Cost Analysis Associated with CTUS of CO₂

Poster Overview

The National Energy and Technology Laboratory (NETL) performs cutting-edge systems engineering and analysis modeling that evaluates the techno-economic, logistical feasibility, life cycle environmental impacts, and market effects of Carbon Capture, Utilization, and Storage (CCUS). Each modeling approach provides a unique perspective of the potential for CCUS in the United States. This poster features a select assortment of recent analysis in each of the modeling areas. Techno-economic and feasibility modeling related to CCUS deployment was performed for both onshore and offshore settings. Onshore, analyses assessed the future feasibility of a CO₂ "intermediate storage" concept, as well as potential for deployment of CO₂-EOR to residual oil zones in the Permian Basin. Offshore, publicly available datasets were integrated with the NETL-developed Cumulative Spatial Impact Layers (CSIL) tool to identify high-suitability offshore regions/sites for CCUS projects in the Gulf of Mexico. Another study presents GIS-based analyses and Monte Carlo simulations to evaluate the benefits of transporting CO₂ via pipeline or ship to offshore injection sites. From a life cycle perspective, the CELIC model is presented. This open-source model defines the life cycle impacts of CO₂ enhanced oil recovery (EOR) by calculating a system's life cycle greenhouse gas emissions for CO₂ captured from different sources. The market research team presented case studies focused on investigating the overall cost of capture from different types of anthropogenic sources and analyzing the reliability of delivery of anthropogenic CO₂ from industrial sources to long-term storage or EOR sites for injection.

Meta-Analysis CCUS Screening Framework of GOM OCS

- Developed a framework to use disparate data and expert opinion to select priority sites
- Incorporates criteria into a quantitative analysis to identify areas with potentially high suitability using NETL developed CSIL tool.
- Quality input from experts weighted for 4 separate scenarios
- Model criteria and ranking

Reliability of CO₂ Delivery from Anthropogenic Sources

- What are Reliable Sources?
  - Consistent
  - Predictable
  - Shute Creek Natural Gas Processing Plant, in Wyoming
  - Inlet gas - 65% CO₂
  - Reproducible analysis to evaluate the reliability of sources. Use inlet volume at other plants where CO₂ sales data is unavailable.

The CO₂ Enhanced Oil Recovery (EOR) Life Cycle (CELIC) Model

- CELIC Calculates life cycle greenhouse gas (GHG) emissions for a CO₂-EOR system
- Users can select 3 sources of injected CO₂:
  - Extracted from a natural dome
  - Captured from a coal-fired power plant
  - Captured from a natural gas power plant
- Several parameters and options allow for the assessment of the system for a wide array of products
  - Electricity, CO₂ Pipeline, Crude Oil, Refined Fuel
- Capable of deterministic and stochastic analyses
- Outputs a time-series analysis that shows changes in GHG emissions for the CO₂-EOR system over time

Offshore CO₂ Transportation Assessment

- Assessed the feasibility of using pipeline or ship for delivery of CO₂ offshore for injection for storage of EOR
- Complete Cost Uncertainty assessment using Monte Carlo simulation Excel add-in to evaluate offshore delivery options

Multi-criteria CCUS Screening Framework of GOM OCS

- Number Criteria
- Investment
- Recovery
- Water Depth
- CO₂ Costs by Faults
- Pipeline Costs
- Shipping Vessel Costs
- Pipeline Costs

Reliability of CO₂ Delivery from Anthropogenic Sources

- CO₂ sales expansion
- Greater than less than average CO₂ sales
- Difference in actual and expected volume
- 85% monthly CO₂ sales are more than 90% of average sales

Residual Oil Zone (ROZ) Resource Appraisal

- 12 county assessment of greenfield CO₂ EOR to San Andres ROZ in Permian Basin
- FE/NETL CO₂ Prophlet and Onshore CO₂ EOR Cost Model used for analyses
- Modeling Results:
  - 35.9 Bbl of oil recoverable
  - 16.6 Billion metric tons of CO₂ purchased
  - 0.39-0.55 metric tons per bbl oil produced

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