Evaluating, Risking, and Ranking Carbon Sequestration Prospects with Application to Gulf of Mexico

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MS Energy and Earth Resources

The University of Texas at Austin, 2022

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Carbon Capture and Storage (CCS) is a critical technology in the fight against climate change but has not yet been deployed at the necessary scale to make an impact. The Gulf of Mexico is a prime location to pursue CCS in the US due to its proximity to concentrated carbon emissions and coincidence with an experienced hydrocarbon history that can lend its expertise to this young field. Using petroleum industry practices as an analogue, prospect inventories - catalogues of discovery opportunities - can be used to improve the selection of carbon storage sites. Carbon storage prospect inventories are used to identify potential projects, quantify their associated risks, and rank them for investment suitability. This paper develops one way that stakeholders can calculate prospect risk and conduct initial prospect screenings so that their resources can be effectively allocated to prospects with the highest chance of economic and technical success.

This work improves upon existing carbon storage prospect inventories in the Miocene section in offshore Texas and Louisiana by incorporating fault seal as a trapping mechanism and including lithological and petrophysical data from a 3D geologic model. Incorporating fault seal allowed smaller prospects previously identified to be grouped into larger, more continuous traps over several stratigraphic intervals that may be more attractive to developers. Including stratigraphic and petrophysical data allowed prospect trap, seal, capacity, and injectivity to be more precisely estimated and risked. A new workflow compiling risk and de-risking factors was built to quantify geological and surface risk associated with each prospect. Prospects were characterized and risked by re-analyzing well log and seismic data, implementing geostatistical principles, and constructing a capacity-based, discounted cash flow model to quantify economic potential under current and potential future political conditions.

This workflow shows that it is possible to risk and rank CCS prospects using commonly available data which is a step forward in making CCS projects more accessible to potential developers. By clearly re-defining prospects with additional information and quantifying their risks, this research gives developers more information on their sequestration options, augmenting the probability of making high-quality investment.