How to discover a storage resource: following the principles of the SPE-SRMS what is required to classify as storage resource as ‘discovered’?

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Abstract

**How do we know if a storage resource is actually realisable – i.e. it is discovered?** Is the presence of a permeable rock sufficient? How does a developer, financier or policy maker gain sufficient confidence that CO\(_2\) can be stored in a particular area to proceed with a project?

There are top down estimates of global storage capacity that give confidence that there should be sufficient storage capacity to make a huge contribution to the fight against climate. There are also a variety of storage atlases and published storage estimates for specific basins, reservoirs or structures. However, the methodology and maturity of uncertainty assessment varies considerably (and is often not clearly stated) such that estimates from a variety of sources cannot be meaningfully added together to get from the bottom up to a global estimate. In addition, the current dataset is incomplete, with estimates for significant regions missing.

The SPE have released the SRMS (Storage Resource Management System) which could tackle the first of these problems if a consistent set of principles are widely adopted for classification (of resource maturity and ‘certainty’) and associated storage resource estimation methodology.

The SRMS provides such an initial framework of principles. The OGCI has reviewed this framework against publicly available CO\(_2\) storage resource estimates to highlight how the SPE-SRMS might be utilized. This exercised also highlighted critical areas where challenges might occur. One such point is the transition from potential storage capacity (or an exploration activity) to contingent storage capacity – i.e. what constitutes the discovery of storage capacity?

One region explored by the project was the Captain Sandstone formation in the UK North Sea. This region has been extensively studied by a number of projects, including the Longannet and Peterhead CCS projects that were part of the UK’s former attempt as commercialising CCS on power

CO\(_2\) storage resource estimates have been generated for the Captain Sandstone, in its entirety or targeting a specific region, by several parties, and for a variety of purposes. Some of the estimates discussed include:

- **CO2STORED. UK CO\(_2\) Storage Evaluation Database**, hosted by the British Geological Survey (BGS) and The Crown Estate. Captain sandstone saline aquifer unit (whole) and discovered oil and gas fields as potential storage resources.
- **BGS / Herriot Watt. Simulation study of saline aquifer storage.**
The discovery status of a resource represents a critical ‘gate’ between the prospective and contingent resource categories. For hydrocarbon resources, a discovery is relatively easily demonstrated following the observation of mobile hydrocarbons in an exploration well. Discovery of storage resources in a saline aquifer formation is more complex. Reviewing the classification of existing storage estimates highlights some questions? How large an area can a single well ‘discover’? What is required to discover an open store (where injected CO\textsubscript{2} is free to migrate laterally) versus CO\textsubscript{2} storage resources utilising a ‘trap’ which prevents lateral migration?

The SPE_S RMS highlights the requirement for direct data to support a discovery (well penetration of both containment and storage formations, with log and/or core data to support suitability, plus a flow test or suitable analogue for injectivity). It is also important to make an assessment of the quantity that can be ‘stored’, which implies both that the quantity can be injected into the connected porespace in the short-term, and ‘contained’ safely without release to surface (or seabed) in the long-term.

The OGCI propose that discovery for a storage resource requires additional emphasis on the demonstration of ‘containment’ compared to hydrocarbon resource. Many estimates in the literature take the pore volume of a formation and multiply this by a storage efficiency, but they do not critically look at storage efficiency factor with containment in mind. In order to justify a storage resource as discovered the formation’s ability to hold the proposed mass of CO\textsubscript{2} all but permanently, must be demonstrated. The storage resource is defined as the ultimate quantity of CO\textsubscript{2} that will remain in a store (be it dissolved, mineralised, buoyancy trapped, or capillary trapped) after thousands of years. Hence a resource could not be classified as a contingent resource until the expectation of a competent seal (to contain the injected CO\textsubscript{2}) is demonstrated (with direct supporting evidence) over the entire reservoir area where the CO\textsubscript{2} plume might migrate in the long-term. In some cases, this may also be a function of the development (well locations, injection rates etc.).

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