Carbon Storage in Southern Europe: The 'S' in CCUS

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1. Introduction

In the current mandate, the EU has confirmed that Carbon Capture, Utilization and Storage [CCSU] will be an essential part of the toolbox to decarbonise our economy.

A significant number of EU CC projects, including in Southern Europe, some comprising U, have been already announced. The majority of them have secured financing from their national governments eg in Germany, Norway – and Greece under the European Recovery and Resilience Facility (RRF), and directly from the EU, initially from Horizon 2020 and eventually from the Innovation Fund and Connecting Europe Facility, some in the Electrification of Industry and Hydrogen category. Furthermore, a number of these European projects have joined the list of European Projects of Common Interest (PCI).

The significance of Europe in CCUS is illustrated in the map below.

CCUS projects worldwide [1]

With projects in the Electrification of Industry and Hydrogen category in particular, the EU aims to accelerate the achievement of its ambition to abandon coal-fired generation by 2025 and transform its thermal power plants into "green hubs" linked to four energy axes: green hydrogen, energy storage, renewables and electricity system flexibility.

There is also strengthened cooperation between Norway and Switzerland on CCS and CDR. In May 2024 the Norwegian Minister of Energy Terje Aasland had a video conference with the Swiss Minister of Environment, Transport, Energy and Communications, Albert Rösti. In the meeting they signed a Declaration of Intent to strengthen cooperation on carbon capture *and storage* (CCS) and carbon dioxide removals (CDR) between Norway and Switzerland. [2]

2. Policy: not everything is rosy for Europe

On May 19 2024, CCS Europe has released an Action Plan with a number of recommendations for policy makers, the gist of which is as follows:

With *only a handful of CCS projects being operational or under construction*, there is an urgent need to ensure that CCS becomes a reality in Europe, and the time to act is now.

CCS Europe's new Action Plan for Carbon Capture identifies three central priorities for the upcoming European political mandate, to ensure that CCS goes beyond policy promises and leads to concrete action:

- Securing political support for CCS deployment in Member States: Despite its recognised necessity, a number of Member States still lack a fully-developed strategy for CCS deployment. The EU needs to do more to ensure that Member States play their part. This should include the creation of a "CCS Envoy" and the introduction of carbon capture targets in National Energy and Climate Plans (NECPs).
- Strengthening the business case for CCS investment: As recognised by the Commission, the existing funding gap for CCS must be addressed. The EU needs to work closely together with industry to ensure the creation of an adequate business case for CCS, including through measures to establish financial support mechanisms in Member States and streamlining existing EU funding.
- Developing a regulatory framework to support CCS deployment: The current mandate has brought a number of targets for CCS deployment. Targets for capture and storage need to be supported by means of accelerating permitting procedures for capture plants, transport infrastructure, and CO2 storage sites. [3]

3. Focus on Carbon Storage

CCS, in case of no possibility of CCU. In this case, course, Transport and Storage become ubiquitous

Storage can take place either in depleted gas reservoirs, usually 1. Off the coast but also 2. On-land in some cases.

Prominent examples in Southern Europe of amenable reservoirs in the first category include depleted gas reservoirs

- depleted gas reservoirs off the coast of Ravenna, Italy
- the under seabed storage in an exhausted deposit of Prinos, near Kavala, Greece
- offshore permanent storage in the depleted Black Sea gas field of Galata, 16 miles offshore Varna, Bulgaria

As for the On-land opportunities, two of them stand out in terms of maturity

- a depleted gas field in Aquitaine, a project capturing carbon from industries in the south-west of France and in the north of Spain and storing it in, and
- in 2025, Bulgaria hopes to have the largest underground gas storage facility in the Balkans after the completion of a large-scale project to expand and modernize the facility in Chiren in northwestern Bulgaria

4. Storage in Southern Europe: a race against time

In Southern Europe, just a quick review of the supply/demand situation, shows that not enough storage is [nor will be] available in time to serve the plethora of CCS storage that aspire to be on-line in the next few years.

4.1 Ravenna, Italy’s CCS site in depleted gas reservoirs off the coast of Ravenna in northeast Italy with Eni and Snam as Hub developer/T&S.

Phase 1 is in construction and expected to operation in but 2024 will cover the capture of just 25,000 tons of CO2 emitted from Eni’s natural gas treatment plant in Casalborsetti, while Phase 2, scheduled to start in 2027, aims to allow storage of 4 million tonnes of carbon dioxide per year: 1 million tonnes will come from plants owned by Eni and the remaining 3 million tonnes will be reserved for third party industrial emitters. The Potential impact by 2030 is 10 MtCO2/year. Initial CO2 source is power while Potential CO2 sources comprise steel, chemicals, ceramics, cement, waste to energy. Transport to the hub is done by pipeline.

4.2 Galata, Bulgaria is expected to start operations in 2028, will have a capacity of 800,000 tonnes of CO2 per year, the emissions of a specific local cement plant.

4.3 The **Ciren, Bulgaria**, expansion project, worth EUR 300 million will be able to store up to one billion cubic meters of gas, doubling its current capacity. In addition, the facility will have the possibility of extracting and pressurizing some 8-10 million cubic meters a day, an upgrade from the 3-4 million cubic meters currently being handled in Chiren. Furthermore, a Green hydrogen pilot project has been launched at Chiren gas storage facility since September 23. Hence, Ciren will not be much of a contributor to CCS proper.

4.4 Conversely, **PYCASSO**, the project capturing carbon from industries in the south-west of France and in the north of Spain and storing it in a depleted gas field in Aquitaine, is planned to transport about 1 mtpa of CO2 by 2030 – a promising venture.

4.5 We have left **Prinos CO2 Storage** for the end:

Prinos’ budget is estimated at over 1.5 billion euros, 900 million of which will be undertaken by Energean and 600 million by DESFA. Energean will construct CO2 storage that is expected to be able to accommodate 2.5 to 3 million tons of CO2 per year once it is in full operation.

The project is divided into two phases, with phase one aiming for a storage capacity of 1 million tons per year by the end of 2025 and phase two reaching full capacity by the end of 2027.On 29 Μαΐου 24, the CEO and Country Manager of Energean in Greece Dr. Katerina Sardis said at the EMGF panel that ‘Energean is working intensively to submit a request within June to the competent authority, EDEYEP, for the acquisition of a storage permit, for the preparation and submission of the Environmental and Social Impact Study, as well as for the binding market test, which will lead to the conclusion of contracts with the industries interested in CO2 storage and the taking of the Final Investment Decision for the project.’

"However, there are significant delays at bureaucratic level, with a typical example that the process of approving the granting of State Aid by the Commission concerning the Recovery Fund has already taken almost a year, given the Fund's own suffocating dates," she said, adding that there are also significant shortcomings in financial tools.

Ms. Sardis concluded by urging to learn from earlier regulatory mistakes, which essentially led to the cancellation of the natural gas storage project in South Kavala, in order to avoid CO2 storage in Prinos. [4]

5. Storage outside the EU

Nearby, but outside the EU, there are the following Carbon Storage possibilities, that might be used by European emitters, especially if/when the issue of the prohibition on transboundary CO2 transfer under the London Protocol [5] is resolved.

Of note are the following

5.1 Egypt: This is an offshore O&G reservoir in Alexandria. The storage capacity of the hub is estimated at '5-100 million mt CO2' [6]

5.2 S.Arabia: The Aramco Jubail hub aims to capture and store 9 MtCO2 emissions per year by 2027, a key part of Saudi Arabia's interim sequestration target of 44 MtCO2 per year by 2035. The storage site is onshore, saline. Status: pre-FEED in final stages, In operation: 2027. [7]

6. Conclusion

Carbon Capture is one of the solutions to minimize GHG emissions. It is especially addressed to hard-to-abate industries such as power, chemical, cement, refining, mining, steel, metallurgy, aluminium and other non-ferrous metals, magnesia, lime etc.

Storage sites are being developed in Europe, but at a slow rate. This is especially true of Southern Europe.

Adequate financing for a number of European CCSU projects has been secured from national governments and directly from the EU, through from programs such as Horizon 2020, the Innovation Fund and Connecting Europe Facility, some in the Electrification of Industry and Hydrogen category. Nevertheless, establishing financial support mechanisms in Member States and streamlining existing EU funding is necessary.

However, even successful projects are facing policy bottlenecks. Measures are needed notably encouraging political support for CCS deployment in some Member States, and especially developing a regulatory framework to support CCS deployment: Targets for capture and storage need to be supported by means of accelerating permitting procedures for capture plants, transport infrastructure, and CO2 storage sites.

Otherwise, the only solution remains CCU, with all its technology and market limitations.

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