Assessing Romania's Oil- and Gas Reservoirs for Low-Risk, High-Capacity CO_2 Storage Opportunities

Introduction

The Net-Zero Industry Act (Regulation (EU) 2024/1735) sets a Union-wide objective of developing 50 million metric tons per year of operational CO_2 injection capacity by 2030. The obligation to deliver this capacity is distributed among oil and gas producers in the EU according to their historical production shares, with Member States responsible for ensuring compliance and enabling the necessary infrastructure development. According to the Commission's 2025 allocation decision, Dutch producers carry the largest share of the obligation, while Romanian entities account for roughly one-fifth of the total EU requirement (European Commission, 2025). Romania's National Energy and Climate Plan recognizes carbon capture and storage (CCS) as a strategic priority and signals support for its deployment. Nevertheless, implementation of CCS projects in Romania remains at an early stage. The 2030 storage capacity objective therefore highlights the need to accelerate carbon storage development across the Union.

To date, most European CCS activity is concentrated in the North Sea region, with emerging projects such as Prinos (Greece) and Ravenna (Italy) expanding capacity in Southern Europe. Romania, however, lacks a clear storage pathway; relying on distant facilities would incur substantial transport costs and logistical complexity.

In this study we evaluate Romania's mature oil and gas fields as candidate CO_2 storage sites. These reservoirs are generally well-characterized, often possess significant storage capacity, and potentially have infrastructure that could be repurposed for CCS. We identify the lowest-risk fields, and assess their proximity to the country's major emitters, highlighting source-sink pairings that minimize transport distances, simplify permitting, and enhance project viability.

Finally, we outline a transferable methodology that can be applied to other high-demand regions to rapidly screen CO_2 storage potential and pinpoint the most promising targets for further assessment.

Methodology

This study compiled a database of candidate CO_2 storage sites in Romania's producing and depleted oil and gas fields. Using a consistent workflow across all assets, we (i) estimated the theoretical CO_2 storage capacity for each reservoir to enable like-for-like comparisons, (ii) applied a screening-level risk ranking to identify the most technically viable and lowest-risk candidates, and (iii) integrated the ranked storage sites with the spatial distribution of major CO_2 emitters to generate a prioritized portfolio for subsequent, detailed evaluation.

The assessment draws on field-level data from the S&P Global Energy CERA Upstream Solutions databases, which were used to estimate the theoretical CO_2 storage capacity of each reservoir via the equation:

CO_2 Storage Capacity = EUR * Bg (gas) or Bo (Oil) * CO2 Density * Storage Efficiency

A storage efficiency of 0.90 was applied to gas reservoirs, assuming pressure depletion is the primary recovery mechanism, while 0.65 was used for oil reservoirs to reflect typical waterflood and/or EOR operations and potential pressure support from an active aquifer.

To screen for suitability and support prioritization, two independent risk indices were computed for each field: (1) Capacity & Injectivity risk, capturing the reservoir's ability to accept CO_2 at useful rates and retain it, and (2) Containment: Well risk, reflecting containment threats associated with legacy wells, particularly relevant in Romania given drilling activity dating back to 1857. The risk ranking follows a workflow in which geological attributes are classified into risk classes (per Table 1), assigned importance weighted scores, normalized, and then summed to produce overall indices for each risk category.

Finally, the capacity estimates and risk rankings were spatially overlaid with the locations of Romania's major CO_2 emitters to identify source–sink pairings and to prioritize sites that combine high potential capacity, lower screening risk, and shorter transport distances, thereby improving project feasibility and supporting efficient maturation of the most promising opportunities.

Table 1: Criteria for defining the risk class of CO_2 storage entities

	Class				
Criteria	**1**	**2**	**3**	**4**	**5**
Capacity & Injectivity					
Depth (m)	<300	300-799	>3500	3001-3500	800-3000
Virgin Temp/ Pressure (KPa & oC)	>69,000 &/or >150		<7380 &/or <31.1		7380 – 69,000 & 31.1 – 150
Resource Type	Coal seam	Basalt	Oil Field	Brine aquifer	Gas Field, Saline Aquifer
Porosity (%)	<10	10-14	15-19	20-25	>25
Permeability Thickness (mDm)	<10000		10000-100000		>100000
Compartmentalization			Yes		No
Storage Volume (Mt)	<1	1-5	6-10	11-100	>100
Containment: Wells					
Number of wells	>500	100-500	20-100	1-20	0
Well density (wells / km^2)	>5	1-5	0.5-0.99	<0.5	0
Oldest well	< 1905	1905-1940	1941-1990	1991-2020	>2020

Results

The analysis of more than 500 oil and gas fields shows that the bulk of Romania's CO_2 storage potential is concentrated in the Transylvanian Basin in the center of the country, where numerous medium-to-large gas reservoirs are present (Fig. 1); the western part of the country contributes only modest, small-scale capacity, while several south-Carpathian fields also exhibit appreciable volumes.

The suitability of these sites from a geological point of view has been assessed through the Capacity & Injectivity ranking score. Figure 1 shows the distribution of the fields that have received the highest ranking (green). Approximately 18 % of the examined fields received a ranking score greater than 3 (out of 5), indicating the most favorable candidates for CO_2 storage. One of the main contributing factors for a low ranking is a low permeability-thickness of the reservoirs. Permeability-thickness has been used as an indicator of the ability to inject, low values still fall within the performance envelope of active CCS projects worldwide, implying suitability for smaller-scale capture-and-injection schemes, whereas a subset with superior reservoir properties could support larger hub-based operations.

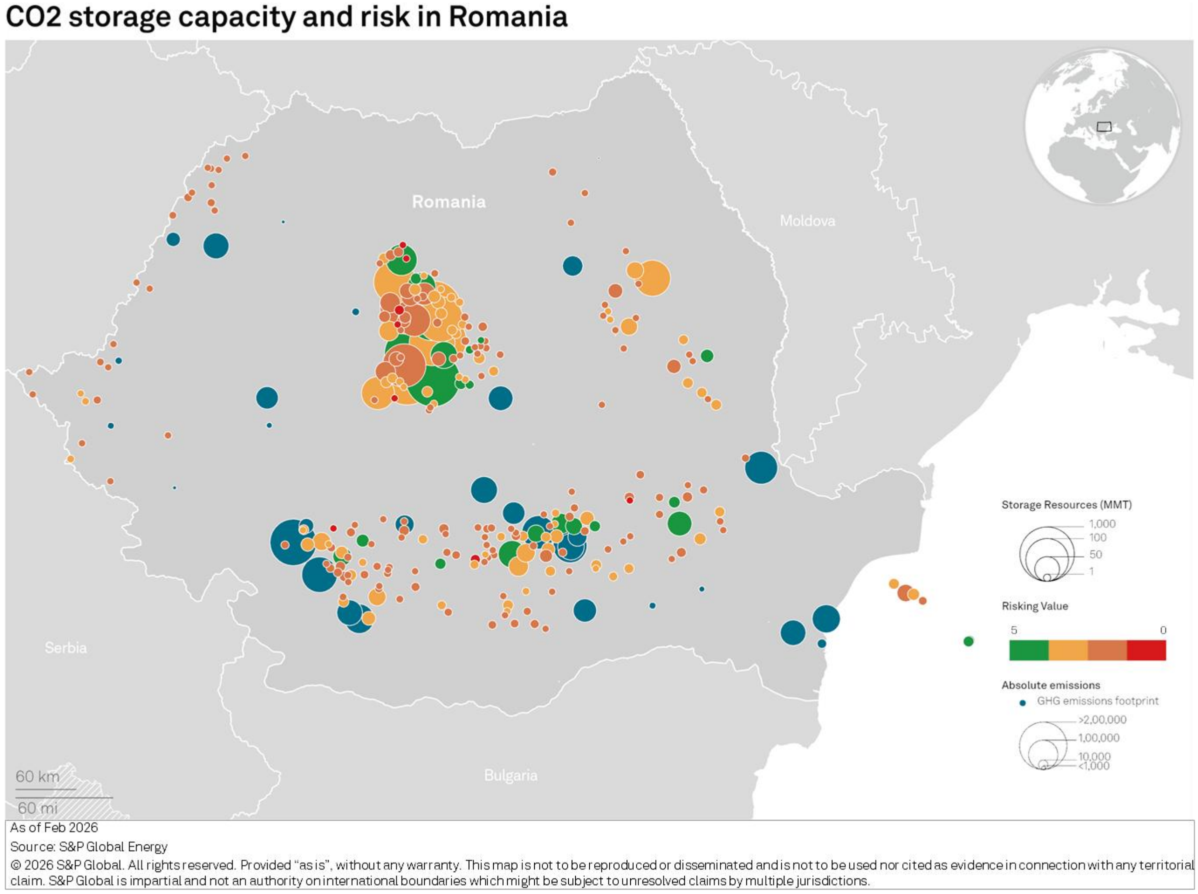

Figure 1: *Map showing the storage capacity of fields with a capacity of >1 MMt. The size of the points is proportional to the storage capacity, the color of the points is relative to the Capacity & Injectivity risk, with green indicating the best projects and red the worst. The blue points show the location of the key emitters; the size is relative to the emissions.*

Well-related risks dominate the assessment of the suitability of fields for carbon storage. Over 80 % of fields scored below 2 (out of 5) for the containment-well metric, and only 2 % exceeded a score of 3, reflecting the legacy of extensive, often antiquated drilling activity with over 6,000 wells pre-dating 1940. These wells are expected to have a significant chance of leakage with cementing technology being in its infancy or not used prior to this date.

Applying a filter for fields with >5 MMt storage volume and both containment-well and capacity-&-injectivity scores above 2.5 isolates six high-ranking storage sites; Figure. 2 maps these locations relative to the principal emitters. This shows that these fields are located within 50 km of key emitters which could form the basis of capture-storage projects with the potential to store >15 years of emissions from major emitters.

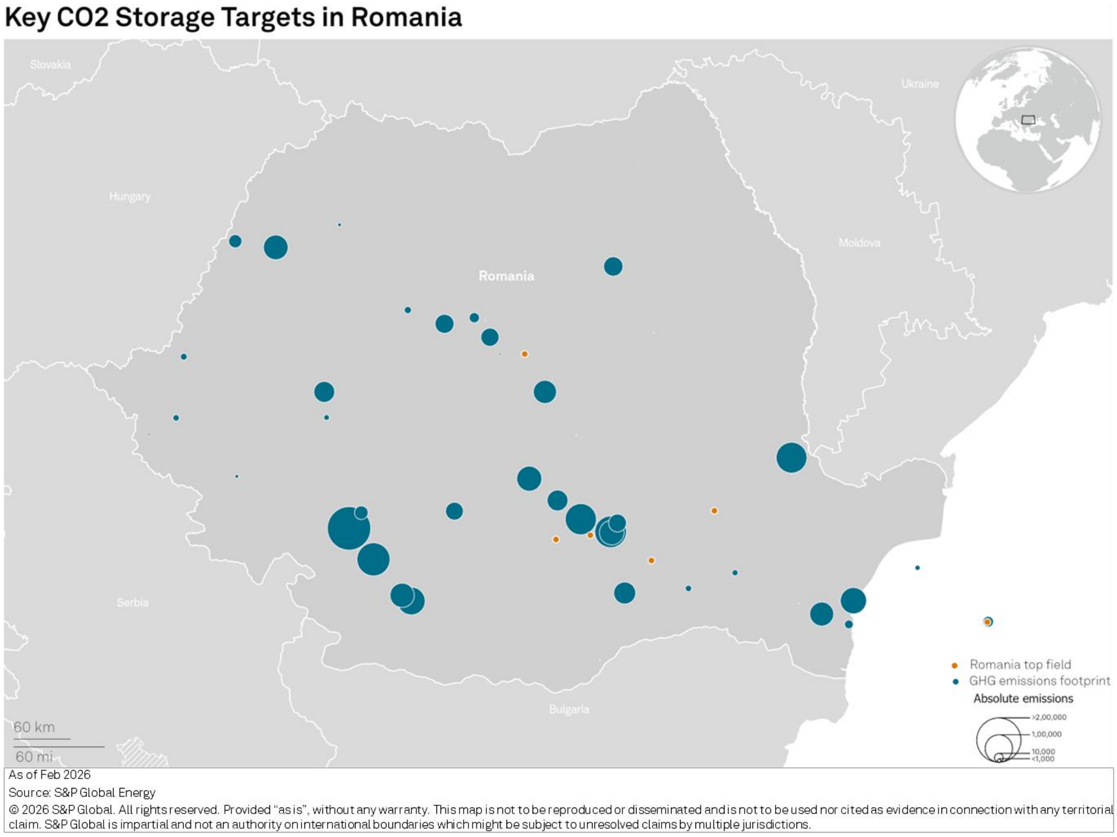

Figure 2: *Location of the top six fields following the high-level screening study of Romania, (orange) and their proximity to key emitters (blue) in the country.*

Conclusions

The screening of over 500 Romanian oil- and gas reservoirs demonstrates that the country possesses a substantial, yet unevenly distributed, CO_2 storage resource. Potential leakage through existing wells has been highlighted as the key risk associated with using oil and gas fields for carbon storage and is likely to rule out a significant number of storage sites. By applying a consistent capacity calculation and a dual-risk ranking (capacity & injectivity, containment-well), we identified a small subset of high-ranking fields, six sites that combine >5 MMt storage potential with risk scores above 2.5, as prime candidates for near-term carbon-storage projects. These low-risk fields provide feasible source-sink pairings that can minimize transport costs and accelerate deployment. The methodology presented here offers a rapid, reproducible framework for other regions with similar storage demands, enabling policymakers and developers to prioritize sites, highlight legacy well integrity issues, and advance the EU's 2030 decarbonization targets.

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References

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