Progress updates: Storage projects and providers

CETP CO_2RR – Deliverable 3.3

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Introduction

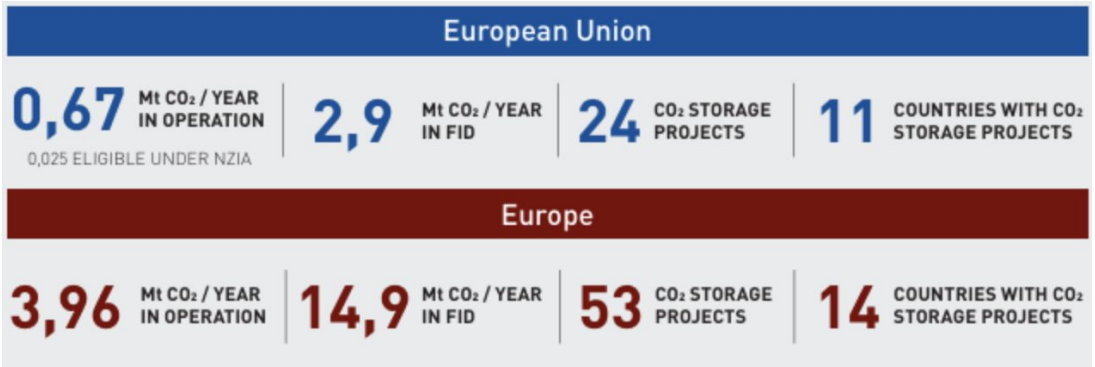
Context

CO_2 storage is a foundational infrastructure for Europe's climate strategy. While long-term capacity is abundant, near-term storage access, project timing and regulatory alignment are critical to enabling rapid CCS and CDR scale-up.

This document provides a status update on CO_2 capture projects and storage providers outlining the role of CO_2 storage in Europe, key project and scale-up considerations, and the current regulatory framework for CO_2 transport and geological storage.

CO2 storage in Europe

- **Geological CO_2 storage is a critical enabler of European net-zero and net-negative climate targets.** It underpins both CCS (hard-to-abate industrial emissions) and CDR pathways (e.g. BECCS, DACCS).
- Europe has very large **theoretical geological storage capacity** (hundreds of $GtCO_2$), distributed onshore and offshore. Despite large theoretical capacity, **injection-ready sites are limited in the near term**.
- The EU **Net-Zero Industry Act sets an objective of 50 $MtCO_2$/year of storage capacity by 2030** within the EU.
- Additional large-scale **capacity is developing in neighboring regions**, enabling cross-border CO_2 value chains.



Source: IOGP (2025)

Project considerations & scale-up dynamics

Cost

- Storage prices are typically not publicly disclosed by operators.
- Indicative market ranges are ~50–120 CHF/tCO_2, depending on volume, site characteristics and infrastructure access.

Timeline

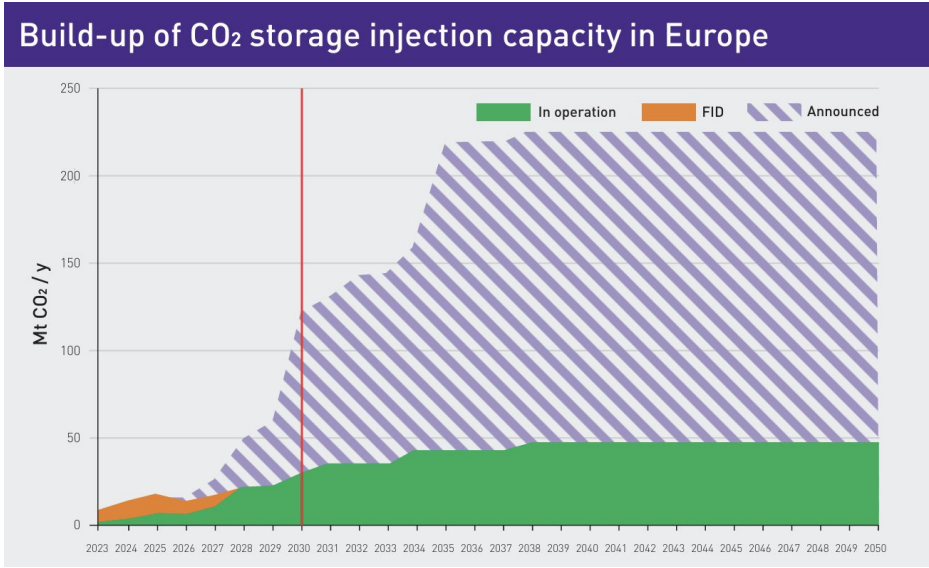
- Storage capacity must often be secured 1–2 years before injection.
- Allocation decisions are required well ahead of capture project commissioning.

Location & access

- Access depends on proximity to pipelines, shipping terminals and CO_2 hubs.
- Competition for early storage capacity is increasing as CCS/CDR projects scale across Europe.

Scale-up challenge

- First-wave projects benefit from early access to storage and infrastructure.
- Later projects may face tighter availability and higher costs if storage development lags capture deployment.



Source: IOGP (2025)

Regulatory landscape

CO_2 transport and geological storage in Europe are governed by international, EU and national regulations. Rules apply across the full value chain, including cross-border transport, offshore and onshore storage. The regulatory framework is evolving and continues to be refined as deployment accelerates.

London Protocol – International Maritime Organization (IMO)

- Cross-border transport of CO_2 for geological storage requires bilateral agreements between countries.
- The London Protocol amendment enables international cooperation for CO_2 storage.
- Domestic CO_2 storage does not require bilateral agreements.

EU Directive on the Geological Storage of CO_2 (CCS Directive)

- Requires prevention of leakage and protection of human health and the environment.
- Mandatory financial security prior to injection to cover long-term liabilities.
- Continuous monitoring during operation and defined post-closure obligations.

National regulators (EU Member States)

- Storage permits awarded through transparent licensing processes.
- Clear allocation of long-term liability and monitoring responsibilities.
- National support schemes and structural requirements may apply.

Permanent geologic storage of CO2

- Geologic storage deep underground offers a safe and reliable form of CO2 storage. It is a well-established practice that is highly engineered and strictly regulated, and has been in safe, commercial operation for decades.

- It is widely accepted – including by the IPCC – as **a permanent solution to sequester carbon emissions**.
  - CO2 sequestered in geological formation is stored at timescales of millenia, making it one of the most durable forms of carbon storage.

- Geologic storage sites can be found **offshore** or **onshore**.

- The main types of geologic storage include:
  - **Saline aquifers** and **saline formations**;
  - **Depleted oil and natural gas reservoirs**;
  - **Basalt formations**; and
  - **Shales and coal seams**.

Permanent use cases

- There are also permanent use cases for captured CO2, such as carbon mineralisation in concrete products. In this case, CO2 is not sequestered geologically, but stored in long-lived products.
- Through chemical reactions, biogenic CO2 can be turned into solid carbonate minerals. These minerals permanently store the CO2 and can be used in the construction industry, often as aggregates or cement.
- This enables permanent storage for emitters without access to geological storage.

Scalability	0.1–1 GtCO2 per year globally
Certification	Possible through Verified Carbon Standards
Permanence	Over 1,000 years
Availability	Likely 2025 Some pilot projects in operation
Location	Various, including Switzerland, UK and Germany
Cost	USD 100–600 /tCO2
Comments	Several technologies exist and are available in Europe (e.g. Neustark; Sika).

Status update with storage providers

Northern Lights – Project Longship

Entities – Project	Northern Lights – Project Longship
Location	Norway
Type of storage	Offshore; geologic
CO2 capacity	Phase I: 1.5 Mtpa; Phase II: 3.5 Mtpa; Phase II: TBD
Start of injection	Phase I: 2025; Phase II: 2028
FID status	Phase II: Completed end of 2024
Min. vol. flexibility	Not yet (only pilot volumes) – plans to accept from 2027–2028
Delivery modalities	Bulk CO2 ships; exploring delivery via trucks and small bulk ships
Discussion status & other comments	CO2RR partner ; advanced discussions to explore delivery of smaller volumes

INEOS – Greensand Future Project

Company – Project	INEOS – Greensand Future Project
Location	Denmark
Type of storage	Offshore; geologic
CO2 capacity	Phase I: 400 ktpa; Phase II: 3 Mtpa; Phase III: 8 Mtpa
Start of injection	Phase I: 2026; Phase II: 2028; Phase III: 2030
FID status	Phase I: Completed Q4 2024
Min. vol. flexibility	Yes
Delivery modalities	Mainly truck delivery via Port of Esbjerg
Discussion status & other comments	Advanced discussions to secure storage for Swiss emitter

Gas Storage Denmark – CO2RYLUS

Company – Project	Gas Storage Denmark – CO2RYLUS
Location	Denmark
Type of storage	Onshore; geologic
CO2 capacity	200,000 tCO2 (no expansion)
Start of injection	On hold
FID status	2030+
Min. vol. flexibility	Yes
Delivery modalities	n/a
Discussion status & other comments	Working towards future permit application. Existing infrastructure of operator enables a fast upscaling, with reservoirs already used for methane.

Carbfix – CODA Terminal

Company – Project	Carbfix – CODA Terminal
Location	Iceland
Type of storage	Offshore ; mineral
CO2 capacity	350,000 tCO2
Start of injection	2027–2028
FID status	n/a
Min. vol. flexibility	Yes
Delivery modalities	n/a
Discussion status & other comments	Discussions pending

Horisont Energi

Company – Project	Horisont Energi
Location	Norway
Type of storage	Offshore; geologic
CO2 capacity	20 Mtpa
Start of injection	2030–2032
FID status	–
Min. vol. flexibility	Yes
Delivery modalities	Exploring truck offloading and hub concept for shared T&S
Discussion status & other comments	Ongoing discussions

ENI – Ravenna CCS

Company – Project	ENI – Ravenna CCS
Location	Italy
Type of storage	Offshore; geologic
CO2 capacity	Phase I: 25 ktpa; Phase II: 4 Mtpa
Start of injection	Phase I: 2024; Phase II: 2026
FID status	Phase I: taken; Phase II: unknown
Min. vol. flexibility	No
Delivery modalities	Focused on delivery pipeline for local industrial emitters
Discussion status & other comments	Discussions on hold as focus is currently on Italian emitters

Neustark

Company – Project	Neustark
Location	Switzerland
Type of storage	Onshore; mineral (products)
CO2 capacity	50 ktpa
Start of injection	2023
FID status	No FID needed – smaller units
Min. vol. flexibility	Yes – focused on small volumes
Delivery modalities	Only operated by truck
Discussion status & other comments	Exploring collaborations on value chain towards geological storage sites

Energean – Prinos CO2

Company – Project	Energean – Prinos CO2
Location	Greece
Type of storage	Offshore
CO2 capacity	Phase I: 1 Mtpa; Phase II: 3 Mtpa
Start of injection	Phase I: 2026; Phase II: 2029
FID status	–
Min. vol. flexibility	–
Delivery modalities	Only pipeline and ship delivery envisaged
Discussion status & other comments	Discussions on hold as focus is initially on large volumes

Gasunie / EBN – Porthos

Company – Project	Gasunie / EBN – Porthos
Location	Netherlands
Type of storage	Offshore; geologic
CO2 capacity	2.5 Mtpa
Start of injection	2026
FID status	FID taken October 2023
Min. vol. flexibility	No
Delivery modalities	Pipeline delivery only
Discussion status & other comments	n/a as capacity is sold out

Gasunie / EBN / Shell / TotalEnergies – Aramis

Company – Project	Gasunie / EBN / Shell / TotalEnergies – Aramis
Location	Netherlands
Type of storage	Offshore; geologic
CO2 capacity	Phase I: 7.5 Mtpa; Ramp-up: 22 Mtpa
Start of injection	2028–2029
FID status	Expected first half of 2026
Min. vol. flexibility	Dependent on CO2next terminal
Delivery modalities	Mainly pipeline and ship delivery envisaged
Discussion status & other comments	Not a priority initially as focus is on large volumes

Terega – Pycasso

Company – Project	Terega – Pycasso
Location	France
Type of storage	Onshore; geologic
CO2 capacity	Phase I: 1–3 Mtpa; Phase II: 5 Mtpa
Start of injection	Phase I: 2032; Phase II: 2035
FID status	Expected 2029
Min. vol. flexibility	–
Delivery modalities	Focused on large industrial emitters in the region
Discussion status & other comments	Initial location cancelled because of local opposition – new location being explored

Carbon Catalyst / Perenco CCS – The Poseidon Project

Company – Project	Carbon Catalyst / Perenco – Poseidon
Location	UK
Type of storage	Offshore; geologic
CO2 capacity	Phase I: 1.5 Mtpa; Phase II: 5 Mtpa; Phase III: 10 Mtpa
Start of injection	Phase I: 2029; Phase II: 2032; Phase III: 2034
FID status	Expected 2027
Min. vol. flexibility	–
Delivery modalities	Focus on delivery by ship and pipeline
Discussion status & other comments	Initial discussions

CarbonCause

carboncause

Company – Project	CarbonCause
Location	Spain
Type of storage	Offshore; geologic
CO2 capacity	100 ktpa
Start of injection	2025
FID status	–
Min. vol. flexibility	–
Delivery modalities	–
Discussion status & other comments	Initial discussions

Eberhard

Company – Project	Eberhard
Location	Switzerland
Type of storage	Onshore; mineral (products)
CO2 capacity	–
Start of injection	–
FID status	–
Min. vol. flexibility	Yes
Delivery modalities	–
Discussion status & other comments	Initial discussions for decentralised storage

Recoal

Company – Project	Recoal
Location	Switzerland
Type of storage	Onshore
CO2 capacity	–
Start of injection	–
FID status	–
Min. vol. flexibility	yes
Delivery modalities	–
Discussion status & other comments	Initial discussions for decentralised storage

Harbour Energy / INEOS – Greenstore

Company – Project	Harbour Energy / INEOS – Greenstore
Location	Denmark
Type of storage	Onshore; geologic
CO2 capacity	Est. 250 Mt total
Start of injection	2029, pending regulatory approval
FID status	Expected 2027
Min. vol. flexibility	–
Delivery modalities	–
Discussion status & other comments	Identified as suitable storage site after comprehensive mapping and investigations in 2023 by National Geological Survey of Denmark and Greenland (GEUS).

Project Bifrost

Company – Project	Danish Underground Consortium (TotalEnergies, Nordsøfonden and BlueNord [previously Noreco]), DTU, Orsted – Project Bifrost
Location	Denmark
Type of storage	Offshore; geologic
CO2 capacity	Phase I: 2–3 Mtpa; Ramp-up: 16 Mtpa
Start of injection	Phase I: 2030; Ramp-up: 2032
FID status	–
Min. vol. flexibility	–
Delivery modalities	Offshore transport via refurbished existing pipeline and shipping
Discussion status & other comments	Public funding from the Energy Technology Development and Demonstration Programme (EUDP)

Project Ruby

Company – Project	CarbonCuts / Nordsofonden / BlueNord – Project Ruby
Location	Denmark
Type of storage	Onshore; geologic
CO2 capacity	–
Start of injection	Construction 2028–2030
FID status	Expected 2027
Min. vol. flexibility	–
Delivery modalities	–
Discussion status & other comments	License granted by Danish state for investigation over next few years. Geological surveys being conducted in 2025–2026.

Project Norne

Company – Project	Fidelis, Ross Energy, GSD, Rambol, Port of Aalborg, Port of Kalundborg – Project Norne
Location	Denmark
Type of storage	Hub/ Offshore; geologic
CO2 capacity	15 Mtpa at full expansion
Start of injection	2028–2030 conditional on approval by DEA
FID status	–
Min. vol. flexibility	–
Delivery modalities	Pipeline
Discussion status & other comments	Designated EU Project of Common Interest (PCI) in November 2023; Awarded Connecting Europe Facility funding; Awarded an Exploration License by the Danish Minister of Climate, Energy and Utilities in 2025.

Other identified projects

Kalundborg CCS	Iroko
TarraCO2	Kinno
CCS Moravia	Atlas
MOL Hungary CCS Project	Albondigas
Danube Removals	Engas CCS
Smeaheia	Luna
Trudvang	Havstjerne