The University of Texas at Austin

M.S. Energy and Earth Resources

Evaluating, Risking, and Ranking Carbon Sequestration Buoyant Traps with Application to nearshore Gulf of Mexico

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Abstract

It is critical to streamline investment into CCS projects to reduce the concentration of greenhouse gases in the atmosphere and reduce the impacts of climate change. The Gulf of Mexico is a prime location to develop CCS projects due its vast geologic carbon storage potential, proximity to concentrated CO2 emissions, and coincidence with an experienced hydrocarbon industry that can lend its expertise to this young field. The petroleum industry uses prospect inventories, catalogues of discovery opportunities, to identify potential projects, quantify their associated risks, and rank them to focus on prospects to maximize the potential of high-quality investments (Lottaroli et al 2018). This work improves upon existing prospect inventories considering only buoyant traps in the Miocene section in state and nearshore federal waters of offshore Texas and Louisiana (TexLa Dataset) by incorporating fault seal as a trapping mechanism and including lithological and petrophysical data from a comprehensive 3D geologic model. The result was larger, amalgamated buoyant traps prospects which are more likely to support development projects due to their size and continuity.

The usefulness of a prospect inventory is realized when the subsurface and above ground risks associated with each buoyant trap prospect are quantified, allowing prospects to be ranked by suitability for project development. Quantifying risk differentiates prospects, highlights those of greatest promise, and allows developers to make more informed choices about which projects to pursue. Subsurface risk was evaluated by considering structural trap, confining zone, well leak, capacity, and injectivity risk. Aboveground risk was examined by looking at the political and permitting conditions in the region and building a sequestration discounted-cash flow valuation model to quantify each prospect's economic potential. This work shows that it is possible to risk and rank CCS prospects using commonly available data and quantitative, repeatable workflows that can be applied anywhere in the world.

The final useful output of this work is a ranked list of the buoyant trap storage opportunities within the Miocene section of the TexLa region. Broad risk ranking were conducted using Common Risk Segment (CRS) maps. More differentiating risk-weighted values for the prospects were calculated using Expected Monetary Value ($MM).

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