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## EUROPE'S INDUSTRIAL CARBON MANAGEMENT: FROM POLICY FRAMEWORKS TO INFRASTRUCTURE AND DEPLOYMENT



Online



**EuroGeoSurveys, the Geological Surveys of Europe \***



# Beyond Mapping: Turning Europe's CO<sub>2</sub> Storage Knowledge into Climate Action

Europe's ambition to achieve climate neutrality relies not only on reducing emissions, but also on managing the carbon dioxide that cannot be avoided. This means that developing a credible pipeline of CO<sub>2</sub> storage projects is essential.

Geological CO<sub>2</sub> storage is a necessary component of Europe's decarbonization strategy. From a (geo)scientific and technical perspective, research and operational experience demonstrate that CO<sub>2</sub> can be injected and retained securely in geological formations over very long timescales. The core scientific question—*can CO<sub>2</sub> be stored securely underground?*—has been convincingly answered.

Long term security of CO<sub>2</sub> storage is assured through management, monitoring, reporting, and verification processes in line with the

European CO<sub>2</sub> Storage Directive; including thorough site characterisation; assessment and management of risks; and well integrity standards.

The challenge Europe now faces is of a different nature. As large-scale deployment must accelerate to meet industrial and climate targets, the key bottleneck is the availability of **trusted and comparable geoscientific data** that supports decisions by policymakers, regulators, and investors. Scaling CO<sub>2</sub> storage from individual projects to a pan-European system requires a shared understanding of where geological opportunities for secure storage exist, how mature they are, and how projects can be developed responsibly and efficiently.

In this context, the pan-European CO<sub>2</sub> Storage Atlas, developed by EuroGeoSurveys in the Geological Service for Europe (GSEU) project and available through the European

Geological Data Infrastructure (EGDI), represents an important step, providing a standardized and harmonized overview of potential storage resources across Europe. Underground CO<sub>2</sub> storage assets can be viewed within a consistent European framework, bringing together the latest data from national assessments and building on predecessors of the atlas (e.g. CO<sub>2</sub>Stop). Alongside underground CO<sub>2</sub> storage potential, EDGI brings the additional value of a harmonized overview of multiple uses including hydrogen storage potential, and resources such as groundwater and critical minerals, supporting holistic strategies for use of the subsurface to achieve Europe's sustainability goals.

The current Storage Atlas is not an end point. Its real value lies in how it will evolve through the efficient addition of new data to de-risk storage prospects and functionalities to support investor decisions. To support Europe's Industrial Carbon Management Strategy, the CO<sub>2</sub> Storage Atlas must become **a living infrastructure, and one of the pillars of the future permanent Geological Service for Europe**, capable of translating geological knowledge into operational and policy-relevant insights.

One direction of value propagation lies in alignment of the Storage Atlas with emerging data transparency requirements under the Net-Zero Industry Act (NZIA). The NZIA introduces a new policy environment in which industrial planning, permitting, and investment decisions increasingly depend on clear visibility of infrastructure capacity, timelines, and constraints. Storage resources identified in the Atlas will need to be connected to future data releases and regulatory processes foreseen under NZIA. Static information products are unsuitable for this task. What is required is a flexible data platform that can be easily updated with new data and integrated

into broader industrial and policy workflows. The Storage Atlas and EGDI will serve as a gateway—linking subsurface knowledge to Europe's emerging governance framework for carbon management.

A second, and equally important, direction concerns the extension of the Atlas beyond capacity mapping towards **decision support for investability**. Geological storage capacity, while essential, does not automatically translate into viable storage projects. Investors and policymakers must assess a wider set of parameters: remaining uncertainties, financial opportunities, risk mitigation options, regulatory readiness, and the likely trajectory from exploration to operation. Without this additional layer of information, large volumes of theoretical capacity remain disconnected from real-world deployment. The Atlas provides insights into technical readiness of storage opportunities using an established Storage Readiness Level system (Akhurst et al., 2021) to communicate what is needed to move from opportunity to operation. The pace and scale required for CO<sub>2</sub> storage deployment demand tools that help distinguish between long-term potential and near-term opportunities, enabling resources to be prioritized effectively.

Regulatory alignment and investability assessment share a common requirement: **long-term governance of information**. CO<sub>2</sub> storage is, by nature, a multi-decadal undertaking. Storage sites are characterized over years, developed gradually, operated for decades, and monitored well beyond closure. Each project brings new learnings. Without responsibility for maintaining and governing subsurface geoscientific data, even the most sophisticated tools will lose relevance.

This is why a long-term institutional perspective is indispensable. A Geological

Service for Europe (GSE) has been proposed to ensure continuity, transparency, and trust in the management of Europe's geological knowledge. By providing a stable framework for data curation, harmonization, and access, such a public service would allow products like the Storage Atlas to remain up-to-date and authoritative over time. And it would anchor subsurface information within a public-service mandate, ensuring that strategic decisions are supported by robust and openly accessible evidence.

Europe already possesses the geoscientific expertise and geological potential needed for large-scale CO<sub>2</sub> storage. The next phase depends on converting that knowledge to support durable decision-making. Moving beyond mapping is therefore not a technical refinement, but a strategic necessity. If Europe succeeds in this transition to a net zero future, the Storage Atlas will not simply document the subsurface, it will actively shape Europe's pathway to climate neutrality.

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**Pan-European Atlas of Sustainable Geo-Energy Capacities – CO<sub>2</sub> Storage**



**Storage Readiness Level (SRL) of geological traps**

- SRL1-First-pass assessment of storage capacity at country-wide or basin scales
- SRL2-Site identified as theoretical capacity
- SRL3-Screening study to identify an individual storage site & an initial storage project concept
- SRL4-Storage site validated by desktop studies & storage project concept updated
- SRL5-Storage site validated by detailed analyses, then in a relevant 'real world' setting
- SRL6-Storage site integrated into a feasible CCS project concept or in a portfolio of sites (contingent storage resource)
- SRL7-Storage site is permit ready or permitted
- SRL8-Commissioning of the storage site and test injection in an operational environment
- SRL9-Storage site on injection

