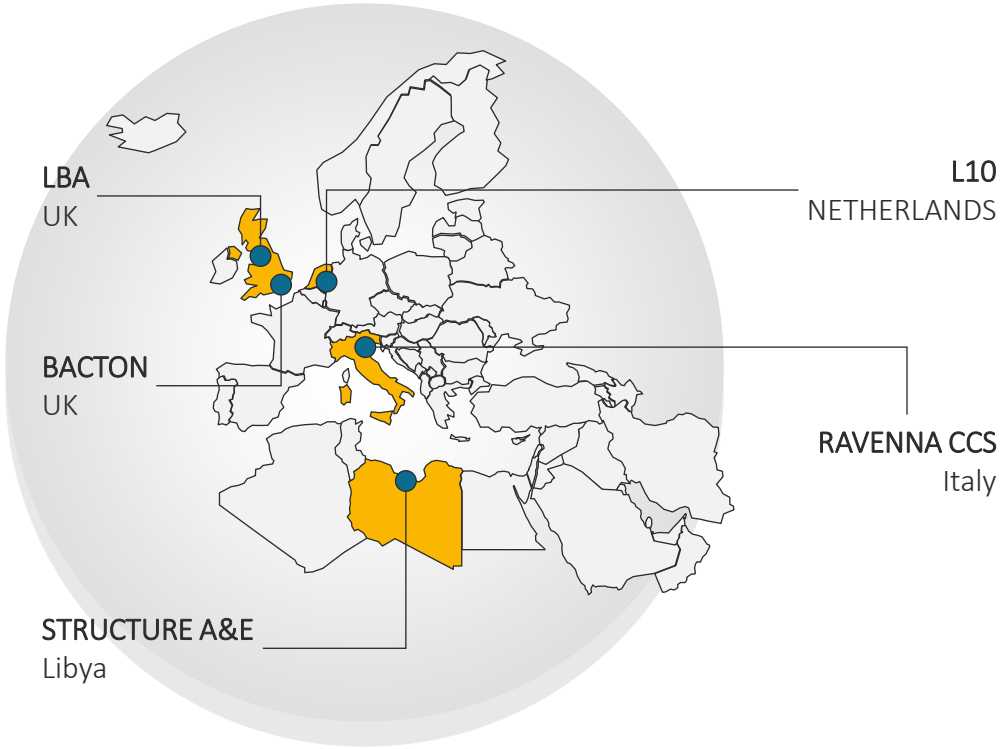
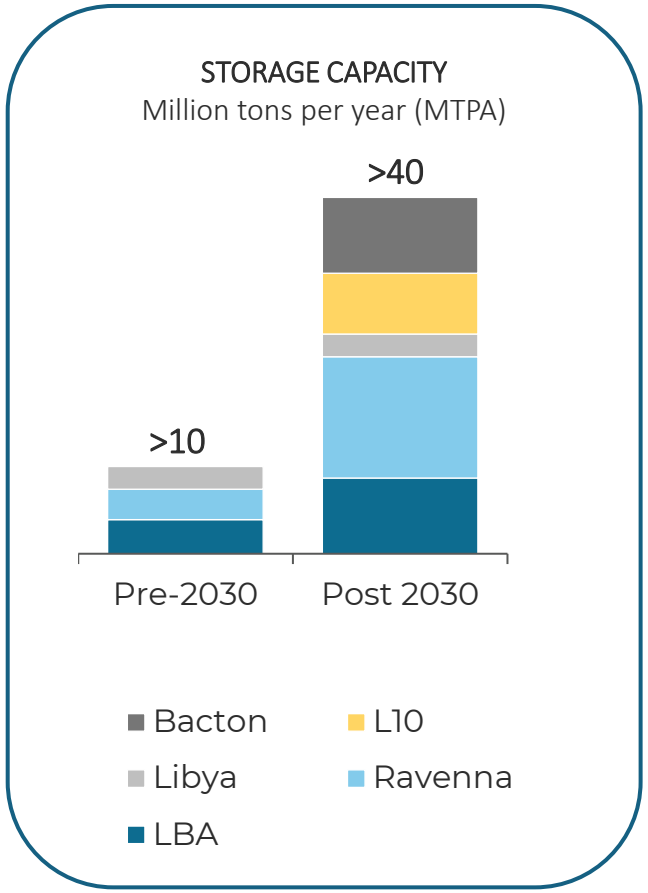
# Ravenna CCS



# Eni CCS Strategy

## Key catalyst for the energy transition in line with EU Decarbonization Strategies




Gross storage capacity about **3 Gtons***

*Including potential currently under evaluation in the Mediterranean, in the North Sea and in the Asia-Pacific region

Broad and high-impact strategic T&S portfolio

Strong operatorship for efficient project delivery

Integrated project management along value chain, supporting third-party decarbonisation

**Strategic partnership** with Global Infrastructure Partners (**GIP**) in **Eni CCUS Holding**

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# Context and urgency for CCS deployment

## Importance of CCS

The EU faces highly ambitious decarbonisation targets, requiring the full deployment of all available solutions

CCS provides a safe, proven, mature, and scalable solution particularly well-suited to industrial applications and essential for the Hard-to-Abate (HtA) sectors, where it delivers the most effective and large-scale $CO_2$ avoidance and competitive per-ton abatement costs.

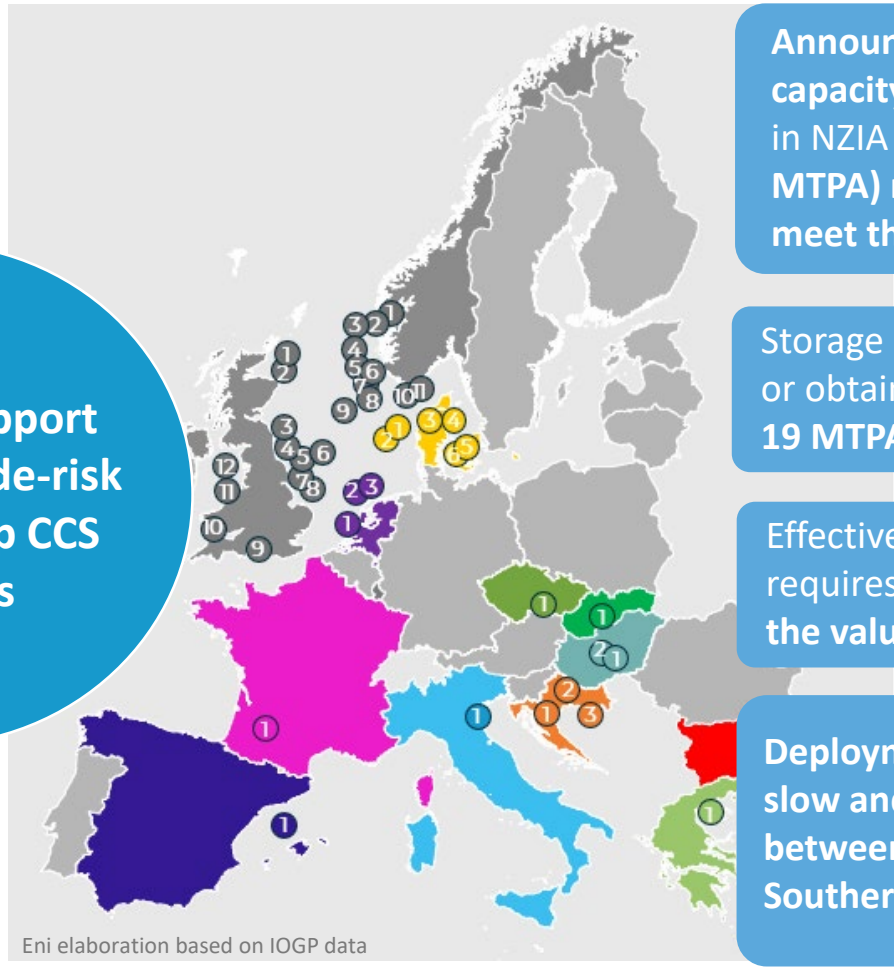
## EU Climate Targets

Industrial Carbon Management Strategy and Net Zero Industry Act's target

**50 MTPA of $CO_2$ injection capacity by 2030**

**Funding support essential to de-risk and scale up CCS projects**

## Announced $CO_2$ storage projects in the EU



Eni elaboration based on IOGP data

**Announced injection capacity in the EU** reported in NZIA national reports **(33 MTPA) not sufficient to meet the target**[1]

Storage permit submitted or obtained reaching only **19 MTPA**

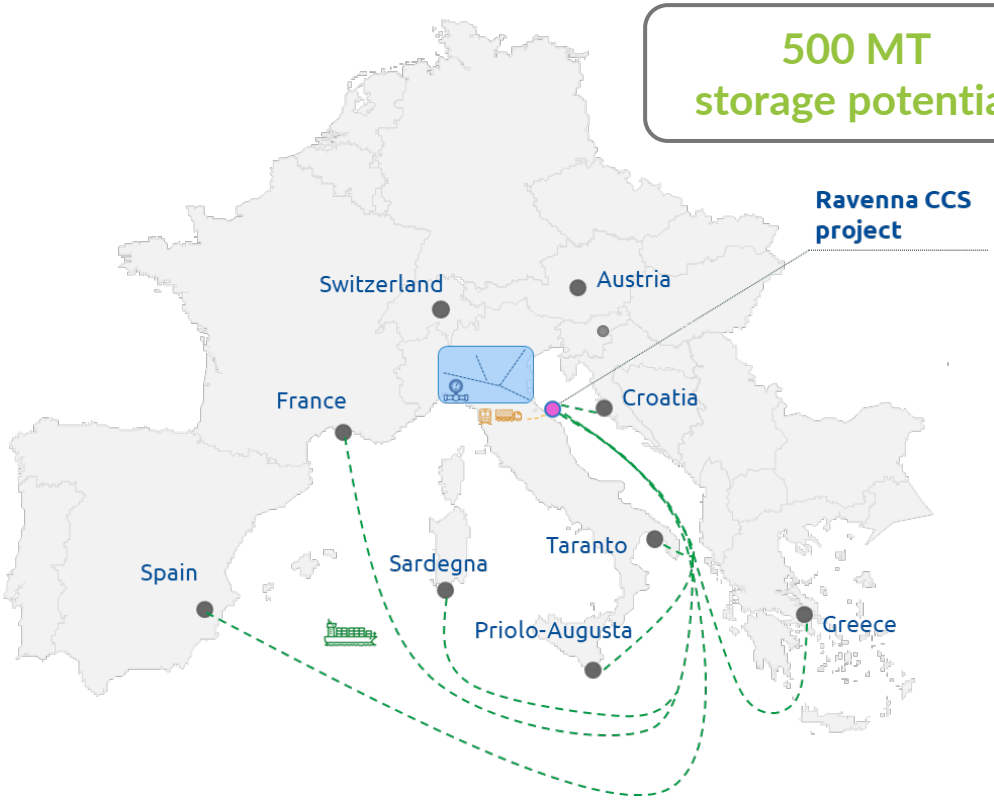
Effective deployment requires **alignment along the value chain**

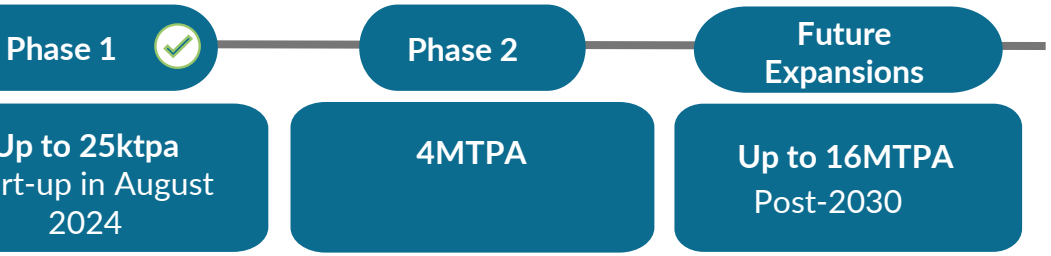
**Deployment pace remains slow and unbalanced between Northern and Southern EU**

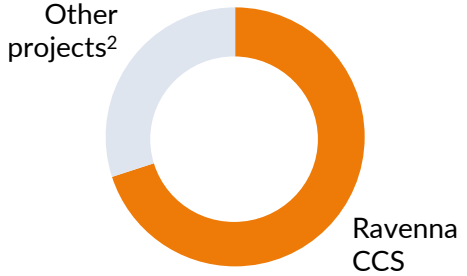
1. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52026DC0252

# Ravenna CCS - Strategic Hub of Reference in the EU-Med Area

- Infrastructure for the **reception, offshore transport and permanent geological storage of $CO_2$** in depleted offshore gas fields. $CO_2$ **received through multi-modal transportation solutions,** including pipeline, shipping, truck and train
- The project is **developed in JV by Eni, Operator, and Snam** (50% participating interest). Snam will develop and operate the onshore network for $CO_2$ transport
- **Over 500 million tons of storage capacity** and up to **16 million tons of annual injection capacity** supporting industrial decarbonization in Italy and Southern European
- **Strong Market traction with Expressions of interest exceed 30 MTPA,** including 7 MTPA[1] already supported by Innovation Fund (>1 B€) and other national funds (c.a.390M€, including Vicat CCfD award)
- **Project of Common Interest (PCI),** which will involve, in addition to the Italian emitters, also the emitters from **France, Greece and Croatia.**



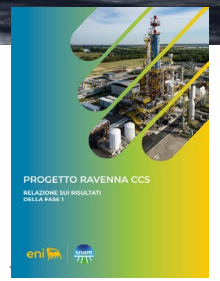




*Ravenna CCS project accounts for **over 70%** of the announced **cumulative storage capacity in the EU Mediterranean Region***

[1] Include the result of the 2024 Innovation Fund call
[2] Total capacity based on the declared capacity of other projects currently under development in the MED regions (Prinos, TarraCO2)

# Ravenna CCS Fase 1




Report on the results of Ravenna CCS Phase 1 available on website: www.ravennaccs.com

## The Ravenna CCS Phase 1 project started in August 2024 with injection for permanent storage of up to 25ktpa of CO2 captured from the Casalborsetti gas treatment plant

### Main features

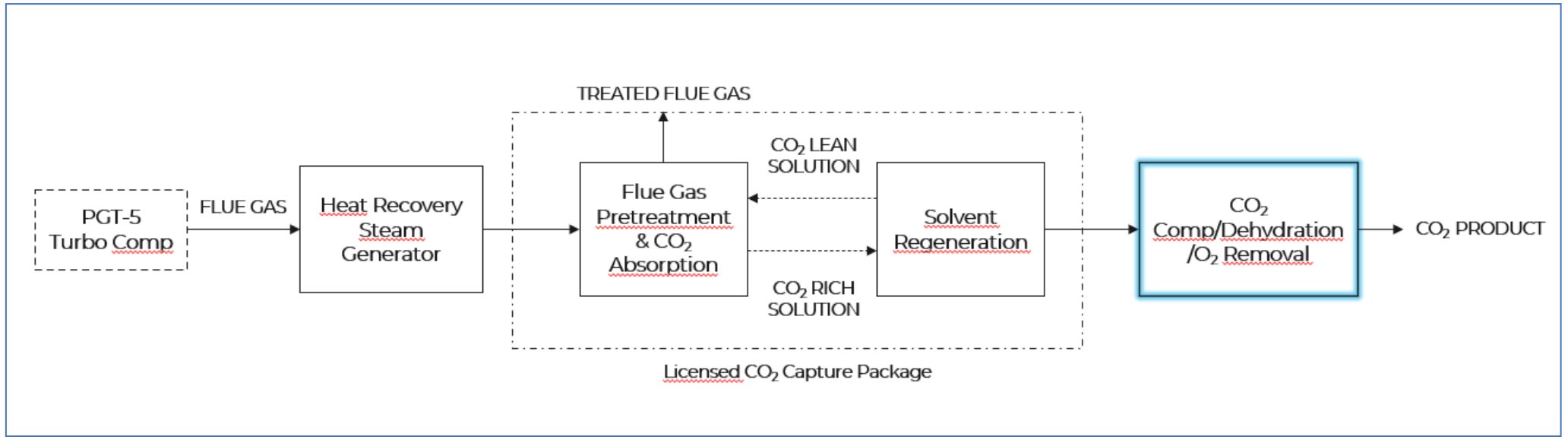
- $CO_2$ captured at Eni's gas treatment plant in Casalborsetti
- $CO_2$ transported to the offshore platform through the reuse of an existing pipeline
- $CO_2$ injected into the Porto Corsini Mare Ovest reservoir through the reuse of an existing well
- Injection period: August 2024 – August 2025
- **Performance**
- The average $CO_2$ capture efficiency reached 91.9%, with peaks of up to 96%.
- The effectiveness and safety of the injection operations were confirmed, along with the containment of $CO_2$ within the reservoir and the integrity of both the injection well and the cap rock.
- No environmental impacts resulting from the injection operations were detected.

The effectiveness and safety of CCS technology were confirmed, while monitoring systems for both the facilities and the environment were successfully validated, and the evidence required to optimize the development of Phase 2 was collected.



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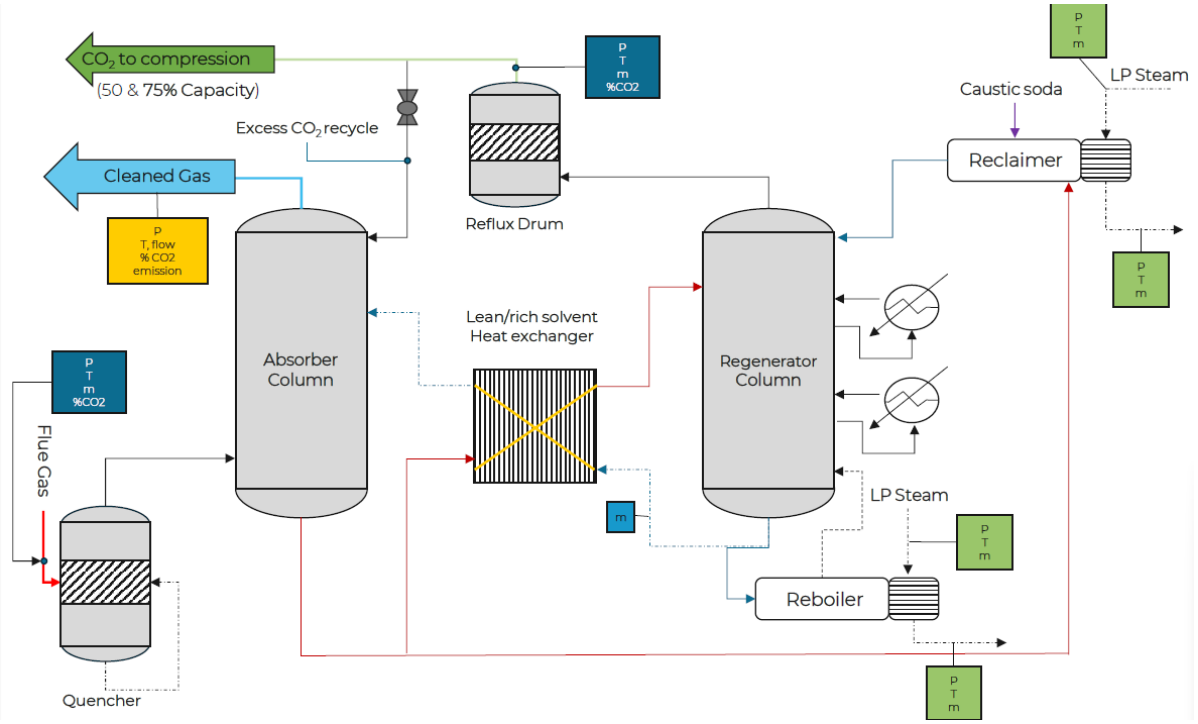
# Capture process at Casalborsetti plant

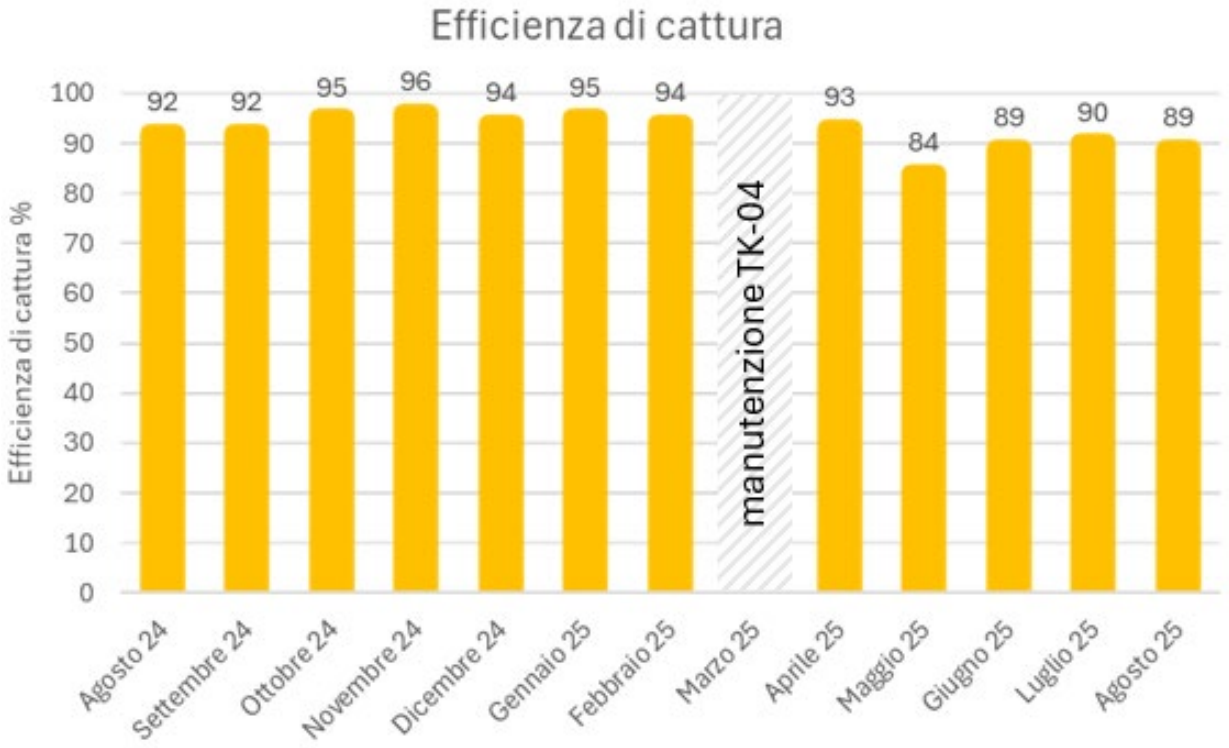



**The key process steps include:**

- Flue Gas Cooling: Exhaust gas (~500°C) is directed into a Heat Recovery Steam Generator, reducing temperature to ~200°C;
- Quenching & Absorption: The gas is further cooled in a quenching column (~35°C), then fed to the absorber where $CO_2$ is removed using an amine solvent;
- Regeneration: The solvent is regenerated in a stripper column, releasing high purity $CO_2$;
- Compression: $CO_2$ is compressed in a four-stage unit (30 or 50 bar);
- $CO_2$ Conditioning

# Capture Efficiency



# $CO_2$ Conditioning

To guarantee the required purity for transport, after the onshore compression $CO_2$ stage undergoes:

- Oxygen removal ($H_2$ reaction)
- Dehydration (molecular sieves)

Continuous monitoring showed that:

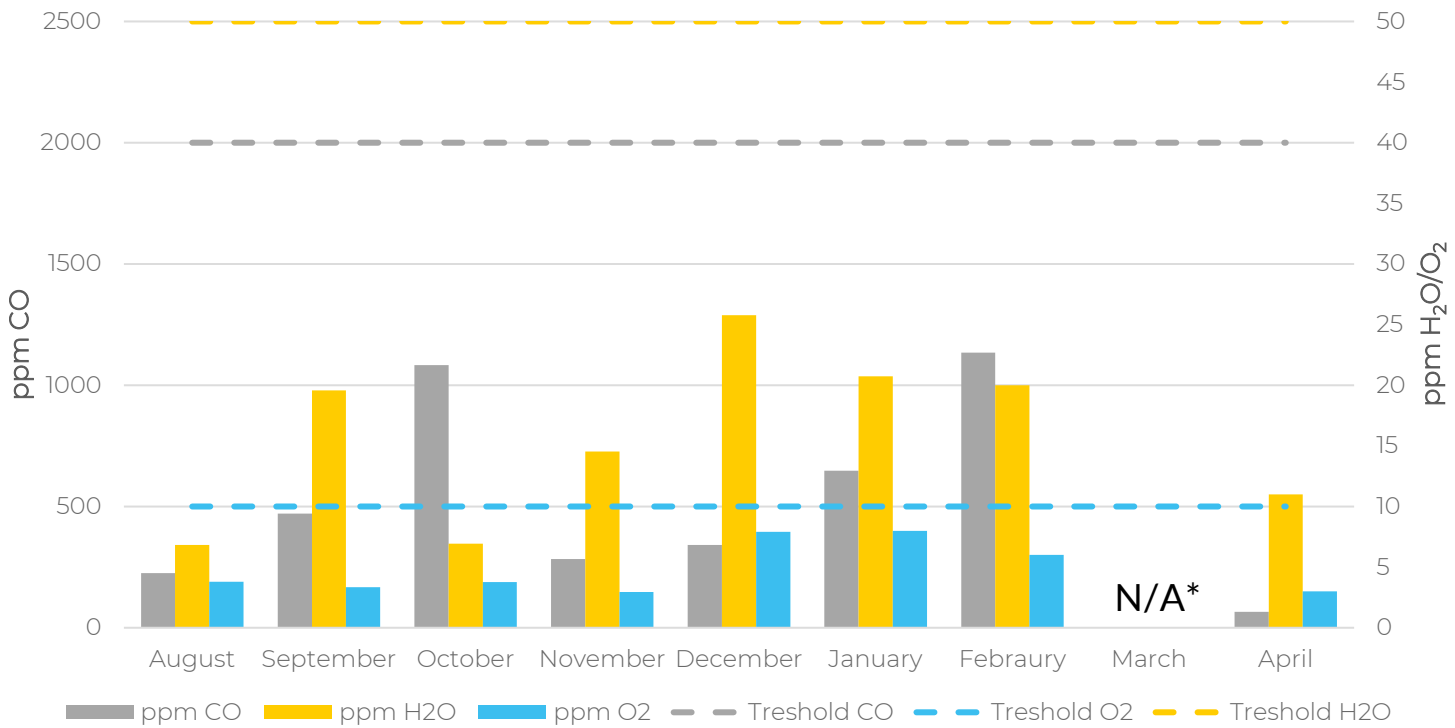
- Average $CO_2$ **purity is >99.5%**
- $O_2$, CO and $H_2O$ content is well below specified limits

Additionally, time-matched periodic gas samples were collected and analyzed at the pipeline inlet and at the wellhead:

- H2S, NOx, SOx are below detectability threshold (2-3ppm)



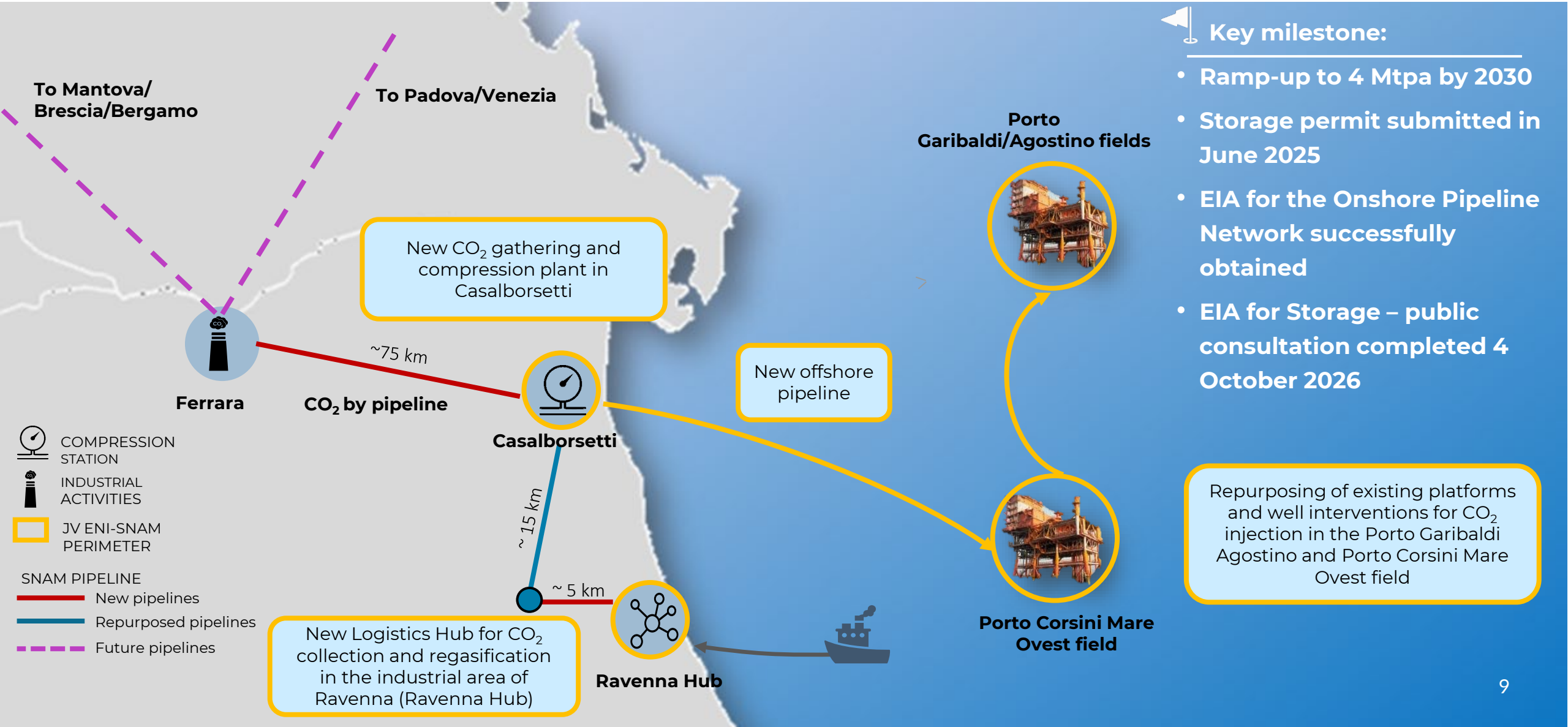
**Purification package**






* Casalborsetti compressor planned maintenance during March

# Ravenna CCS Fase 2



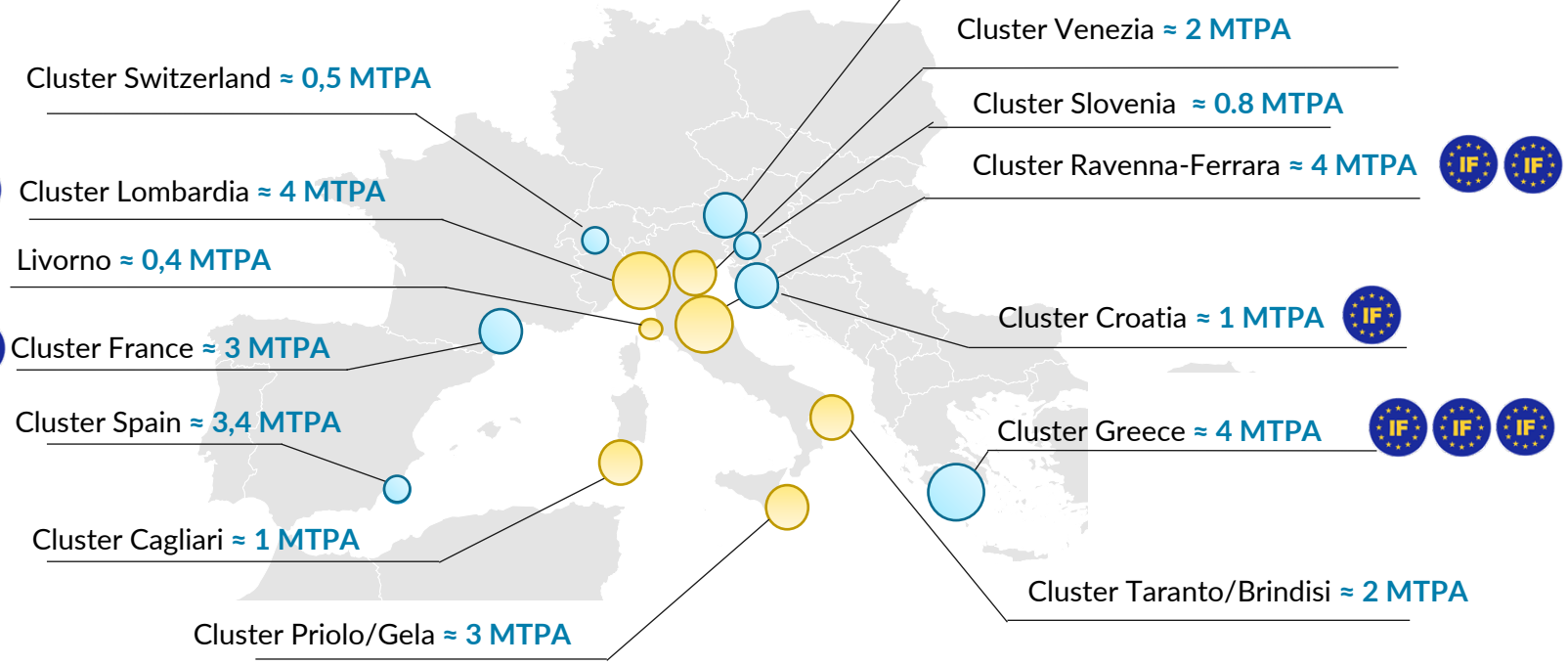

## Key milestone:

- **Ramp-up to 4 Mtpa by 2030**
- **Storage permit submitted in June 2025**
- **EIA for the Onshore Pipeline Network successfully obtained**
- **EIA for Storage – public consultation completed 4 October 2026**

Repurposing of existing platforms and well interventions for $CO_2$ injection in the Porto Garibaldi Agostino and Porto Corsini Mare Ovest field

# Ravenna CCS Phase 2 is supported by considerable demand

## AGREEMENTS WITH DOMESTIC AND NON-DOMESTIC EMITTERS FOR 31 MTPA




Non-domestic ≈ 14 M  Italy ≈ 17 MTPA (out of which 5 MTPA from Eni)

> 1 MTPA  < 1-3 MTPA  >3 MTPA

Innovation Fund winners: 6+ MTPA

Trigger to more than
**>1.5 billion euros IF grants and other national funds**

Note: CO2 volumes related to non-binding agreements

# Italian Ministry of Environment and Energy Security: study on key technical, economic, and regulatory enablers for CCUS development

**Objectives**

Define potential business model and indicate support mechanisms for the CCS value chain, to be adopted through subsequent implementing measures

The **following aspects were analysed**:

- Possible regulatory frameworks for the T&S segment
- Regulatory gaps
- Mapping of potential storage capacity and sites
- Mapping of Italian potential clusters and support mechanisms
- Value chain costs and funding gap

Published in August 2025

Stakeholders involved*

**Results**

- Analysing the Levelized Cost of Carbon Avoided (LCCA), CCS resulted to be the most competitive decarbonization lever after energy efficiency and renewables
- $CO_2$ transport pipeline network and storage as regulated infrastructures
- Italian emitters supported through Contracts for Difference (CfD) mechanisms

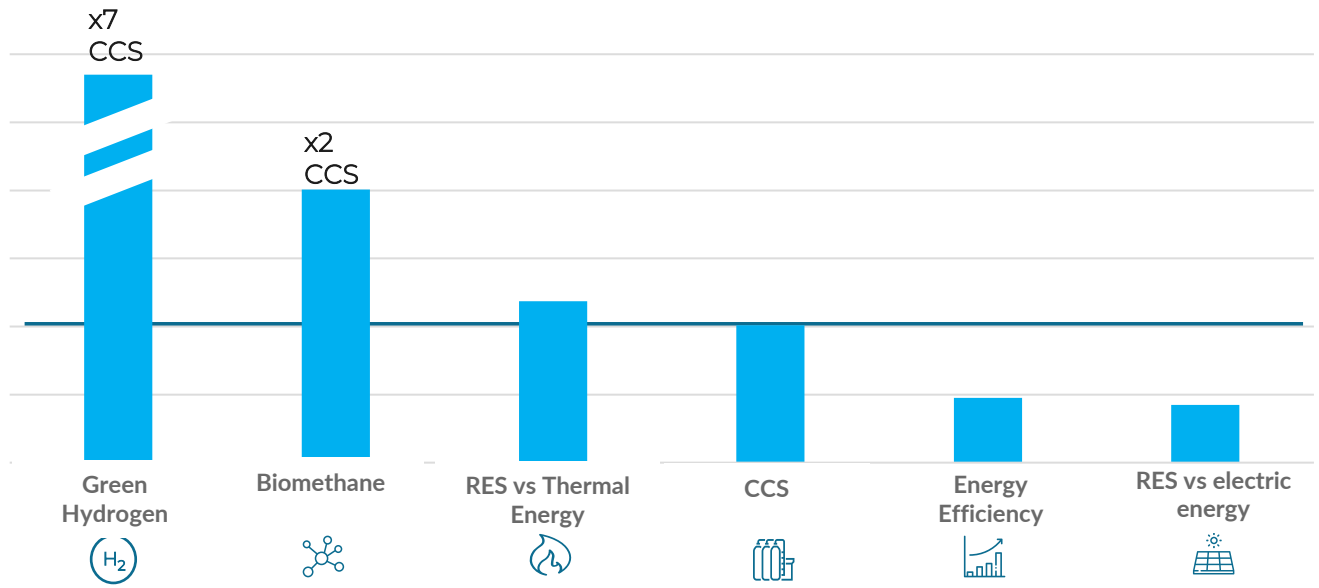
*Eni and Snam, in their quality of infrastructure operators, supported the study by providing data on the Ravenna CCS project and the related connection modalities with emitters (shipping and pipeline)



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# CCS: an Efficient Decarbonization Lever and an Effective Solution for Hard-to-Abate Sectors

## Comparison of Average Costs[1] Across Decarbonization Levers




CCS offers a competitive $CO_2$ abatement cost
compared with other decarbonization options, maximizing emissions reductions per euro invested.

## Use of CCS Across Industrial Sectors

| Sectors | Decarbonization solutions |
|---|---|
| Electric Energy (CCGT) and Waste to Energy | |
| Non metallic minerals (cement) | |
| Non metallic minerals (ceramic) | |
| Non metallic minerals (glass) | |
| Paper | |
| Chemicals | |
| Primary steel (BF/BOF and DRI) | |
| Secondar steel (EAF + DRI) | |
| Heating | |
| Machineries | |
| Textiles | |
| Food, beverage and tobacco | |
| Light transport | |
| Heavy transport | |

*Hard to abate*

The energy efficiency option has not been considered, as it is generally applicable wherever technically feasible.

For industrial sectors that are difficult to electrify or decarbonize at scale, CCS is the only solution capable of delivering effective $CO_2$ emissions abatement.

1. Based on data from the CCUS Study published by the Italian Ministry of the Environment and Energy Security (MASE) in August 2025, using the Ravenna CCS Phase 2 project, with a storage capacity of 4 million tonnes per year (MTPA), as the reference case.

# Refineries among the most suitable sectors for CCUS adoption



MASE CCUS Study

Tabella 3 – Indice di rilevanza CCUS dei settori oggetto di applicabilità del processo di cattura della CO2

| Indice rilevanza CCUS | Settore | Range Conc $CO_2$ (vol %) | Range volumi per impianto Min-Max (ktCO2) | Volumi medi per impianto (ktCO2) | Tipologia emissioni $CO_2$ | Configurazione Cattura | Considerazioni |
|---|---|---|---|---|---|---|---|
| 1a | Cemento, Calce | 15 – 30 | 10 - 900 | 271 | Processo: 65%<br>Combustione: 35% | Retrofit | Assenza di altre opzioni per la decarbonizzazione delle consistenti emissioni di processo (>50%). |
| | Waste to Energy | 8 – 12 | 5 - 850 | 141 | Processo: 0%<br>Combustione: 100% | Retrofit | Assenza di altre opzioni per la decarbonizzazione.<br>Limiti incertezza normativa ETS. Contributo target ESR. |
| 1b | Raffinazione, chimica, H2 blu | 10 – 26 | 2 - 6.000 | 266 | Processo: 15 %<br>Combustione: 85 % | Nuovo<br>Retrofit | Leva competitiva sia per emissioni di processo che di combustione.<br>Leva abilitante per l'idrogeno blu/verde.<br>Contiguità nelle attività know how. |
| | DRI (Acciaio) | 10 – 25 | 1.000 – 2.000 | 1500 | Processo: 20÷40 %<br>Combustione: 60÷80 % | Nuovo | Taglie rilevanti ed economie di scala, nuovi impianti che potrebbero essere già progettati in un'ottica CCUS, leva competitiva per il mercato (CBAM, rottami etc.). |
| 2 | Vetro | 8 | 1 - 200 | 42 | Processo: 25÷35 %<br>Combustione: 65÷75 % | Retrofit | Emissioni processo e livelli di concentrazione CO2 adatte a CCUS. Applicabilità di interesse, da valutare caso per caso sulla base di taglia e localizzazione. |
| | Acciaio secondario, metalli, fonderie | 2 – 26 | 5 - 5.000 | 127 | Processo: 15%<br>Combustione: 85% | Retrofit | Applicabilità di interesse, in competizione altre opzioni decarbonizzazione, da valutare sulla base di taglia e localizzazione. |
| 3 | Termoelettrici Utility (CCGT) | 3 - 5 | 900 – 2.000 | 1500 | Processo: 0%<br>Combustione: 100% | Nuovo<br>Retrofit | Taglie grosse ed economie di scala. Disponibilità potenziale di energia termica di recupero. Incertezza fattore di utilizzo e opzioni di decarbonizzazione concorrenti. |
| | CHP (*) | 3 - 5 | 10 – 2.000 | 374 | Processo: 0%<br>Combustione: 100% | Nuovo<br>Retrofit | Applicabilità di interesse. Competitività da valutare sulla base di taglia e disponibilità di calore per cattura.<br>Presenza di opzioni concorrenti di decarbonizzazione. |
| | Ceramica | 5 | 1 - 200 | 42 | Processo: 15÷25 %<br>Combustione: 75÷85 % | Retrofit | Applicabilità di interesse. Basse concentrazioni.<br>Taglie limitate, valutare potenzialità distretti hub. |
| | Carta | 3 - 5 | 2 - 200 | 38 | Processo: 0%<br>Combustione: 100% | Retrofit | Applicabilità di interesse. Basse concentrazioni.<br>Taglie piccole, assenza emissioni di processo. |
| 4 | Altra industria | | 1 - 200 | 21 | Processo: 0%<br>Combustione: 100% | Retrofit | Applicabilità di interesse limitato. |
| | BECCS | | 1 - 200 | 21 | Processo: 0%<br>Combustione: 100% | Retrofit | Applicabilità di interesse.<br>Limitata dal contesto normativo attuale da rivalutare. |

(*) L'indice di rilevanza CHP potrebbe crescere in funzione della produzione di calore da cogenerazione. Gli impianti CHP accoppiati a impianti di cattura, sottoforma di impianti accessori e ausiliari, fanno riferimento all'indice di rilevanza del settore a cui è applicata la CCUS.



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# Third party access and supporting mechanism

## Third party access to transport and storage infrastructure

**Disegno di legge delega:** law delegating to the Government to establish a comprehensive regulatory framework for $CO_2$ transport and geological storage activities, with the following priciples:

- $CO_2$ transport through dedicated networks and geological storage activities subject to regulation by the Italian Regulatory Authority for Energy, Networks and Environment (ARERA);
- Access to transport and storage infrastructure will be granted on a transparent and non-discriminatory basis, according to efficiency criteria, including economic efficiency, through a tariff system that is predictable, transparent and based on predefined regulatory principles.

Capacity allocation mechanisms[1]: a significant share of transport and storage infrastructure capacity allocated through long-term capacity bookings, potentially via Open Season procedures

## Supporting mechanism for emitters

Potential national supporting mechanism for $CO_2$ capture projects[1)]:

- **Contract for difference**
- **Capital grant**

EU supporting mechanisms:

- **Innovation Fund (in force)**
  B€ 40 , 2020-2030
- **Industrial Decarbonisation Bank (annunciato)**
  **B**€100, 2028-2040

*1. Riferimento «Studio CCUS: Analisi degli aspetti tecnici, economici e normativi funzionali allo sviluppo della filiera CCUS», MASE, Agosto 2025.*

# Ravenna CCS is a flagship project

The Ravenna CCS project is a fundamental enabler for European industrial decarbonization

**Key enabler of both European and Italian decarbonization strategies**

- ✓ Delivering 8% of EU ICM Strategy and NZIA climate targets by 2030
- ✓ Meeting Italy NECP's 4 MTPA storage target by 2030
- ✓ Enabling Innovation Fund and other national funds capture projects for >7MTPA and >€ 1.5 billion in grants

**Reference CCS Hub for Southern Europe and Mediterranean**

- ✓ Largest storage site in the Mediterranean (>500 Mt potential capacity)
- ✓ Multimodal $CO_2$ intake (pipeline, ship, train and truck) for cross-border flows
- ✓ Fully integrated project from transport to storage

**Delivering consistent progress across Project Phases**

- ✓ Strong commitment, technical and operational capability of Eni and Snam in underpinning the development of the project
- ✓ Phase 1 KPIs executed with excellent performance and technical maturity paving the way for Ravenna CCS Phase 2
- ✓ Phase 2: Storage permit submitted in June 2025, Environmental Impact Assessment (EIA) for storage submitted in July 2026 and for onshore pipeline network obtained in January 2026

**Supporting Industry Competitiveness and Economic Growth**

- ✓ Safeguarding the competitiveness of the Italian and European industry sector
- ✓ Kickstarting a new, high-value supply chain, securing existing jobs and sustaining economic growth