

## **In-situ oil-shale recovery, carbon capture and storage, and the importance of large projects**

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Today, three driving forces dominate questions of energy production and technology development: energy security, climate and other environmental concerns, and economics. Each of these drivers has become important and has large, well-organized advocates. Solutions that serve the largest portion of all three drivers are most likely to succeed commercially. In this context, concerns about the carbon footprint and associated greenhouse gas emissions of unconventional hydrocarbon production, predominantly oil sands and oil shale, present a substantial challenge to large-scale development. Solutions that reduce the emissions footprint substantially are likely to be favored by a wide range of stakeholders. In this context, it is reasonable to expect that both efficiency improvements and carbon management will be central to successful oil-shale production. Specifically, carbon capture and storage (CCS) can play a critical role in reducing many associated emissions, both from co-produced gases (which often have a large CO<sub>2</sub> fraction) and from generating stations used to power in-situ recovery methods.

Thankfully, sites of large oil shale resources, particularly the Piceance Creek and Uinta basins, appear to have geology extremely well suited to geological carbon storage. These basins have many high-capacity, porous and permeable units with high injectivity and capped by impermeable zones. Structural, stratigraphic, and hydrologic traps are abundant. In this context, it is highly desirable to accelerate an experimental CCS program in these basins. Proposed projects should be large. Specifically, they should be large enough to achieve these goals:

- demonstrate commercial scale viability
- test key geological thresholds (e.g., pressure buildup, induced seismicity, reservoir heterogeneity)
- provide information that will help regulatory and permitting agencies craft project requirements that serve public interests without undue burden
- provide a substantial platform for monitoring and verification

Geological assessments that can help with the siting and

planning of such projects should remain a high priority to decision makers in regions of high oil shale potential.