Introduction

The CO_2 Storage Resource Catalogue (CSRC) has been commissioned by the Oil and Gas Climate Initiative (OGCI) and is led by the Global CCS Institute (GCCSI). Halliburton (Cycles 4, 5, 6) and Storegga (previously known as Pale Blue Dot Energy; Cycles 0-3) have carried out technical assessment, database population, and reporting and are supported by the GCCSI.

The CO_2 Storage Resource Catalogue (CSRC) aims to build a global view of the commercial readiness of CO_2 storage resources in key markets and has four main objectives:

- Support the deployment of CCS as a sustainable CO_2 abatement technology.
- Build confidence in CO_2 storage resources to support the deployment of CCS.
- Provide a visible platform for global storage potential.
- Establish the CO_2 Storage Resources Management System (SRMS) as a robust reporting mechanism for CO_2 storage.

The CSRC aims to accelerate the development of global commercial-scale CCS projects and enhance investor confidence. By providing a transparent and global perspective on CO_2 storage resource potential and commercial maturity, the CSRC facilitates informed business decision-making. With six cycles covering every country worldwide, the CSRC is a pivotal tool for operators, investors, governments, and the public to build confidence in project safety, corporate and State climate goals, and project investments.

This paper describes the history and rationale behind the CSRC, outlines the SRMS assessment approach, provides an overview of global discovered and undiscovered resources to date within the current cycle, and demonstrates the tangible impact of the CSRC in guiding business decisions and driving resources towards commercial viability. As the international community grapples with the urgency of climate action, the CSRC is a valuable tool for informing stakeholders, fostering transparency, and deploying sustainable and effective CCS solutions – one of the most pressing challenges of our time.

Method: Building the CO_2 Storage Resource Catalogue (CSRC)

The CSRC has been developed over six annual cycles. This paper summarises the project's status in 2025 when all final countries are undergoing assessment. (Figure 1).

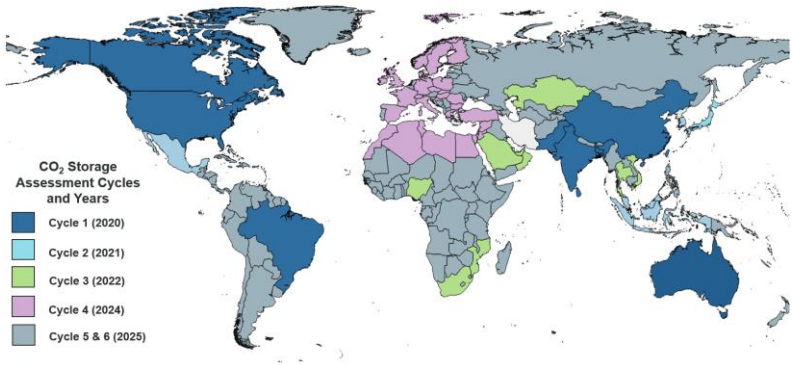

Figure 1 Geographic Coverage of the CO2 Storage Resource Catalogue in July 2025

Workflow

The assessment team collates a bibliography of publicly available information sources and evaluations. After reviewing the evaluation documents, the team applies the SRMS system and assigns storage resources to their appropriate maturity class. The CSRC database is populated with critical data from the evaluation, including the assessment notes, to support and clarify assessment decisions. After review, the data is publicly available on the OGCI website at https://www.ogci.com/ccus/co2-storage-catalogue.

Data Sources

All sources must be in the public domain. The bibliography for each cycle typically contains a wide range of information sources, from regional-scale, national and multinational CO_2 storage resource assessments to more detailed evaluations, often targeting a basin, sub-basin, or formation, and finally down to focused technical studies of a field or site. The availability of published evaluations strongly influences the ability to assess a site's storage resources. The assessment includes no new technical work and solely evaluates the published storage resources. The prime role of the CSRC is to classify the resource against the SRMS based on information in the published assessment.

Note that CO_2 storage resources uploaded to the Catalogue do not reflect the opinion of the OGCI, as the Catalogue is a compilation of publications duly referenced in the Catalogue.

Scope of the CSRC

Exclusion of CO_2 Enhanced Oil Recovery (CO_2-EOR) – The CSRC and SRMS include CO_2 storage in saline formations and current or future depleted oil and gas fields but currently exclude CO_2-EOR and other storage options such as unmineable coal, mineralisation, and organic-rich shales.

Minimum Threshold Resource of 10 million tonnes (Mt) – The CSRC aims to support large-scale commercial project development. To support this, a 'minimum threshold' of 10 Mt for a resource should be included in the Catalogue. This is flexible in its application. For example, the site is included when a pilot or demonstration project has successfully injected and stored CO_2 and has the potential for continued or additional injection. The Global CCS Institute also maintains a list of pilot projects (past, current, and planned), which provides the most up-to-date information on each project [2].

The CO_2 Storage Resource Management System (SRMS)

The SRMS intends to support the CCS industry similarly to the Petroleum Resource Management System (PRMS) for the oil and gas industry. The SRMS aims to:

- Enable nations to map the progression of storage resource maturity in a key evolving industry.
- Create consistency in resource terminology to improve communication of critical issues between practitioners, financiers, regulators, and policymakers.
- Improve confidence regarding resource assessments with potential CCS customers unfamiliar with subsurface issues but need to make significant business decisions.

The SRMS was published in 2017 [1] and is applied in all CSRC assessments. Work to create the CO_2 Storage Resource Catalogue initiated in 2017 with Cycle 0 [3], which tested and provided critique on the assessment of CO_2 storage sites using the SRMS. A classification flowchart (Figure 2) was developed from the SRMS by Storegga (then Pale Blue Dot Energy) to enable clear and consistent classification of storage resources.

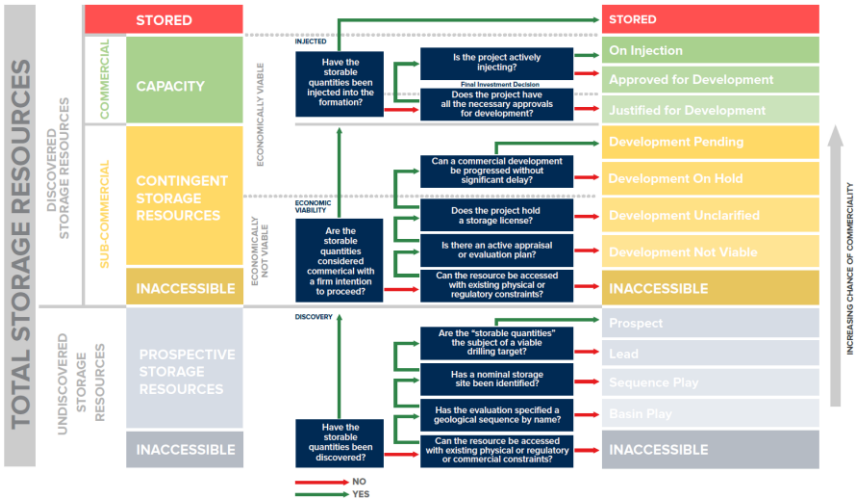

Figure 2 Flowchart for the classification of storage resources based on the SRMS guidelines and terminology

Note that the SRMS does not separate the 'Play' classification into 'Sequence' and 'Basin', but this was recommended during Cycle 0 to distinguish sites in the Catalogue with a lower level of maturity within the Play classification.

SRMS is a project-based classification system. The SRMS guidelines state, "To assign resources of any class, a development plan consisting of one or more projects needs to be defined." To gain 'project' status, a level of development plan, conceptual or derived from modelling, must be available or implied, along with a stated mass of CO2, an associated development plan that includes the number of wells required to inject that mass of CO2, and any associated water or brine extraction and disposal. This means that both Undiscovered and Discovered resources may be defined in association with notional projects. The development plan, which may be based on appropriate analogues for Prospective resources, is expected to mature as the project progresses through the SRMS. However, the reality is that many resources lack a published development plan due to a lack of data available in the source bibliography or due to the limitations of the evaluations. To aid in identifying resource sites with a published development plan, each database entry records whether the site was recognised as a 'Project' or not.

Summary of Global CO_2 Storage Resources

Commercial projects, including those where CO_2 injection is already occurring or approved for development, contribute just 3.1 Gt to the overall storage resource inventory—representing less than 0.024% of the total. In contrast, the aggregated global resource estimate reported at the commencement of Cycles 5 and 6 in the CSRC exceeds 14,000 Gt. This is an encouraging indicator of the vast storage potential required for CCS to play a critical role in achieving global net zero by 2050. However, global storage resources remain overwhelmingly dominated by the Undiscovered and Sub-Commercial SRMS classes.

Saline formations dominate the resource inventory because they are generally orders of magnitude volumetrically larger than depleted oil and gas fields. The large volumes are further expanded when saline formations are included in national and regional scale studies. However, the resource estimates for the saline formations rely primarily on volumetric calculation and, as such, should be flagged as carrying low confidence in the estimates. Saline formations are commonly classified as Undiscovered – Inaccessible because of (1) inadequate data to confer discovered status and (2) lack of a regulatory framework for CO_2 storage in most countries, meaning that this vital resource is not commercially accessible in most countries. Oil and gas fields only contribute 4% (575 Gt, 3%) of the aggregated storage resource in the CSRC. Most of this resource is classed as Discovered: Inaccessible due to (1)

lack of information about when the site could become available for storage and (2) lack of a regulatory framework for CO_2 storage in most countries.

121 Gt of the aggregated global resource is within the 100 sites in the CSRC that are considered to merit project status (For SRMS classification, a project is defined as a potential resource for which some level of storage development plan is attached; see Section 3.4 for further details). A historical lack of policy to actively drive investment and make CCS commercially accessible (e.g., by developing regulations for CO_2 storage) has been a barrier to project development and progression.

Ideas for CCS Stakeholders to Aid Resource Progression

Supporting countries in developing CCS-specific regulatory and legal frameworks is vital to advancing the global CCS industry. Offering a regulatory toolkit, providing examples, and highlighting best practices can help move a country's CCS resources from 'Inaccessible' to 'Prospective Storage Resources,' a critical step in building a robust CCS sector.

Additionally, encouraging the publication of storage evaluations is essential. A thorough review of existing journals can identify gaps, potentially leading to new publications that address those gaps. This effort is crucial for ensuring that resources of any maturity class are added to the CSRC database and updated over time.

The continued development of the SRMS also plays a key role. By establishing practical resource evaluation standards and offering clear guidance on technical issues like the definition of discovery and the treatment of CO_2 injection into pore spaces initially occupied by natural CO_2, the SRMS will evolve to meet industry needs. Furthermore, using the SRMS for resource bookings and publishing supporting information will provide transparency and credibility. Projects that follow the SRMS guidelines can advance through the necessary commercial milestones, fostering a more structured and reliable pathway to success in CCS development.

References

[1] Society of Petroleum Engineers (SPE). CO2 Storage Resources Management System. SPE; 2017.

[2] Global CCS Institute. CO2RE Database. 2022. Available at: https://CO2re.co/. Accessed February 2024.

[3] Pale Blue Dot Energy. A Preliminary Storage Resource Classification: D01 Report. 2017.

[4] National Energy Technology Laboratory (NETL). Carbon Storage Atlas V. US Department of Energy; 2015.