Legal and Regulatory Frameworks and Incentives for CCS/CCUS

Prepared for:
United States Energy Association (USEA)

Consensus Program Briefing
CO₂ Storage – Optimizing Large Volume First Mover Projects by Managing Short and Long Term Security and Liabilities

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Successful implementation of CCS/CCUS will require addressing critical environmental regulatory issues and keeping abreast of emerging policy issues, including:

- Taking advantage of 45Q tax credits
- Demonstrating “secure geologic storage”
  - EPA reporting requirements for storage with CO₂ EOR.
  - International (ISO) standards for establishing secure storage sites
- Obtaining storage site construction, injection, and operating permits
- Complying with Class II and/or Class VI injection and post-injection monitoring requirements
Main U.S. Efforts to Incentivize CCS

- Bipartisan Budget Act of 2018 (BBA)
  - Enhancements to IRC Section 45Q
- California Low Carbon Fuel Standards (LCFS)
- State Incentives/Regulatory Frameworks
CCUS Economics 101 – 45Q Example

**Cost of Capture**
- Equipment x Financing % Rate
- O&M
- Energy penalties

Less than:

**CO₂-EOR Storage**

- Total of: 45Q Tax Credit $35/ton
- plus EOR Sales Revenues
- minus Transport Cost to EOR field

**OR**

**Saline Storage**

- Total of: 45Q Tax Credit $50/ton
- minus Storage Charges by Saline Operator
- minus Transport Cost to Saline Reservoir
### IRS Section 45Q -- Highlights

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<th>Bipartisan Budget Act of 2018</th>
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<td>▪ New facilities need to &quot;break ground&quot; by EOY 2025.</td>
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<td>▪ Credit goes to the <strong>owner of the capture equipment</strong> but allows <strong>transfer</strong> of qualified credits.</td>
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<td>▪ $50/mt for geologic storage and $35/mt for EOR (reaches maximum value in 2026, increasing thereafter with inflation).</td>
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<td>▪ Capture &gt; <strong>500,000</strong> metric tons CO₂/year for electric generating units; &gt; <strong>100,000</strong> metric tons CO₂/year for other industrial facilities.</td>
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<td>▪ Available for <strong>12 years</strong> from date carbon capture equipment is placed in service.</td>
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### Issues of Concern with 45Q

- Is 12 years of credits enough for commercial viability?
- What types of business models will involve?
- What will be the role and appetite for financial institutions and tax equity players?
- Is the 12/31/2025 deadline achievable for large, complex (e.g., power generation or direct air capture) projects?
- What impact will CCS have on electricity dispatch? Can 45Q enhance dispatch by lowering marginal costs?
- What if the tax credits are converted to “direct pay”? 
Carbon Capture, Utilization, and Storage Tax Credit Amendments Acts

- Extends the commence construction window to the end of 2030.
- Provides a direct pay option, rather than just a tax credit.
- Increases the 45Q credit value (different bills have different value targets)
  - To as much as $120 per metric ton for saline formations (some propose smaller increases).
  - To as much as $75 per ton for storage in oil and gas fields (some propose smaller increases).
- Amends other conflicting and disincentivizing provisions of the tax code.

SCALE Act

- Establishes the CO₂ Infrastructure Finance and Innovation Act (CIFIA) program to finance shared CO₂ transport infrastructure.

American Jobs Plan

- Establish ten “pioneer” facilities that demonstrate carbon capture retrofits; $15 billion in demonstration projects, including, but not exclusive to, CCS projects.
- Extends the commence construction window to the end of 2030.

Several bills also lower the threshold capture amount for various categories of facilities.
What Additional Support can States Provide?

- Clear and supportive state regulatory policies
- Clear rules for long term storage
  - CO₂ storage trust funds; rules for CO₂/pore space ownership, responsibility, and liability
- CO₂ pipelines – common carrier/eminent domain
- Financial incentives for carbon capture
  - Financial assistance, off-take priority, cost recovery, eligibility under “clean energy” standards, assumption of long-term liability
- Tax incentives/optimization
  - Additional tax credits for CO₂-EOR + storage, tax exemptions for “pollution control equipment” associated with CO₂ capture
Steps in Pursuit of CCS with 45Q Credits

Achieving IRS certification for Section 45Q credits is the LAST step in a multi-step process. Working backwards:

- Getting the 45Q credits simply involves claiming the credits on IRS Form 8933.
- Entities claiming credits need to demonstrate that the CO₂ is injected into “secure geological storage.”
  - Several methods are available for this demonstration.
- The MRV Plan generally presumes that permit applications for all injection wells have already been approved or have at least been submitted for approval.
  - This is not a trivial process.
Establishing “Secure Geologic Storage”

- EPA Greenhouse Gas Reporting Program (GHGRP) Subpart RR and federal/state Underground Injection Control (UIC) program rules are the status quo.

- For storage with EOR, accepted alternative to Subpart RR is the use of standards for EOR published by the International Standards Organization (ISO)

- Subpart RR:
  - Accounting framework only – no authority for containment assurance.
  - For CO₂-EOR, not required to report under Subpart RR unless operator chooses to opt-in
  - To get 45Q credits for EOR, operator must opt in.
  - Facilities reporting under Subpart RR must have an EPA-approved, site-specific monitoring, reporting and verification (MRV) plan.
CO₂-EOR Technology: A Closed-Loop System

Purchased CO₂
Anthropogenic and/or Natural Sources

Injected CO₂

Recycled CO₂ from Production Well

Zone of Efficient Sweep

CO₂ Dissolved (Sequestered) in the Immobile Oil and Gas Phases

CO₂ Stored in Pore Space

Driver Water

Water

CO₂

Miscible Zone

Oil Bank

Additional Oil Recovery

Immobile Oil

Immobile Oil
Alternative Approaches for Establishing “Secure Geologic Storage” with CO$_2$-EOR

- Subpart RR of the EPA Greenhouse Gas Reporting Program (GHGRP)
- International Standards Organization (ISO) 27916: 2019
- The California Low Carbon Fuel Standard (LCFS) and associated CCS Protocol.
Subpart RR: Geologic Sequestration of Carbon Dioxide

- Accounting framework only – to report CO₂ sequestered on an annual basis – no authority for containment assurance.

- EOR facilities not required to report under Subpart RR unless operator chooses to opt-in, or wells are permitted as Class VI
  - To get 45Q credits for EOR, operator must opt in.

- Facilities reporting under Subpart RR must have an EPA-approved site-specific monitoring, reporting and verification (MRV) plan.
Major Elements of a Subpart RR MRV Plan

- Delineation of active and maximum monitoring areas
- Identification of potential surface leakage pathways for CO₂
- Strategy for detecting and quantifying surface leakage of CO₂
- Strategy for establishing the baseline for monitoring CO₂ leakage
- Site-specific variables that will be used for estimating leakage

Once the facility has an approved MRV plan, the following are required to be reported to EPA annually:

- Amount of CO₂ received, data used to calculate the amount, and the source of the received CO₂.
- Mass balance equation inputs used to calculate the amount of CO₂ sequestered.
ISO 27916-2019 addresses three principal issues:

- Safe, long-term containment of CO₂ stored in association with CO₂-EOR.
- Periodic / cumulative quantification of associated storage.
- Documentation provisions for operational management, containment assurance, quantification of storage, and termination.

Some stakeholders claim that ISO 27916-2019 addresses concerns with Subpart RR.
Along with minimum site selection criteria, project must satisfy expansive set of requirements throughout its lifetime:

- Maintaining, updating and submitting changes to plans as necessary
- Constructing wells in accordance with specified standards
- Undertaking monitoring to ensure site integrity is maintained; no leakage
- Plugging wells that protect against leaks
- Monitoring the site for at least 100 years post injection.

Requirements remain until site closure has been granted.
Highlights of Similarities and Differences

- **Mechanisms apply to different operational/storage situations:**
  - Subpart RR applies to saline storage & CO₂-EOR projects that “opt in”
  - ISO 27916 only applies to CO₂-EOR
  - LCFS/ Protocol applies to saline storage and CO₂-EOR

- **Responsible regulatory authorities vary:**
  - Subpart RR a reporting requirement, EPA enforcement applies only to reporting, and not containment assurance.
  - ISO 27916 is voluntary, cannot conflict with or override existing requirements or law; can only become binding if codified.
  - LCFS/CCS Protocol applies to anyone seeking credits under the LCFS, regardless of whether project is in California.
Subpart RR and ISO 27916 acknowledge applicability of existing regulatory programs.
- CCS Protocol regulates these activities explicitly; and those seeking credits under the LCFS must comply even if other jurisdictions also regulate the same activities.

Subpart RR/ISO 27916 are primarily performance-based.
- While LCFS/CCS Protocol often provides an extensive list of things that MUST be done.

No requirements are specified for post-injection site care and site closure under Subpart RR and ISO 27916; assumed addressed under other compliance requirements.
- Under LCFS/CCS Protocol, post monitoring must be at least 100 years after injection has been completed.
From 20 years’ worth of R&D, a significant foundation of experience regarding CO$_2$ storage has been established.

In 2010, U.S. EPA promulgated Underground Injection Control (UIC) well (Class VI) requirements for geologic storage of CO$_2$.

- All Class VI CO$_2$ storage wells permitted to date associated with R&D projects; rule originally not intended to apply to R&D projects.

- Most of the commercial-scale CO$_2$ storage wells permitted to date and in operation are Class II wells associated with CO$_2$-EOR.

EPA guidance confirms that CO$_2$-EOR via Class II wells can result in stored CO$_2$; conversion to Class VI is not required for assuring storage.
Permitting Considerations – Class II vs. Class VI

- Class VI permits for EOR operations are substantially more complicated than Class II permits.
- Permitting Class II wells for EOR operations can be done more expeditiously than Class VI for geologic storage.
- However, economics may be easier to predict for Class VI.
- Some financial firms prefer supporting Class VI-based projects to promote “sustainability”.

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<th>EPA Well Class</th>
<th>Enhanced Oil Recovery</th>
<th>Geologic Sequestration</th>
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<tr>
<td>Purpose</td>
<td>Injection for purposes of enhancing oil recovery</td>
<td>Injecting CO₂ into geologic formations for permanent storage</td>
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<tr>
<td>No. of Current Permitted Wells</td>
<td>~ 140,000</td>
<td>2</td>
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<tr>
<td>Vol. of CO₂ Injected</td>
<td>~ 70 million tonnes per year</td>
<td>~ 1.3 million tonnes per year</td>
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<tr>
<td>States with Regulatory Primacy</td>
<td>40</td>
<td>2</td>
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| Approx. Timeline for Permitting | 1-3 months | 1-3 years???
To date, the timeline for obtaining Class VI permit approval has been long.

Post injection site care (PISC) required until CO\(_2\) plume is stabilized (regulations have 50-year “default”).

EPA still unclear on how to ensure financial responsibility.

Process for allowing states to acquire primacy for Class VI well permitting has been slow.

Need clarity on possible conversion from Class II to Class VI

Greater Class VI regulatory certainty may be necessary to encourage large numbers of new Class VI projects.
  – However, this certainty may only come with “testing the system.”
What Class VI Injection Permits Must Demonstrate

- Injection zone(s) of sufficient areal extent, thickness, porosity, permeability, and TDS concentration < 10,000 mg/l to receive the total anticipated volume of CO$_2$.

- Confining zone(s) free of transmissive faults/fractures and of sufficient areal extent and integrity to contain the injected CO$_2$ stream and displaced formation fluids and allow injection at proposed maximum pressures and volumes without initiating or propagating fractures in the confining zone(s).

- Identification of all underground sources of drinking water (USDW) in which the concentration of TDS is less than 10,000 mg/l to ensure that CO$_2$ from the injection zone will not migrate into any USDW.

- Maintenance of pore pressures in the injection zone at less than 90% of the fracture gradient.
Keys Parts of the Class VI Permit Application

- Summary of Operating and Reporting Requirements
- Area of Review and Corrective Action Plan
- Testing and Monitoring Plan
- Well Plugging Plan
- Post Injection Site Care and Site Closure Plan
- Emergency and Remedial Response Plan
- Well Construction Details
- Financial Assurance Demonstration
- Stimulation Plan
Challenges Faced by Regulators

- Limited developer experience in permitting Class VI wells applies also to regulatory agencies.
- Concerns exist that regulatory agency personnel much increase (and both the state and federal level), to handle the anticipated number of permit applications that could be forthcoming.
- Efforts being pursued in Congress and some states to increase staffing to meet this demand.
- Additionally, efforts are underway to develop training resources to give agency staff the tools and knowledge required.
Concluding Thoughts

- Recent incentives – 45Q, the CA LCFS, and discussions on regional deployment initiatives – has created a new “buzz” associated with CCS/CCUS in the US:
  - Coupled with continued strong investment in RD&D

- **However, substantial challenges remain:**
  - Need for clarity on 45Q implementation – early projects will be key indicator.
  - Lack of a track record for expediting approval for CO₂ storage projects.
  - Uncertainty/anxiety concerning the requirements for “certifying and quantifying” volumes stored
  - Are the timelines for commencing construction and receiving credits enough?

- Nonetheless, if these challenges can be overcome, a major kick-start of CCS deployment could result.