Carbon accounting and reporting for carbon capture and storage and engineered carbon removals

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Table of contents

Cover photo: Occidental

Disclaimer

This report (the Report) was prepared by Perspectives Climate Group GmbH in collaboration with Carbon Limits AS on request by the Oil and Gas Climate Initiative ("OGCI"). The Report aims to review the accounting and reporting of emissions, emission reductions and carbon removals resulting from carbon capture, utilization, and storage (CCS) and engineered carbon removal (ECR) activities at national, corporate, and project levels. It explores existing approaches, highlighting gaps and challenges in applying the guidelines examined. It needs to be highlighted that this subject area is highly dynamic and currently many entities are working to improve the overall carbon accounting ecosystem. The Report serves as a discussion starter in the process of addressing the identified gaps.

In preparation of the Report, the project team conducted several interviews with relevant external stakeholders and held a workshop with representatives from a range of global organizations with interests in this area. Feedback was used in an aggregated form to inform the study.

Carbon Limits contributed to the corporate-level accounting and reporting section, while Perspectives contributed to the national inventory reporting, compliance and voluntary carbon market section and other market-based mechanisms. The examples featured in the Report are for illustrative purposes only and do not reflect the position of any particular project or corporation. The findings in the corporate-level accounting and reporting section are based on the information available during the writing of the Report. Consequently, any new reports or updates that have been released since then are not included in this study.

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Abbreviations

ACCU	Australian Carbon Credit Unit
ADX	Abu Dhabi Securities Exchange
API	American Petroleum Institute
BECCS	Bioenergy with Carbon Capture and Storage
BTR	Biennial Transparency Reports
CCS	Carbon Capture and Storage
CCUS	Carbon Capture, Utilization and Storage
CDR	Carbon Dioxide Removal
CRT	Common Reporting Tables
CSRD	Corporate Sustainability Reporting Directive
DAC	Direct Air Capture
DOC	Direct Ocean Capture
ECR	Engineered Carbon Removals
EOR / EGR	Enhanced Oil Recovery / Enhanced Gas Recovery
ESG	Environmental, Social, and Governance
ESRS	European Sustainability Reporting Standards
ETF	The Enhanced Transparency Framework
ETS	Emissions Trading Scheme
EU	European Union
GCC	Global Carbon Council
GHG	Greenhouse Gas
GRI	Global Reporting Initiative
GS	Gold Standard
GS4GG	Gold Standard for Global Goals
IFRS	International Financial Reporting Standards
IPCC	The Intergovernmental Panel on Climate Change
ISO	The International Organization for Standardization
ISSB	International Sustainability Standards Board
JV	Joint Venture
KPI	Key Performance Indicator
LULUCF	Land Use, Land Use Change and Forestry
MRV	Monitoring, Reporting and Verification
NDC	National Determined Contribution
NIR	National Inventory Report
QA/QC	Quality Assurance/Quality Control
SASB	Sustainability Accounting Standards Board
SEC	Securities and Exchange Commission
TCFD	Task Force on Climate Related Financial Disclosures
TFI	Task Force on National Greenhouse Gas Inventory
UNFCCC	United Nations Framework Convention on Climate Change
VCM	Voluntary Carbon Market
VCS	Voluntary Carbon Standard

Definitions

Carbon dioxide removal	"Refers to technologies, practices, and approaches that remove and durably store carbon dioxide (CO_2) from the atmosphere"[a]
Consolidation approach	The chosen method by which a company defines its organizational boundaries (operational control, financial control, or equity share).[b]
Control	"The ability of a company to direct the policies of another operation. More specifically, it is defined as either operational control (the organization or one of its subsidiaries has the full authority to introduce and implement its operating policies at the operation) or financial control (the organization has the ability to direct the financial and operating policies of the operation with a view to gaining economic benefits from its activities)."[a]
Double counting	A term used to describe when the product-level environmental attribute credit of a stored ton of CO_2 is claimed by more than one entity. This can happen in several ways: **Double Issuance:** Two different registries issue credits for the same activity. **Double Claiming:** The same reduction or removal is claimed in multiple compliance or voluntary markets. **Double Use:** A single credit is used multiple times for compliance or voluntary programs.
Engineered carbon removals	A form of carbon dioxide removal that involves human designed technologies and industrial/engineering systems that remove CO_2 from the atmosphere and store it durably (separate to natural carbon-cycle processes).
Equity share approach	"A consolidation approach whereby a company accounts for GHG emissions from operations according to its share of equity in the operation. The equity share reflects economic interest, which is the extent of rights a company has to the risks and rewards flowing from an operation."[b]
Financial control	"The ability to direct the financial and operating policies of an entity with a view to gaining economic benefits from its activities."[b]
Financial control approach	"A consolidation approach whereby a company accounts for 100 percent of the GHG emissions over which it has financial control. It does not account for GHG emissions from operations in which it owns an interest but does not have financial control."[b]
Geological storage	"Injection accompanied by storage of CO_2 streams in underground geological formations"[c]

a Per IPCC ARG WGIII: CDR Factsheet: https://www.ipcc.ch/report/ar6/wg3/downloads/outreach/IPCC_AR6_WGIII_Factsheet_CDR.pdf
b Per the Greenhouse Gas Protocol (*Corporate Value Chain [Scope 3] Accounting and Reporting Standard or Land Sector and Removals Standard*).
c Per EU CCS Directive Definition 1.

Intervention accounting	"An estimate of the GHG impacts of actions relative to counterfactual baseline scenarios or other performance standards."[b]
Inventory accounting	"Accounting for GHG emissions, removals, and other accounting categories over time within a defined inventory boundary relative to a historical base year."
Mitigation outcome	Any quantified greenhouse gas emission reduction or removal.
Offsetting	"Refers to entities compensating for greenhouse gas (GHG) emissions they have caused by funding carbon dioxide (CO_2) or GHG reduction projects elsewhere. Generally, each carbon offset credit represents one metric ton of CO_2, or its equivalent GHG."[d] Climate-related claims that include the use of offsets must be substantiated by methodologies that ensure the integrity (e.g., additionality, permanence) and accurate accounting of these offsets and thus reflect coherently and transparently the resulting impact on the climate.[e]
Operational boundaries	"The boundaries that determine the direct and indirect emissions associated with operations owned or controlled by the reporting company."[b]
Operational control approach	"A consolidation approach whereby a company accounts for 100 percent of the GHG emissions over which it has operational control. It does not account for GHG emissions from operations in which it owns an interest but does not have operational control."[b]
Organizational boundaries	"The boundaries that determine the operations owned or controlled by the reporting company, depending on the consolidation approach taken (equity or control approach)."[b]
Parallel reporting	In some instances, two or more companies may account for the same emission within Scope 3. Because of this type of reporting, Scope 3 emissions should not be aggregated across companies to determine total emissions in a given region.[f]
Pool	"A physical reservoir or medium where a greenhouse gas or its constituent elements are stored."[b]
Product storage	The storage of CO_2 in products or materials, such as cement, bio-based plastics, or synthetic fuels.[b]
Reduction	An action taken to decrease the amount of greenhouse gases emitted compared to business-as-usual circumstances.
Removal	"The transfer of a greenhouse gas from the atmosphere to storage within a non-atmospheric pool."[b]

d Per Carbon Better: https://carbonbetter.com/story/insetting-vs-offsetting/
e Proposal Green Claims Directive, Article 21: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52023PC0166
f Per the Greenhouse Gas Protocol. Scope 3 Frequently asked questions (https://ghgprotocol.org/sites/default/files/2022-12/Scope%203%20Detailed%20FAQ.pdf)

Reporting	"Presenting data to internal management and external users such as regulators, shareholders, the general public or specific stakeholder groups."[b]
Sink	"Any biogenic or technological process, activity or mechanism that removes greenhouse gases from the atmosphere." This definition of sink, based on the transfer of a GHG from the atmosphere, is consistent with UNFCCC and IPCC guidelines for national GHG inventories. Under this definition, the sink is the process of removing the gas from the atmosphere (i.e., direct air capture, biogenic removal) whereas the pool is the reservoir where the gas is stored, as defined above. The term sink is also sometimes used (in other literature) to describe the reservoir or pool where carbon is stored."[b]
Storage (sequestration)	"The process of maintaining CO_2 or carbon in a pool for a period of time."[b] Storage duration varies by storage method.

01

Introduction and background

Photo: Eni

Introduction and background

Accurate, harmonised and robust carbon accounting and reporting is critical for scaling carbon capture and storage and removals effectively. This report provides an overview of existing carbon accounting reporting frameworks for carbon capture and storage (CCS) and engineered carbon removals (ECR) and analyses these instruments across national, corporate and project levels. It is intended to be an exploratory paper to highlight potential gaps and opportunities for current approaches and enable further discussion.

Global efforts to scale CCS and ECR activities are reliant on a variety of business models, which are often supported by credible carbon crediting mechanisms and well-functioning markets (both compliance and voluntary). Carbon markets typically rely on having robust and transparent carbon accounting frameworks in place, to promote the integrity of carbon transactions which also serve to enhance confidence amongst carbon market stakeholders. CCS projects can be large scale projects, with multiple actors along the value chain, that cover a variety of activities including capture, transport and storage and can be operated in different nations or sub-national jurisdictions. This complexity further emphasises the critical need for effective carbon accounting and reporting that includes all elements of the carbon capture, transport, and storage system and how to track and report emission reductions and removals across various frameworks and jurisdictions.

The report is structured into several chapters:

Chapter 2 of the report focuses on national reporting principles, including existing national GHG inventory reporting requirements related to CCS and the 2027 Methodology Report on Carbon Dioxide Removal Technologies.

Chapter 3 offers an introduction of corporate accounting and reporting for CCS/ECR activities, reviewing existing frameworks and approaches to account for emissions, reductions, and removals from CCS/ECR activities. This chapter draws on the GHG Protocol and LSR Standard for illustrative purposes, without presenting them as definitive frameworks, noting that their use is optional and companies typically apply a combination of standards. The study identified some of the challenges and potential gaps in accounting and reporting of emissions, emission reductions and removals associated with CCS/ECR projects.

Chapter 4 reviews project accounting approaches for CCS/ECR integration into market-based mechanisms, both compliance and voluntary carbon markets (VCM).

Chapter 5 concludes this report, examining findings and highlighting opportunities for further work alongside a call to action for updating and harmonizing the various reporting and accounting methods.

In preparation for the report, the team has conducted several interviews with relevant external stakeholders representing companies involved in CCS/ECR projects. The project team has also organized a 2-hour workshop with representatives from such organizations as Carbon Counts, Global CCS Institute, IEA GHG, IPIECA, KAPSARC, and WBCSD. The workshop highlighted opportunities to improve guidance on accounting and reporting emissions from CCS/ECR related activities both on corporate and national levels. The participants agreed that existing guidelines leave room for interpretation that may lead to double counting of emissions, emission reductions and removals.

02

National carbon accounting and reporting principles

Photo: Adobe Stock

National carbon accounting and reporting principles

IMPORTANCE OF ACCURATE CARBON ACCOUNTING FOR CCS ACTIVITIES

Sub-national, national and international reporting frameworks can require coverage of CCS and ECR activities. Accurate and transparent carbon accounting for these activities is essential to demonstrate verifiable emissions reductions and removals and underpin compliance with national and international reporting frameworks, such as those established by the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement. Reliable carbon accounting practices also enhance investor and stakeholder confidence, provide credible chain of custody to verify emission reductions or removals and ensure that CCS projects qualify for carbon credits and other financial incentives.

SCOPE AND LIMITATIONS OF THE REVIEW

The scope of this review encompasses the analysis of existing national GHG inventory reporting requirements related to CCS activities. This includes examining the standards and reporting frameworks under the UNFCCC and the Paris Agreement. However, the review is subject to certain limitations. These include the availability and accessibility of data, the varying levels of detail in national reporting frameworks, and the evolving nature of carbon accounting. These limitations necessitate a cautious interpretation of the findings and underscore the need for ongoing updates to this type of analysis as new information becomes available.

Existing national GHG inventory reporting requirements related to CCS

Under the UNFCCC, Annex I Parties[a] are required to submit annual GHG inventories that include detailed information on anthropogenic emissions by sources and removals by sinks of greenhouse gases not controlled by the Montreal Protocol.[1] These inventories must cover all sectors and gases, following the methodologies outlined in the 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines.[2] The inventories are expected to be transparent, consistent, comparable, complete, and accurate, and to use standardized reporting formats such as the Common Reporting Tables (CRT). The reporting guidelines established by the UNFCCC outline the methodologies for estimating emissions and removals (including engineered), which are primarily based on the IPCC guidelines.

Under the Paris Agreement, parties to the agreement have additional obligations to enhance their reporting and transparency mechanisms. Nationally Determined Contributions (NDCs) must include plans for mitigating GHG emissions, and countries are encouraged to use robust accounting approaches to track progress towards their targets. The Enhanced Transparency Framework (ETF) under the Paris Agreement further strengthens these requirements, mandating biennial transparency reports (BTRs) that include national inventory reports.

a Annex I Parties "include the industrialized countries that were members of the OECD (Organisation for Economic Co-operation and Development) in 1992, plus countries with economies in transition (the EIT Parties), including the Russian Federation, the Baltic States, and several Central and Eastern European States."
United Nations Framework Convention on Climate Change (UNFCCC), 2025. Parties & Observers. Retrieved November 27, 2025 from https://unfccc.int/parties-observers

NATIONAL INVENTORY ARRANGEMENTS

Annex I Parties are required to use the 2006 IPCC Guidelines for estimating anthropogenic emissions and removals. Different tier methods are applied based on national circumstances, prioritizing higher tiers for key categories. Key categories are identified and estimated following IPCC good practice guidance, utilizing country-specific emission factors and activity data when available.

To ensure the quality of inventories, countries must establish and maintain robust institutional arrangements, including data collection and estimation procedures. Each country must designate a single national entity responsible for the inventory and develop a quality assurance/quality control (QA/QC) plan, incorporating peer reviews.

REPORTING REQUIREMENTS

Annex I Parties must submit an annual inventory that includes a National Inventory Report (NIR) and CRT tables. The base year for reporting is generally 1990, with exceptions for some economies in transition. Emissions and removals must be reported on a gas-by-gas basis in mass units, with emissions by sources listed separately from removals by sinks. Reporting on additional GHGs and precursor gases is encouraged. Verification involves comparing national CO_2 emissions estimates from fuel combustion with IPCC reference approach estimates. To maintain consistency across time series and improve accuracy, countries must conduct recalculations when necessary and continuously improve data quality, methodologies, and inventory management practices. Annex I Parties must archive all relevant inventory information to enable reconstruction by expert review teams. They should use notation keys[b] to transparently indicate methodological or data gaps. The NIR must be detailed and comprehensive, covering the base year and the most recent ten years.

SPECIFIC REQUIREMENTS FOR CCS INCLUSION IN NATIONAL INVENTORIES

For CCS activities, the IPCC provides detailed guidelines on how to account for CO_2 transport, injection and storage. These guidelines are integrated into the UNFCCC's reporting framework, requiring countries to report on CCS activities under specific sectors such as energy and industrial processes. The key requirements include:

- Identification of CO_2 Sources and Sinks: Countries must identify and report the sources of CO_2 being captured and the pools where it is stored.
- Quantification of Captured and Stored CO_2: Accurate measurement and verification of the amount of CO_2 captured and stored are essential. This includes monitoring CO_2 transport and injection into storage sites.
- Reporting on Leakage and Monitoring: Countries must report potential leakage from storage sites and implement robust monitoring plans to ensure the long-term integrity of CO_2 storage.

Tables 1, 2 and 3 provide an overview of the coverage and categorization of CCS data reported in NIRs. These outline the specific sections and scope of the data presented.

b These keys ensure transparency in reporting, enabling reviewers and stakeholders to understand gaps or peculiarities in the inventory data, such as NO (Not Occurring), NE (Not Estimated), NA (Not Applicable), IE (Included Elsewhere), and C (Confidential).

NOTE: Emissions related to biomass fuel are to be reported under Memo Items in CRT Table 1 Sheet 2:

> *"CO_2 emissions from biomass combustion for energy are reported in the energy sector as memo item and estimated and reported in the Agriculture, Forestry and Other Land Use (AFOLU) Sector as part of net changes in carbon stocks. The capture of biogenic CO_2 emissions from biomass combustion, or other processes, should be treated consistently with CO_2 capture from fossil fuel combustion and reported in the Energy and/or IPPU Sectors. Once captured and added to the carbon capture and storage process there is no differentiated treatment between biogenic carbon and fossil carbon. Both captured biogenic and fossil CO_2 should not be added to the total emissions, i.e. net emissions should be reported (also see Section 5.3 of Chapter 5 in Volume 2 of the 2006 IPCC Guidelines). Non-CO_2 emissions from biomass combustion are reported in the Energy Sector. Non-CO_2 fugitive emissions from production of fuels (e.g. charcoal or biochar) are reported in the Energy Sector (see Table 4.3.1 in Chapter 4, Volume 2 for the correct allocation of non-CO_2 fugitive emissions from fuel transformation)."*[3]

TABLE 1. Classification and definitions of reporting of emissions and "removals" (table reproduced from IPCC Guidelines for National Greenhouse Gas Inventories)[4]. Removals here do not refer to storage of CO_2 from the atmosphere or from biogenic sources, but all CO_2 stored.

Category Code and Name			Definition	96 GLs category code	Gases
1 C 1		Transport of CO_2	This comprises fugitive emissions from the systems used to transport captured CO_2 from the source to the injection site. These emissions may comprise losses due to fugitive equipment leaks, venting and releases due to pipeline ruptures or other accidental releases (e.g., temporary storage).	–	CO_2
1 C 1	a	Pipelines	Fugitive emissions from the pipeline system used to transport CO_2 to the injection site.	–	CO_2
1 C 1	b	Ships	Fugitive emissions from the ships used to transport CO_2 to the injection site.	–	CO_2
1 C 1	c	Other (please specify)	Fugitive emissions from other systems used to transport CO_2 to the injection site and temporary storage.	–	CO_2
1 C 2		Injection and Storage	Fugitive emissions from activities and equipment at the injection site and those from the end containment once the CO_2 is placed in storage.	–	CO_2
1 C 2	a	Injection	Fugitive emissions from activities and equipment at the injection site.	–	CO_2
1 C 2	b	Storage	Fugitive emissions from the end equipment once the CO_2 is placed in storage.	–	CO_2
1 C 3		Other	Any other emissions from CCS not reported elsewhere.	–	CO_2

TABLE 2. CRT 1C emission reporting table and mass of CO_2 transported and injected (table reproduced from IPCC Guidelines for National Greenhouse Gas Inventories). The numbers are filled in the white cells.[4]

Category	Activity (Gg)		Annual mass of fugitive CO_2 emissions to the atmosphere or sea bed (Gg)[II]
	Annual mass of CO_2 transported	Annual mass of CO_2 injected[I]	
1C1 – Transport of CO_2			
1C1a – Pipelines			
1C1b – Ships			
1C1c – Other (please specify)			
1C2 – Injection and Storage[III]			
1C2a – Injection			
1C2b – Storage			
1C3 – Other			

I. Excluding recycled CO_2 for enhanced recovery.
II. Corrected for baseline background fluxes.
III. Fugitive emissions during above-ground operations such as processing and CO_2 recycling during enhanced oil and gas recovery operations should be reported as fugitive emissions from oil and natural gas and reported under the appropriate categories for that sector.

TABLE 3. CRT 1C Accounting of mass of CO_2 captured, transported and stored and emissions related to the project activity (table reproduced from IPCC Guidelines for National Greenhouse Gas Inventories).[3]

Category[I]	CO_2 (Gg)
Total amount captured for storage (A)	
Total amount of import for storage (B)	
Total amount of export for storage (C)	
Total amount of CO_2 injected at storage sites (D)	
Total amount of leakage during transport (E1) category 1C1	
Total amount of leakage during injection (E2) category 1C2a	
Total amount of leakage from storage sites (E3) category 1C2b	
Total leakage (E4 = E1 + E2 + E3)	
Capture + imports (F = A + B)	
Injection + leakage + exports (G = D + E4 + C)	
Discrepancy (F – G)	

I. Once captured, there is no differentiated treatment between biogenic carbon and fossil carbon. Emissions and storage of both biogenic and fossil carbons will be estimated and reported.

Example of a country reporting CCS activities: Norway

Norway has implemented a comprehensive approach to reporting CCS activities, which is detailed in their NIR 2025[5]. This approach includes capturing, transporting, and storing CO_2 from natural gas production at fields like Sleipner Vest and Snøhvit. The detailed methodologies and reporting structures provide insights into how CCS activities are monitored and reported under various CRT tables.

CO_2 CAPTURE

At the *Sleipner Vest field*, natural gas containing approximately 9% CO_2 is processed to reduce the CO_2 content to 2.5% to meet gas sales specifications. The removed CO_2 is then injected into the Utsira Formation, a geological saline aquifer selected for its suitability for long-term storage due to its high porosity, permeability, and the presence of a cap rock to prevent leakage. The aquifer is located above the hydrocarbon producing interval and the injected CO_2 is therefore not used for enhanced gas recovery (EGR). The CO_2 injected has been in decline since 2011, due to the depletion of the field.

Emissions from the capture process, e.g., diffuse emissions from the CO_2 capture plant (amine absorber) and the compressor, including any vented CO_2 when injection facilities are not operating and minor leaks from compressors, are reported under CRT table 1.C (CO_2 Transport and Storage). This table also includes data on total CO_2 captured and injected.

CO_2 TRANSPORT

Captured CO_2 is transported via pipeline from the capture facilities to the injection sites. There is no significant transport element at the Sleipner Vest field, however further north at the *Snøhvit field*, CO_2 is transported 152 km from the Hammerfest LNG plant to injection wells.

Emissions from CO_2 transport, such as diffuse emissions from compressors and any venting during transportation interruptions, are included under CRT 1.C. Emissions specifically from venting during transport disruptions are detailed in CRT 1C1a. In 2025, Norway reported these emissions as Not Estimated (NE), and the emissions from equipment at the onshore site is reported as part of the emissions from the Hammerfest plant.

CO_2 STORAGE

CO_2 storage in Norway involves injecting CO_2 into geological formations like the Utsira Formation at Sleipner and the Tubåen and Stø formations at Snøhvit. These formations are chosen for their ability to provide long-term, secure CO_2 containment. Monitoring techniques include 4D seismic surveys, gravimetric monitoring, and pressure measurements to ensure the CO_2 remains stored without leakage.

Since 2013 direct emissions from the injection facilities are included in EU-ETS. In the NIR any leaks or venting at the storage site are reported under CRT table 1C2a (Injection). This category covers all emissions related to the injection process, ensuring any unexpected releases are documented.

MONITORING AND VERIFICATION

Norway employs rigorous monitoring methodologies to track the behaviour of stored CO_2. These include 4D seismic surveys to monitor CO_2 plumes, gravimetric measurements, and regular pressure checks. These methods are essential for verifying that CO_2 remains securely stored and for detecting any potential leaks.

REGULATORY COMPLIANCE

The storage of CO_2 in Norway is regulated by the *Pollution Control Act*[6] and specific regulations for geological storage. Operators are required to obtain permits, monitor storage sites, and report annually to the Norwegian Environment Agency. This regulatory framework ensures that CO_2 storage operations adhere to national and international standards and Norway can meet its national reporting requirements.

2027 Methodology Report on Carbon Dioxide Removal Technologies, Carbon Capture, Utilization and Storage (supplement to the 2006 IPCC Guidelines)

The IPCC Task Force on National GHG Inventory (TFI) convened an Expert Meeting in July 2024 and a Scoping Meeting in October 2024. These discussions focused on Carbon Dioxide Removal (CDR) methods outlined in the AR6 WGIII Report and acknowledged that several CDR activities are already addressed by the existing IPCC Guidelines. However, it has been announced that the 2027 Methodology Report on Carbon Dioxide Removal Technologies, Carbon Capture, Utilization, and Storage (Supplement to the 2006 IPCC Guidelines) will be developed to address some of the identified gaps. It has been emphasized that this work will not revise the 2006 IPCC Guidelines but will provide new guidance in areas where gaps or outdated science have been identified. Following these discussions, a work plan has been released in 2025[7], with details of some of the important updates outlined in Annex A of this report.

National carbon accounting and reporting principles – Conclusions

The NIR has very specific reporting requirements. It has a separate section on CCS, including the mass transported and injected. Biogenic and fossil CO_2 injected and stored is treated equally in the NIR and categorized as removal. Emissions from biomass combustion for energy count as removals in the final mass balance, although their importance through separate reporting and labelling as removals is lost. Removals are only accounted for in AFOLU reporting. There are no ECR-specific reporting mechanisms for emissions accounting and reporting.

The 2027 Methodology Report on Carbon Dioxide Removal Technologies, Carbon Capture, Utilization, and Storage (Supplement to the 2006 IPCC Guidelines) will be developed to address some of the identified gaps:

- The CRT table 1C only focusses on emissions from transport and injection & storage. In the Norway example the emissions related to the capture site are reported in the CRT 1C table.
- All CO_2 stored in geological formations is currently treated as CO_2 removed, definitions are intended to be updated or further clarified through the development process.
- Unclear if emissions from energy used for capture, transport and storage is reported separately in the tables related to Energy, 1A: fuel combustion and/or 1B: Fugitive emissions from fuels as the 1C table only includes fugitive emissions or venting of the CO_2 during transport, injection and storage.
- Transport needs to be expanded to cover more modes of transport and cross border adjustments.
- A category for atmospheric carbon removal via direct air capture (or engineered removals and use or storage of captured CO_2 should be expressly recognised in national inventories separate from natural removal solutions.

03

Introduction to corporate accounting and reporting for CCS/ECR activities

Photo: Adobe Stock

Introduction to corporate accounting and reporting for CCS/ECR activities

An increasing number of companies have been reporting their GHG emissions, either in response to regulatory requirements across various jurisdictions or voluntarily. This chapter provides an overview of elements of GHG accounting frameworks, particularly the GHG Protocol, relevant to CCS/ECR activities.

Review of existing corporate accounting and reporting frameworks

Companies can choose to use and reference various guidance documents to calculate the emissions *generated* by CCS/ECR activities and report these findings on a corporate level. This report does not provide a comprehensive review of all regulatory frameworks, but instead focuses on those in the EU and US, two jurisdictions with large geographical coverage and various existing projects and efforts in CCS/ECR. Companies may currently be reporting on either because they are required by a jurisdiction's regulatory requirements or because they desire to do so to inform stakeholders. Regulatory requirements or voluntary guidance provide companies with a framework for reporting climate- and emissions-related information to investors, customers, and other stakeholders to assess the company's performance, impact, and potential risks and opportunities.

Companies may be required to make disclosures based on developing regulations. For example, while IFRS is voluntary in and of itself, 36 jurisdictions around the world have adopted or are considering adoption of the International Financial Reporting Standards (IFRS) standards as of July 2025 thus making it mandatory in these jurisdictions to report in line with IFRS.[a] Another example of a mandatory disclosure requirement is the European Union (EU) Corporate Sustainability Reporting Directive (CSRD), effective since early 2023[b], which outlines the information certain EU and non-EU companies are required to disclose using the European Sustainability Reporting Standards (ESRS) – for example, reporting Scope 1, 2, and 3 emissions in accordance with *ESRS E1 Climate Change*.[8,9] The EU standards closely align with IFRS S2 standards.[j] The US Securities and Exchange Commission (SEC) also regulates company disclosure requirements under the Enhancement and Standardization of Climate-Related Disclosures for Investors.[10] The SEC finalized its climate disclosure rule in early 2024, but implementation has remained stayed as of February 2026, pending judicial review[c].[11] Many other countries and jurisdictions around the globe have disclosure regulations.

In addition to these regulatory requirements, companies can choose to report voluntarily. Voluntary climate-related disclosure guidance documents include, but are not limited to:

- *Abu Dhabi Securities Exchange (ADX) Environmental, Social, and Governance (ESG) Disclosure Guidance*; intended for use by companies listed on the ADX[12]
- *CDP Corporate Questionnaire and Reporting Guidance[13];* this is the only framework which explicitly covers reporting of carbon capture and injection/storage into long-term storage pools, but the coverage is limited

a SS Governance. (2025, July 8). The latest in ESG and stewardship regulation – July 2025. ISS Insights. Retrieved July 15, 2025, from https://insights.issgovernance.com/posts/the-latest-in-esg-and-stewardship-regulation-july-2025/

b In July 2025, the Council of the EU adopted a negotiating mandate on the Commission's Omnibus I package proposal, aimed at reducing the reporting burden for companies by removing approximately 80% of them from the scope. The proposal is currently under negotiation with the European Parliament. Reference: Osborne Clarke. (2025, July 14). ESG Knowledge Update | July 2025. Osborne Clarke Insights. Retrieved July 15, 2025, from https://www.osborneclarke.com/insights/esg-knowledge-update-july-2025

c Osborne Clarke. (2025, July 14). ESG Knowledge Update | July 2025. Osborne Clarke Insights. Retrieved July 15, 2025, from https://www.osborneclarke.com/insights/esg-knowledge-update-july-2025

- *Global Reporting Initiative (GRI) 305: Emissions 2016*; was under review and has now been replaced by GRI 102: Climate Change 2025, which will come into effect on January 1, 2027. The new standard expands the scope of climate-related disclosures and aligns more closely with international frameworks such as the GHG Protocol, IFRS S2, and the EU's ESRS E1. GRI 305 will be withdrawn once GRI 102 comes into effect.[d]

- *Petroleum industry guidelines for reporting greenhouse gas emissions, Second edition*; jointly developed by the International Petroleum Industry Environmental Conservation Association (Ipieca) and the American Petroleum Institute (API).[14]

- *International Financial Reporting Standards (IFRS) S2: Climate-related Disclosures*; developed by the International Sustainability Standards Board (ISSB), a standard-setting body within the IFRS Foundation.[15]

Recently, two voluntary disclosure organizations have aligned with the IFRS. The Sustainability Accounting Standards Board (SASB) became part of the IFRS Foundation in 2022, and while the SASB standards are still available for use, their climate-related content has been aligned with IFRS S2 and will ultimately be replaced by the ISSB's new standards.[16] Similarly, the Task Force on Climate Related Financial Disclosures (TCFD) disbanded in 2023, with the International Sustainability Standards Board (ISSB) assuming responsibility for monitoring climate-related disclosures under the IFRS Foundation.[17] The ISSB standards – IFRS S1 (General Requirements for Disclosure of Sustainability -related Financial Information) and IFRS S2 (Climate-related Disclosures) represent a consolidated global baseline for sustainability reporting. These standards require entities to disclose material information about climate-related risks and opportunities that could affect enterprise value. Under IFRS S2, organisations are required to report Scope 1, 2, and 3 GHG emissions consistent with the GHG Protocol.

However, it is important to note again that these disclosure frameworks are designed for the purpose of corporate emissions reporting, which includes emissions from CCS/ECR activities. Many of them also cover emissions reductions (which can be achieved via CCS activities) but they do not provide guidance on how to report emissions removed by ECR projects.

While the disclosure standards offer guidance on what to include in greenhouse gas emissions reporting for companies that are required or choose to report such information, there are several sources of guidance for companies to choose from when calculating these emissions. For example, the API *Compendium of Greenhouse Gas Emissions Methodologies for the Natural Gas and Oil Industry complements the Ipieca/API Petroleum industry guidelines for reporting greenhouse gas emissions.*[18] The Compendium is a compilation of common GHG emission estimation methodologies; although it is intended for use in the petroleum industry, the document states that the methodologies "can be used by other industries, particularly those that utilize fossil fuels." The document provides specific guidance on accounting of vented and fugitive emissions from carbon capture processes and storage pools. Although it is not explicit on accounting for GHG reductions or removals, the methodologies provided could be used to estimate CO_2 emissions captured within various fossil-fuel related processes. For companies looking for more specific, project-level guidance for quantifying GHG emissions, reductions, and removals related to CCS/ECR projects, the International Organization for Standardization (ISO) has published ISO/TR 27915:2017: Carbon dioxide capture, transportation, and geological storage – Quantification and verification.[19] Although this is a technical report rather than a published standard, it enables companies to understand the current best practices for project-level accounting of both emissions and emissions reductions/removals from CCS/ECR projects. ISO has also published the standard ISO 14064-1:2018, Greenhouse Gases, which is applicable for emissions and removals accounting and reporting on the company level, although it is less explicitly geared towards CCS/ECR projects.

d Global Reporting Initiative. (2025). GRI 1.102: Climate Change 2025 – Frequently Asked Questions (FAQs). Retrieved July 15, 2025, from https://www.globalreporting.org/media/qadh4mpf/gri-102-climate-change-2025-frequently-asked-questions-faqs.pdf

Many companies use the GHG Protocol which provides three standards for companies to use when developing GHG inventories: the *Corporate Accounting and Reporting Standard*[20], the *Corporate Value Chain (Scope 3) Accounting and Reporting Standard,*[21] and the Land Sector and Removals Standard (Version 1.0) which applies to anthropogenic activities in the land sector, as well as other CO_2 removal technologies. GHG Protocol accounting standards are more generalized than those from API or ISO, which may make them more widely applicable, but leaves room for interpretation in terms of how emissions should be accounted for within specific sectors. Additionally, the overall intent of the GHG Protocol is to provide guidance for company-wide emissions reporting; as such, it should not be applied to the broader carbon market or national-level emissions accounting, which often involve different system boundaries and require more specific guidance on the quantification of emission reductions – aspects that are addressed in Chapters 2 and 4. Figure 1 summarizes the existing frameworks on disclosures and accounting practices.

FIGURE 1. Overview of common corporate accounting frameworks

Despite the abundance of disclosure reporting frameworks, a commonality amongst the ones mentioned here is that they all refer to the GHG Protocol in some capacity, underlining the prevalence and widespread use of these standards in corporate emissions reporting. A detailed figure demonstrating this can be found in Annex B summarising some of the relationships between these standards and how they relate to or rely on one another. To assist in harmonization of standards, on 9 September 2025, the International Organization for Standardization (ISO) and the Greenhouse Gas Protocol announced a strategic partnership to harmonise their global greenhouse-gas accounting standards, thereby signalling an intention to create a unified framework for emissions-measurement, terminology and reporting[e].

e International Standards Organisation (2025) ISO and GHG Protocol announce strategic partnership to deliver unified global standards for greenhouse gas emissions accounting. Retrieved October 30, 2025, from https://www.iso.org/news/2025/09/iso-and-ghgp-partnership

This development complements the work of the International Sustainability Standards Board (ISSB) and is intended to further strengthen the alignment of corporate disclosures with globally-consistent emissions data requirements.

It is also important to note that the Global CCS Institute has developed a report titled "An ESG Reporting Methodology to Support CCS-Related Investment"(2022).[23] While not a disclosure framework or calculation methodology, the document highlights the difficulties in comprehensively reporting CCS activities on a corporate basis and proposes how existing leading frameworks can incorporate CCS-specific guidance. Although many existing standards may allow for reporting on CCS, including CCS-specific guidance which cascades through corporate reporting can actively promote the technologies by providing companies with clarity on carbon reporting. However, the methodology proposed in the Global CCS Institute's report does not cover ECR projects and accounting for removals.

Approaches to account for emissions, reductions, and removals from CCS/ECR activities under different business models

ACCOUNTING OF EMISSIONS, REDUCTIONS AND REMOVALS ASSOCIATED WITH CCS/ECR PROJECTS

Despite the many disclosure reporting frameworks, there are limited CCS/ECR-specific guidelines for corporate-level accounting and reporting of emissions, reductions and removals. Generic guidelines (such as the GHG Protocol Corporate Accounting and Reporting Standard and the Land Sector and Removals Standard) provide generic, cross-sector rules for removals with geologic storage (including ECR), but not a CCS/ECR-sector standard. It is also important to note that CCS activities involving CO_2 captured at a source preventing an emission is not accounted for and reported as a removal under this standard.

Different business models within CCS/ECR projects

A company's involvement in a CCS/ECR project can vary based on the business model it adopts, i.e., which parts of the value chain it is involved with and in what capacity. This chosen business model will affect the scope of corporate GHG accounting and reporting by determining which parts of the CCS/ECR value chain are included within its boundaries.

To date, the prevailing approach of companies undertaking CCS/ECR activities is to follow a single business model: they would build, own, and operate capture, transport and storage activities. However, new business models are emerging where the CCS/ECR value chain is divided among different entities, responsible for dedicated components, impacting the boundaries for accounting and reporting emissions. Broadly, this report explores three reporting levels:

1. **Project level**: this encompasses all CCS/ECR activities - capture, transport, utilization (not covered in the study) and storage for a given project;
2. **Business Model level:** this includes only the activities within the specific business model and may only represent a small section of the project's value chain; and
3. **Company level:** this involves only the activities within the company's boundaries.

In the traditional full chain model, all these levels were the same, as a single company managed the entire value chain. However, with the advent of new business models, these levels can differ significantly because:

- The business model level may not cover the entire value chain,
- Activities within a single business model can be carried out by multiple companies,
- Companies might consist of several entities, leading to multi-level company reporting.

The GHG protocol corporate standard[24] categorizes a company's emissions into:

- Direct and indirect: direct emissions are those from sources owned or controlled by the reporting company, while indirect emissions result from the company's activities but occur from sources owned or controlled by other entities.
- Three scopes: Scope 1 covers direct emissions, Scope 2 includes indirect emissions from purchased energy, and Scope 3 encompasses all other indirect emissions.

Based on the International Energy Agency's (IEA) classification of business models[25], several possible value chain structures were identified for CCS/ECR value chains. Table 4 outlines emission[f] accounting boundaries for CCS/ECR-related emissions for each business model, following the GHG Protocol allocation rules shown in colours. This enables the identification of potential gaps under common value chain structures for CCS projects:

TABLE 4. The boundaries and associated allocation rules for CCS/ECR-related emissions

Note: This table is structured from the perspective of the business model provider (e.g., capture-as-a-service provider, transporter, or storage operator), not the original emitter.

All direct and indirect emissions included in the business model provider's reporting
Only indirect emissions from the company's value chain are included (i.e. Scope 3 emissions)
Emissions are out of the company accounting boundaries

Value chain	Description	Emission accounting boundaries		
		Capture	Transport	Storage
Full-chain model	In this model the entity seeks to capture and store its own CO_2. The overall value chain is financed, built, owned and operated by a single company. **Capture:** CO_2 is captured directly from the company's plant. **Transport:** CO_2 is transported through the company's own network. **Storage:** the CO_2 is stored at a site owned and operated by the company.			

f CCS-EOR projects are excluded from the scope of this study, but the same rules depicted below would apply. The GHG Protocol indicates that in these types of projects, companies must include any carbon losses from the geological reservoir in their reporting boundaries.

Value chain	Description	Emission accounting boundaries		
Self-capture with third-party CO_2 offtake	In this model, the value chain is divided, with the entity focusing on capturing its own CO_2 and relying on third parties for transport and storage. **Capture:** CO_2 is captured from the entity's plant. The entity builds, owns and operates the capture unit, and then either sells the captured CO_2 or contracts for its transport and storage to a third party. **Transport:** CO_2 is transported using the network of the third party. **Storage:** CO_2 is stored at a storage site owned and operated by the third party.	Capture	Transport (in Scope 3 reporting)	Storage (in Scope 3 reporting)
Capture-as-a-service	In this model, the value chain is divided, with the entity focusing on capturing CO_2 from third parties while relying on others for the remaining parts of the value chain: **Capture**: the entity builds, owns, and operates the capture unit to capture CO_2 from third parties' plants. The third party pays the entity for this capture service and then sells/pays for the transport and storage of the captured CO_2 to another third party. **Transport**: CO_2 is transported through the network of a third party. **Storage**: CO_2 is stored at a storage site owned and operated by a third party.	Capture	Transport	Storage
CO_2 transport and storage as-a-service	In this model, the value chain is divided, with the entity focusing on transporting and storing CO_2 captured by third parties: **Capture:** CO_2 is captured at a third party's plant, which finances, builds, owns, and operates the capture unit. The third party pays the entity for transport and storage services. **Transport**: CO_2 is transported through the entity's network. **Storage**: CO_2 is stored at a site owned and operated by the entity.	Capture	Transport	Storage
CO_2 transport as-a-service	In this model, the value chain is divided, with the entity focusing on transporting CO_2 captured by third parties while relying on others for storage: **Capture:** CO_2 is captured at a third party's plant, which finances, builds, owns, and operates the capture unit. The third party pays the entity for transport services. **Transport**: CO_2 is transported through the entity's network. **Storage**: CO_2 is stored in third party storage site.	Capture	Transport	Storage
CO_2 storage as-a-service	In this model, the value chain is divided, with the entity focusing on storing CO_2 captured by third parties while relying on others for transport: **Capture:** CO_2 is captured at a third party's plant, which finances, builds, owns, and operates the capture unit. The third party pays the entity for storage services. **Transport**: CO_2 is transported through third party's network. **Storage**: CO_2 is stored at a site managed by the entity.	Capture	Transport	Storage

After identifying the relevant emissions to be accounted for, the relevant entities need to understand how to appropriately report them. The GHG Protocol provides several consolidation approaches to attributing emissions to a corporation (equity share, operational control, and financial control). These consolidation strategies will influence how emissions are distributed and reported in the companies' documentation.

The GHG Protocol distinguishes 3 consolidation approaches (equity share, operational control, financial control) which should be applied consistently across Scope 1, 2, and 3 emissions:

- **Operational control approach:** a company accounts for 100% of the GHG emissions from operations over which it has operational control. It does not account for emissions from operations where it has an interest but lacks operational control.
- **Financial control approach:** a company accounts for 100% of the GHG emissions from operations over which it has financial control. It does not account for emissions from operations where it has an interest but lacks financial control.
- **Equity share approach:** a company accounts for GHG emissions from operations based on its share of equity in the operation. The equity share represents the economic interest, indicating the extent of the company's rights to the risks and rewards from an operation.

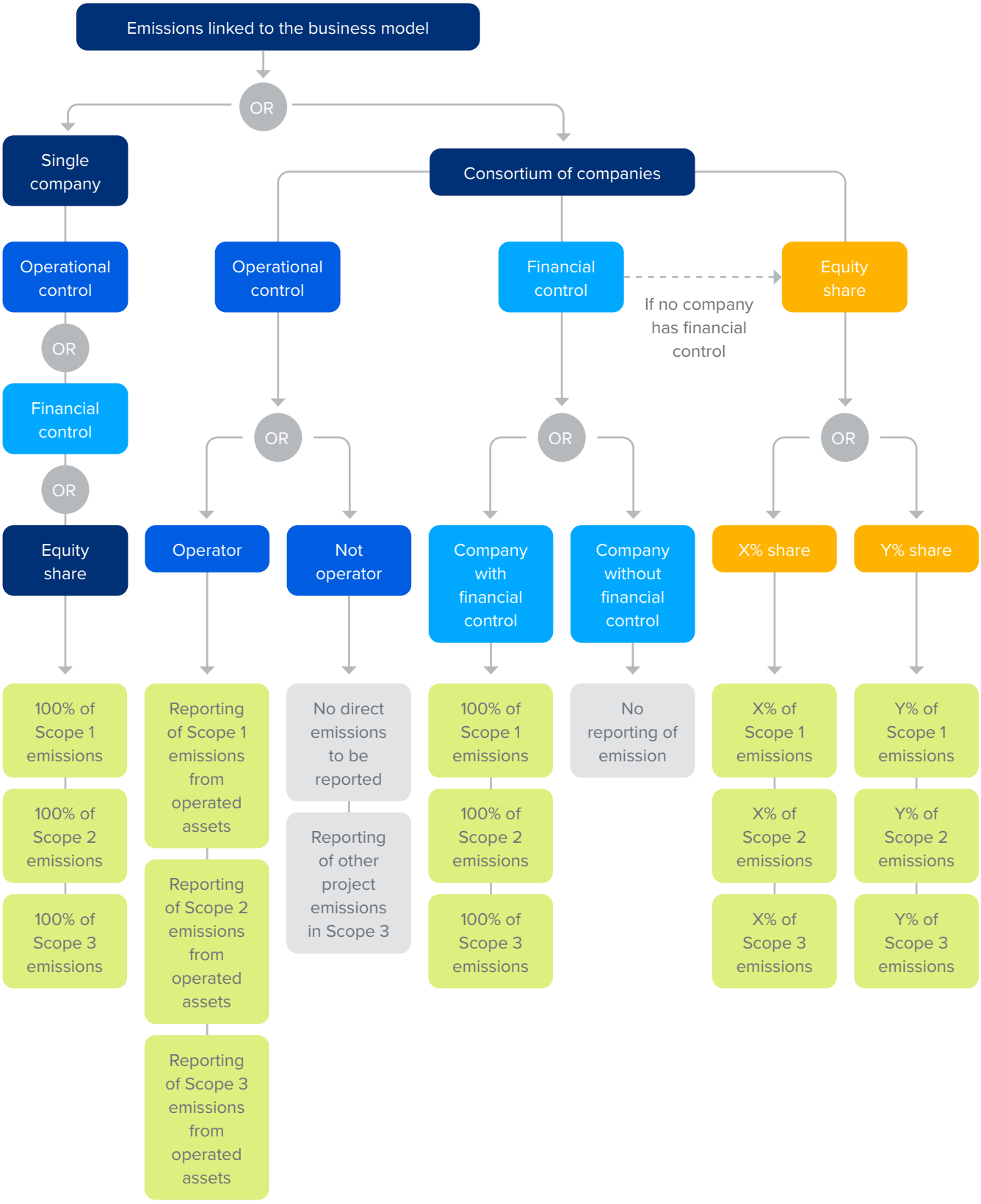
Accounting and reporting for GHG emissions related to CCS/ECR activities within a single company

When a project is carried out by a single company the chosen consolidation approach does not affect the reporting. In such cases, the company always reports 100% of the direct and indirect emissions associated with the project under its Scope 1, 2 and 3 emissions, regardless of whether the operational control, financial control, or equity share approach is used. This is because it builds, owns and operates the activities so it has control in every way the control is defined.

Accounting and reporting for GHG emissions related to CCS/ECR activities within a consortium of companies

However, oil and gas companies frequently partner on projects. CCS/ECR activities are no exception. Reporting and allocating GHG emissions and reduction/removal among a consortium of companies can be challenging. When a firm owns only a fraction of an asset, operates an asset it does not own, or owns an asset that is operated by others, allocating emissions within its reporting boundaries becomes more complex. The GHG Protocol and IPIECA provide guidelines for navigating these arrangements. Figure 2 summarizes the application of these principles:

FIGURE 2. Accounting and reporting within a consortium of companies



Unlike projects conducted by a single company, the consolidation approach affects how each company within a consortium reports emissions and allocates reductions or removals.

According to the GHG Protocol, to ensure consistency in the consolidation of the data, all levels of reporting should follow the same consolidation approach. The same consolidation approach should be applied to all activities or operations.

The GHG Protocol does not require companies to use a specific reporting approach, although it advocates using both equity share and control approaches to capture various aspects of GHG emissions.[26] Companies should choose the method that best suits their business operations and reporting needs.

- The operational control approach is sometimes used in the oil & gas industry, where one company is designated as the joint venture operator. It is consistent with reporting programs such as the EU Emissions Trading Scheme and mandatory US reporting.[12] Direct data access makes it cost-effective and valuable for performance tracking.

- The financial control approach connects GHG accounting with financial accounting but may not include all industry-specific arrangements. It focuses on corporations that have more than half financial control over a joint venture, which is similar to equity ownership but excludes certain structures—such as joint arrangements that are equity accounted or proportionally consolidated under international financial reporting standards, particularly common in the petroleum industry[11].

- The equity share approach assesses the economic stake in a joint venture, including liabilities and risks. It is an appropriate approach for firms to have the capability to manage extensive reporting, including data from operations beyond their control.

According to GHG Protocol[27] and IPIECA[14], here are the key considerations to take into account when choosing a consolidation approach:

- Government reporting: typically necessitates operational control for compliance.

- Cost and data access: operational control is less expensive and easier to maintain than equity shares, which can require more resources.

- Commercial reality: equity shares better represent economic interest and obligation than control-based approaches.

When partnering, a company can choose to conduct CCS/ECR activities as a joint venture (JV)[g] with other companies. In that case, another level of reporting should be added: once the emissions have been allocated to the JV, the companies behind it also need to distribute emissions between themselves for their own corporate reporting.

g If the JV is independent (IJV), it reports its own Scope 1 and 2 emissions, while partner companies report their share under Scope 3, Category 15 (Investments).

Table 5 illustrates this situation:

Example of GHG protocol principles applied to a CCS/ECR project

Business model behind the project:
CO_2 transport as-a-service
Project composition: consortium of companies:
Company X: operates the transport network.

JV (comprises companies A, B and C):
owns 100% of the transport network
Company A: Owns 40% of the JV
Company B: Owns 30% of the JV
Company C: Owns 30% of the JV

Emissions reported twice (once at JV level, once at company level)

Consolidation approaches	Operational control		Equity share		Financial control	
Type of emissions	Scope 1 & 2	Scope 3	Scope 1 & 2	Scope 3	Scope 1 & 2	Scope 3
Company X	100% of Scope 1&2 emissions linked to CO_2 transport	Scope 3 emissions linked to CO_2 transport	No reporting of emissions		As no company has more than 50% of financial control, the equity share allocation principle is applied	
Joint Venture	No reporting of emissions	Scope 3 emissions linked to CO_2 transport = direct emissions from company X	100% of Scope 1&2 emissions linked to CO_2 transport	Scope 3 emissions linked to CO_2 transport		
Company A	No reporting of emissions		40% of JV Scope 1&2 emissions	40% of JV Scope 3 emissions		
Company B			30% of JV Scope 1&2 emissions	30% of JV Scope 3 emissions		
Company C			30% of JV Scope 1&2 emissions	30% of JV Scope 3 emissions		

Potential for double counting of GHG emissions

In the scenario above, when using the equity share approach, emissions are reported twice: by the joint venture and by the entities that own it (Company A, B and C). The intention of this duplication in voluntary corporate public reporting, is not to aggregate emissions across entities[h] rather to ensure that all owners are accountable for their share of emissions.

Another instance of double counting can occur when multiple companies hold stakes in the same joint operation and use different consolidation methods – such as Company A using the equity share approach and Company B using the financial control approach. To avoid this situation, the GHG Protocol recommends agreeing on a common approach and specifying it in a contract.

h The GHG Protocol states: "When two or more companies hold interests in the same joint operation and use different consolidation approaches (...) emissions from that joint operation could be double counted. This may not matter for voluntary corporate public reporting as long as there is adequate disclosure from the company on its consolidation approach" (p20).

ACCOUNTING FOR EMISSIONS REMOVED OR REDUCED BY THE CCS/ECR PROJECT

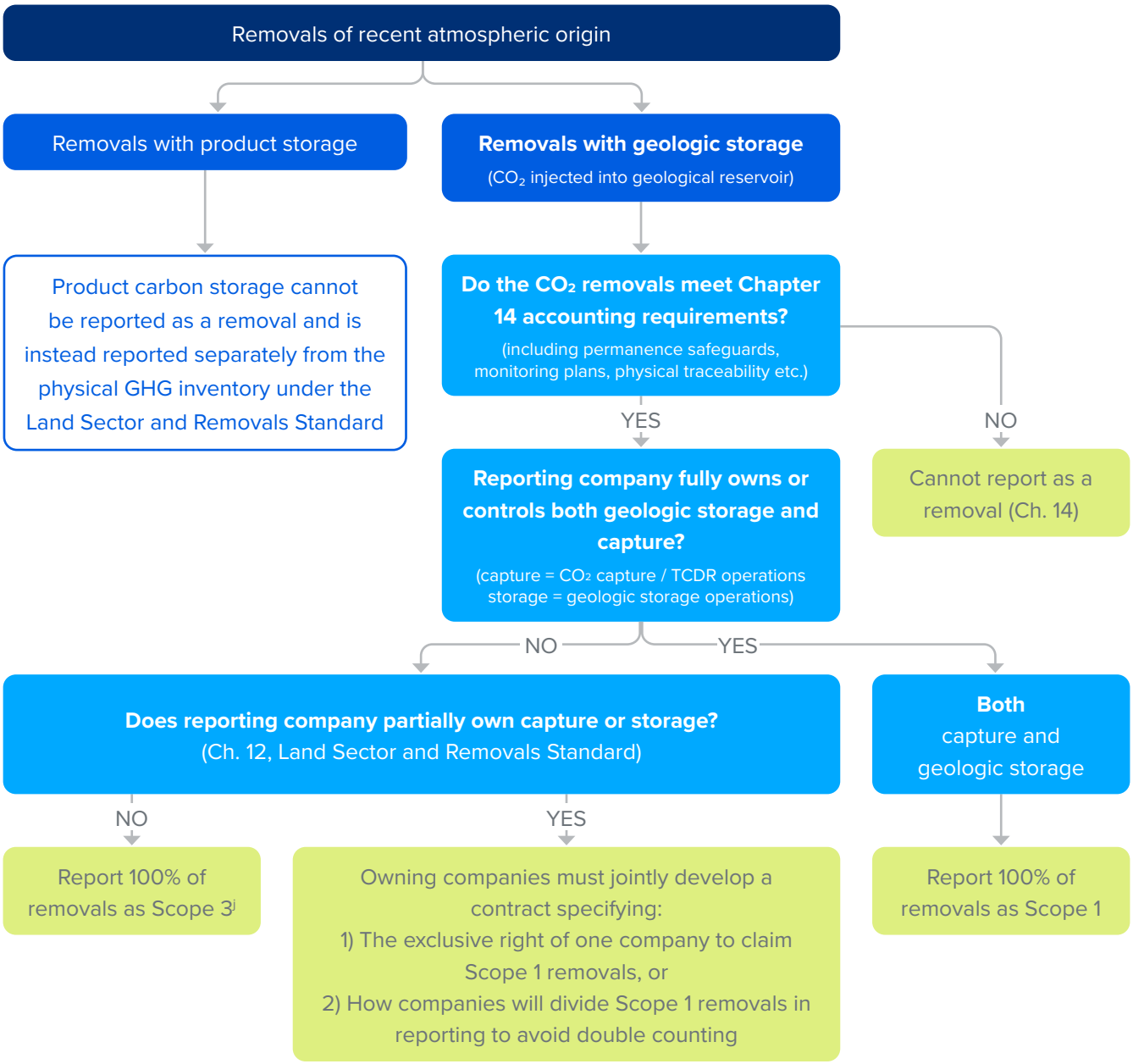
Removals accounting

Emissions reductions and engineered carbon removals (ECR) are generally reported under separate categories (i.e., emissions reductions are generally reflected as a decrease in reported emissions, whereas removals should be separate and not be subtracted from total reported emissions). While this chapter draws on the Greenhouse Gas Protocol Land Sector and Removals Standard to reflect recent developments in removals accounting, it should be noted that companies typically may apply a combination of standards, including the GHG Protocol Corporate Accounting and Reporting Standard and the Scope 3 Standard. The LSR Standard represents one of several emerging references relevant to CCS/ECR, and its application remains optional and evolving. This report therefore uses the LSR Standard as an illustrative lens for removals-related accounting, without implying it is the sole or definitive framework, and recognising that the LSR guidance documentation was still pending when this work was completed. The Land Sector and Removals Standard applies to anthropogenic activities in the land sector, as well as other CO_2 removal technologies. CCS activities involving CO_2 collected at a source preventing an emission is not accounted for and reported as a removal under this standard. When reporting in accordance with the GHG Protocol Land Sector and Removals Standard, removals with storage in a product **are not reported as a removal or emission, but instead as an optional "Product Carbon Storage" category, separate from the physical GHG inventory**. It is important to note that for removals reporting, Scope 1 and 3 are conceptually different from how they are defined in emissions reporting.

The decision tree in Figure 3 summarizes how removals are categorized by the GHG Protocol during reporting. It is important to note how the GHG Protocol Land Sector and Removals Standard defines the following terms used in the figure: **CO_2 removals with geological storage** comprises net CO_2 removals resulting from annual net increases to carbon stored in geologic carbon pools from carbon derived from biological or technological CO_2 sinks. **CO_2 capture** is collection of CO_2 from a source for storage within a non-atmospheric pool. It is important to note that the Standard distinguishes removals by durability and outlines monitoring requirements which must be met for emissions removals to be reported as shown in Figure 3.

The decision trees highlights the complexities in allocating reductions arising from emission removal activities, particularly when allocating Scope 1 reductions when the sink is owned but the pool is not, and vice-versa. It is also important to note that version 1.0 of the standard does not apply to forestry; forest-sector removals will be addressed in a future version.

FIGURE 3. Simplified decision tree for accounting for net CO_2 removals with geologic storage [i]



Source: Analysis based on the Greenhouse Gas Protocol Land Sector and Removals Standard
Note: the Standard's Guidance is forthcoming (~Q2, 2026) and may provide further specification on some of the rules shown above

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i The GHG Protocol Land Sector and Removals Standard considers "net" removals to be carbon that was removed from the atmosphere and stored in a carbon pool, and "gross" removals to be just the amount of carbon that was transferred out of the atmosphere. "Net" removals refer to removals that meet the relevant Land Sector and Removals Standard requirements for reporting removals in the GHG inventory. Lifecycle emissions associated with the removal pathway must still be accounted for in the relevant emissions categories and should not be ignored when presenting the climate impact of the activity.
Where no single entity owns or controls both the CO_2 sink and the geologic storage pool, Scope 1 removal reporting may be allocated only through a contractual agreement among the entities that own or control parts of the removal and storage pathway, and only to avoid double counting.
Separate reporting requirements apply once accounting eligibility is established, see Chapter 14.2.2 of the LSRS.

j Report as Scope 3 only where value-chain attribution, traceability, monitoring, permanence, and performance requirements are met.

The GHG Protocol *Land Sector and Removals* Standard outlines that when no single entity owners or controls both the sink and the pool of the CO_2 removals, the multiple entities involved in the geological removal and storage pathway shall develop a contractual agreement.

This agreement must specify a range of key requirements including: the allocation of ownership rights, responsibilities for emissions and losses of stored carbon across the entire pathway, and mechanisms to apportion Scope 1 removals and avoid double counting.

To summarize, although most situations warrant removals to be reported under Scope 3 using the definitions reflected in Figure 3, there are two circumstances under which a company can report net removals with geologic storage in their Scope 1 inventory:

1. The company has full ownership/control of both the carbon sink and the storage pool, or

2. The company **partially** owns the sink and/or pool and has developed a contract agreement with the other asset owners which specifies that the reporting company can claim all or part of the removals in their Scope 1 inventory, so long as there is no double counting of Scope 1 removals between the various asset owners. It is also important to note that when an asset is owned by multiple entities, the GHG Protocol recommends that each entity use the same consolidation approach(es) when reporting to avoid double counting. The Protocol clearly states that the contractual agreement is not an instrument to transfer the scope 1 removal to an entity outside of the removal and storage pathway

Companies undertaking engineered carbon removals (ECR) or carbon storage activities may experience a reduction in their adjusted inventory used for target tracking when adjustments are made to reflect the transfer or sale of credits. While physical GHG inventories remain unchanged, the LSRS requires companies to separately account for removals adjusted for credits issued to prevent double counting. As a result, although these activities may represent a significant component of companies' climate strategies and are often supported through carbon crediting mechanisms, the accounting treatment can affect how these contributions are reflected in target tracking where credits are transferred to other entities.

The GHG Protocol Land Sector and Removals Standard requires companies that account for and report Scope 3 removals with geological storage in their GHG inventory to only do so 'if they have physical traceability' to the entity or entities capturing the CO_2 received at the injection site and the entity or entities operating the CO_2 injection site and geologic storage reservoir. The Standard also prohibits double claiming. Companies shall not double count a tonne of GHG emission reduction or removal that has been generated in their organizational boundary or value chain with a tonne of GHG emission reduction or removal that has been issued, if the credit is retired and used (or could potentially be used) as an offset or for compensation targets. It recommends that companies involved in the generation of such credits sign a contract stating which company may claim ownership of removals.

The LSR Standard intentionally separates inventory accounting from credit accounting. Removals supporting crediting cannot be double counted in corporate net zero targets or buyer inventories.

Chapter 14.2 of the Land Sector and Removals Standard specifies geologic storage requirements that must be met in order for a company to report CO_2 removals. These conditions include ongoing storage monitoring, traceability, calibration with primary data, uncertainty, and reversals accounting. Notably, the latter condition states that emissions reversals must be reported not only if there is a loss of a previously reported removal (and the carbon pool is now outside of the company's inventory reporting boundary), but also if the company can no longer adequately monitor previously reported removals to ensure their continued long-term storage. Further implementation detail in the forthcoming Guidance document would be beneficial as such requirements introduce a range of practical challenges and limitations. In particular, storage monitoring without a defined time period presents a significant barrier for potential project developers.

Identification of challenges in the existing corporate accounting and reporting of CCS/ECR-related emissions and emission reductions

This section outlines key insights into where current corporate GHG accounting and reporting guidance may have challenges in addressing emerging CCS/ECR business models. To support this analysis, a set of illustrative cases (provided in Annex C) was developed to cover different CCS/ECR supply chain models in order to identify challenges in the existing corporate accounting and reporting guidelines. When applied to the accounting decision trees (based on the current GHG Protocol Corporate Accounting and Reporting Standard and Land Sector and Removals Standard) outlined in the previous section, the case studies revealed challenges resulting from the emergence of new business models within CCS/ECR supply chains.

For this exercise, "challenges" mean situations where the reporting of emissions or removals is either not covered by the existing guidelines, leaves room for interpretation or might encompass practical challenges or reporting misalignments across various participants due to new scenarios that may arise in the CCS/ECR supply chains. **It is important to note that the absence of identified challenges in specific cases does not imply consensus on underlying accounting principles or standards, but rather reflects that current guidance provides an interpretation (though not universally agreed)**

The conclusions of the analysis are presented below in Table 6.

Note: In cases involving multiple parties, it is assumed that Company A has contractual agreements in place with all other parties relating to the allocation of emissions.

TABLE 6. Cases explored and challenges identified

#	Case name	Description	Challenges identification
1	**Full Chain Model**	A company owns a fossil power plant and builds, owns, and operates a capture unit that captures CO_2 and stores it on-site. All CCS activities are internal to the company.	Nil
2	**Part Chain Model (Biogenic CO_2)**	A company captures biogenic CO_2 from its biomass facility and outsources transport and storage to a third-party provider.	Contractual and MRV conditions must be met otherwise removals are Scope 3 or not reportable
3	**Carbon Removal Credits**	A company captures biogenic CO_2 from its biomass facility and outsources transport and storage. It sells a portion of the removals as carbon credits to another entity.	Scope 1 removals can only be claimed where contractual and MRV conditions are met. Establishing attribution of Scope 3 removals may also be challenging due to traceability and anti–double counting requirements.
4	**Joint Venture**	A company captures biogenic CO_2 from its biomass facility and outsources transport and storage to a joint venture between two other companies.	Double counting at corporate level acceptable as long as consolidation approach is consistent and disclosed (known feature of corporate accounting)

5	**Leasing Transport**	A company captures biogenic CO_2 from its biomass facility and outsources transport and storage to a joint venture, which leases transport assets from a third party.	Requires consolidation approach across multiple parties
6	**Licensing Storage**	A company captures fossil CO_2 from its facility and outsources transport and storage. The storage operator holds a license to store CO_2 on land owned by another entity.	Nil
7	**Extended Value Chain**	A company captures fossil CO_2 from its power plant and outsources transport and storage. A third party buys low carbon power from the power plant.	Inventory accounting remains scope-based; no dedicated mechanism for upstream suppliers to claim simple Scope 3 reductions from downstream CCS.
8	**Carbon Credit Ownership and Electricity Claims**	A company captures biogenic CO_2 and outsources transport and storage. It sells all removals as carbon credits. It also sells electricity to another entity.	Nil (assuming Company A does not claim that it sells low-carbon electricity or charge a premium from Company H – if it does there is a gap)

The above cases enabled the identification of the following challenges in the existing guidelines:

1. In current CCS/ECR value chains, it is uncommon for one company to own both the pool and the sink. Under the Land Sector and Removals Standard, Scope 1 removals can only be claimed where contractual and MRV conditions are met; otherwise removals are Scope 3 or not reportable. This places the reporting burden on operators across the chain, requiring project developers to understand the applicable rules and collaborate to establish appropriate contractual arrangements.

2. In the case when the storage site is not owned by the company operating the storage site, all emissions associated with storage should be reported by the operating company. There is no guidance on whether the company that owns the site should report any emissions.

3. In the case when product was sold to a third party which in turn used carbon capture technology, reduction of emissions from sold products should be reflected in the supplier's reporting, however there is currently no guidance on how to trace those reductions.

4. The Land Sector and Removals Standard suggests that purchased removals should be reported separately from emissions and outside of scopes. On the buyer's side, this approach might disincentivize the purchase of removals in the voluntary carbon market (VCM).

Scope 3 accounting and reporting initiatives

Accounting and reporting of Scope 3 emissions introduces a range of complexities and can lead to outcomes such as parallel reporting. Examining Case 4 in detail illustrates what parallel reporting is and where reporting differs from carbon accounting. By expanding the complexity of the case, the concept of one emission being reported by multiple entities in multiple scopes is highlighted.

EXAMPLE CASE (AS PER CASE 4 IN ANNEX C)

- Company A owns a biomass power plant. It builds, owns and operates a capture unit that captures **100,000 tCO_2/year (biogenic)**. The operational emissions onsite are **100 tCO_2/y**.
- Company A buys transport and storage services from a third-party provider, a joint venture between companies B and D, who own equal transport and storage components (50% of the T&S each).
- Company B operates 2 ships which transport CO_2 to a storage site operated by Company D. The operational emissions of the 2 ships are **800 tCO_2/y**. The operational emissions of the storage site are **100 tCO_2/y.**
- Company C buys carbon removal credits corresponding to **50,000t/y bioCO_2** from Company A.
- Capture facilities are located in Country X where CO_2 is then transported and stored in Country Y.

No gap identified Gap identified

	Emissions (Scopes 1 & 2)	Emissions (Scope 3)	Removals (Scope 1)	Removals (Scope 3)	Reported separately
Company A	100 tCO_2	900 tCO_2		50,000 tCO_2	
Company B	Operational control: 800 tCO_2 Equity share: 450 tCO_2	Equity share: 0 Operational control: 0 tCO_2			
Company C					50,000 tCO_2
Company D	Operational control: 100 tCO_2 Equity share: 450 tCO_2	Equity share: 0 Operational control: 0 tCO_2			
Joint Venture	Operational control: 0 Equity share: 900 tCO_2	Operational control: 900 tCO_2 Equity share: 0			

Potential claims and reporting for this case can then occur as follows:

	NIR	ETS	VCM	Claim scenario 1	Claim scenario 2
Company A	100 tCO_2 in CRT 1A or B 100,000 tCO_2 in CRT 1C in Country X	100 tCO_2 in Country X	Issued 99,000 tCO_2	99,000 tCO_2 towards NDC in Country X or Y, with appropriate CA if required	49,000 tCO_2 towards NDC in Country X or Y, with appropriate CA if required
Company B	400 tCO_2 in CRT 1A or B in Country X + 400 tCO_2 in CRT 1A or B in Country Y	400 tCO_2 in Country X + 400 tCO_2 in Country Y			
Company C			Retired 50,000 tCO_2	Contribution claim	50,000 tCO_2 for voluntary offsetting of emissions
Company D	100 tCO_2 in CRT 1A or B in Country Y	100 tCO_2 in Country Y			

Parallel reporting happens towards corporate sustainability reporting, the NIR and the ETS. Carbon accounting is done for the ETS and VCM to be able to quantify the ETS allowances to be surrendered and the amount of carbon credits issued in a certain year. Cross border activities show reporting of emissions to be appropriately distributed between the countries.

Claiming of the actual achieved removals can be done in different ways. Both countries, naturally, would like to be able to write the achieved removals towards the country's NDC target. However, this would mean that the same tonne of CO_2 removed is counted in both the countries that Companies A and B are situated in. Corresponding adjustments and authorizations as discussed and implemented under Article 6 of the Paris Agreement need to be in place between the countries to only account these removals to either Country X or Y or share the removals according to a certain proportionality key.

Company A generates and sells carbon credits on the voluntary carbon market to their buyer (Company C). Company C can opt to claim these removals as a contribution claim towards any of the host countries (depending on who will write the removals to which NDC) or Company C can voluntarily offset the CO_2 against their emissions, only if these removals are not counted towards any country's NDC.

Some organizations are beginning to explore ways to improve the tracking of Scope 3 emissions and reductions. One such initiative is the Verra Scope 3 Standard (S3S)[k], which aims to provide a structured framework for accounting and reporting Scope 3

k Verra, Public Consultation on Scope 3 Standard Program, March 2025 Public Consultation on Scope 3 Standard Program - Verra

emission reductions. The proposed standard seeks to establish clear methodologies for quantifying and documenting emissions reductions within value chain activities, including those related to sold products. By addressing this gap, the initiative aims to enhance transparency and consistency in corporate emissions reporting.

Other initiatives focus on market-based mechanisms like supply shed/value chain intervention or chain of custody models, e.g., mass balance or book-and-claim method. The GHG protocol collected information on Scope 3 accounting methods.[27] Companies purchase products or commodities from common pools or distribution systems, and direct contracting with suppliers or traceability to individual points of origin are not feasible.

Another market-based Scope 3 accounting method is the Chain of Custody (CoC) models. CoC systems are paper trails that show the sequence of custody, control, transfer analysis and disposition of products and result in a document showing the GHG reduction along the value chain. A framework for CoC is given in ISO 22095[28].

Here, only the mass balance and book and claim methods are described.

The mass balance CoC system requires the exact amount (mass) of certified product to be tracked along the supply chain and then reconciled to reflect the amount of certified product in the end product. Certified and uncertified products are mixed, and the end product will have an average emission reduction attached to it.

The book and claim (B&C) CoC is described as follows:

“The book and claim CoC is based on sustainability certificates. A buyer purchases certificates for a specified volume of certified products and certified and non-certified products are free to flow through the value chain with no traceability or physical connection between the certified product or the end product. These sustainability credits are traded through marketplaces separate to those which trade the products. Typically, a central authority makes sure the number of credits issued equals the sustainability claims being made”.

To be able to create the sustainability certificates often a mass-balance or product accounting method is applied.

Corporate accounting and reporting for CCS/ECR activities frameworks – Conclusions

1. For corporate level reporting, companies may choose to report according to one or several climate-related disclosure guidance documents standards, such as CDP, GRI, IFRS, Petroleum industry guidelines for reporting greenhouse gas emissions by IPIECA and API and others.

2. The 2026 GHG Protocol Land Sector and Removals Standard now provides generic, cross-sector rules for removals with geologic storage (including ECR), but not a CCS/ECR-sector standard.

3. Earlier draft GHG Protocol guidance left significant interpretation gaps for ECR. Some of these have been addressed in the updated standard but challenges still remain. There remains a lack of guidance for CCS.

4. As new business models are emerging where the CCS/ECR value chain is divided among different entities, accounting and reporting emissions and reductions / removals becomes more complex.

5. GHG Protocol principles are subject to interpretation, and different companies can account for emissions and emissions reduction differently.

6. There are gaps in the current accounting principles that can lead to double claiming of emissions and other questions related to emission/emission reduction attribution. Some standards such as the Land Sector Removals Standard contain explicit anti-double-counting rules.

7. Incompatibilities between corporate and product level accounting lead to questions related to emissions removal or reduction attribution.

8. Companies undertaking engineered carbon removals (ECR) or carbon storage activities may see a reduced contribution reflected in their adjusted inventory used for target tracking when credits are transferred or sold, as the LSRS requires these to be accounted for separately from the physical inventory to prevent double counting.

9. Clearer guidance on long-term storage monitoring requirements (particularly defined timeframes) is needed, as current uncertainty may pose a significant barrier to project development.

10. Existing standards lack guidance on complex cases involving Scope 3 emissions including **defining tiers of the value chain** or in instances where removals are not clearly defined as being associated with **Scope 3 categories associated with** products, materials or services **that are purchased, processed, used or sold by the reporting company.**

11. Accounting for emissions associated with CCS and ECR activities may benefit from the development of industry-specific guidelines on corporate level accounting.

04

Review of approaches for CCS/ECR integration into compliance and voluntary carbon markets

Photo: Northern Lights

Review of approaches for CCS/ECR integration into compliance and voluntary carbon markets

This chapter aims to summarize different carbon market mechanisms for CCS projects (both compliance and voluntary) and identifies market readiness for CCS. The Global CCS Institute and the International Carbon Action Platform, amongst others, give more detailed information on this subject and the reader is referred to their reports. Additionally, this chapter provides an overview of key voluntary carbon crediting programs and the methodologies for CCS projects, covering standards such as Gold Standard, VERRA, Puro Earth, the American Carbon Registry, the Global Carbon Council, and Isometric.

CCS project activities in compliance schemes

The majority of carbon pricing mechanisms are cap-and-trade schemes and/or carbon taxes. The International Carbon Action Partnership (ICAP) reports every year on the developments of Emissions Trading System (ETS) worldwide, while the World Bank keeps a carbon pricing dashboard evergreen. Any pricing for carbon is done on a tonne of CO_2 equivalent, a measurement of the total greenhouse gases emitted, expressed in terms of equivalent measurement of carbon dioxide.

It was the carbon tax implemented in Norway in the 1990s that moved Statoil (Equinor) to capture CO_2 from the production of sour gas from the Sleipner field and store it in a saline aquifer at the production site. The combination of gas quality requirements and the new CO_2 tax made on-site storage a cost-effective compliance solution. Thirty years later, CCS is gradually being incentivized through market-based mechanisms.

ANALYSIS OF MARKET READINESS

As of April 2025, there are 38 Emissions Trading Schemes (ETS) in force. 11 are under development and a further 9 countries are considering implementing an ETS[29]. Of the 36 that are active 9 mention carbon capture and storage: The EU, Switzerland, UK, Alberta, Colorado, Ontario, Saskatchewan, Philippines (under development), and South Korea. Where emissions are reduced by capturing CO_2 from the flue gasses released upon combustion of the fuel source, these reductions are compensated under an ETS, through the need for fewer allowances the following year. ECRs are treated differently, as they are sourced from either the atmosphere or from biomass, and biomass in most ETSs' – if sustainable – is treated as a zero emissions source, not requiring any allowances.

Some ETSs' allow in part offsetting using (domestic) carbon credits, to compensate for buying allowance. On average, 5-10% of the total emissions can be offset. For example, the Australian Safeguard Mechanism covers all direct (Scope 1) GHG emissions from facilities emitting over 100,000 tCO_2e per year in the electricity, mining, oil and gas production, manufacturing, transport, domestic aviation, and waste sectors. It allows the use of Australian Carbon Credit Units (ACCUs) for offsetting. It does not have a limit to surrendering ACCUs[30]. One of the approved methods is carbon capture and storage[31].

In Kazakhstan the same procedures are allowed, but the country does not have a domestic CCS protocol. "Domestic offset credits in all economic sectors (GHG reduction or absorption activities) outside the scope of the ETS are allowed. Project applicants can submit their

projects for consideration to the Ministry of Ecology and Natural Resources for approval and issuance of offset credits. These are carried out in accordance with IPCC methodologies and rules developed by the ministry". CCS including ECR could, therefore, be considered by the Kazakhstan authorities.

The maps in Figures 4 and 5 show the overview of countries applying, developing or considering an ETS. Market readiness for voluntary offsets, including CCS, inside an ETS is represented in the map shown in Figure 5.

Protocols for carbon accounting and emission reporting for CCS in voluntary and compliance markets

Carbon accounting and emission reporting from CCS is done differently by region: voluntary and market-based mechanisms show fragmentation. Below are some examples of requirements in carbon accounting and emission reporting in different continents.

EUROPEAN UNION (EU) – EU ETS AND CCS DIRECTIVE

The EU CCS directive has been active since 2009, the latest update was in 2023 and a new guidance on the directive was released in July 2024.[32] The CCS Directive focuses on geological storage of CO_2, not the full value chain. The other parts of the value chain are defined by the EU ETS MRR requirements for stationary installations and maritime transport. The EU ETS II will include road transport and become fully operational in 2027. A complete methodology for CCS has not been developed, in comparison to the CCS discussion for National Inventory Reporting in page 11.

Allowances need to be purchased ex-ante and surrendered ex-post operations. Any allowances that are still available to the operator after annual operation can be traded at the EU ETS carbon price to operators that are short on allowances (=emitted CO_2 beyond their emissions cap). If a capture facility is attached to a power station to capture emissions from the flue gas, the operator may reduce their compliance duty thus have surplus allowance that can be traded. Emissions compliance duty for transport and storage, if run on fossil fuel-based energy, will remain under the control of the EU ETS and need to continue to purchase and trade allowances.

Since CCS is covered by the EU ETS Directive, allowances must be surrendered for any leaked CO_2 to compensate for the fact that the emissions were initially credited as "not emitted",[33] this includes biogenic emissions.

AUSTRALIA – AUSTRALIA CARBON CREDIT UNIT (ACCU) SCHEME CCS METHODOLOGY

Eligible emission avoidance or sequestration projects can earn ACCUs since 2011. The reporting and demand is controlled by the National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015. The ACCUs are either sold for offsetting on the secondary market (private sector, including safeguard facility owners) or sold to the Australian Government. CCS projects are eligible under the ACCU Scheme and are classified as emission avoidance projects *as the release of greenhouse gases to the atmosphere from industrial facilities or resource activities is avoided by capturing, transporting, and injecting the emissions into geological formations for permanent storage*. ACCUs can only be generated from industrial processes or oil and gas activities. However, enhanced oil recovery (EOR) and DAC are excluded[34].

The ACCU Scheme is a regulated voluntary scheme and uses a project carbon accounting methodology, that includes all parts of the value chain with the aim to achieve emission reductions, not emission reporting. At time of writing (September 2025) only one CCS project was registered in the scheme since 2021, with the first ACCUs issued in November 2025[35].

US – CALIFORNIA LOW CARBON FUEL STANDARD (LCFS) CCS PROTOCOL

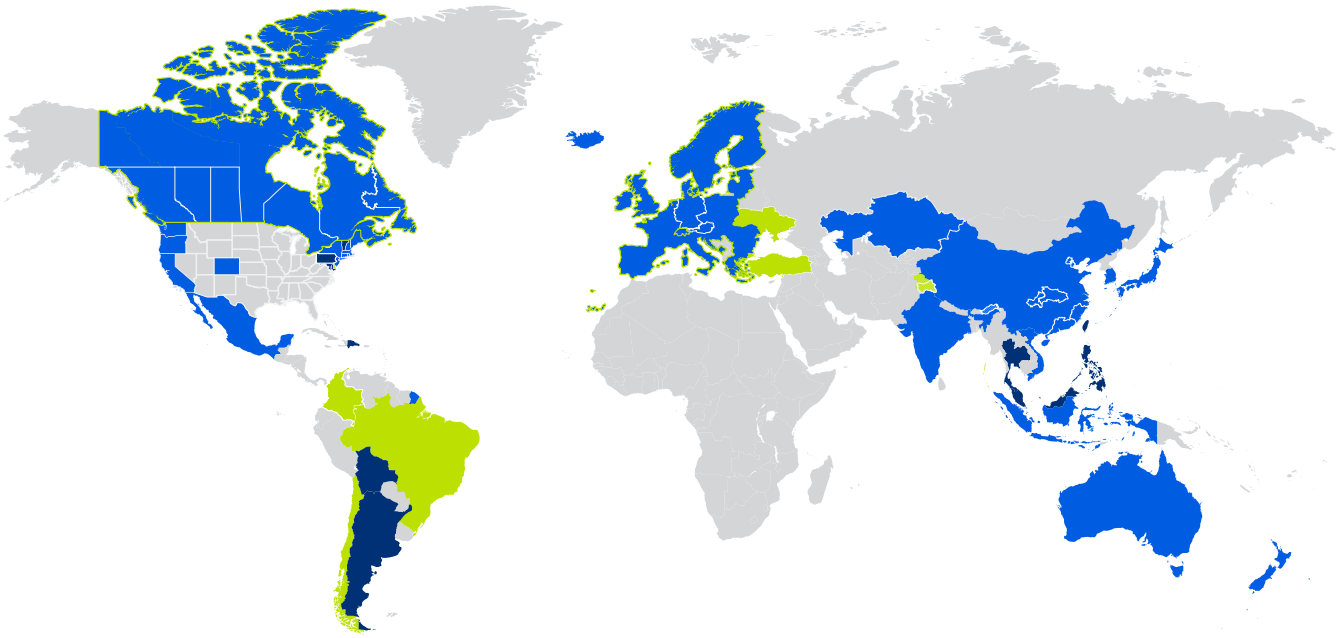
Under the LCFS, transportation fuels sold in California (in volumes above a de minimis level) are assigned a carbon intensity score, based on a life cycle analysis, and expressed in terms of greenhouse gas pollution per unit of useful energy (gCO_2e/MJ). The LCFS regulations establish a schedule of declining target carbon intensity scores and require that transportation fuel sellers meet these targets, either by decarbonizing their own supply chains and/or acquiring credits from other fuel producers. Every fuel with a carbon intensity score above the target level incurs "deficits," and every fuel with a carbon intensity score below the target earns "credits." In practice, this means that sellers of conventional fossil gasoline and diesel fuels incur deficits, which they can match with credits to comply with policy targets. Credits are bankable, meaning parties can earn or purchase them and hold them for future compliance use as needed. DAC is also a recognised project type under the California LCFS.

The CCS protocol as developed by the California Air Resources Board (CARB)[36], includes in the system boundary all CO_2 sources, sinks and reservoirs and as such is a project-based carbon accounting methodology. CO_2 sequestration for EOR is eligible under the program. Currently, CCS projects approved by CARB pursuant to the CCS Protocol under the LCFS enable transportation fuel providers that sell fuel into California to quantify the net annual GHG emission reductions from CCS projects. If the resultant carbon intensity of an approved fuel pathway is calculated to be below the state's CI target, then the CCS project can generate additional LCFS credits.

Photo: Adobe Stock

FIGURE 4. Emission trading schemes in 2026[49]

In force (41) Under development (7) Under consideration (9)



CANADA

- British Columbia Output-Based Pricing System
- Alberta Technology Innovation and Emissions Reduction Regulation
- Saskatchewan Output-Based Performance Standards Program
- Canada Federal Output-Based Pricing System
- Ontario Emissions Performance Standards Program
- Québec Cap-and-Trade System
- Newfoundland and Labrador Performance Standards System
- Nova Scotia Output-Based Pricing System for Industry
- New Brunswick Output-Based Pricing System

U.S.A

- Regional Greenhouse Gas Initiative (RGGI):
  - Connecticut
  - Delaware
  - Maine
  - Maryland
  - Massachusetts
  - New Hampshire
  - New Jersey
  - New York
  - Rhode Island
  - Vermont
- Washington Cap-and-Invest Program
- Oregon Climate Protection Program
- California Cap-and-Trade Program
- Massachusetts Limits on Emissions from Electricity Generation
- Colorado GEMM
- New York State
- Vermont
- Pennsylvania
- Maryland

CENTRAL AND SOUTH AMERICAS

- Mexico ETS
- Colombia
- Brazil
- Chile
- Bolivia
- Dominican Republic

EUROPE

- EU ETS:
  - EU Member States
  - Iceland
  - Liechtenstein
  - Norway
- UK ETS
- Austrian National ETS
- German National ETS
- Montenegro ETS
- Switzerland ETS
- EU ETS 2
- Turkey
- Ukraine

ASIA

- Kazakhstan ETS
- China National ETS
- Korea (Republic of Korea ETS)
- Saitama Target Setting ETS
- Tokyo Cap-and-Trade Program
- Indonesia Economic Value of Carbon Trading Scheme
- New Zealand ETS
- Australia Safeguard Mechanism

China ETS Pilots:

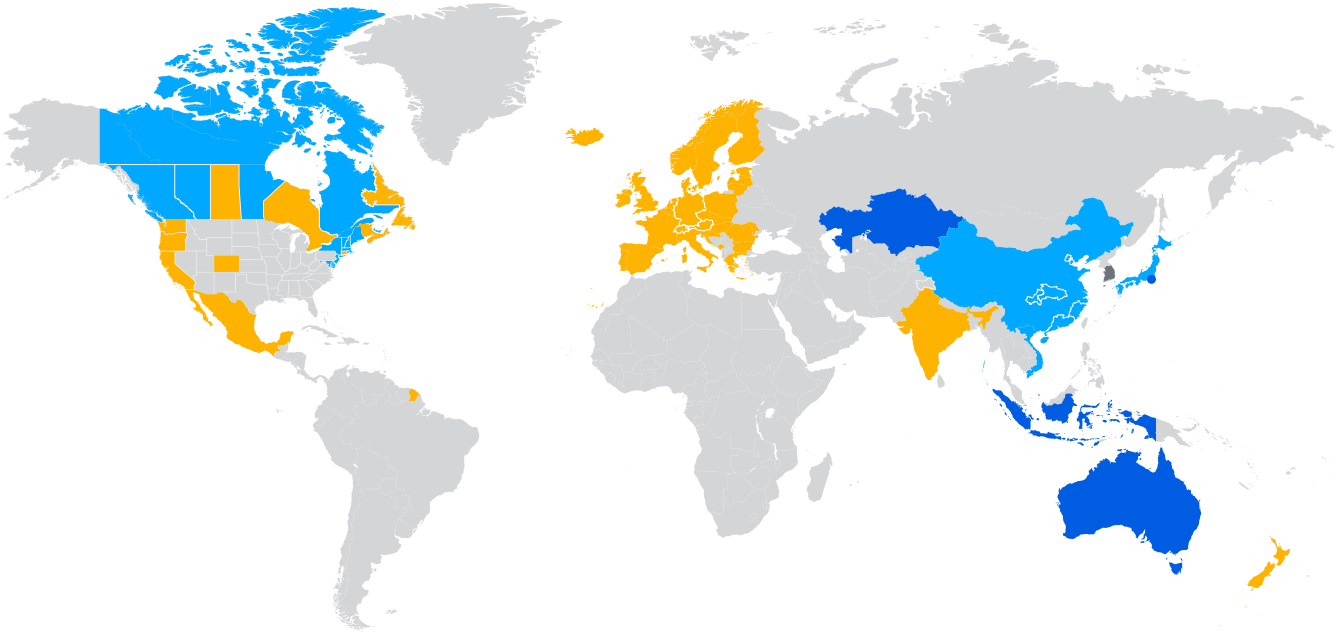
- Beijing
- Chongqing
- Fujian
- Guangdong
- Hubei
- Shanghai
- Shenzhen
- Tianjin

- Japan
- Vietnam
- India
- Taiwan, China
- Thailand
- Malaysia
- Philippines

Note: The legend counts ETS systems. Some entries also show supporting jurisdictional detail beneath the relevant ETS.
Source: Adapted from International Carbon Action Partnership. ETS Map.

FIGURE 5. Voluntary offsets allowed in ETS[49]

Allowed without quantitative limits
Allowed with quantitative limits
Not allowed
International offset allowed



AMERICAS

Canada Federal OBPS	75%	1.40 $MtCO_2e$
British Columbia OBPS	40%	N.A.
Québec Cap-and-Trade System	8%	4.02 $MtCO_2e$
RGGI	3.3%	2.08 $MtCO_2e$
Alberta TIER	80%	16.08 $MtCO_2e$
Washington Cap-and-Invest Program	8%	4.30 $MtCO_2e$
Oregon Climate Protection Program	15%	3.62 $MtCO_2e$
California Cap-and-Trade Program	4%	10.70 $MtCO_2e$
Mexico ETS	10%	27.31 $MtCO_2e$
Saskatchewan OBPS		
Ontario EPS		
Newfoundland and Labrador Performance Standards System		
New Brunswick OBPS		
Nova Scotia OBPS		
Colorado GEMM		
Massachusetts LEEG		

EUROPE

- UK ETS
- EU ETS
- German National ETS
- Austrian National ETS
- Switzerland ETS
- Montenegro ETS

ASIA

Kazakhstan ETS	100%	167.40 $MtCO_2e$
Saitama ETS	100%	6.30 $MtCO_2e$
Tokyo Cap-and-Trade Program	100%	12.20 $MtCO_2e$
Indonesia Economic Value of Carbon Trading Scheme	100%	256.80 $MtCO_2e$
Australia Safeguard Mechanism	100%	1.22 $MtCO_2e$
China National ETS	5%	262.20 $MtCO_2e$
Beijing	5%	2.2 $MtCO_2e$
Tianjin	10%	7.40 $MtCO_2e$
Hubei	10%	17.90 $MtCO_2e$
Shanghai	5%	5.25 $MtCO_2e$
Fujian	10%	11.62 $MtCO_2e$
Guangdong	10%	29.70 $MtCO_2e$
Shenzhen	20%	N.A.
Chongqing	5%	3.92 $MtCO_2e$
Japan GX-ETS	10%	N.A.
Vietnam	30%	80.52 $MtCO_2e$
Korea ETS	5%	28.36 $MtCO_2e$
India		
New Zealand ETS		

Offset credits are increasingly becoming key features in ETS design, particularly in newly implemented systems.

Out of 38 ETSs globally, 24 allow domestic offset credits for compliance – with South Korea being the only one accepting international credits.

Domestic offsets are the current focus, but Article 6 implementation could increase demand for international units in the future.

Compliance-driven demand for offsets may grow, but constraints remain from generous free allocations and low allowance prices.

Removals in voluntary and compliance markets

EU – CARBON REMOVAL AND CARBON FARMING CERTIFICATION FRAMEWORK (EU-CRCF)

In November 2024, the Council of the European Union (EU) gave the final green light to the regulation establishing the Carbon Removals and Carbon Farming (CRCF)[a] certification framework. The regulation entered into force 20 days after its publication in the EU's Official Journal on 6 December 2024.

In November 2025, the EU implemented regulation 2025/2358 laying down rules on certification schemes, certification bodies, and audits under Regulation (EU) 2024/3012 of the European Parliament and of the Council.[37]

The regulation sets out the rules and requirements for certified units, as well as provisions for certification methodologies and schemes, issuance of units and an EU-wide registry. The framework covers permanent carbon removal activities, carbon storage activities that capture and store carbon in long-lasting products for at least 35 years and carbon farming activities that enhance carbon sequestration and storage in forests and soils or reduce greenhouse gas emissions from soils, carried out over a period of at least five years.

The European Commission is developing certification methodologies, with support from the EU Carbon Removals Expert Group. The Expert Group focusses on draft elements for methodologies for permanent carbon removals (Biogenic Carbon Capture and Storage, Direct Air Carbon Capture and Storage and biochar), carbon farming (peatland rewetting, agriculture and forestry), and carbon storage in buildings. In March 2025, the draft methodology for DACCS and BECCS was released and is expected to be adopted by the Commission in 2026.

In parallel, the EU Commission is searching for certification schemes to issue credits between 2026 and 2028. An EU-wide registry is to be launched in 2028.

UK GREEN GAS REMOVALS (GGR) FROM CCS

The UK released at the end of 2023 their business model update for power BECCS business models[b]. It includes an update on the government's approach to developing methodologies for engineered GGRs, including MRV. The indicative Heads of Terms for the GGR Business Model provides a framework for the principal terms and conditions that are expected to be included in the GGR Agreement for initial projects.

The UK government has ambitious aims to deploy at least 5 $MtCO_2$/yr of engineered removals by 2030, scaling up to around 75-81$MtCO_2$/year by 2050. The UK ETS authority is considering the inclusion of engineered removals within the UK ETS, aiming to incentivise investment and provide a source of demand for removals from polluting sectors, subject to robust MRV and the management of any wider impacts. The UK government, in collaboration with the British Standards Institute (BSI) are developing technology specific methodologies for engineered removals (such as BECCS and DACCS) to define the requirements around the quantification and MRV. Phase 1, minimum quality threshold, were finalised by Q3 2025[38,39], after which the methodologies are to be developed.

The UK has committed to legislating integration of removals in the UK ETS by 2028, with removals entering the market by the end of 2029. The allowance design will be based on baseline and monitoring methodologies currently in development. The removal allowances will be awarded to the project developers ex-post, after sequestration has taken place and been verified. The Authority will consider the differentiation between removal allowances and UK emission allowances when implemented, to incentivise a continued emission reduction and removal operators to scale.[40]

a https://climate.ec.europa.eu/eu-action/carbon-removals-and-carbon-farming_en
b https://www.gov.uk/government/publications/greenhouse-gas-removals-ggr-business-model

ARTICLE 6.4 – REMOVAL STANDARD

In addition to the Article 6.4 Methodology Standard's requirements,[41] activities involving removals and emission reduction activities with reversal risks must also meet the requirements of the Removals Standard.[42] The Removals Standard defines removals as "the outcomes of processes by which greenhouse gases [GHGs] are removed from the atmosphere as a result of deliberate human activities and are either destroyed or durably stored through anthropogenic activities." This definition covers all GHGs, making it broader than the IPCC's definitions of carbon dioxide removal which covers only carbon dioxide. It is limited to activities that destroy or "durably store" the removed GHGs, making it narrower than the IPCC's definition of anthropogenic removals which does not refer to the durability of storage.

The Removals Standard covers requirements for monitoring and reporting during and after the crediting period, accounting of removals, methodologies, addressing reversals, avoiding leakage, and avoiding other negative environmental and social impacts and respecting human rights and the rights of Indigenous Peoples. Methodologies for removals need to incorporate these requirements.

The Standard's requirements for monitoring and reporting during the crediting period are comparable to current requirements under existing carbon crediting programmes. Removals are determined by the sum of the net change in the GHGs stored, minus the net change in emissions and any leakage and past crediting deficits. If this sum is positive, it determines the amount of A6.4ERs to be issued. If this sum is negative, it is recorded as a "crediting deficit" for future A6.4ER calculations and no A6.4ERs are issued. Where a project generates both removals and emission reductions, both shall be reported separately in the monitoring report.

The Removals Standard requires monitoring and reporting to continue also after the end of the last crediting period, to assess whether any reversals have occurred, quantify the number of reversals and confirm the continued storage of the GHGs. The accounting of net removals shall be carried out for each year of the post-crediting period. However, no A6.4ERs are issued for the net removals occurring during the post-crediting monitoring period. The Removals Standard does not specify a duration for the post-crediting period monitoring and reporting, but activity participants can request its termination if they can demonstrate that the stored GHGs are at a negligible risk of reversal, or the potential future reversals are remediated.

Activity participants are required to prevent and minimise the risk of reversals. They must conduct a reversal risk assessment, including a risk mitigation plan, using a reversal risk assessment tool to identify, assess and mitigate reversal risks, and calculate an overall percentage-based risk rating. This percentage will determine the proportion of A6.4ERs to be transferred into the Reversal Risk Buffer Pool Account and identify A6.4ERs with a negligible risk of reversal (tagged in the mechanism registry). The assessment must be part of the project design document, and it must be reviewed and revised every five years.

In case reversals nonetheless occur for issued A6.4ERs, the Article 6.4 Supervisory Body must be notified and fully remediated in line with the Removals Standard. The standard distinguishes between avoidable and unavoidable reversals, where the first is in the influence and control of the project developer and for the latter it is not. The SBM will establish a Reversal Risk Buffer Pool Account in the mechanism registry for remediating avoidable and unavoidable reversals in full through cancellation of an equivalent amount and type (authorised or mitigation credit units (MCUs)) Buffer A6.4ERs. Upon issuance of A6.4ERs, a share proportionate of the activity's risk rating is transferred to the pool as Buffer A6.4ERs, and upon a reversal event, an equivalent amount of Buffer A6.4ERs are cancelled for remediation of reversals. For avoidable reversals, the activity developer must replenish the buffer pool with an equivalent amount and type of A6.4ERs. Developers should have sufficient coverage under an insurance policy or comparable guarantee products to cover avoidable reversal risks.

Voluntary carbon crediting programs related to CCS activities

The typical carbon project certification cycle is outlined in Annex D of this paper. As illustrated on the right side of the figure in Annex D, project proponents must follow key steps to register their project under one of the voluntary carbon crediting programs. Although each carbon crediting program may follow a similar process for project validation, monitoring, and verification, and issuance of credits, the specific terminology, requirements, and procedural steps can differ depending on the standard used. These variations can be seen in several areas, including the eligibility criteria for project types, the methodologies used to calculate emission reductions or engineered carbon removals, the documentation and reporting requirements, the specific protocols for monitoring and verification, and the processes for engaging and consulting with stakeholders.

IDENTIFICATION OF AN APPROPRIATE METHODOLOGY

As depicted in Annex D, the first step in designing a carbon project for CCS activities is to select an appropriate methodology. To assist with this process, Table 7 provides a comprehensive list of all currently available CCS methodologies within the voluntary carbon market. This table presents information, including the names of each methodology and the carbon crediting programs, or standards, under which they have been published.

TABLE 7. Available CCS methodologies/protocols as of December 2025

Carbon crediting programmes	Methodologies/protocols
Gold Standard	• Methodology for Biomass Fermentation with Carbon Capture and Geologic Storage (v2.0) • Applicability Scope Expansion to the Methodology for Biomass Fermentation with Carbon Capture and Storage (v1.0) • Methodology Tool 03 - Project Emissions Calculations and Monitoring Requirements for Geological Storage Complexes (v1.0) • Methodology Tool 04 - Reversal risk assessment for geological storage (v1.0) • Carbon Sequestration through Accelerated Carbonation of Concrete Aggregate (v1.0) • Engineered Carbon Dioxide Removal (v1.0)
Verra	• VM0049 Methodology for Carbon Capture and Storage (v1.0) • VMD0056 CO_2 Capture from Air (Direct Air Capture) (module) (v1.0) • VMD0057 CO_2 Transport for CCS Projects (module) (v1.0) • VMD0058 Module for CO_2 Storage in Saline Aquifers and Depleted Hydrocarbon Reservoirs (module) (v1.0) • VMD0059 CO_2 Capture from Bioenergy (module) (v1.0) • VT0012 Accounting Non-VCS CO_2 in CCS Projects (tool) (v1.0) • VT0013 Differentiating reduction and removals in CCS projects (tool) (v1.0) • CO_2 Utilization in Concrete Production (v1.0)
Puro Earth	• Geologically Stored Carbon Methodology (v. 2) • Carbonated Materials (v.2)

Carbon crediting programmes	Methodologies/protocols
American Carbon Registry	• Methodology for the Quantification, Monitoring, Reporting and Verification of Greenhouse Gas Emissions Reductions and Removals from Carbon Capture and Storage Projects (v2.0 is currently under Scientific Peer Review)
Global Carbon Council	• Methodology for project activities involving the capture, transport and geological storage of carbon dioxide (v1.1) • GCC Guidance for Geological Storage (v1.1)
Isometric	• Biogenic Carbon Capture and Storage (v1.1) • Subsurface Biomass Carbon Removal and Storage(v1.0) • Biomass Geological Storage (v1.1) • Bio-oil Geological Storage (v1.1) • Direct Air Capture (v1.1) • CO_2 Storage in Saline Aquifers (mod) (v1.1) • CO_2 Storage via In-situ Mineralization in Mafic and Ultramafic Formations (mod) (v1.1) • Direct Ocean Capture and Storage (mod) draft (v1.0)
Other[c] (Climeworks/Carbfix)	• Permanent And Secure Geological Storage of CO_2 By In-Situ Carbon Mineralization (v1.0) • Carbon Dioxide Removal by Direct Air Capture (v2.0)
Other[c] (Drax-Stockholm Exergi)	• Methodology for measuring net carbon dioxide removal through bioenergy with carbon capture and storage (BECCS) (v0.9)

Throughout the methodology assessment process, project owners should carefully evaluate how the eligibility criteria of various methodologies align with the specific design of their project activity or activities and determine if the methodology is eligible to be used in the desired market. This involves reviewing the requirements of each methodology, including project type, project location, technological specifications, storage and transport requirements, and any other necessary conditions. For this study, some of the applicability criteria for each methodology are summarized in the tables below and Annex E of this paper.

The crediting period is the timeframe during which GHG emission reductions or removals from a project are eligible for recognition as carbon credits. Different carbon crediting mechanisms and methodologies may set varying lengths for these periods, depending on their specific requirements and goals. Understanding this period is essential for project developers, as it dictates when they can generate and monetize carbon reductions and removals based on their project's performance. An overview of the available crediting period options is summarized in Table 8.

c Among the various CCS methodologies, the Climeworks/Carbfix and Drax-Stockholm Exergi,methodologies have not been developed under a voluntary carbon crediting program. The Climeworks/Carbfix and Drax-Stockholm Exergi methodologies were validated by DNV, a global leader in quality assurance, by advising on the principles of methodology development and ensuring robustness and accuracy of the approach.

TABLE 8. The crediting period options

Standards/methodologies	Crediting period
Gold Standard - Methodology for Biomass Fermentation with Carbon Capture and Geologic Storage	40 years (no more than a maximum of five certification renewal cycles)
Gold Standard - Carbon Sequestration Through Accelerated Carbonation of Concrete Aggregate	15 years (5 years and renewable twice)
Verra	42 years (seven years, five times renewable)
Puro Earth - Geologically Stored Carbon Methodology	45 years (15 years and renewable twice)
American Carbon Registry	Unlimited (10 years and no limit for renewal)
Global Carbon Council	30 years or up to the end of technical life
Isometric	5 years (the maximum Crediting Period is 5 years, unless otherwise specified by the relevant Certified Protocol)
Climeworks/Carbfix	The lifespan of the facility
Drax-Stockholm	45 years (15 years and renewable twice)

Methodologies include specific criteria for geographical boundaries, requiring projects to be located within defined regions. Therefore, project developers should review these criteria in accordance with the selected methodology to ensure eligibility. An overview of the geographical applicability criteria for existing CCS methodologies is provided in Table 9.

TABLE 9. The Geographical boundary of the methodologies

Standards/methodologies	Project location
Gold Standard - Methodology for Biomass Fermentation with Carbon Capture and Geologic Storage	Worldwide
Gold Standard - Carbon Sequestration Through Accelerated Carbonation of Concrete Aggregate	Worldwide
Gold Standard - Engineered Carbon Dioxide Removal	Worldwide
Verra	Worldwide

Puro Earth - Geologically Stored Carbon Methodology	The methodology includes a list of jurisdictions that are considered to have a robust legal framework for the environmentally safe geological storage of carbon dioxide. However, if any other jurisdiction meets the criteria outlined in the methodology, it is also eligible.
American Carbon Registry	United States, U.S. Territories, Canada, or Mexico (Other locations will be included in subsequent updates)
Global Carbon Council	Worldwide
Isometric	US and EU
Climeworks/Carbfix	Worldwide
Drax-Stockholm	EU, EEA, US, UK

QUANTIFICATION APPROACHES FOR THE GHG EMISSION REDUCTIONS AND CO_2 REMOVALS UNDER VOLUNTARY CARBON MARKET

Each methodology defines quantification approaches for the GHG emission reductions and engineered carbon removals based on the project type. For instance, Figure 6 illustrates the project boundary according to the Verra methodology for carbon capture and storage. Depending on the project technology and design, the project proponent must adhere to the specified quantification methods. The baseline emission calculation method described in this methodology entails establishing a reference scenario that reflects the emissions that would occur in the absence of the project. Additionally, the methodology details procedures for quantifying the CO_2 that is captured and stored, as well as the project emissions and any potential leakage that may arise during the process. Generally, project proponents must quantify baseline emissions, project emissions and leakage emissions according to their project design and boundary.

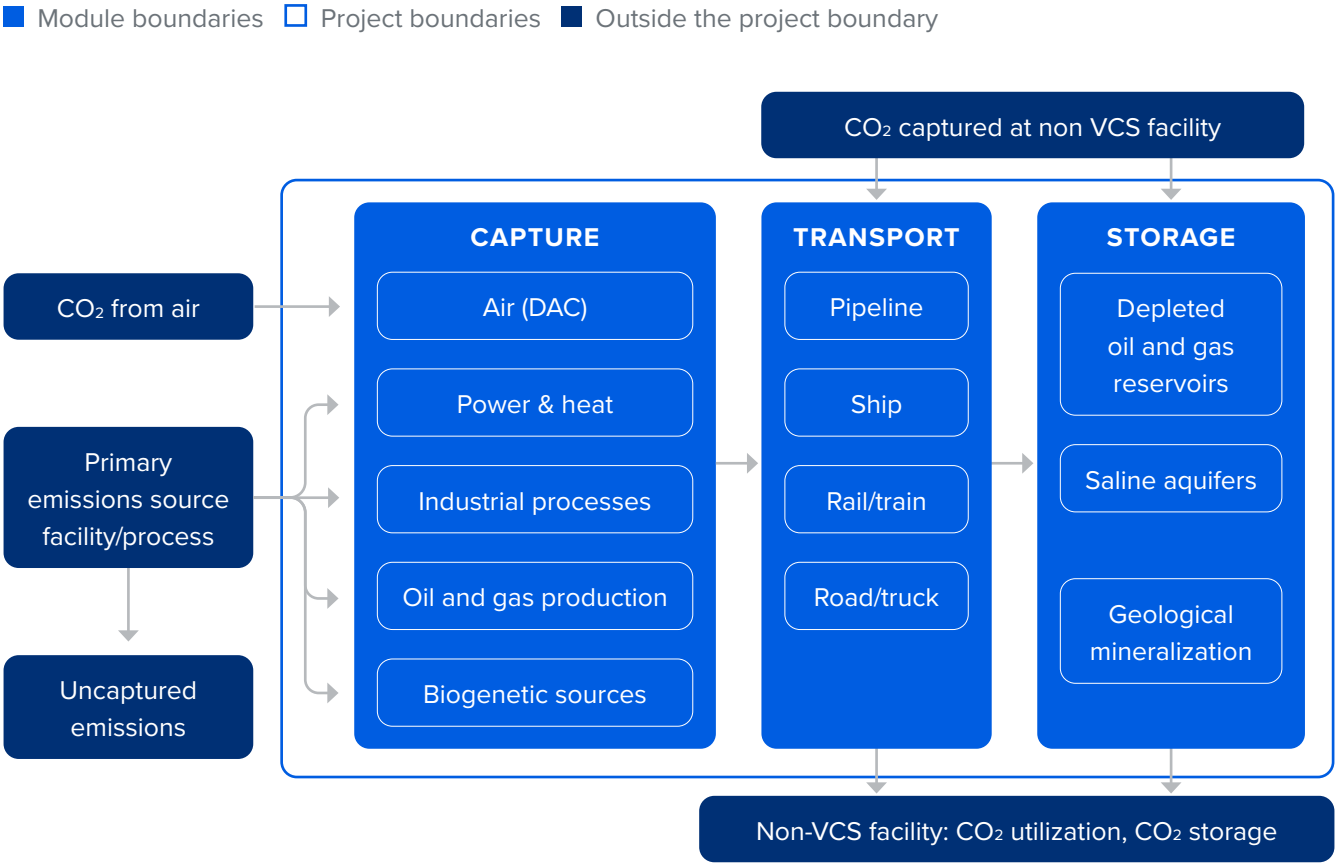
- **Baseline emissions** refer to the amount of CO_2 that would have been released into the atmosphere in the absence of a CCS/ECR project. This normally means that baseline emissions are considered equivalent to the total gross CO_2 that is injected.
- **Project emissions** refer to the GHG emissions generated directly by a CCS/ECR project during its implementation and operation.
- **Leakage emissions** encompass the GHG emissions associated with the project activity, including upstream and downstream emissions related to energy consumption, emissions from materials used in capture and construction, market leakage due to electricity displacement, and supply chain emissions.

All project emissions and leakage emissions must be deducted from the baseline emissions (the total amount of CO_2 injected) to determine the project's net mitigation outcomes in terms of carbon reductions and removals. However, the quantification must be conducted based on the selected methodology and standard. It is essential for ensuring that the assessment aligns with the specific requirements set forth by the selected carbon crediting framework. Different methodologies may have distinct approaches for calculating emissions, and adhering to these guidelines is crucial for maintaining accuracy and credibility in the results. By adhering to the relevant methodologies and standards, project developers can ensure their carbon reductions and removals are accurate, verifiable, and transparent.

Additionally, CCS/ECR projects have the potential to leverage existing infrastructure, such as shared CO_2 transport and storage systems, which enhances both efficiency and cost-effectiveness in the deployment of these technologies. However, it is crucial for project proponents to accurately allocate emissions associated with the project to ensure comprehensive environmental accountability and transparency.

Therefore, during the methodology assessment, this should be considered, and the selected methodology's criteria must be fulfilled. For instance, a tool[43] is developed under Verra to help project proponents effectively manage the allocation of emissions associated with CCS/ECR projects, as shown in Figure 6.

FIGURE 6. Project boundary illustration of Verra's methodology for carbon capture and storage[44]



ENSURE GENERATION OF HIGH-QUALITY CARBON CREDITS IN CCS PROJECTS

Identification of baseline scenario and demonstrating additionality

For a carbon capture and storage project, the baseline scenario represents the activities and associated greenhouse gas emissions that would occur if the CCS/ECR project were not implemented. Accurately defining the baseline scenario is crucial to ensure a reliable comparison between the GHG emissions that would have been released without a CCS project and the GHG reductions or removals achieved through its implementation. Therefore, project developers should follow the guidelines outlined in the selected methodology to establish a conservative baseline scenario that accurately reflects GHG reductions or removals, avoiding overestimation. The baseline scenario for removals through CCS projects for DACCS or BECCS retrofit do not need further consideration than the mass of CO_2 injected, however, a newly installed bioenergy source facility including CCS will need to account for the emissions that were not emitted in the scenario prior to the implementation

of the project activity, still the baseline emissions will be related to the injected CO_2 at the storage site, but the project and leakage emissions will need to be determined including the source facility within the project boundary.

In addition to defining the baseline scenario, it is essential to demonstrate the additionality of the project. Additionality ensures that the emission reductions or removals would not have occurred without the financial support provided by carbon credit revenues. Project developers must adhere to the rules and guidelines established by the selected crediting program and methodology to demonstrate additionality.

Monitoring and verification

Every carbon crediting methodology includes specific monitoring and reporting requirements that must be followed by project developers during the project's implementation phase. These guidelines ensure that all relevant data are collected, monitored, and reported consistently. Furthermore, carbon crediting programs maintain a list of accredited Validation and Verification Bodies that conduct comprehensive audits to verify the accuracy of the project's claims. Hence, project developers should follow all requirements according to the selected carbon crediting program's guidelines to ensure the integrity and accuracy of their emissions reductions and removals.

Addressing permanence and reversal risks

The GHG emission reductions or removals from a CCS/ECR project activity must be permanent, although the definition of the durability of permanence is still under debate. For geological storage, depending on the crediting programme, it ranges between 100 to 1000 years. If there is a risk of reversal, measures must be implemented to address those risks and compensate for any reversals. Crediting programmes may have different approaches to mitigate reversal risks. For instance, some methodologies require a buffer pool system that allows the cancellation of an equivalent quantity of removals in the event of a reversal. It is important for project developers to carefully assess the risk of reversal and select the most appropriate mitigation approach in accordance with the requirements of the chosen crediting program to ensure long-term integrity.

Ownership and transparency

CCS/ECR projects may involve cross-border cooperation, and due to their complexity and the participation of multiple stakeholders (e.g., capture site operators, storage site operators), it is essential to establish clear and transparent ownership of carbon credits. Ownership should be clearly disclosed in public documents, such as the Project Design Documents (PDD), allowing all stakeholders to understand the respective roles and responsibilities of the project proponents. Additionally, carbon crediting mechanisms establish principles to prevent double counting. Project developers must implement measures to avoid double counting, ensuring that the same emissions reductions or removals are not claimed by multiple entities or a country, in accordance with the varying requirements of the selected crediting program.

Need for harmonization in the carbon markets reporting and accounting rules

As has been described in Chapter 3, the GHG Protocol is the most commonly used standard when it comes to corporate emissions reporting, but it is not an accounting system. Baseline and monitoring methodologies can improve quantification and verification of emissions reduction or carbon dioxide removals. Standards are being set on the regulated market by the EU and UK, on a global scale through Article 6.4 and on the voluntary carbon market through the different carbon crediting programmes as highlighted in Table 7.

There are groups of carbon removal project developers who have signed a comment[45] with a call for a joint standard for CDR, no matter the project activity. These initiatives help to push standardization across sectors. This type of support is needed, specifically when CCS projects are crossing jurisdictional boundaries.

Review of approaches for CCS/ECR integration into compliance and voluntary carbon markets – Conclusions

1. Carbon markets deploy accounting methods to achieve a mitigation outcome: emission reduction or carbon dioxide removal.

2. Compliance approaches often apply a carbon tax and/or a cap-and-trade scheme to achieve emission reduction, up to the present removals are not integrated into all compliance markets.

3. The voluntary carbon market applies baseline and monitoring methodologies to quantify the mitigation outcome.

4. Baseline and monitoring methodologies comprise of the following requirements: applicability conditions, baseline scenario, additionality, quantification of project and leakage emissions and a monitoring plan. Considering removals:

    - Different crediting programs can have different methodologies and requirements for determining the concept of permanence, ranging between 100-1000 years for geological storage.

    - In many cases, the baseline scenario doesn't require contemplation beyond the mass of injected CO_2 in the storage complex.

    - Some methodologies assume ECR projects are automatically additional, as they only incur costs. However, regulatory surplus can change with implementation of new legislation and projects supported by public money should pass an investment analysis to prove additionality.

5. Some domestic market mechanisms, while voluntary, are eligible to surrender (part) of their credits towards the host country's compliance carbon market (often ETS).

6. The carbon markets show fragmentation in the number of CCS/ECR methodologies and carbon crediting programmes. Methodologies should be robust and have environmental integrity but should also be practical for the project developer. Harmonization in the MRV approach will benefit the project developer who needs to report emissions to the authorities and to the corporate, while in parallel quantify their achieved emission reductions or carbon dioxide removals.

05

General conclusion and considerations

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General conclusions and considerations

Emission reporting and carbon accounting for carbon capture and storage and engineered carbon removals has many facets as this report has identified.

Carbon accounting helps to quantify a climate positive mitigation outcome, either emissions reductions or carbon dioxide removal. Emissions and removals from CCS and ECR projects can be accounted for and reported to authorities (national inventory reporting), in response to a carbon tax and/or ETS , or as part of corporate sustainability reporting. In addition to this, accounting and reporting is further complicated by the fact that organisations may choose to report on their emissions at a company level or on a project level. There are many interplays between these levels, and this report has highlighted some of the existing challenges with carbon accounting for CCS and ECR projects. In order to support deployment of CCS and ECR projects, there is a need to further understand how accounting and reporting of these activities are impacted and interact across the various levels of reporting.

Interaction with stakeholders and industry bodies has highlighted that the rules for reporting emissions related to CCS and specifically removals were not well understood, validating the development of this study as a starting point for further efforts. Further discussion, updating of existing rules and guidance and creation of new rules and guidance could be considered by the IPCC TFI, the partnership between ISO and the GHG Protocol and the Carbon Measures International Chamber of Commerce hosted Technical Expert Panel on these identified challenges:

NATIONAL INVENTORY REPORTING (NIR)

- The common reporting table 1C considers a combination of emission reporting and quantification of total CO_2 stored. Carbon dioxide removals are not currently considered other than under LULUCF. Any removals achieved can be mentioned in a “memo” table, but are not reported.
    - NIR could be better aligned with the NDC target and removals should be properly accounted for.
    - Differentiation of reduction and removal would be beneficial, as CO_2 stored no matter the source is considered removed.
    - The quantification of removals (or emission reduction) is currently based on leakage within the CO_2 stream and does not consider the net amount removed/reduced, as the project emissions are (should be) represented in different tables, this is not clear from the reporting requirements.

CORPORATE SUSTAINABILITY REPORTING

- For corporate level reporting, the most commonly used guidance is the GHG Protocol.
- Earlier draft GHG Protocol guidance left significant interpretation gaps for ECR. Some of these have been addressed in the updated standard but challenges still remain. There remains a lack of guidance for CCS.
- The GHG Protocol principles are subject to interpretation. As it is a reporting framework, there may be accounting gaps for industry-specific application, especially when trying to reconcile corporate- and product-level accounting of removals or reductions. Accounting for emissions reductions and removals associated with CCS/ECR activities can benefit from the development of industry-specific guidelines on corporate level accounting.

CARBON MARKET MECHANISMS

- Harmonization of carbon accounting principles for CCS/ECR projects could support project development of CCS projects.
    - Project developers need to report emissions to the authorities and secure investment for the CCS/ECR activity. Different reporting and accounting principles increases complexity and confusion, create less transparency and make the results incomparable.
- CCS activities are increasingly recognized in either voluntary domestic or compliance carbon markets
    - Removals could be integrated into the compliance market-based mechanisms to incentivize and ultimately scale ECR activities.

COMBINING REPORTING AND ACCOUNTING APPROACHES

- Parallel reporting of emissions reductions and removals towards a company's voluntary inventory, the NIR and ETS does not itself lead to double counting of mitigation outcomes, provided that the same mitigation outcomes are not claimed toward multiple mitigation targets.
- A project that is registered with multiple crediting programmes can lead to double counting if appropriate guidance is not in place
    - An emission reduction project that is registered with an ETS, cannot register with a voluntary crediting programme to receive verified emission reductions to sell the same verified emissions reduction on the VCM. This would be categorised as double counting (e.g., an EU waste-to-energy plant cannot generate reduction carbon credits, but only removal carbon credits).
    - An ECR project registered with the VCM could have parts of the value chain under the ETS. Related emissions become surrendered allowances towards the ETS and are counted as project emissions in the VCM project and subtracted from the baseline emissions. This effectively leads to a situation of double credit issuance, which is allowed on the carbon markets.
- A company may report on performed emissions removals, but cannot use a removal credit toward a compliance obligation if:
    - The associated mitigation outcome has been transferred or claimed by another party (which may include governments); or
    - The mitigation outcome is being claimed by more than one Party to the Paris Agreement, otherwise it becomes double counting.

Ultimately, further collaboration and harmonisation of standards across national, corporate, project and product reporting layers and addressing of the gaps identified in this report will enable the CCS and ECR industry to accelerate in order to realise climate goals.

06 Annexes

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Annexes

Annex A: Proposed updates 2027 Methodology Report on Carbon Dioxide Removal Technologies, Carbon Capture, Utilization and Storage (supplement to the 2006 IPCC Guidelines)

VOLUME 1: GENERAL GUIDANCE AND REPORTING (UPDATE)

- Chapter 8 of the 2019 Refinement to the 2006 IPCC Guidelines – Reporting Guidance and Tables (Update)
    - Update in relation to categorization of new source/sink categories or recategorization of existing (e.g. 1.C). Update of all reporting tables, clarifying that the CO_2 emissions are adjusted by CO_2 capture (negative quantities) to derive net CO_2, explanations to reporting tables: fugitive emissions during international CO_2 transport; CO_2 from biomass fuels in international transport, CO_2 from CCU-products/e-fuels I international transport, CO_2 captured during international transport, CO_2 from biomass in IPCC sectors 1B & 2, 3A and 4, how to report carbon capture in all sectors, differentiating fossil/CCU; biomass & atmospheric origins.

VOLUME 2: ENERGY

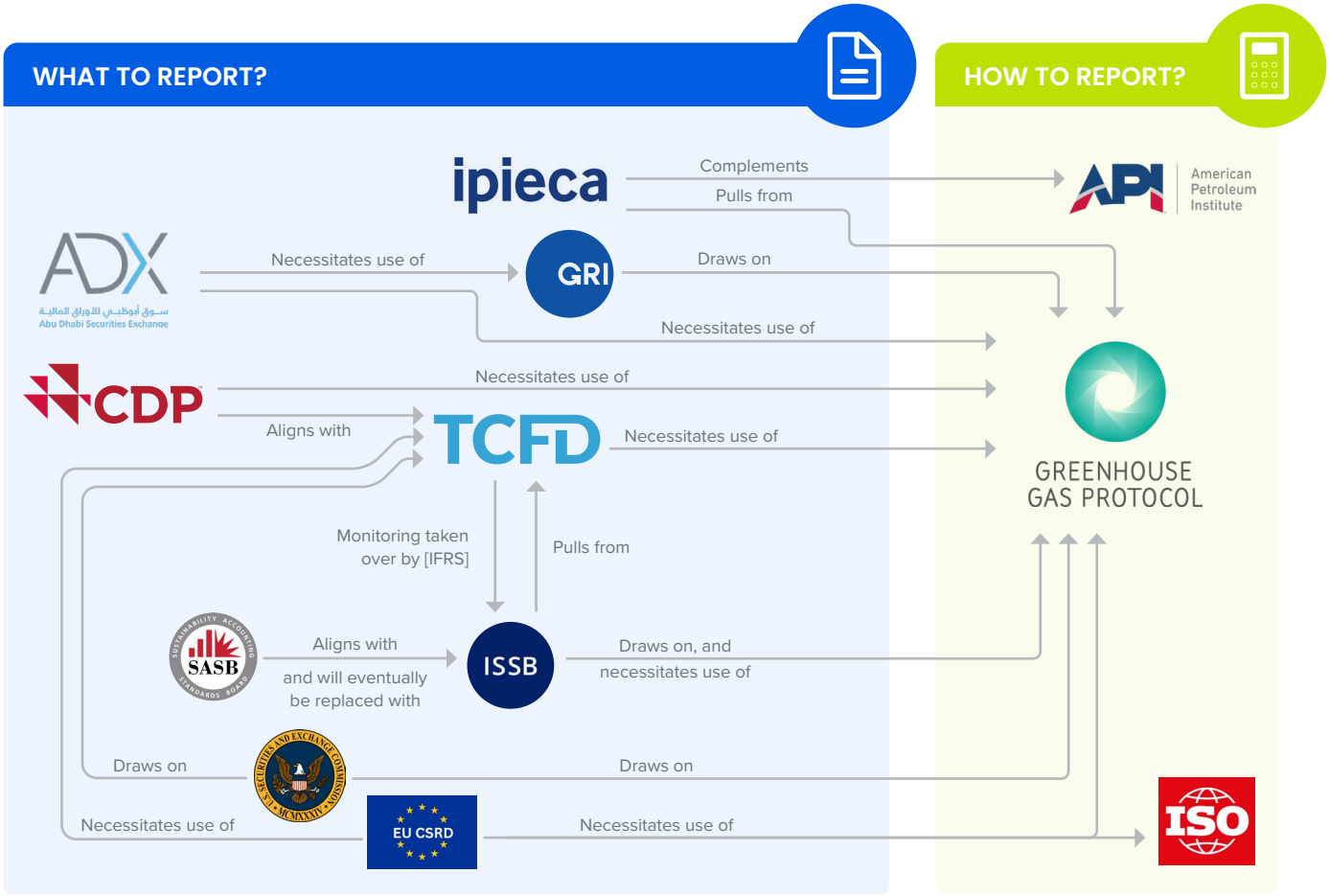
- Chapter 4 Volume 2 of the 2019 Refinement to the 2006 IPCC Guidelines – Fugitive Emissions
    - Clarification in relation to the emissions from transport, injection and sequestering of CO_2 in relation to enhanced oil, gas, and coal-bed methane recovery
    - Placeholder: Depending on the decisions made in relation to CCU, there might be a need for additional guidance in this chapter, e.g. in relation to new emission factors for the production of fuels based on captured CO_2

VOLUME 6 CARBON DIOXIDE CAPTURE, TRANSPORT, UTILIZATION AND STORAGE (NEW AND UPDATE)

- Chapter 1. Introduction (New)
    - The basic concepts and terms and definitions related to CCUS should be addressed inter alia: technology, removal, short- and long-term storage, “negative” emissions.
- Chapter 2. Carbon Dioxide Capture from process gases (Update)
- Chapter 3. Direct Air Capture (New)
- Chapter 4. Carbon Dioxide Utilization (New)
    - Possible ways of CO_2 utilization e.g. enforced carbonation of industrial and mining wastes, critical mineral extraction, mineralisation (surface), synthetic fuels.
    - Tracking of captured CO_2, national carbon dioxide balance matrix (sources of captured CO_2 vs. final use and short- and long-term storage).
- Chapter 5. Carbon Dioxide Transport (Update)
    - Update in relation to all sub-categories (CO_2 transport (ship/rail/pipeline/truck) and cross border transfers)
- Chapter 6. Carbon Dioxide Injection and Geological Storage (Update)
    - Update in relation to all sub-categories (injection, long term storage, other)
    - Mineralisation (subsurface)

Annex B: Relationships between different corporate accounting frameworks

Sources: ADX[1], CDP[46], TCFD[47], GHG Protocol[48,49], Watershed[50], IFRS[8], TechTarget[51], GRI[4], API[10], ISO[11], KPMG[52], Deloitte[53], PWC[54]



Note: In the figure, "draws on" indicates that the standard incorporates ideas from a secondary standard (e.g., uses the GHG Protocol concepts of Scope 1/2/3 emissions or consolidation approaches), while "pulls from" indicates that the standard directly incorporates guidance from a secondary standard.

Annex C: Cases

Note: In cases involving multiple parties, it is assumed that Company A has contractual agreements in place with all other parties relating to the allocation of emissions.

CASE 1 – FULL CHAIN MODEL

- Company A owns a fossil power plant.
- Company A builds, owns and operates a capture unit on the power plant that captures **100,000 tCO_2/year.** The operational emissions of the capture unit are **100 tCO_2/y**.
- Company A stores this CO_2 on site. The operational emissions of the storage site are **100 tCO_2/y**.

Following the GHG Protocol, here is how emissions and reductions should be reported in the year y:

	Emissions (Scopes 1 & 2)	Emissions (Scope 3)	Removals (Scope 1)	Removals (Scope 3)
Company A	200 tCO_2 (emissions from operating CCS) and -100,000 tCO_2 in total emissions compared to the previous year (net reduction of 99,800 tCO_2)		Storage of fossil CO_2 does not remove CO_2 from the atmosphere, but rather prevents its release to the atmosphere, therefore cannot be reported in removals	

☐ No gap identified ■ Challenges identified

In this case, no significant challenges are identified. A single company manages the entire CCS/ECR value chain, handling all related activities (Full-chain model). As a result, all emissions across the value chain should be reported by Company A , whereas emission reductions are reflected as changes in the company's actual emissions inventory over time relative to previous year.

CASE 2 - PART CHAIN MODEL (WITH BIOGENIC CO_2)

- Company A owns a biomass power plant.
- Company A builds, owns and operates a capture unit on the power plant that captures **100,000 t bioCO_2/year.** The operational emissions of the capture unit are **100 tCO_2/y** of fossil CO_2.
- Company A buys transport and storage services from a third-party provider, company B.
- Company B builds, owns and operates 2 ships which transport CO_2 to its storage site. The operational emissions of the 2 ships + the storage site are **900 tCO_2/y.**

Following the GHG Protocol, here is how emissions and removals should be reported in the year y:

	Emissions (Scopes 1 & 2)	Emissions (Scope 3)	Removals (Scope 1)	Removals (Scope 3)
Company A	100 tCO_2	900 tCO_2		100,000 tCO_2
Company B	900 tCO_2			

No gap identified Challenges identified

In this case, the CCS/ECR value chain is split between two companies, requiring emissions to be allocated accordingly.

In current CCS/ECR value chains, it is uncommon for one company to own both the pool and the sink.

Under the Land Sectors Removal Version 1.0, Scope 1 removals can only be claimed where contractual and MRV conditions are met; otherwise removals are Scope 3 or not reportable. Additional constraints apply including full life-cycle and land criteria.

CASE 3 – CARBON REMOVALS CREDITS

- Company A owns a biomass power plant.
- Company A builds, owns and operates a capture unit on the power plant that captures **100 000 t bioCO_2/year.** The operational emissions of the capture unit are **100 tCO_2/y** of fossil CO_2.
- → Company A buys transport and storage services from a third-party provider, company B.
- Company B builds, owns and operates 2 ships which transport CO_2 to its storage site. The operational emissions of the 2 ships + the storage site are **900 tCO_2/y** (fossil).
- Company C buys carbon removal credits corresponding to **50,000 t/y bioCO_2** from Company A.

	Emissions		**Physical removals** (independent of credit issued / retired)		**Removals adjusted for credit issued**		**Reported separately** (purchased credit)
	SCOPE 1 & 2	**SCOPE 3**	**SCOPE 1**	**SCOPE 3**	**SCOPE 1**	**SCOPE 3**	
Company A	100 tCO_2	900 tCO_2	NO SCOPE 1: A does not own both snk and pool	100,000 tCO_2 Full physical removal; Independent of credits sold	-	50,000 tCO_2 Physical (100,000) minus credits issued (50,000)	-
Company B	900 tCO_2	-	-	-	-	-	-
Company C	-	-	-	-	-	-	50,000 tCO_2 Purchased removal credits; reported outside of scopes

No gap identified Challenges identified

In this case, Company A shall report inventory removals within its organizational and operational boundaries while separately disclosing any carbon credits that are issued and transferred in order to prevent double claiming. Under the Land Sector and Removals Standard, companies separately report: (a) inventory emissions and removals within Scopes 1, 2, and 3, and (b) any carbon credits issued, transferred, or retired outside of the inventory boundary. Where removals are issued as carbon credits and transferred to another entity, the issuing company must disclose these volumes separately to prevent double claiming.

In this scenario, no company controls both the atmospheric sink and the geologic storage pool. Absent a contractual allocation granting exclusive reporting rights to one entity, Scope 1 removals cannot be claimed by either Company A or Company B. Instead, removals may be reported in Scope 3 by the entity able to attribute the stored CO_2 to its value chain, provided that monitoring, traceability, permanence, and anti–double counting requirements are met. Establishing these claims does however represent another challenge, as if the parties are unable to agree on reporting rights for Scope 1 removals, similar challenges may arise in establishing attribution of Scope 3 removals.

The purchasing company (Company C) reports the acquired carbon removal credits separately from its inventory and may not deduct them from its Scope 1, 2, or 3 emissions. This represents a practical challenge for entities that may wish to report Scope 1 removals as a contractual arrangement must be in place to enable this.

This treatment reflects the principle that removals and credits must be transparently accounted for without double counting. The framework does not exclude removals simply because they are credited; rather, it requires exclusive claims and clear disclosure of transferred volumes. Where multiple entities share elements of the removal pathway (e.g., sink and storage operated by different parties), contractual allocation of reporting rights is permitted under the Standard to enable Scope 1 reporting while maintaining accounting integrity.

CASE 4 – JOINT VENTURE

- Company A owns a biomass power plant.
- Company A builds, owns and operates a capture unit on the power plant that captures **100,000 tbioCO_2/year.** The operational emissions of the capture unit are **100 tCO_2/y** of fossil CO_2.
- Company A buys transport and storage services from a third-party provider, a joint venture between companies B and D, who own equal parts of the transport and storage components (50% of the T&S each).
- Company B operates 2 ships which transport CO_2 to a storage site operated by Company D. The operational emissions of the 2 ships are **800 tCO_2/y**. The operational emissions of the storage site are **100 tCO_2**.
- Company C buys carbon removal credits corresponding to **50,000t/y bioCO_2** from Company A.

	Emissions		**Physical removals** (independent of credit issued / retired)		**Removals adjusted for credit issued**		**Reported separately** (purchased credit)
	SCOPE 1 & 2	**SCOPE 3**	**SCOPE 1**	**SCOPE 3**	**SCOPE 1**	**SCOPE 3**	
Company A	100 tCO_2	900 tCO_2	NO SCOPE 1: A does not own both snk and pool	100,000 tCO_2 Full physical removal; Independent of credits sold	-	50,000 tCO_2 Physical (100,000) minus credits issued (50,000)	-
Company B	Operational control: 800 tCO_2 Equity share: 450 tCO_2	Equity share: 0 Operational control: 0 tCO_2	-	-	-	-	-
Company C	-	-	-	-	-	-	50,000 tCO_2 Purchased removal credits; outside scopes
Company D	Operational control: 100 tCO_2 Equity share: 450 tCO_2	Equity share: 0 Operational control: 0 tCO_2	-	-	-	-	-
Joint Venture	Operational control: 0 Equity share: 900 tCO_2	Operational control: 900 tCO_2 Equity share: 0	-	-	-	-	-

☐ No gap identified ■ Challenges identified

In this case, the CCS/ECR value chain is divided between two companies, one of which is a joint venture between two partners, requiring emissions to be allocated accordingly. The allocation of emissions within the JV will depend on the chosen consolidation approach:

- If the operational control approach is used, only the operator reports the emissions in its Scope 1&2 reporting.

- If the equity share approach is followed, both shareholders report emissions in proportion to their equity share in the JV. In this case, Company B has no operational control over the storage, as it is operated by Company D and when following the Equity share approach 50% (as it owns 50% of the JV) of the emissions are already accounted in its Scope 1&2 reporting and should then not be reported again as Scope 3.

- In this scenario, when using the equity share approach, emissions are reported twice: by the joint venture and by the entities that own it. This is not a gap in the GHG Protocol but a known feature of corporate accounting.

Similarly to the previous case, Company A shall report removal values adjusted for sold credits when accounting for progress toward a GHG target to avoid double use. Company C separately reports purchased credits outside of the scopes. Similarly to the cases above, no company can claim Scope 1 removals.

CASE 5 – LEASING

- Company A owns a biomass power plant.
- Company A builds, owns and operates a capture unit on the power plant that captures **100,000 tbioCO_2/year.** The operational emissions of the capture unit are **100 tCO_2/y** of fossil CO_2.
- Company A buys transport and storage services from a third-party provider, a joint venture between companies B and D, who own equally the transport and storage components (50% of the T&S each).
- Company B operates 2 ships, leased (operating lease) from Company E, which transport CO_2 to a storage site operated by Company D. The operational emissions of the 2 ships are **800 tCO_2/y**. The operational emissions of the storage site are **100 tCO_2**.
- Company C buys carbon removal credits corresponding to **50,000 t/y bioCO_2** from Company A.

	Emissions		**Physical removals** (independent of credit issued / retired)		**Removals adjusted for credit issued**		**Reported separately** (purchased credit)
	SCOPE 1 & 2	**SCOPE 3**	**SCOPE 1**	**SCOPE 3**	**SCOPE 1**	**SCOPE 3**	
Company A	100 tCO_2	900 tCO_2	NO SCOPE 1: A does not own both snk and pool	100,000 tCO_2 Full physical removal; Independent of credits sold	-	50,000 tCO_2 Physical (100,000) minus credits issued (50,000)	-
Company B	Operational control: 800 tCO_2 Equity share: 50 tCO_2	Operational control: 0 Equity share: 400 tCO_2	-	-	-	-	-
Company C	-	-	-	-	-	-	50,000 tCO_2 Purchased removal credits; outside scopes
Company D	Operational control: 100 tCO_2 Equity share: 50 tCO_2	Operational control: 0 Equity share: 400 tCO_2	-	-	-	-	-
Company E	Operational control: 0 Equity share: 800 tCO_2	-	-	-	-	-	-
Joint Venture	Operational control: 0 Equity share: 100tCO_2	Operational control: 900 tCO_2 Equity share: 800 tCO_2	-	-	-	-	-

☐ No gap identified ■ Challenges identified

In this case, the CCS/ECR value chain is divided between two companies, one of which is a joint venture between two partners. In addition, the JV is leasing an asset from a third party. As this is an operating lease it falls under Scope 3.

Similarly to the previous case, Company A shall report removal values adjusted for sold credits when accounting for progress toward a GHG target to avoid double use. Company C separately reports purchased credits outside of the scopes. Similarly to the cases above, no company can claim Scope 1 removals, unless stated otherwise in a contract.

A new challenge arises in this case; how emissions should be allocated between Company B, Company D, the JV and Company E. Like in the previous scenario, when using the equity share approach, emissions are reported twice: by the joint venture and by the entities that own it. This duplication is not problematic in voluntary corporate public reporting, as the intention is not to sum up the emissions from different reporting entities.

Under the Land Sector Removals Standard, this complexity should be addressed by the parties:

1. picking a consolidation approach
2. applying it consistently
3. disclosing it appropriately.

Emissions may appear in multiple corporate inventories and that is acceptable under the GHG Protocol.

CASE 6 – LICENSING STORAGE

- Company A owns a fossil power plant.
- Company A builds, owns and operates a capture unit on the power plant that captures **100,000 tCO_2/year.** The operational emissions of the capture unit are **100 tCO_2/y**.
- → Company A buys transport and storage services from a third-party provider, Company B.
- Company B builds, owns and operates 2 ships which transport CO_2 to a storage site. The operational emissions of the 2 ships + the storage site is **900 tCO_2/y**.
- Company B has a license to store CO_2 on the site owned by Company I.

Following the GHG Protocol, here is how emissions and reductions should be reported in the year y:

	Emissions (Scopes 1 & 2)	Emissions (Scope 3)	Removals (Scope 1)	Removals (Scope 3)	Reported separately
Company A	+100 tCO_2 and -100,000 tCO_2 in total emissions compared to the previous year (net reduction of 99,900 tCO_2	900 tCO_2			
Company B	900 tCO_2				
Company I					

☐ No gap identified ■ Challenges identified

In this case, the storage site is not owned by the company storing CO_2, however, the operator of a geological storage reservoir is the entity that holds a well permit or license, therefore emissions associated with storage should be reported by Company B. Under the Land Sector and Removals Standard, CCS emissions and removals are attributed to the operator or consolidating entity, not a passive landowner.

CASE 7 – EXTENDED VALUE CHAIN

- Company G sells gas to Company A.
- Company A owns a fossil-fueled power plant.
- Company A owns and operates a capture unit on the power plant that captures **100,000 tCO_2/year** (fossil). The operational emissions of the capture unit are **100 tCO_2/y** of fossil CO_2.
- Company A buys transport and storage services from a third-party provider, Company B
- Company B owns and operates the transport and storage components. The operational emissions of transport and storage are **900 tCO_2/y**.
- Company H buys low-carbon power from Company A.

	Emissions (Scopes 1 & 2)	Emissions (Scope 3)	Removals (Scope 1)	Removals (Scope 3)	Reported separately
Company A	100 tCO_2 and 100,000 tCO_2 less in total emissions compared to the previous year	900 tCO_2			
Company B	900 tCO_2				
Company G	Emissions from gas production	Emissions from burnt gas sold to Company A minus 99,900 tCO_2 captured			
Company H	Emissions from electricity purchased (if zero-carbon electricity then zero emissions)	Energy-related emissions not included in Scope 1 or Scope 2 (i.e. transmission and distribution losses)			

☐ No gap identified ■ Challenges identified

GHG Protocol asks to reflect Scope 3 reductions, where GHG reductions are determined by comparing changes in the company's Scope 3 emissions from the Scope 3 categories over time relative to a base year, therefore, 100,000 tCO_2 captured by Company A should be reflected as a reduction of Scope 3 emissions of Company G. Inventory accounting remains scope-based; there is no dedicated mechanism for upstream suppliers to claim simple Scope 3 reductions from downstream CCS. LSR instead provides intervention accounting for describing these effects which presents a practical challenge for entities seeking to claim Scope 3 reductions.

Similarly, there is currently no guidance or scope for Company B to claim a Scope 3 reduction for the storage of CO_2 for its client (Company A)

CASE 8 – CARBON CREDIT OWNERSHIP AND LOW-CARBON ELECTRICITY CLAIMS

- Company A owns a biomass power plant.
- Company A builds, owns and operates a capture unit on the power plant that captures **100,000 t bioCO₂/year** (biomass). The operational emissions of the capture unit are **100 tCO₂/y** of fossil CO₂.
- Company A buys transport and storage services from a third-party provider, Company B
- Company B owns and operates the transport and storage components. The operational emissions of transport and storage are **900 tCO₂/y**.
- Company C buys carbon removal credits corresponding to **100,000 t/y bioCO₂** from Company A.
- Company H buys power from Company A. Company H has been notified by Company A that the removals were sold on VCM.

	Emissions		**Physical removals** (independent of credit issued / retired)		**Removals adjusted for credit issued**		**Reported separately** (purchased credit)
	SCOPE 1 & 2	**SCOPE 3**	**SCOPE 1**	**SCOPE 3**	**SCOPE 1**	**SCOPE 3**	
Company A	100 tCO₂	900 tCO₂	NO SCOPE 1: A does not own both snk and pool	100,000 tCO₂ Full physical removal; maintained independently of full credit sale	-	0 tCO₂ Physical (100,000) minus all credits issued (100,000) = 0; reflected in target-trackinng only	-
Company B	900 tCO₂	-	-	-	-	-	-
Company C	-	-	-	-	-	-	100,000 tCO₂ All purchased removal credits; outside scopes
Company H	0	Energy-related T&D losses (not in scope 1 or 2)	-	-	-	-	-

No gap identified Challenges identified

Since Company C is purchasing carbon removal credits from Company A and assumes ownership of those credits, Company A should not claim that it sells low-carbon electricity or charge a premium from Company H. This scenario does not create any new gap because the electricity purchased by Company H is already low-carbon, as it comes from biomass.

Under the Land Sector and Removals Standard and its credit rules, if A sells all removals as credits, it cannot also use those removals in net-zero targets or market its electricity as carrying the same removal benefit. H's electricity is low-emissions because of biomass, but BECCS-related removals are attributed to the credit buyer.

Annex D: Typical certification cycle according to established crediting standards

1. ACTIVITY DESIGN

Timeline dependent on project proponent

Select an appropriate methodology for the proposed project. This can be an existing or new methodology. If an appropriate one doesn't exist, project developers can propose their own (subject to further review)

Development of project design document and preparation of supporting documents. The project developers prepare the documents required by the standard and supporting evidence that justify assumptions and applications of the methodology to the proposed activity (e.g. to demonstrate additionally)

2. VALIDATION

Project validation. This process determines whether a project meets all the rules and requirements. The project must have completed the project design document, validation report and supporting documents.

Independent third-party assessment and document review. Independent assessment is conducted by an accredited validation and verification body (VVB). This consist of a desk review and field visit to confirm that the project is in line with the requirements. The project developer is responsible for hiring the third-party verifier from the list of approved VVBs.

3. REGISTRATION

Project registration. Once all documents have been reviewed and any clarification and resolutions addressed, the project will be registered and listed on the registry.

4. MONITORING

Temporal, subject to data quality/availability

Project monitoring to measure GHG emission reductions or removals. Monitoring takes place according to the selected methodology and monitoring plan as per the chosen standard. Projects must continue to engage with stakeholders and complete the monitoring report in order to be certified

5. VERIFICATION

3–6 months

Third-party verification. Independent assessment is conducted by an accredited validation and verification body. A desk review and field visit are conducted to provide independent confirmation that the project is in line with the requirements of the respective standard.

6. ISSUANCE

Issuance of credits. Once the project has been verified by the independent third-party and the verification request has been approved, the project developer is allowed to submit an issuance request to have the project listed on the registry and receive subsequent credits. Details of credit issuance is listed on the registry.

Annex E: Some applicability criteria for various methodologies/protocols

APPLICABILITY CRITERIA FOR CO_2 SOURCES

Standards/methodologies	Eligible CO_2 source facilities
Gold Standard- Methodology for Biomass Fermentation with Carbon Capture and Geologic Storage	Fermentation process (only renewable biomass)
Gold Standard-Carbon Sequestration Through Accelerated Carbonation of Concrete Aggregate	The source of CO_2 used shall be direct air capture (DAC) or biogenic origin
Gold Standard-Engineered Carbon Dioxide Removal[a]	Direct air capture (DAC), Direct ocean capture (DOC), CO_2 capture in biomass, CO_2 capture from the industrial processing of biomass (e.g.: Combustion (bioenergy), Anaerobic digestion, Fermentation, Gasification, Pyrolysis)
Verra-Methodology for Carbon Capture and Storage	Capture at various types of source facilities (power plants, biogas, bioethanol, waste to energy projects and industrial plants) and capture of atmospheric CO_2 (DAC)
Verra-CO_2 Utilization in Concrete Production	CO_2 only from sources where the CO_2 would have otherwise been emitted to the atmosphere (Industrial processes that produce CO_2 as a byproduct such as ammonia, hydrogen and ethanol production) and CO_2 from direct air capture.
Puro Earth-Geologically Stored Carbon Methodology	Biogenic sources (the biomass must be sustainable) and DAC.
Puro Earth -Carbonated Materials	Biogenic sources or from direct air capture
American Carbon Registry	Eligible CO_2 source facilities include industrial processes, DAC and emissions from sustainable biomass sources (ethanol production)
Global Carbon Council	Eligible CO_2 source facilities include industrial process and fossil fuel- or biomass-fired electric generating facilities or WE facilities), and DAC facilities
Isometric	Sustainable sourced biomass utilization activities (utilize animal waste, biosolids, agricultural or forestry residues and/or convert the biomass to bio-oil via pyrolysis or similar processes or utilize bio-oil produced by a third-party supplier utilize), DAC facilities
Climeworks/Carbfix	Capture at various types of source facilities (fossil-based CO_2 as well as point sources of biogenic and capture of atmospheric CO_2 (DAC))
Drax-Stockholm	Power plants fired with solid biomass sourced from managed forests or biomass residues from wood processing

a The list of eligible activity types may be revised or expanded in future versions, depending on the latest scientific insights, as it has not yet been approved.

APPLICABILITY CRITERIA FOR STORAGE METHODS

Standards/methodologies	Eligible storage activities
Gold Standard- Methodology for Biomass Fermentation with Carbon Capture and Geologic Storage	Geologic storage complex
Gold Standard- Carbon Sequestration Through Accelerated Carbonation of Concrete Aggregate	Concrete aggregate (carbonation of CO_2)
Gold Standard-Engineered Carbon Dioxide Removal	Geological storage, where CO_2 is either pressurized and injected as a liquid or supercritical fluid, dissolved in a solution to facilitate mineralization, converted from biomass into bio-oil for injection, or injected as carbon-rich slurries into geological reservoirs. Additionally, carbon can be utilized as a feedstock to produce durable products and materials with a lifespan of over 200 years, including stable carbonate minerals, biochar, and biopolymers.
Verra-Methodology for Carbon Capture and Storage	Geological carbon sequestration (saline aquifers and depleted oil and gas fields), mineralization on rocks as well as long-term storage in products (construction material)
Verra-CO_2 Utilization in Concrete Production	Concrete (mineralization of CO_2)
Puro Earth -Geologically Stored Carbon Methodology	Geological carbon sequestration (such as deep saline aquifers, salt caverns, depleted hydrocarbon reservoirs or into subsurface igneous (ultramafic, mafic, intermediate, or silicic) rock formations suitable for rapid mineralization.
Puro Earth -Carbonated Materials	Building materials (carbonation of CO_2)
American Carbon Registry	Saline formations and depleted or producing oil and gas onshore or offshore reservoirs (including enhanced oil recovery
Global Carbon Council	Geological carbon sequestration (a saline aquifer or a depleted, non-producing oil and/or gas reservoir(s)
Isometric	Natural or engineered subsurface features and geologic formations (reservoirs, saline aquifers, caverns or mines), CO_2 storage into saline aquifers, mafic or ultramafic formations (such as basalts or ophiolites) and via ex-situ mineralization with mine tailings
Climeworks/Carbfix	Geological storage reservoir and basaltic rock (mineralization of CO_2)
Drax-Stockholm	Geologic carbon sequestration (into deep rock formation but active or depleted oil and gas reservoirs are not applicable)

APPLICABILITY CRITERIA FOR TRANSPORT METHODS

Standards/methodologies	Eligible transport activities
Gold Standard- Methodology for Biomass Fermentation with Carbon Capture and Geologic Storage	Pipeline, rail or truck
Gold Standard- Carbon Sequestration Through Accelerated Carbonation of Concrete Aggregate	Truck
Gold Standard-Engineered Carbon Dioxide Removal	Road vehicles, rail, ships and/or pipelines
Verra-Methodology for Carbon Capture and Storage	Pipeline, ship, rail and truck
Verra-CO_2 Utilization in Concrete Production	Pipeline, rail, truck, ship
Puro Earth -Geologically Stored Carbon Methodology	Pipeline, ship, rail, road
Puro Earth -Carbonated Materials	N/A
American Carbon Registry -	Pipeline, ship, rail, road
Global Carbon Council	Pipeline, ship, rail, road
Isometric	Trucks, rail, ships, pipeline and aircraft
Climeworks/Carbfix	Pipeline or any other transportation mode
Drax-Stockholm	Pipeline, ship, rail and road

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