on the already verified and thereby confirmed data.

5.3.3 Rigorous verification and checking of emissions reports

The EU ETS requires reasonable assurance for all certifications. The audit therefore goes well beyond what is required for a limited assurance statement. An auditor must confirm not only that data and documentation look technically fine but also that figures add up and the scrutinized documentation is sufficient to confirm that the accounting of emissions is in line with the available specific requirements, free of mistakes, and that after the verification the risk of mis-/underreporting of emissions is reasonably low.

The verification process involves desk review activities and an onsite audit. To allow the verifier to do its work, the operator must grant it sufficient insight into the monitoring system and the status quo on the ground. Data from primary sources throughout processing to the aggregate final reporting data must be transparently laid down. Depending on the complexities of an installation, this may involve a lot of data review and checking also onsite.

Once all misstatements or deviations have been corrected by the operator, the auditor certifies the report and submits the signed document to the operator. With that step, the verification is completed, and the report can be handed in to the CA. The competent authority checks and ultimately accepts emissions reports. It may also request adjustments, prescribe emissions, and – in case of underreporting of emissions – apply sanctions (100 EUR per t CO₂).

5.4 Lessons learned and discussion

The ETS delivers a compelling example of a system where the accounting function of a reporting entity is embedded in a comprehensive ecosystem of general principles, checks and balances amongst involved actors, and concrete accounting requirements. How do these compare to those in other frameworks?

Looking first at the principles that guide accounting work, not all of them feature equally under other frameworks we discuss in this paper. Firstly, *completeness* requirement is treated differently under the CSRD, where a materiality analysis may help exclude monitoring of emissions of minor relevance. It shows that under a scheme where no hard compliance and/or direct pricing is implemented, more pragmatism may be granted. This may help reduce costs for emissions monitoring and the proper equipment for that.

Still depending on the case, increased rigor may also seem more appropriate: e.g. experience from the NFRD showed that the framework was poor at delivering comparable, transparent data, thus data *consistency* was low. This may have hampered the NFRD's effectiveness in channeling relevant and trusted non-financial information to investors and civil society. The impact assessment by the EU commission that accompanied the CSRD legislation proposal identified too much flexibility and too little granularity/specificity in the NFRD requirements as the reason to this.

The degree of *accuracy* in accounting under the frameworks varies much. The so-called “tier system” in the EU ETS focuses on larger emissions while smaller emissions (source streams) and emitters are relieved from additional burden. This is done without compromising on the overall accuracy of emissions accounting in the scheme. Low accuracy in accounting is evident when looking at scope 3 emissions data companies currently present under their voluntary reporting. For some, scope 3 emissions account for the largest share of their emissions. For example, Thyssenkrupp, a major German steel producer and industry plant manufacturer (cement) has 11 times more emissions in the use phase of its products than under its own operations' control (scope 1 and 2). In the absence of real data from the value chain, these emissions estimates are based on highly insecure proxy data, thereby reducing the quality and trustworthiness of the provided information.

While in the EU ETS the correct MRV of covered scope 1 emissions is the backbone of the framework (the mantra goes: “a ton is a ton”). Even in a voluntary reporting context, the all over *integrity* of information may count no less. In the end, trustworthiness is a fundamental safeguard to the usability and relevance of the data as such. The success in bridging the accountability gap through transparency reporting may also relate to how companies report on their emissions to stakeholders. Scope 1 and 2 information was frequently lumped together,

despite deserving individual evaluation. Data aggregates like this cannot be understood without further context. At times, they clearly laid the ground for misleading statements regarding corporate action on decarbonization. Data may suggest that corporates have made big progress on (deep) decarbonization, while they just aggressively bought cheap renewable energy certificates in the market. No matter whether a company can maintain such a compensation strategy (energy attribution certificates may become more costly over time), the compensation strategy does not help with the required systematic decoupling of operations from emissions. With the pressure on corporates to commit to the Paris Agreement and to contribute to the decarbonization through their own actions, such opaque spots are at best problematic and at worst openly misleading.

In the face of data that comes with high uncertainty, at times even exceeding the accounted emissions itself – as scope 3 emissions data may do – following a principle of *continuous improvement* and a humbler stance on communication vis-a-vis stakeholders may be a good advice. The same also applies to more *conservativeness* regarding the voluntary communication of accounting claims.

As the discussion of principles above shows, arriving at adequate data ready for reporting is a task that deserves attention and support through diligent provisions at the framework level as well as through adequate functions and *processes inside a company*.

Even for “soft” voluntary emissions accounting, *adequate resources and skills* to properly monitor and compile the data as well as due diligence to manage the overall process should be foreseen. Where resources for accounting in the first place are scarce though, results may rest on shaky foundations. If the internal compliance or legal department then was to take over the quality assurance role, the risk may be high that the willingness to report data at all may strongly wane. Such effects can be seen in the form of *greenhushing* where corporates simply shun voluntary reporting as it brings legal or reputational risks.

Under compliance frameworks, not to report (well) is no real option. Here *sanctions* apply to non-compliance. They effectively disincentivize gaming and incomplete or opaque reporting. This disciplinary function is prominent in the EU ETS with its high CO₂ prices. In the case of the CSRD, non-reporting is expected to result in penalties also. As the reporting is connected to the standard procedures of mandatory corporate financial filings, the applicable penalty would be 25,000 EUR for every 6 weeks of delay. Sanctions are also important on a macro-perspective, as deviations/different handling of requirements by individuals could lead to market distortions amongst competing companies and thereby affect the functioning of the market at large.

The internal accountability challenges with certain schemes may well expand beyond the corporate boundaries. Such problems may exist with CSRD requirements as well as with CBAM. For CBAM, companies must deal with an evident *principal-agent problem*: As importers they report and are liable for upstream embedded emissions data from outside of their own operations. But they typically have no direct access to the primary data which is compiled by producers abroad. As contracts with suppliers may only partly consider these information-based asymmetries, a moral hazard remains.

As the EU ETS case shows, the interplay with other actors who fulfil formalized functions may define a conducive framework to assure both good data and legal assurance in a complex accounting environment. In the EU ETS, auditing work and administrative oversight play important roles. Based on this, one may argue that in compliance schemes, *third-party verification* is a critical safeguard. Also, for other transparency schemes where complex data cannot be evaluated by even an informed reader external review seems reasonable.

Under the mandatory CSRD, qualified accountants who regularly review company filings are foreseen as verifiers. It remains to be seen if they are well enough prepared for the task. . Moreover, so-called TIC (Testing, Inspection and Certification)-companies may support their verification work. The final political decision on this has not yet been taken. The strength of these often EU ETS-accredited verifiers is a stronger *technical understanding*, based on now almost two decades of emissions accounting in the EU ETS. If the regulator decides to allow their contribution, they may be included in accounting teams where the qualified accountant otherwise would lack such special competence. How this integration is effectively implemented may have a result on the quality of audits and in the end the reported data.

The *type of assurance* is also important when assessing its quality. For CBAM the auditing requirements will follow the stringent requirements of the EU ETS, thus reasonable assurance must be guaranteed through rigorous data checking. In contrast to that, the CSRD requires only limited assurance in its phase-in years, and it is not clear whether there will be a transition to reasonable assurance soon.

If more leniency were to be implemented on non-financial data, the quality of accounting work would most likely be hampered. Moreover, in voluntary frameworks like the CDP where the general oversight of communicated data is left to the market, still the verification of scope 1 to 3 data is incentivized through scoring. Again, the baseline is only limited assurance.



6 Carbon Accounting and Financial Statements

The disclosure of carbon-related information is on the rise. This is reflected in a strong uptake of voluntary reporting. It is also reflected in stronger mandatory standards that shape such disclosure, including requirements for the reporting in financial statements.

6.1 General considerations

How shall allowances/certificates be valued?

In accordance with the German Income Tax Act and the German Commercial Code (HGB) the allowances are to be disclosed as current assets.

The approach to valuation depends on whether the allowances are purchased or allocated for free.

- For purchased allowances, the law foresees a valuation at acquisition cost (§ 255 (1) HGB³⁸).
- For free allocation volumes, there are in general two possible valuation options. Either the assets are valued at a symbolic value (e.g. 1€) or at a fair value (based on market prices), which reflects opportunity costs.

In general, clear regulations on the treatment of assets in financial statements seem helpful as they create comparability. Carbon prices that reflect real opportunity costs can be seen as a fair approach. Still, that may prompt taxation effects as these values do change. A fixed value or a reminder value helps avoid consideration of such taxation effects. A further alternative is a nil-value approach, where a tradeable security received at no cost is valued at 0 (net liability approach). However, this leads to the invisibility of emission allowances in financial statements. With the increased importance of climate (induced) effects on company values, the nil value approach seems to be unjustified.

Should allowances be treated as financial instruments?

Since 2018, EU emissions allowances have been considered financial instruments under the Markets in Financial Instruments Directive (MiFiD II)³⁹. In principle, this requires all companies trading carbon allowances to have a license. In Germany, the BaFin issues such licenses. However, there is an exception for companies operating an installation covered by the EU ETS and trading allowances for their own need only.⁴⁰

The treatment as financial instruments has implications for the oversight regime and thus depends on the jurisdiction's financial sector oversight approach in general.

A differentiation between certificates traded on the spot market vs. derivatives (options, forwards) could be made. Both are defined as financial instruments in the EU.

³⁸ Handelsgesetzbuch § 255 Bewertungsmaßstäbe.

³⁹ DIRECTIVE 2014/65/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 15 May 2014 on markets in financial instruments and amending Directive 2002/92/EC and Directive 2011/61/EU.

⁴⁰ FutureCamp (2018): MiFiD II: Seit 3. Januar gelten auch CO₂-Zertifikate als Finanzinstrumente.

If allowances are treated as financial instruments, the advantage is that they are subject to financial supervision and thus regulated. The disadvantage, however, is that trade barriers are higher due to this supervision.

Shall allowance trading be subject to VAT regulations?

In the EU, a reverse-charge approach applies. This means that a tax is due, but it is to be paid by the buyer, not the seller. This approach avoids potential fraud via tax reimbursements (see Chapter 8). Accordingly, the invoice for the transaction does not include the tax.

In general, it seems reasonable not to tax the surrender of allowances for compliance reasons. Similarly, keeping an initial free allocation tax-exempt is also sensible.

Shall costs of the purchase of allowances (and project certificates) be deductible for companies like other operative costs?

The general deductibility of allowance costs is reasonable as any revenues generated from the sale of allowances is also subject to corporate taxation. This equally includes situations when companies sell (surplus) allowances in the market that they received for free (=based on free allocation).

6.2 Further regulation and practice

The EU Taxonomy and the NFRD

Based on emission profiles and properties, the EU Taxonomy further amends this information by defining green products and activities and how to report on these. Already in the financial year 2022, most companies that fall under the NFRD reported both on eligibility and alignment of their CAPEX, OPEX, and turnover of their economic activities.

The upcoming CSRD requirements

In the EU, with the CSRD amendments to the EU Accounting Directive, carbon pricing effects will become visible in management reports. The standard ESRS1 defines a general must for a robust materiality analysis that is also externally verified. Based on the outcome of that mandatory analysis, relevant climate-related data including emissions must be reported as defined per applicable Environmental Standard 1 (E1). The reporting focus here is also on respective effects in monetary terms, i.e. risks or opportunities to the balance sheets/business prospects.

Further ESG disclosure under voluntary reporting

The accounting of climate related data may be discussed in terms of the risks or impacts they pose to financial statements. In the end, corporations must provide standardized, non-misleading information to capital markets. This means that also data channelled through other formats with a broader spectrum of data points and granularity like CDP must be consistent – if not even audited with the same assurance. This need does limit the willingness to disclose climate related information beyond what is demanded by capital market requirements and law.

6.3 Lessons learned

Fiscal and accounting rules for the treatment of allowances in an ETS will usually follow the general rules that apply in the country for other (intangible) assets. Special needs and circumstances, e.g. for medium-sized companies, may be an adequate reason for special rules, reducing the burden for such players from complicated financial sector oversight rules.



7 Company-level reporting – two practical examples

This section provides two fictitious practical examples of emission accounting under the EU ETS framework from the perspective of an operator. They showcase the implementation of key MRV aspects from the legislation, providing tangible case studies from the point of view of companies that are subject to the reporting requirements of the EU ETS. They exemplify how operators prepare a tailor-made monitoring plan in general terms but specific enough to define fundamental aspects of the ongoing monitoring. They then shortly lay down central aspects of the implementation side of the MRV cycle. The following examples are from the two key sectors of steel and cement. Both sectors are large emitters also in China.

7.1 Example 1: Integrated steel plant

The presented example is an integrated iron and steel work plant using Blast Furnace-Converter (BF-BOF).

Duty to report under the EU ETS

Our steel plant is subject to the EU ETS as its activity is generally covered by the ETS. Annex I of the ETS directive sets a capacity threshold of larger than 2.5 tonnes per hour. This threshold is met by our facility. Moreover, the directive defines that CO₂ emissions only must be monitored.

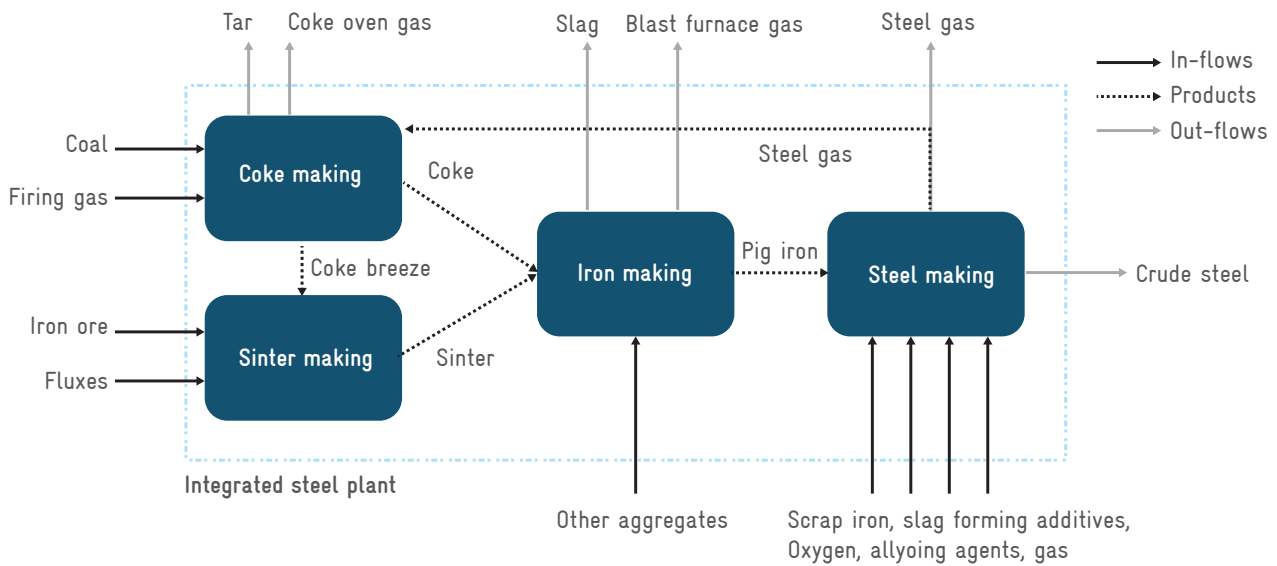
Definition of the reporting boundaries, emission sources and source streams

As to understand the scope of reporting for the installation, the operator needs to define the installation boundaries including all relevant emission sources.

By the definition of the Directive the operator must report on all emissions (here CO₂) that accrue from all activities at the defined site. In Germany, the exact installation boundaries are defined by its GHG emission permit. The permit is obtained from local approval authorities in course of the general licensing of the installation. The steel plant at hand has an integrated permit (see figure below for overview). It encompasses a cooking plant, a sinter plant, a blast furnace and steel mill process (converter). Coal is first processed into coke in the coke plant and the sinter plant combines iron ore, fluxes, and coke breeze into an iron sinter, which is then fed into the blast furnace together with coke to produce pig iron. Finally, this pig iron is converted into steel in the Basic Oxygen Furnace and its content is adjusted with specific alloying agents in the secondary metallurgy steel working facilities.

The emissions sources in our facility encompass all process steps with process and combustion emissions.

Figure 4: Example 1: Installation overview of a large integrated steel plant.



Preparing the monitoring concept in the form of a structured monitoring plan

Before the first reporting year and the monitoring starts, the operator explicitly spells out relevant details in a well-structured monitoring plan that is to be approved by the competent authority. Data range from the general reporting duties to relevant installation boundaries and foreseen emissions. The monitoring practice incl. types of monitoring and how accuracy requirements shall be met on a single source stream basis must be clarified.

In the course of the preparation of the monitoring plan, the operator estimates the expected annual emissions of around 5 million tCO₂. For this C installation (>500k tCO₂e), the highest requirements apply.

Steel mills have various diffuse emission sources throughout the production process. Thus, the mass-balance approach is most adequate for monitoring.

For all fuel and material inputs and material outputs the operator sorts and clusters the source streams by size. In the steel plant at hand, this includes source streams like coal or natural gas used in the steel making as well as the use of propane gas used in ignition processes.

On the input-side, the use of coal with 5,500,000 t CO₂ in emissions is by far the largest emissions source. It needs to be monitored by the highest standards, involving measurement of volumes and routine analysis of the quality of this input stream.

Further inputs like iron ore are also to be considered as well as inputs like natural gas or liquid gas (incl. for start-up processes). Depending on the share they account for in total emission they may eventually be classified in the group of de-minimis sources.

For this latter group of source streams (jointly accounting for less than 2% of all emissions) facilitations in the accounting apply. This is the case for diesel fuel that is used to drive an emergency power unit. Despite its minimal size, it is still to be included in the reporting (see completeness principle). The simple estimation approach used refers to the hourly utilization rate, the average hourly consumption rate, and the default values for diesel provided by national authorities.

On the output-side stands the produced steel with its embedded carbon content that needs to be monitored through regular analysis. As scrap is usually driven in a circle inside the facility, it would usually not occur as a relevant source stream.

The table below summarizes these source streams, for some of the relevant fuel inputs alongside material inputs and outputs.

Table 4: Example 1: Monitoring concept of a large integrated steel plant.

EMISSIONS BY SOURCE STEAM	EMISSIONS CATEGORY	ACTIVITY DATA	TIER	ACCURACY/ REQUIRE-MENT	MEASUREMENT USED
[...]					
INPUT: coal 5,500,000 t CO ₂	Major	Volume	4	1.5 %	The weight of used coal is determined based on calibrated measurements. The measurement may not exceed 1.5% uncertainty.
		Quality	3	Analysis, at least every 20,000 t of coal, at least 6 times per year.	Regular analysis in accredited laboratory to determine the net calorific value (NCV) and the carbon content
[...]					
INPUT: Diesel 30 t CO ₂	De-minimis	Volume	-	Estimated as de-minimis	Based on delivery documentation and invoices, plus/or based on typical utilization rates and fuel consumption (kg/h)
		Quality	2a	Default values by national authority (DEHSt-list)	Use of default values provided by Germany's competent authority DEHSt: 0,0741 t CO ₂ /GJ (EF), 42.6 GJ/t (NCV)
[...]					
OUTPUT: steel 100,000 t CO ₂	Major	Volume	4	1.5 %	The weight of steel production is determined based on calibrated measurements. The measurement may not exceed 1.5% uncertainty.
		Quality	3	Analysis, at least every 50,000 t, 4 times per year.	Regular analysis in accredited laboratory to determine the carbon content
[...]					

Source: FutureCamp/TCD

Finally, the operator should define all data flows and the data management (from raw data to final data in the report), presenting that in a transparent flow diagram, and carry out a risk analysis to attest that there are no substantial residual risks to the correctness of reporting data obtained from the established monitoring and reporting system with its data management.

Reporting duties

The reporting must follow the approved monitoring plan. The plan is to be checked in a routine cycle at least every two years to ensure that possible improvements have been considered.

For the preparation of the report, the operator compiles all primary and relevant secondary data for the reporting year, as defined in the approved data flow. In Germany, the reporting is executed through the „Form Management System” (FMS) that creates the report based on the preexisting structure of the monitoring plan's form sheets. The verifier also reviews/confirms this data in the same system. In the course of the preparation of the report in the first quarter of the year that follows the reporting year, this third-party verifier also inspects the installations, checking the credibility, consistency, integrity, and reliability of the data provided.

The verifier exports the finalized report from the FMS and sends it to the operators via a dedicated middleware for signature and encryption (virtual post office, VPS). Additionally, the verifier body certifies and records the amount of CO₂ emissions in the official register. Subsequently, plant operators confirm this data and submit the verified emission report again via VPS to the competent authority by end the of March.

7.2 Example 2: Cement plant

The second example is a cement production site for the production of cement clinker in rotary kilns.

Duty to report under the EU ETS

Our cement plant is subject to the EU ETS as its activity is generally covered by the ETS. Annex I of the ETS directive sets a capacity threshold of larger than 500 tonnes per day. This threshold is met by our installation. Moreover, the directive also defines that CO₂ emissions must be monitored.

Definition of the reporting boundaries, emission sources and source streams

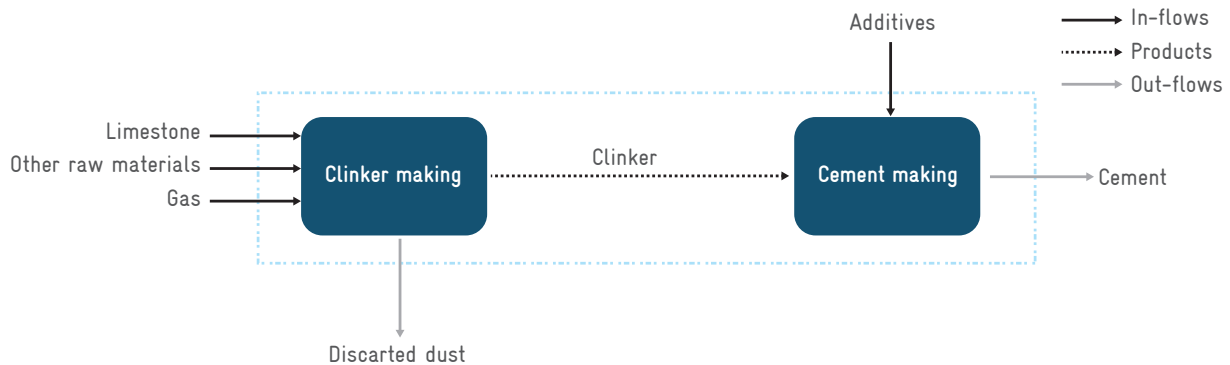
As with all installations under the EU ETS, there must be an approved monitoring plan in place before the monitoring starts. In the case of our cement plant, there are two separate permits for each of the units.

In clinker production, clinker is obtained by heating of limestone along with other raw materials in a kiln. The process results in emissions from the limestone, forming calcium oxide, which then reacts with silica, alumina, and iron oxides present in the raw materials to form clinker.

Cement is obtained by grinding clinker along with other additives to achieve the desired properties in the second installation.

In clinker production, combustion emissions occur during heating due to the burning of fuels (here: coal and gas) while process emissions stem from the carbonates and non-carbonates present in input and raw materials. In the following, we look at clinker production only.

Figure 5: Example 2: Installation overview of a cement plant.



Preparing the monitoring concept in the form of a structured monitoring plan

The expected annual emissions of the clinker production stand at 480,000 tCO₂. Thus, the installation is a category B installation (<500k but larger than 50k t CO₂e).

Process emissions from clinker production (310,000 t CO₂) account for the larger part of emissions. To arrive at that, the operator estimates the activity rate of clinker production based on expected cement deliveries and the material balance, considering the dispatch of clinker (cl), clinker supplies as well as clinker stock variation. For the emissions factor for clinker (metal oxides), the operator can recur to a country-specific default factor.

For the accounting of combustion emissions (150,000 t CO₂), the operator refers to the measurement of activity data and relevant analysis data (incl. from shipping documentation).

Looking at used instruments and their uncertainty, operators need to carry out uncertainty assessment and indicate the results in the monitoring plan. In the case of the application of calibrated devices, this is not necessary. But operating conditions, the regular calibration and quality assurance must be guaranteed by the operator. This method is to become the basis also for regular accounting in the reporting years.

In our example, the operator also uses a calibrated Coriolis flowmeter to measure the natural gas use. As this is a de-minimis source stream (natural gas consumption accounts for <1,000 t CO₂ p.a.) the operator may eventually decide to stop the costly calibration or change for a cheaper equipment as an estimation would also be permissible. Still, if better data for reporting is available, it shall be used.

Table 5: Example 2: Monitoring concept of a cement plant.

EMISSIONS BY SOURCE STREAM	EMISSIONS CATEGORY	ACTIVITY DATA	TIER	ACCURACY/ REQUIREMENT	MEASUREMENT USED
Clinker 310,000 t CO ₂	Major	Volume	2	2.5%	Output method Calculation Method B: The weight of clinker is determined based on calibrated measurements. The measurements may in total not exceed 2.5% uncertainty.
		Quality	1	Default value	Default value MRR (0.525 tCO ₂ /t clinker)
Coal 140,000 t CO ₂	Major	Volume	4	1.5 %	The weight of used coal is determined based on calibrated measurements. The measurement may not exceed 1.5% uncertainty.
		Quality	3	Analysis, at least every 20,000 t of coal, at least 6 times per year.	Regular analysis in accredited laboratory to determine the net calorific value (NCV) and the emissions factor (EF)
[...]					
Natural gas 900 t CO ₂	De-minimis	Volume	-	Estimation	Calibrated Coriolis flow measurement with 1.5% uncertainty.
		Quality		Default values by national authority (DEHSt list)	
[...]					

Source: FutureCamp/TCD

Reporting duties

The reporting duties follow the same logic as for the steel plant.

8 Supervision and fraud prevention

The roll-out of market-driven policies with raised ambitions together with further private-led climate commitments has led to rapidly rising carbon market prices and assets with a strong expansion of relevant market values. Intangible assets like emissions permits in trading schemes or offset certificates from the voluntary market become increasingly relevant. The same also applies to emissions positions and properties as well carbon-related claims at large.

Carbon trading and related assets or claims are often new. Often they span across national boundaries and expand dynamically. This means that there is still a lack of transparency which makes these carbon trading systems vulnerable. Looking at the EU ETS in Germany and the EU, we can see aspects of non-compliance, market abuse, and outright fraudulent, criminal action. For regulators and market actors alike, there is a strong interest in maintaining environmental integrity as incidents may undermine not only trust in the system but also threaten the values and impacts of related transactions.

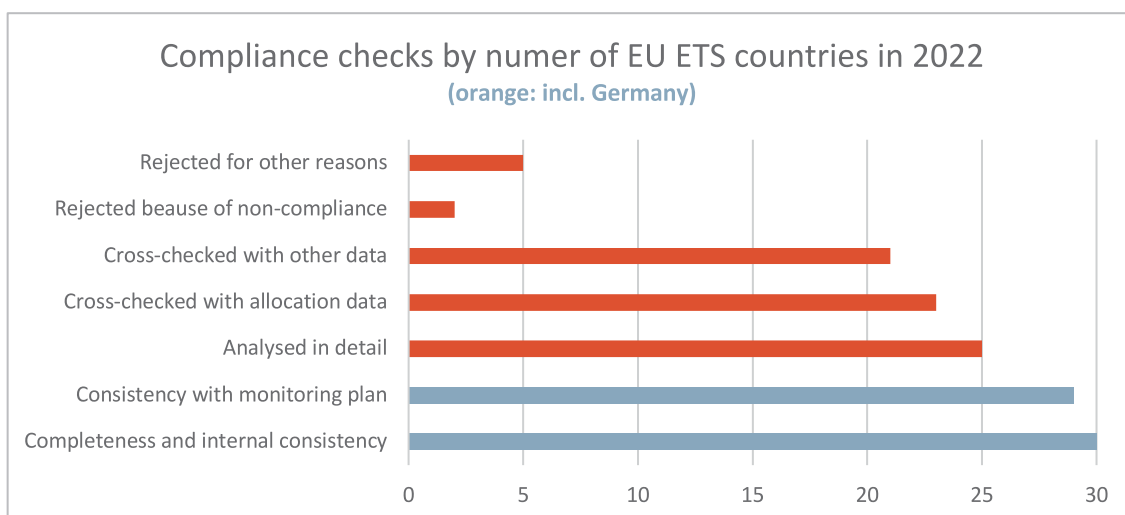
8.1 Supervision and compliance checks

In the EU, the supervision of the carbon market is in the hands of financial authorities of all Member States, coordinated by the European Securities and Markets Authority (ESMA) as the European Regulator. In Germany, the national role is taken over by the Federal Financial Supervisory Authority (BaFin). It closely cooperates with the German Emissions Trading Authority (DEHSt).

Compliance checks

EU ETS market data shows that throughout the EU, ETS countries compliance checks on reports were undertaken. As a standard procedure, the regulatory bodies routinely check reports for completeness. In Germany, this standard inspection also encompasses a consistency check with the monitoring plan. This can be easily performed as the reporting templates in Germany are directly generated from the accepted monitoring plans. Looking at other EU ETS countries this procedure in most cases applies to 100% of installations, though this share may also be as low as 20% in Austria or just 3% in Sweden.

Figure 6: Compliance checking in the EU ETS



8.2 Compliance problems and fraudulent action

Non-compliance, market abuse, and other types of fraudulent action

In the following section we use the definition of corruption/integrity risks taken from a LSE paper⁴¹ that moves the focus away from action to prevent/delay climate action to cases of corruption and poor integrity in climate action. It distinguishes between

- (A) Misuse and diversion of financial flows through bribery, money laundering, misappropriation of funds and tax fraud
- (B) Climate-washing, i.e. misleading advertisements and public communications, misleading environmental, social, and governance (ESG) credentials
- (C) Abuse of processes, i.e. failure to obtain free, prior, and informed consent (FPIC), conflicts of interest and collusion among actors.

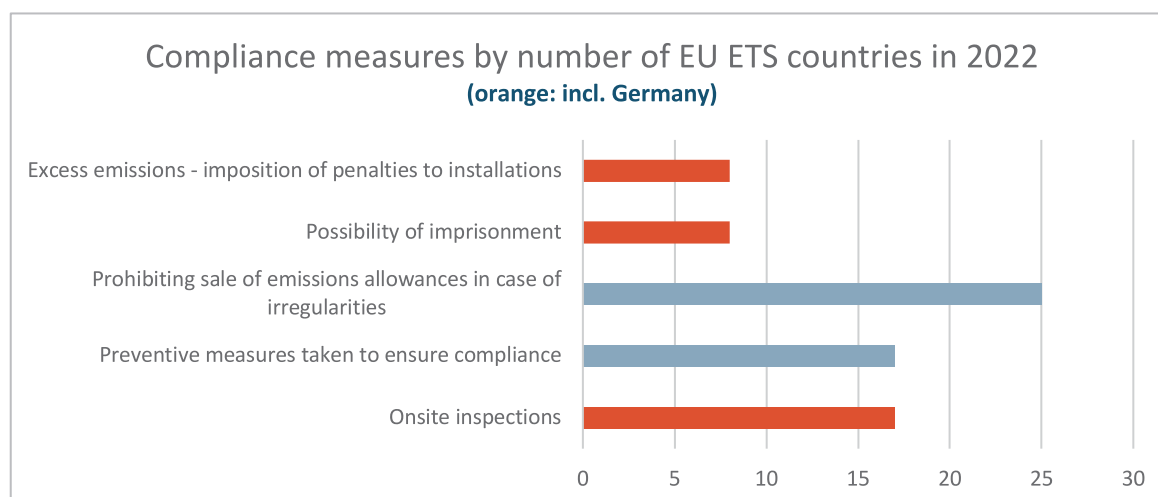
8.3 Carbon market specific problems

Compliance measures under the EU ETS

While for more than 99% of emissions under the EU ETS operators meet compliance as required, there are cases of non-compliance that are penalized. E.g. there is a penalty of 100 EUR for each ton of CO₂ emitted for which no allowance was surrendered on time (end of April). From 2024 onwards, this deadline has been postponed to 30 September.

The chart below shows the sanctioning for non-compliance under the EU ETS in 2022.

Figure 7: Compliance checking in the EU ETS.



According to an analysis executed by the EU, the use of electronic reporting systems in the EU did enhance the efficiency of the compliance system. For the management of monitoring plans, emissions and verification reports in 2022, 12 EU ETS countries are using such IT systems, and electronic templates. Amongst these 8 countries also applied such systems to the allocation side of reporting.

41 Chan T, Ford L, Higham C, Pouget S and Setzer J (2023): Corruption and integrity risks in climate solutions: an emerging global challenge.

8.4 Examples of fraud in the ETS

Some cases of fraud were part of the learning and improvement process of the EU ETS. This section provides a short description of some cases, and, where applicable, changes to regulation that resulted from these cases.

Double counting

In 2009 and 2010, a resale of CER (certified emission reduction certificates) occurred in Hungary, even though these CERs already had been used for compliance with the EU ETS.⁴² This led to amendments to the Registry Regulation.

MRV fraud

As ETS relies on accurate and truthful reporting of emissions by private entities, there is a risk of fraud as companies seek to avoid the full cost of their emissions. In February 2023, investigations for a case in Bulgaria became public that involved a verification company that allegedly knowingly submitted falsified emission reports for thermal and heating powerplants which led to a loss of millions of euros in revenue.⁴³

VAT carousel

In a major VAT fraud scheme, EU member states lost an estimated €5 billion in tax revenue, when criminal networks created fake companies which purchased emission allowances outside of the EU, thus avoiding a VAT rate of 19.6%, and then reselling them to traders in the EU, falsely claiming the sale price was inclusive of VAT.⁴⁴ This kind of fraud has led Germany to deal with carbon-related VAT fraud as tax evasion under its Fiscal Code.⁴⁵

Phishing

As registries and complementary user accounts are an integral part of the EU ETS, they have been subject to phishing attacks. The first known phishing attacks occurred in Germany in 2010 when a fraudulent email asked companies to disclose their account details. Cement manufacturer Holcim lost 1.6 million allowances from its Romanian registry in a phishing attack in 2010, which the criminals quickly resold subsequently.⁴⁶ As elsewhere, phishing remains a threat nowadays that companies must remain vigilant. The DEHSt warned of an ongoing phishing campaign targeting Union Registry data of companies as recently as January 2024.⁴⁷

Hacking of registry accounts

A crime not specific to carbon markets, five member states of the EU have reported hacking of registries and company accounts that led to the theft of allowances. These incidents have led to a tightening of security measures.⁴⁸

42 odc climat (2011): Closing the door to fraud in the EU ETS. Climate Brief.

43 European Public Prosecutor's Office (2023). Bulgaria: EPPD probes into multi-million euro fraud regarding greenhouse gas emissions

44 Europol (2010): Carbon Credit fraud causes more than 5 billion euros damage for European Taxpayer.

45 Chan T, Ford L, Higham C, Pouget S and Setzer J (2023)

46 odc climat (2011)

47 DEHSt (2024): Warning about Phishing Campaign targeting Union Registry

48 odc climat (2011)

8.5 Lessons learned and discussion

The above cases illustrate that despite all efforts to design secure systems, criminals probably always will find ways to conduct fraud and exploit gaps in the system. Closing gaps and loopholes and improving security must be an ongoing process. Authorities and legislators must stay abreast of evolving challenges and new schemes and develop solutions. Digitalizing important processes and introducing measures such as two-factor authentication, as well as stringent verification already greatly limit the probability of criminal actions to succeed and act as a deterrent. While the cases described here are severe, it is important to note that most market participants have been abiding by the rules. Moreover, it is evident that the operation of the EU ETS was far more vulnerable to fraud in the early days than it is now – even though the presently relatively high allowance prices would make theft more attractive than ever.

In general, the high standards for MRV as well as third party verification make this kind of fraud less likely.⁴⁹ Laboratories and verifiers must be accredited. For the verification of emission reports based on the EU Accreditation and Verification Regulation (AVR) and EN ISO 14065. They must maintain their accreditation and thus are subject to surveillance of the responsible accreditation body (in Germany, the DAkkS). The accreditation body assesses procedures and personnel of the verifiers to ensure their competence, impartiality, and independence and perform verification in line with the AVR. Failure to meet the requirements may result in suspension, withdrawal, or restriction of the accreditation (EU Commission 2022).

However, even a system with the most sophisticated rules and safeguards ultimately depends on the integrity of the actors that must choose to uphold them in their everyday actions, as the case of the criminal verifier in Bulgaria shows. Only if the acting parties within a system have internalized that system's values and abide by them out of their own conviction, the system can function and create trust. Severe punishment of any perpetrators helps deter future crime, but it only reacts to a crime that already has occurred, and its deterring effect will depend on the discovery rate of criminal activities. The ethics of the actors therefore are crucial to the functioning of the system – and hard to build, if lacking.

49 Chan T, Ford L, Higham C, Pouget S and Setzer J (2023)



9 Synergies and misalignments in carbon disclosure and market mechanisms

9.1 The value of data

In the last 20 years, Europe and the world have seen the emergence of a full ecosystem of frameworks for carbon accounting, both voluntary and compliance based. Companies deal with these in different ways. To a considerable degree, the compatibility or interoperability of these frameworks shapes and limits the accounting practice. More serious impediments can be the problematic quality of the accounting practice. Thus, it has to be asked, whether the reports and information based on the frameworks provide the proper inventory data that is fit for purpose, allowing the financial markets to channel the funds in the right direction.

The authors of this paper held talks with relevant stakeholders on various occasions in the past years. They reveal a striking lack of trust in data on the side of investors and investor initiatives.

The previous sections of this paper have described the growing reporting ecosystem in Europe and Germany that delivers the data.

In the following, we briefly look at the current state of play in scope 1 to 3 emissions accounting, with a special focus on the principle of comparability in data. This comparability claim features high in the list of expectations for the central GHG Protocol that is the broadest basis for emissions accounting practices today (see section 3). Being one of its core principles, it also shapes the implementation practice within the EU ETS (see 5.1.2).

Scope 1 emissions accounting

In principle, scope 1 emissions accounting in the EU is very straightforward – especially when it comes to large emitters. They are in most cases subject to the EU ETS compliance with its most rigorous accounting approaches including woven-in improvement principles: Common accounting rules are applied at comparable installations. Both over time and between installations, valuable emissions profiles are generated. As the audited data is also transparent to the market via the trading registries, a good accounting basis is laid.

This is of course not the case for actors that do not fall under the ETS scope. Still, standards like the GHG protocol may deliver adequate values here also. While the degree of comparability is undoubtedly lower, it is fair to say that scope 1 emissions accounting is comparably easy. This is different from the other scopes of emissions accounting.

Scope 2 emissions accounting

Often the vast share of emissions in corporate inventories are upstream of their direct operations. Scope 2 emissions capture the effects of energy use (electricity, heat/cooling) that is generated outside of the company's boundaries.

When looking at these accounting practices systemic problems become evident.

First, companies in the past reported either location-based data (the national grid factor), or market-based data (physical emissions from the supplier's plant fleet and effects from further direct/indirect use of energy attribution certificates, EACs), blurring the picture. If the corporate emissions inventories were recalculated based on the published data, it would show that this accounting practice systematically underreports emissions in the overall market.

Second, there is a strong and well-founded critique vis-à-vis the use of market-based accounting practices at large. Extensive literature has cast doubt on whether the use of EACs has incentivized decarbonization through the roll-out of further green capacity in electricity markets at all.

Third, fundamental problems relate to the terminology used: The GHG Protocols speak of “attribution” of emissions (incl. when positively sanctioning the use of EACs in calculations) while “allocation” would be the correct word. This unprecise terminology implies that there is a one-to-one match with reality while the real allocation is based on assumptions and claims that are much dependent on interpretation. Thus, comparability of scope 2 emission data often remains elusive.

Scope 3 emissions accounting

While decarbonization in today's world needs to consider all value chain stages including scope 3 emissions, the accounting practice of these latter emissions is the most complex and it involves many challenges.

Recent practice allowed for the use of spent-based data including emission factors from different origins that vary hugely. The same applies to downstream estimations where the type of data set used has the largest influence on the results. Again, looking at the available data reveals a high uncertainty and a low comparability of information. The result is arbitrary inventory information.

In the field of scope 3, corporate claims are most difficult to test and for that reason often also questionable. One conspicuous example is the communication of scope 3 data in the CDP reporting. The disclosure shows that large automotive corporations often report on all scope 3 data in their (upstream) supply chain, while their own suppliers in the value chain struggle to do so – despite being closer to the primary data. This does not enhance trust in such data reporting.

Going beyond S1-S3 inventory accounting data

In accounting for GHG data, it is important to distinguish between the following:

- (a) ***inventory data accounting*** presented above
- (b) ***consequential accounting*** methods, where impacts of discrete interventions are analysed (e.g. product LCAs) and
- (c) ***performance GHG accounting*** methods where the objective lies in the evaluation or scoring of relevant activities of corporations regarding their performance, e.g. through benchmarking.

These accounting methods are not identical or easily compatible. This often leads to misinterpretations. Moreover, if their use is mixed up, this may strongly compromise the comparability and validity of data.

In the study at hand, the primary focus was on inventory accounting – allowing companies to communicate their emissions at a certain point in time.

At the sideline, we also looked at aspects of performance accounting when discussing the EU Taxonomy or CBAM. Both instruments (also use and refer to the EU ETS benchmarks (= performance matrix applied for free allocation of certificates under the EU ETS for certain heavy-emitting sectors).

In general practice, too often corporate inventory accounting is built on the unchallenged adoption of data from LCA studies. This critique applies regardless of whether the use of the data may not be appropriate in individual cases where a first initial assessment is done. But in the case of e.g., scope 3 inventory accounting, such data – while valid for a hot-spot mapping – is certainly not precise enough. All users should be aware of the ineptitudes and uncertainties associated with such a practice.

9.2 Lessons learned and issues to address

Comparability is key for inventories. This means that other stakeholders must be able to arrive at the same results under similar or the same circumstances. In that regard, the state of play in accounting practice is at best mixed and to a large degree disconcerting. As the past voluntary publication of inventory data is gradually integrated into compliance requirements (see the roll-out of CSRD), many players in the market become aware of the existing consistency problems. What shall stakeholders – also in China – learn from this?

Lessons for corporations

Corporations in the first place should accept that good accounting is challenging. This would mean assuming a humbler approach, applying critical thinking when compiling data, and openly addressing constraints in their approaches while accepting external critique in a positive way to improve accounting processes and data.

Moreover, it is key for companies to accept that solid carbon accounting has an intrinsic value, and that benefit should be integrated into business considerations from the start. Accepting the benefits heads-on helps companies organize resources for proper accounting, beyond what is required by compliance schemes or tempting as easy solutions for problematic claims. If companies want to inform their corporate mitigation actions including planning fundamentally, they need to apply well-founded consequential accounting methods at the sideline of their routine inventory accounting.

On scope 3 data, it may also mean corporates need to shift away from competition/anti-trust-routed thinking to cooperative-based thinking. Only this may help refocus on getting primary data where otherwise unsubstantiated default values would be applied. This supply chain cooperation is also getting more attention now, as the EU CBAM is being rolled out. In the end, Chinese producers may actively endorse this instrument also for marketing purposes, providing their primary data directly to the scheme's registry, thereby also reducing the compliance burden of their trading partners in the EU.

Is the reported data fit for purpose? The guidance for accounting is clearly in flux: Companies discover this when applying for the validation of their scope 3 emissions targets vis-à-vis the Science Based Targets Initiative (SBTi): As of now, spending-based approaches are no longer applicable. It is thus important also to constantly look out and/or get involved in the ongoing review work of the GHG Protocol and ISO norms.

Ultimately the recommendation should apply: No actor/company shall accept a standard for its accounting practices without critically thinking about related constraints and – of course – strengths.

Lessons for investors and other external data users

In the first place, investors and external stakeholders should keep a sober view of things. Emissions data in most cases needs proper interpretation.

When it comes to accounting practices in the EU, investors can well rely on EU ETS data as the scheme's rigor and stringency helps to guarantee well-founded scope 1 accounting data, both audited and publicly available. These carbon volumes (accounting for some 37% of EU emissions in 2022) are priced so that transparent costs can be derived.

For emissions that are not covered by the EU ETS, the upcoming auditing and reporting requirements under the CSRD will help establish more transparency and trust. Moreover, the EU Taxonomy can help to some degree to understand whether larger corporations and their industrial processes fall into the category of low carbon installations or not.

However, to understand the risk and opportunity exposure and profile of their investees in more depth, investors must go beyond inventory and other publicly available performance data only. One driver for such investee data will be the requisite for transition planning, as required by the CSRD. Investors may also need to request further information and interpretations of data (as varying accounting practices may still lead to non-comparable data). This may require the preparation of specific performance-related data. For example, in Germany such further data is published under private sector initiatives in various sectors like the labelling schemes for Green Steel.⁵⁰

More of such valuable data may be derived through initiatives like the CDP where product-specific benchmarking information can be compiled and published.

Many financial market actors request their investees to set SBTi-approved targets. This data functions as a benchmark proxy to understand whether the corporate decarbonisation targets are in line with the 1.5°C trajectory under the Paris Agreement. But - when looking at this type of target-setting more closely -, it shows that the database and requirements companies are tested against often do not deliver comparable or fair results. This has reasons in the way the SBTi initiative operates and which standards it applies. Ultimately, with the current SBTi data, there is a strong risk that fundamentally different units are compared without proper distinction.

Compared to this CDP presents a strong investor-driven platform that requests a broader range of data points from corporations – both transparently and in a more structured way. The objective is to arrive at harmonized, actionable data that is useful also for financial market actors. But if general accounting problems that originate from deficits in the fundamental standards like GHG Protocol persist, there will also be a continued lack of trust in the data. To improve its quality and to overhaul the standards, investors should be strongly involved in initiatives like CDP and the GHG Protocol and use their influence when asking companies to disclose comparable and transparent data regularly.

50 Wirtschaftvereinigung Stahl (2024): LESS: Low Emission Steel Standard.

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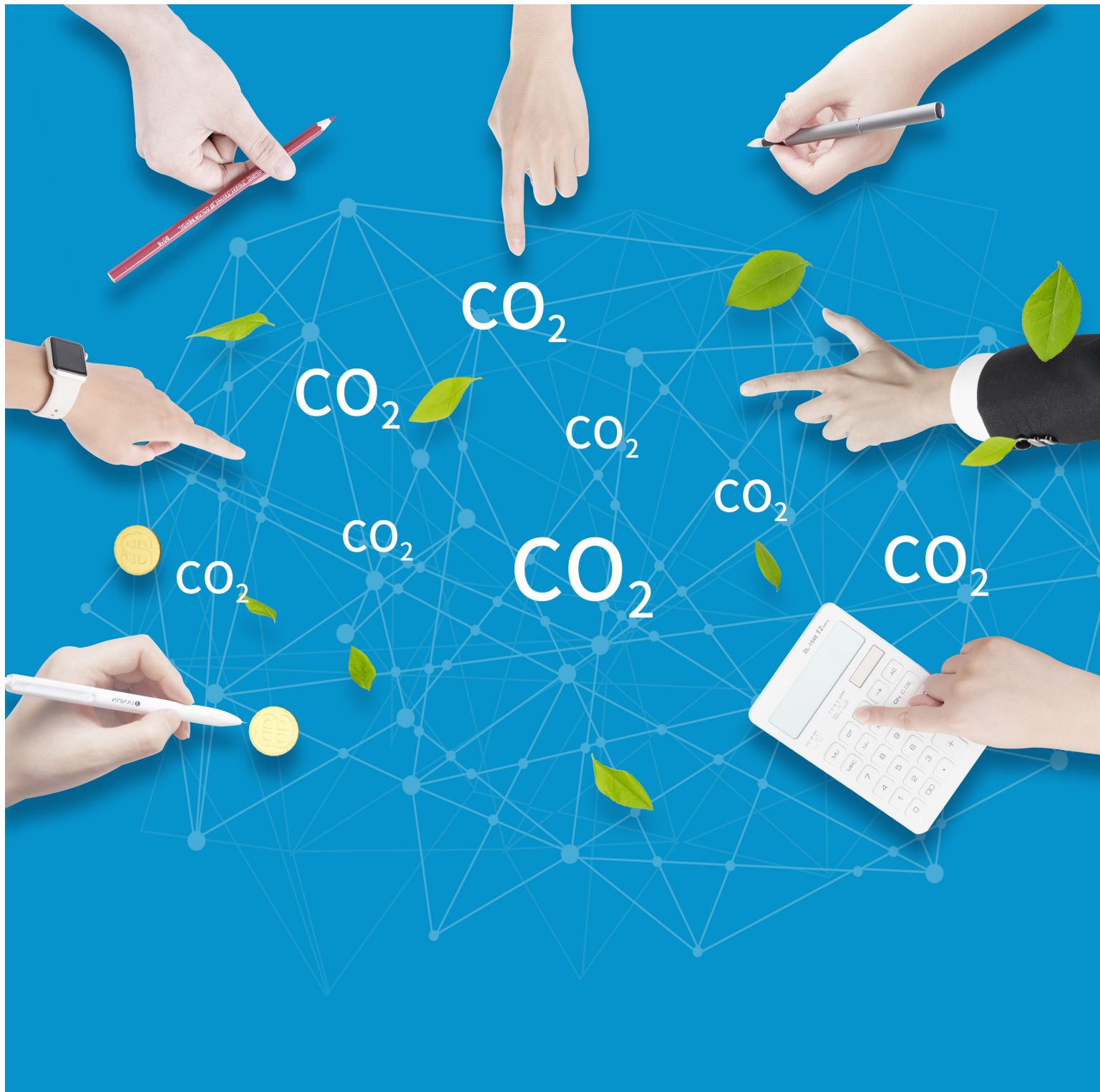
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