

Summary of Breakout and Discussion Sessions

Shared with the participants in the recent meeting sponsored by the Kansas Geological Survey and the State CO2 EOR Deployment Work Group.

Carbon Capture, Utilization, and Storage in Kansas

July 26, 2018

Beren Petroleum Conference Center

Slawson Hall, 1414 Naismith

Lawrence, KS 66046

The following is a summary of the discussions in the afternoon session of the CCUS in Kansas conference. In the meeting, the all-group discussion followed the breakout sessions, but in this summary the order is reversed. During breakout sessions the groups discussed topics that were both specific to the sector and topics that cross-cut sectors. Much of the all-group session focused on cross-cutting challenges.

All-Group Discussion

In the all-group discussion, leaders of the breakout sessions summarized key topics from their respective sessions, and then Brendan Jordan and Marty Dubois led a short summary/discussion of key topics that cross-cut sectors:

Understanding 45Q

- There is a lack of complete understanding of monitoring, reporting and other requirements by 45Q for capturing tax credits.
- **Recommended action:** An in-depth, one-day or partial-day, seminar/webinar on 45Q.

Feasibility for large-scale infrastructure project in the Midcontinent

- Considerable discussion was devoted to the concept of building a trunk line originating in IA or NE and going to the Permian, primarily to capture CO2 from the concentration of ethanol plants in the upper Midwest. The system would allow off-ramps in Kansas for EOR development and on-ramps for additional CO2 supply. Whether that business model is feasible needs further investigation.
- **Recommended action:** Get mid-stream company(s) engaged for a high-level analysis.

Aggregation of CO2 from relatively small, disparate sources

- Aggregation of CO2 from dozens of ethanol plants under different ownership and business structures would require a somewhat complex business model.
- **Recommended action:** Engage more ethanol companies for expanded discussions on the topic

Class VI wells

- Based on past history, difficulties in securing Class VI well permits and burdensome requirements is viewed by most meeting participants as an impediment for saline aquifer storage, especially for smaller companies (small ethanol and independent oil operators).
- **Recommended action:** Evaluate recent and evolving changes related to Class VI permitting: North Dakota and pending Wyoming primacy and possibility of stream-lining application process by EPA.

Breakout Group 1: CO2 Sources, Capture and Transportation, led by Brendan Jordan, Brad Crabtree, Jennifer Hollenbach

The group identified the critical issues potentially limiting the rapid development of CCUS projects in Kansas, and identified issues related to technology, legal, operational, government policy and regulation, achieving sufficient scale through collaboration, sufficient funding, longevity of plants and markets, and volatility of markets. While all issues are important to some degree, that group agreed to focus its attention on the challenge of achieving sufficient scale – meaning that capturing CO2 from ethanol plants is the low-hanging fruit based on low cost of capture, but this strategy requires collaboration with multiple ethanol plants to achieve scale, and requires a complex and expensive pipeline project involving multiple partners. The complexity, expense, and need for collaboration are a barrier to getting a project moving.

The group characterized this challenge as addressing scale and aggregation, possibly through policy. The group first considered whether there are other successful examples of multi-industry collaboration we can use as models or build on. These projects should be looked at in more detail.

- The NRG Petra Nova plant involves at least a two-party partnership between Petra Nova and an EOR operator and may offer some insights in terms of how risk and cost was shared.
- C12 was an ultimately unsuccessful attempt to unitize wells in Kansas but was based on a two-company partnership.

The group considered whether there are natural lead investors.

- A new company or cooperative could be formed
- The ethanol industry could lead
- A large player already present in Kansas, such as Koch Industries or CHS, could lead.
- Another large player could lead

How can we share risk between companies with different risk profiles? How do you allocate risk?

- Build a trunk line originating in IA or NE and going to the Permian, allow off-ramps in Kansas for EOR development and on-ramps for additional CO2 supply. Why go to the Permian? Because the Permian has capacity today for large volumes of CO2, so there isn't off-take risk. Kansas EOR projects are new, and involve some risk, thus you can build a pipeline only to Kansas EOR projects. As long as there are off-ramps, Kansas projects can still benefit.
- The state of Kansas should consider an infrastructure authority to help with the cost of a pipeline.

What are the economic risks going forward? Multi-player projects have to balance risk profiles of all of the participants.

- Building a pipeline is not risky, unless you don't get enough CO2
- The oil operator has multiple forms of risk, including oil price, oil yield from CO2 flood, and whether they will receive a consistent supply of CO2
- Ethanol has oil price and policy risk
- Regulated utility has regulatory risk

Options for a lead investor in a pipeline project

- Big company leads the project
- Consortium (multi-company) is formed
- Or some combination of the above.

The big next steps are

- Discussion between a large player and the Kansas ethanol plants and other sources to explore the viability of a big CO₂ pipeline with multiple sources, capture ethanol CO₂ and carrying it to the Permian, with off-ramps to enable EOR development in Kansas.
- If there is viability for a pipeline project, explore the creation of a consortium to explore participation, roles, financing, and risk-sharing.

Breakout Group 2: Geologic Sites for EOR and Saline Storage, led by Martin Dubois, Tandis Bidgoli, Eugene Holubnyak

Operators that participated in the discussion were generally pessimistic about the likelihood that they would be able to take advantage of 45Q for EOR or for storage in saline aquifers. Before they were willing to allocate resources (manpower and capital) to determining what fields of theirs would be CO₂ candidates they would like to 1) better understand 45Q, especially reporting requirements, and 2) whether large-scale infrastructure (ethanol CO₂ through Kansas) is really possible. At this time, they would rather consider tapping into a large-scale system once it materializes rather than be a part of the process to determine possible Kansas markets.

Key points:

1. Uncertainty in whether a small Kansas operator will be successful in capturing 45Q tax credits is the single most hurdle for the participating oil and gas companies.
 - a. Which reporting rules will be required for EOR (subpart UU or subpart RR)?
 - b. Concerned that costly and burdensome regulations would discourage Kansas operators from investing in field infrastructure
 - c. **Recommended Action:** An in-depth, one-day or partial-day, seminar on 45Q would be very welcomed.
2. Operators would be very interested in knowing whether mid-stream (pipeline) companies believe that a large-scale gathering and transportation system is viable and what it would take to make it happen.
 - a. **Recommended Action:** Enlist a mid-stream company to perform a feasibility analysis
3. Participating operators expressed their opinion that burdensome filing requirements for Class VI wells and field operations and reporting rules (subpart RR) would discourage any Kansas operator from managing a CCS (saline aquifer storage) project.
 - a. Kansas primacy for Class VI wells might make a difference, but participants were skeptical that could happen in Kansas
 - b. **Recommended Action:** More details on North Dakota primacy and 45Q implementation rules

Breakout Group 3: Legal/Regulatory/Public Policy, led by Susan Stover, Chris Steincamp, Joseph Schremmer

Permitting – Class VI wells

There were deep concerns about Class VI well permitting and monitoring requirements especially for small oil and ethanol companies

1. Time to get a permit, costs for equipping, testing, monitoring

2. Consider Kansas getting primacy? North Dakota has it, and Wyoming actively seeking it. KCC explored option ~7 years ago.
3. Possible other remedies:
 - a. Communicate with EPA early, and establish good lines of communication with Regional Headquarters (Class VI) or state regulatory agency.
 - b. To petition for changes to Class VI procedures – begin dialog at EPA regional headquarters administrator, not at D.C. level.

General discussion items

1. KDHE expressed concern that current injection into Arbuckle saline aquifer is running out of room in central – south central Kansas.
2. Discussion on similarities and differences between Class II and Class VI – similar: both store CO₂. Different – Class II going into an under-pressured reservoir.
3. Discussion on similarities between Class 1 (hazardous waste) and Class VI - both are for storage of waste. Both go into the saline aquifer.

Long-term Liability – for EOR or CO₂ storage.

1. Plume migration off the unitized land holding, impacting another estate
2. Long term storage after the plume has stabilized: Solutions?
 - a. Certificate of closure and done? Or ownership transferred to state.
 - b. Trust fund for state to handle any post CO₂ storage site closure monitoring and / or remediation response. Kansas Carbon Dioxide Reduction Act has funding options that could be expanded to include a trust fund.

Pore Space Ownership – mostly (solely at this time?) a concern for CO₂ storage.

1. KDHE Class I wells haven't addressed this issue. Does it need defined?
2. Pore space definition was debate in legislative bill (2011, 2012), but never passed.
3. Based on other states, and Kansas case law, probably belongs to surface estate owner, unless specifically severed from the surface in a lease or contract.

Public Acceptance Critical part of communication. Important to bring in different groups, stakeholders, get education on EOR and CO₂ storage.

Tax Incentives:

1. Federal FUTURE Act (45Q) provides an incentive. What about state tax incentives?
2. There is currently a tax break for renewable energy – consider if CO₂ is germane?
3. There is currently a tax incentive for oil and gas pipeline construction.
4. Existing utility sales tax exemption.