Introduction

2050 targets are rapidly approaching, and carbon sequestration has a vital role to play in a global net zero emissions future. Geological CO_2 storage is seen as the ultimate end result of CCS (Ma, J. et al. 2022), therefore thorough screening and assessment of the subsurface is a foundational layer of a successful CCS project.

Meanwhile, the IEA Net Zero Roadmap suggests that there has been a lack of progress in CCS and that slow deployment and unmet expectations are to blame. The IEA cites that a decrease in project lead times, specifically in relation to CO_2 storage, is vital to achieve Net Zero Emissions (IEA, 2023). Therefore, rapid screening of geological storage is critical to empower operators and decision makers to find the right storage solution in a shorter timescale.

Screening of CO_2 storage sites is essential, but it is also necessary for that screening to be deployed at various scales to rapidly assess competitive options. Not only is there a need to screen basins on a regional scale in order to rank and prioritize the best basins for carbon storage, but once the best basin has been selected, there is also a need to screen at the local scale. Screening at the local scale helps to stratigraphically define aquifers and areas of interest for a storage permit application and further 3D modelling work of the potential storage site.

Fast Track SPQI Methodology

Viridien's carbon storage screening studies have been utilized globally to help screen at both the regional and basin scale, including the South-East Asia region (Shepherd, E. et al. 2024) and more recently over Europe. To assess areas for their carbon storage suitability, these screening workflows rely mainly on a rich legacy, recently digitized geological database (GeoVerse™). Several decades of fieldwork, studies, data collection and transformation efforts were invested to establish the database, and reliance upon it to create screening studies ensures they contain the highest quality data. It also significantly reduces the amount of time it takes to produce carbon storage screening by cutting a large part of the data harvesting efforts and focusing on key factors. Therefore, the quality of carbon storage screening is not compromised by speed in the approach described here.

Regional level screening helps to identify key basins of focus and provide options from a large-scale perspective. For basin scale screening, Viridien has developed a workflow referred to as the Storage Play Quality Index (SPQI) (Duval, G. et al. 2022). This full SPQI workflow includes assessment of a maximum number of properties (13+) mappable at that scale, developed to support the SPE's Storage Resources Management System (SRMS), but does not necessarily provide a rapid decision making tool for the CCS developers to prioritize their options. In order to obtain a first evaluation of potential CO_2 storage sites with sound evaluation in a more reasonable timeframe, a fast track SQPI workflow is proposed.

There are two phases to the fast track SPQI workflow. Phase 1 consists of 3 steps. Firstly, a stop:go analysis, where the basin is screened according to parameters such as: sediment thickness in the carbon storage window, containment issues due to seismicity and faulting, and land access. The regions of the basin that fail these parameters are marked as such, revealing the remaining area of interest. Secondly, the candidate aquifer intervals are stratigraphically defined and finally, each aquifer is assessed via a risk matrix.

Phase 2 then consists of 2 steps which are the fast track SPQI map analysis and capacity estimates. The individual property maps, comprising Gross Depositional Environments (GDE), lithology, top depth-structure, porosity, permeability, net thickness, reservoir temperature and salinity, together with seal GDE, lithology and thickness, are created for each play of interest. These are then convolved into fast track SPQI maps, and finally the average maximum storage capacity is calculated.

Note that Phase 2 of the workflow focuses on subsurface static parameters, whilst Phase 3 (not presented here) focuses on a preliminary 3D dynamic CO_2 plume model to support a future storage permit application.

Vienna Basin Case Study

To highlight the methodology, an example of our fast track SPQI workflow will be presented from a section of the Vienna Basin in Austria.

The need to deploy fast-track basin scale screening in Europe has been demonstrated by the maturing regulations and ever-increasing array of carbon storage licenses being offered in the region. In addition to this, the first onshore carbon storage licensing round took place last year in Denmark, highlighting the need for a robust screening workflow that could work both for offshore and onshore basins. This need for rapid basin scale screening in Europe pushed the development of the fast track SPQI workflow, which can now be applied to any basin worldwide, and can be deployed to support Asia Pacific in both its offshore and onshore carbon storage goals.

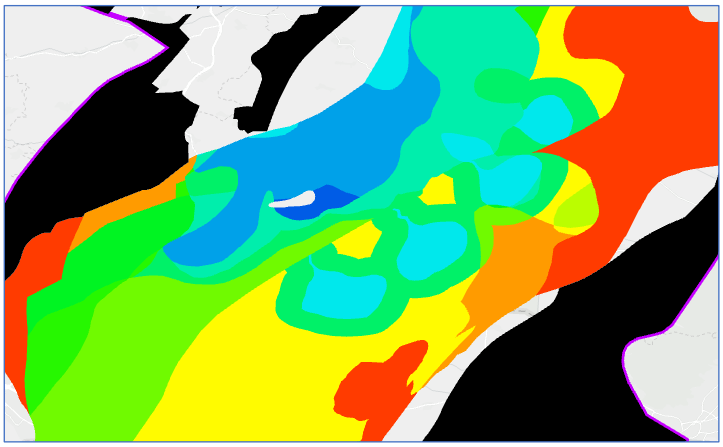

Figure 1 *Extract of the combined Storage Play Quality Index map from a selected play in the Vienna Basin, Austria. This is an example of the output from Phase 2 of the fast track SPQI workflow. Individual property maps are created for each play of interest and are then stacked to create a combined Storage Play Quality Index map for each play.*

Conclusions

The Fast Track SPQI workflow is the combination of several years of development in carbon storage screening workflows and digitization of a global digital geological database. It cuts down the time and efforts of harvesting high quality data. It helps quickly focus on the analysis of key storage parameters for rapid and sound business decisions and prioritization of opportunities for storage developers. The aim is to support, accelerate and increase CO_2 storage permit applications around the world to ensure CCS project lead times are decreased and that a net-zero 2050 is achieved.

References

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