Economic Carbon Capture and the Missing Letter from CCUS

CCUS in Kansas Forum

Keith Tracy | July 26, 2018
Overview

• Using Industrial-Sourced CO₂ for Mid-Continent EOR
• The Missing Letter from “CCUS”
• Commercial Impact of 45Q Tax Credits
• CO₂-EOR and Geologic Sequestration Opportunities
• Conclusions
Cornerpost CO$_2$ LLC

- Consultant to CO$_2$ Sources and CO$_2$-EOR Operators
  - Anthropogenic CO$_2$-EOR expert
  - Authority on Section 45Q tax credits

- CO$_2$ Midstream Asset Development Company
  - Securing CO$_2$ sources for underground injection throughout the US
  - Financial backing to build, own and operate CO$_2$ capture plants and pipelines

- Originator of CO$_2$ Injection Projects
  - Develop new CO$_2$-EOR projects
  - Geologic sequestration well permitting and operations
  - 45Q tax credit opportunities
Using Ethanol-Sourced CO₂ for EOR

- Kansas has the only ethanol plants that capture CO₂ emissions used for CO₂-EOR
  - Arkalon (Liberal KS)
  - Bonanza (Garden City KS)
- First-of-a-kind CO₂ capture plant (Arkalon) has been operational for ~9 years
  - Led to improved design, economics and efficiencies at Bonanza and ADM-Decatur (and future plants)
Using Fertilizer-Sourced CO$_2$ for EOR

- Kansas has the largest fertilizer plant that captures CO$_2$ emissions used for CO$_2$-EOR
  - CVR Partners (Coffeyville KS)
- Area fertilizer plants have the same opportunity:
  - Dodge City, KS
  - Beatrice, NE
  - Woodward, OK
  - Verdigris, OK
  - Pryor, OK

Source: Google Earth
CO₂-EOR in Southern Kansas and Oklahoma

Source: Chaparral Energy
Additional Thoughts on Industrial CO₂ Capture

• Power availability is critical
• Water source is helpful
• Downtime planning is important
• Footprint: ~3-5 acres, near the industrial source’s CO₂ vent
• Construction timetable: typically 20-24 months
• Who Pays Who?
  • CO₂ sources in Kansas typically receive $0.25 to $0.75 million/year, when pipelines/oilfields are nearby
  • Future: CO₂ sources may pay for emissions to be captured and injected
    • 45Q tax credits
    • Ethanol plants may earn a premium on low-carbon fuel (i.e. CA LCFS)
The Missing Letter from “CCUS”

• CC“T”US
  • Carbon Capture
  • Transportation
  • Utilization and Storage

• Pipeline transport is most efficient for large volumes and long distances
  • Large initial capital investment
  • Minimal operational costs
  • Master Limited Partnership (MLP) eligible

Source: CPW America
Pipeline Considerations

• Route Selection
  • Consider paralleling existing corridors
• Obtaining easements takes time
• Public perception
• Price of steel could be impacted by trade wars
• Some Federal Regulatory Issues
  • Engage PHMSA or state-equivalent pre-construction
  • Endangered Species (i.e. American Burying Beetle)
  • Army Corps of Engineers Nationwide Area Permit 12
• Construction
  • Make the pipeline “piggable”; in-line inspection tools are now the norm
  • Rock clause in construction contract creates opportunity for expense overruns
Credit is for 12 years

Tax credits begin on date of first operation

Project must commence construction by 12/31/2023

Values are set by statute through 2026

Credit value for 2027 and beyond will be adjusted based on inflation
  
  Chart assumes annual inflation rate of 1.5%

Projected 45Q Tax Credit Value

- Non-EOR Values
- EOR Values

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<th>Year</th>
<th>NON-EOR Value (per mcf)</th>
<th>EOR Value (per metric ton)</th>
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Assumptions:

- 55mgy ethanol plant
- ~7,500 mcf/d or ~144,000 metric tons/yr of CO₂
- 12 years of credit available
- Full Year Operations starting 1/1/2021

Results:

- Credit in 2021-2032
- ~$68mm total for EOR
- ~$99mm total for NON-EOR
CO$_2$-EOR and Geologic Storage Possibilities

- Oilfields in SW KS with productive Morrow formation
  - Existing CO$_2$-EOR from Morrow fields (i.e. Postle, Camrick, Farnsworth)
  - Example: Interstate Field (near Elkhart)
    - 92 mmbo OOIP
    - 25 mmbo produced to date

- Southeast KS, and South Central KS
  - North Burbank Unit (OK Osage County) proves successful CO$_2$-EOR at 3,000 ft

- Expect regulatory scrutiny on proposed sequestration in Arbuckle
  - Induced seismicity will be an important topic
  - Consider alternative geologic zones/formations for storage

- Should Kansas seek state primacy on class 6 wells?
Possible Carbon Capture Incentives in Kansas

• Existing utility sales tax exemption for manufacturing facilities (ie carbon capture plants) needs to be simplified
  • Required “energy study” is complicated and a deterrent
• Manufacturing sales tax exemption for “integrated production” equipment could be expanded to include CO₂ Pipelines
  • Current exemption only applies to facilities, such as carbon capture plants
• Compulsory unitization of oilfields could be considered
• Eminent domain for CO₂ pipelines is a frequent topic
  • Some states have it; others do not
  • Kansas has eminent domain rights for natural gas pipelines, disposal wells, cemeteries, jails, homes for the aged, and county fair associations
Corporate Structures for Carbon Capture Projects

• Integrated CO$_2$-EOR Company:
  • Operating company (part of WI)
  • Non-operating company (Non-Op, RI/ORRI)
  • Midstream company (carbon capture plants and pipelines)
    • Charges market-based fees for services provided; targets a lower rate of return

• A CO$_2$-EOR Alternative: Midstream company is separately owned
  • Allows upstream capital to focus on oil production, rather than be tied up in midstream assets at a lower rate of return
  • Requires long-term commitments by all parties

• Non-EOR Injection:
  • Joint, or separate, ownership of carbon capture plant and injection well
  • Assets may be independently owned, or be owned by CO$_2$ source (ie ADM)
Future Opportunities

• Timeline:
  • 5 years ago - Coffeyville/Burbank started operations in 2013
  • 10 years ago - Arkalon commenced construction in 2008
  • What will we have 5 or 10 years from now?

• 45Q will likely create a few projects in Kansas

• Paving the path to significant development and large-scale infrastructure
  • Expedite approval of Class 6 well permits – and eliminate unreasonable requirements
  • Oil price sustained at higher levels
  • Economic incentives above current levels
  • Cooperation of players within a project
    • Cooperative unitization of EOR candidate fields
    • Funding partnerships to de-risk projects and monetize 45Q tax credits
Conclusions

• Kansas is a leader in industrial-sourced CO$_2$ capture for EOR
• Experienced personnel are ready to implement carbon capture
• Carbon capture in Kansas is economic, depending on location
• Pipeline infrastructure (the missing “T” in CCUS) will be critical to significant development of carbon capture and EOR in Kansas
• 45Q tax credits are significant
  • 45Q will likely lead to additional carbon capture projects in Kansas
• Some state level incentives may become important considerations
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