The study identifies key issues and discusses the conditions and changes needed to transition from EOR to CCS for existing and future operations.

INTRODUCTION

Most of the CO₂ injected into the reservoir for Enhanced Oil Recovery (EOR) remains permanently trapped underground. In many instances, CO₂ is also recycled as it is a major cost component.

It is this characteristic of EOR operations that makes them potential candidates for CCS project designation. CO₂ costs are also offset by revenues generated from the sale of recovered hydrocarbons. Coupling CCS with EOR could provide a critical financial incentive to facilitate development of CCS projects in the near term.

The underground reservoir in an EOR project is pre-determined by location of the existing oil and gas producing formation. CO₂, just injected from the beginning for CO₂ storage purposes. A separate process will then likely be required to evaluate the reservoir to determine its suitability for long-term underground storage of CO₂ under CCS rules and regulations. Typically, EOR regulations do not account for what happens to the injected CO₂ after EOR activities have ceased.

CHALLENGES OF TRANSITIONING

Site characterization, integrity and monitoring

The appropriateness of a potential CO₂ storage site needs to be carefully assessed primarily by three principal requirements:

- **CAPACITY**
  - whether there is sufficient storage volume and whether it can be accessed

- **INJECTIVITY**
  - whether suitable reservoir properties exist for injection of CO₂ or alternatively industrial supply rates

- **INTEGRITY**
  - whether the site is secure with negligible risk of unintended leakage

Given that depleted oil and gas fields are considered some of the best storage site options for CCS, capacity and injectivity are unlikely to be an issue in the transition from CO₂ EOR to CCS.

Integrity could be a challenge, given the need to ensure permanent storage of CO₂ in order to achieve climate change mitigation aims. Injection wells and abandoned wells have been identified as some of the most probable leakage pathways for CO₂ storage projects.

CO₂ EOR/CCS projects will need to ensure that appropriately robust monitoring regimes are in place to detect leakage, to account for losses in the projects over all emissions inventory and to ensure that measures are put in place to stop leaks when detected. Maintaining well integrity is important throughout the well’s life cycle, from drilling to plugging and abandonment.

Any CO₂ EOR project seeking to transition to a CCS project will have to address the long-term monitoring requirements for CCS storage sites.

DESK RESEARCH

- **LEGAL AND REGULATORY REVIEW AND GAPS ANALYSIS**

Experience has been gained from over 130 commercial CO₂ EOR operations globally. Active CO₂ EOR projects exist primarily in the United States and Canada, with further commercial and demonstration projects, operating in Asia, Middle East and the North Sea. The legal and regulatory review focused on the regimes in the USA, Canada, EU, Australia and Brazil.

- **KEY FINDINGS**

The analysis conducted and the information compiled in this research support the 2013 CSLF finding that:

> “There are no specific technological barriers or challenges per se in transitioning and converting a pure CO₂ EOR operation into a CO₂ storage operation. The main differences between the two types of operations stem from legal, regulatory and economic differences between the two.”

There is a clear regulatory framework for CO₂ EOR in most regions but there are insufficient provisions that would allow a CO₂ EOR operator to follow a clear transition pathway for legal and regulatory approval of a CCS project.