Introduction

This paper aims to summarize a recent study on screening and ranking of depleted oil and gas fields for potential CO_2 storage within the portfolio of one of Europe's major operators. The primary objective is to assess the CO_2 storage capacity of these fields and prioritize them based on their geological characteristics and technical and economic feasibility for long-term CO_2 sequestration.

Method and/or Theory

The methodology involves two key stages: screening and ranking.

Prior to the screening process, an assessment of study resolution and storage capacity definition was put in place. Within the time and resource constraints within the project, the scope of the work was limited to elements in red boxes below in Figure 1(adopted from Bachu et al, 2007)

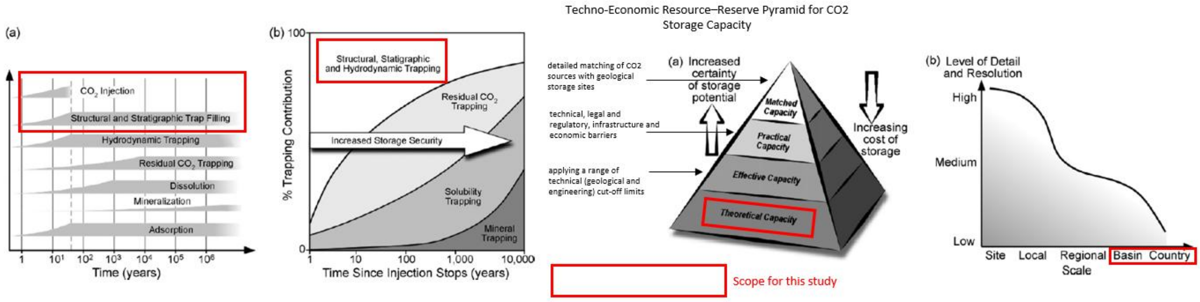

Figure 1: Scope of Study

Subsequently, a screening process was conducted to evaluate the company's depleted oil and gas fields using geological, petrophysical, and operational data. Parameters such as reservoir depth, porosity, permeability, reservoir depletion, and caprock integrity were considered. The screening criteria borrowed elements from Callas et al (2022) shown below, Figure 2. Substantial modifications were made within this study to incorporate Client’s requirements and local context.

Category	Criteria	Disqualifying Threshold
Capacity and Injection Optimization	Depth to Top of Formation	<800 m
	Permeability	<10mD
	Porosity	<10%
	Reservoir Thickness	<10 m
	Minimum Storage Capacity	< the minimum capacity needed for project
Retention and Geomechanical Risk Minimization	Secondary Confining Units	No secondary confining unit
	Top Seal Thickness	<25 m
	Active/Inactive Faulting	Faults active in the Quaternary distance from closest injection well: <2km
	Earthquake Record	$M \geq 3$ (epicenter < 10 km) & $M < 3$ (epicenter < 5 km) to pressure front
	Bottom Seal/potential for pressure transmission to the basement	No bottom seal
	Production from a reservoir below the storage interval	Yes
Siting and Economic Constraints	Sensitive Habitats for depleted fields that are inactive	Critical wildlife habitat for certain species and wilderness study areas
	Population Density for depleted fields are that are inactive	> 75 people per km^2
	Restricted Lands for depleted fields that are inactive	National landmarks, conservation lands, military installments, American Indian Lands, Federal Lands and State Lands
	Maximum Depth to Top of Formation	≥ 10,000 ft (3,048 m)
	Water Depth (if offshore)	>500ft (152.4 m)

Figure 2: Site Screening Criteria for Developed Reservoirs (Callas et al, 2022)

In the second stage, a comprehensive ranking model was applied to prioritize fields based on their suitability for CO_2 storage, focusing on factors such as potential well injectivity, CO_2 retention, geomechanical risk minimization, and proximity to CO_2 sources. Additionally, theoretical storage capacity for each field was estimated using the material balance approach, providing a comparative measure for each candidate's potential.

Conclusions

The study's two-stage screening and ranking system effectively prioritized the depleted fields, clearly identifying those most suitable for large-scale CCS deployment. Fields with high storage capacity and favourable geological and economic characteristics

emerged as prime candidates, while others were deemed less suitable for CO_2 storage or required further technical evaluation due to uncertainties in reservoir integrity or injectivity.

A clear strategy for pilot project selection was proposed, based on a combination of storage capacity estimates and ranking scores. The results demonstrate that this approach provides a structured framework for selecting optimal CCS sites, offering a roadmap for future project development and implementation. The top-ranking fields identified in this high-level study are now subject to more detailed site characterization, requiring new data acquisition and additional simulation and experimental studies.

This work demonstrates the application of a systematic two-stage screening and ranking methodology, identifying the fields most suitable for CO_2 storage within the portfolio of one of Europe's major operating companies. It provides valuable insights to guide future detailed studies and CCS project development, contributing to the advancement of CCS initiatives in Europe.

References

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