Issues/Opportunities Associated with Section 45Q Incentives

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Introduction

- **The stars may be aligning in the U.S. to stimulate wide-scale deployment of CCUS**
  - Let by modifications to the U.S. tax code -- IRC Section 45Q – perhaps combined with other incentives.
- **However, taking advantage of this opportunity is not without many challenges.**
  - What could be the ”devil in the details” regarding 45Q implementation
- **Key questions:**
  - Can new incentives expand the role for CCS/CCUS?
  - Can 45Q incentives also simulate CCS with saline storage?
  - Can/will the U.S. policy/regulatory framework allow this?

Overview of Presentation

- Why could Section 45Q be important?
- What is Section 45Q, and how has it changed?
- What are stakeholders concerned about?
  - What may be the “devil in the details”?
- Is 45Q enough? What else could help incentivize CCS?
- How can 45Q implementation learn from experience?

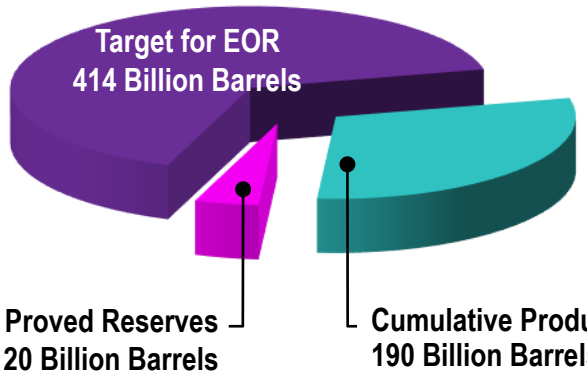
Size of the US CO_2-EOR Prize

In the U.S., about 1/3 of the 624 billion barrel conventional oil endowment will be produced with primary/secondary technologies, leaving behind 414 billion barrels.

Much of this "left behind oil", equal to 284 billion barrels, is technically favorable for CO_2-EOR and is widely distributed across the U.S.

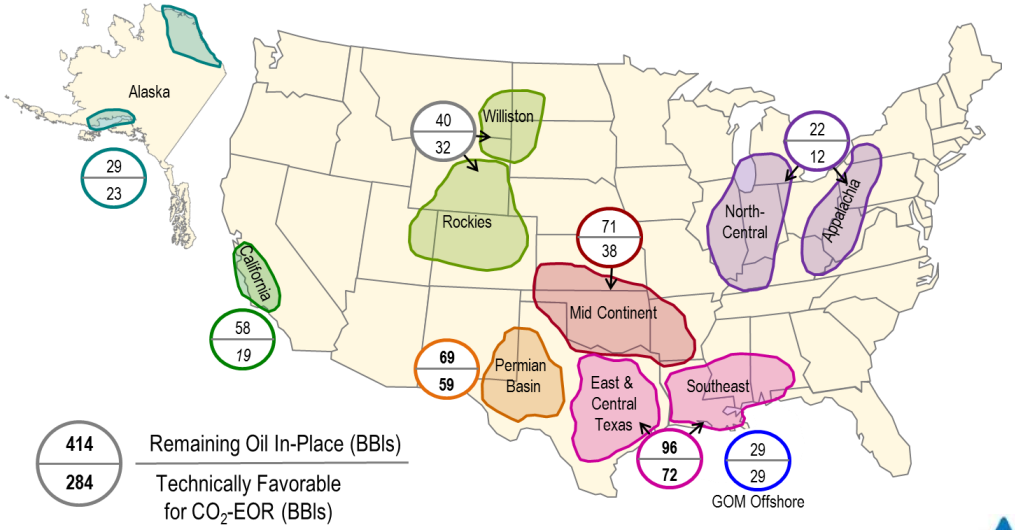
Of this, at least 80 billion barrels is economic at today's prices, and would require 40 billion metric tons of CO_2.

Original Oil In-Place: 624 B Barrels
Remaining Oil In-Place: 414 B Barrels



*Does not include "tight" oil production or reserves.
Source: Advanced Resources International, 2015.

Conventional Domestic Oil Resources Favorable for CO_2-EOR



Source: Advanced Resources International internal analysis, 2016

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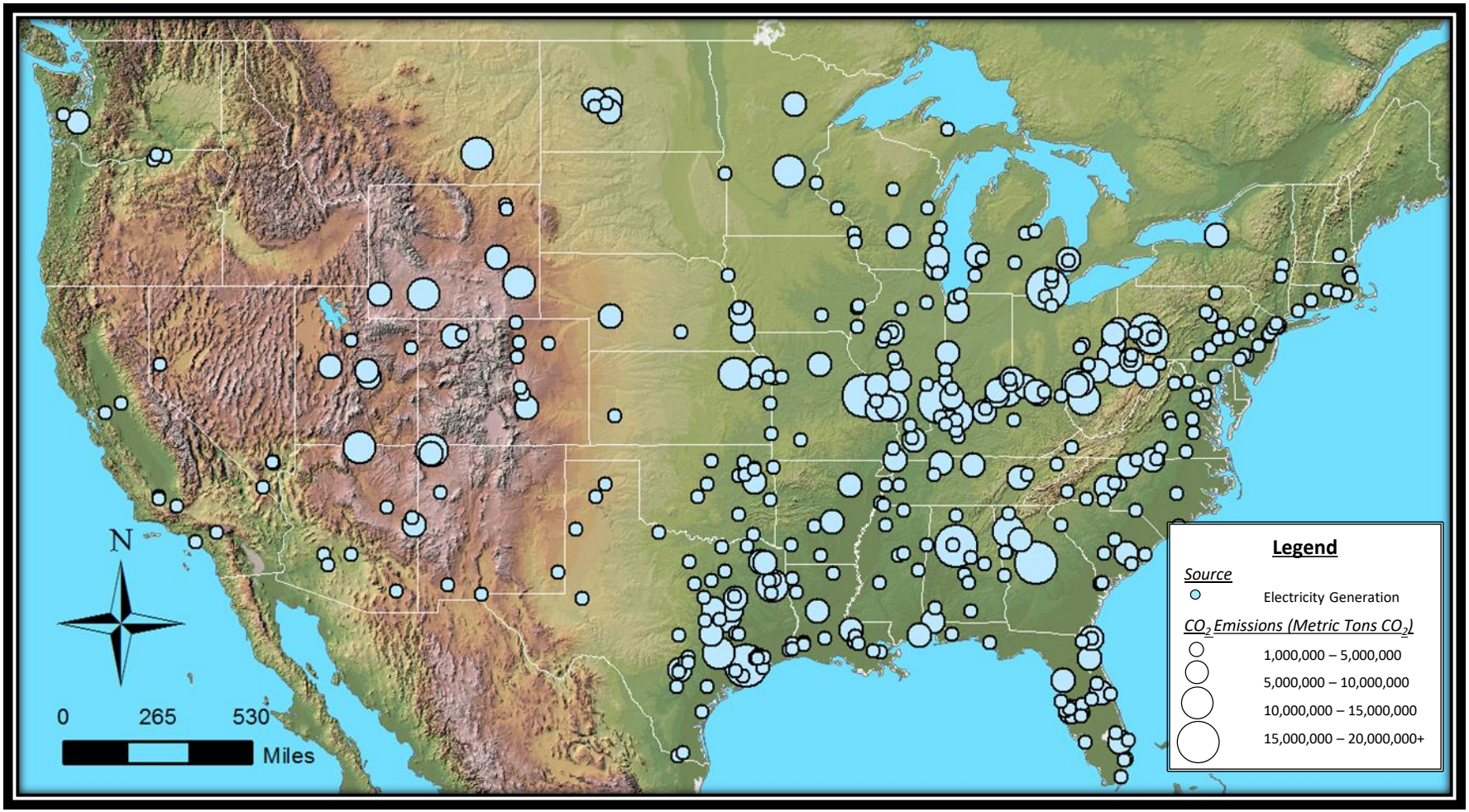
Potential Electric Generation CO_2 Sources Above 1 Million Tonnes/Year



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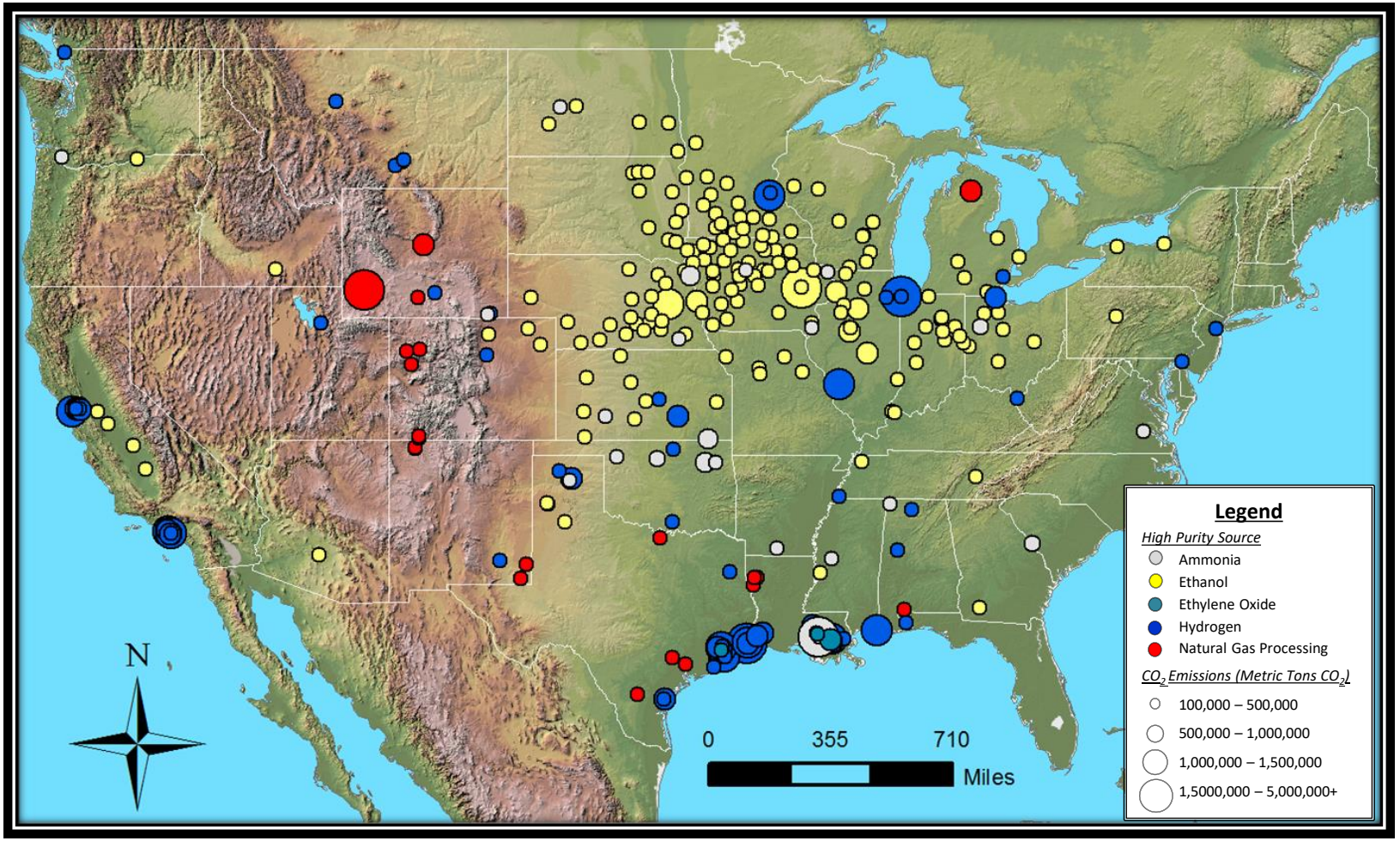
The Low-Hanging Fruit: High Purity Stream Potential CO_2 Sources



Main US Efforts to Incentivize CCS

- **Bipartisan Budget Act of 2018 (BBA)**
  - **Enhancements to IRC Section 45Q**
  - **This is the focus of today's presentation**
- **California Low Carbon Fuel Standards (LCFS)**
- **Regional Incentives/Frameworks**
- **State Incentives**

BBA Enhancements to IRC Section 45Q -- Highlights

Previous 45Q	Bipartisan Budget Act of 2018
▪ 75 million metric ton cap	▪ Eliminates 75 million metric ton cap; applies to new facilities that **"break ground" by EOY 2023.**
▪ Credit based on "captured qualified CO_2"	▪ After enactment, credit based on captured "qualified carbon oxide" (CO_2 and **other carbon oxides**). ▪ Allows for the **transfer** of qualified credits
▪ \$20/metric ton for CO_2 stored and not used for EOR ▪ \$10/metric ton for CO_2 stored and used for EOR	▪ **\$50/mt for geologic storage and \$35/mt for EOR (each rate phases up over 10-year period from 2017 to 2026**). ▪ Existing qualified facilities would continue to receive the original inflation adjusted \$20 and \$10 credit rates.
▪ Available to facility with capture equipment capturing at least 500,000 metric tons CO_2/year.	▪ Capture > **500,000** metric tons CO_2/year for electric generating units; > **100,000** metric tons CO_2 /year for other. ▪ Credit goes to the **owner of the capture equipment**. ▪ Available to "**direct air capture" and "beneficial use** (with 25,000 metric ton threshold)"
▪ Credit available until the 75-million-ton cap is reached.	▪ Credit available for **12 years** from the date the carbon capture equipment is placed in service.

Request for Comments by IRS on 45Q Enhancements

- On May 20, 2019, IRS Issued Notice 2019-32: Request for Comments on Credit for Carbon Oxide Sequestration.
- Comments were due July 4, 2019
- 80-85 unique sets of comments were received by IRS.
- These comments should advise how final implementation guidance is developed by IRS.

Areas of Interest in IRS Request for Comments

- **How exactly will "secure geologic storage" be deemed creditable? Are "equivalent program" options allowable?**
- **If leakage occurs after credits are awarded, what terms will apply to the "recapture" of such awarded credits?**
- How will "qualifying facilities" be defined?
- What will be the requirements for non-EOR "utilization" of CO, and for associated "life cycle analyses," to certify sequestration volumes?
- **How will "commence construction" be established?**
- What will IRS allow for credit transferability, timing, flexibility?
- What forms of project structures/partnerships allowed?

How will "secure geologic storage" will be established?

- Continue to use EPA GHGRP Subpart RR and EPA/state UIC rules for EOR and saline storage (status quo), and/or
- For storage with EOR
  - Allow use of Class II rules and alternative subparts of the GHGRP (PP, UU, W, C), and/or
  - Allow use of new standards for EOR published by the International Standards Organization, and/or
  - Allow other standards (e.g., state standards like California Low Carbon Fuel Standards/CCS Protocol)
- Need to establish relevant government authority for certifying creditable captured CO_2.
- Can confidential business information be protected, while still providing sufficient transparency?
- Need to align with state resource conservation law.

If leakage occurs, what terms will apply to the "recapture" of awarded credits?

Issues to consider:

- Is there a "statute of limitations" on awarded credits --- how far back can credits be recaptured?
  - Defined number of years
  - After 12 years when credits no longer available
- What is the trigger for recapture?
- To what storage volumes is recapture applied ("last in, first out")
- To what does recapture provisions not apply ("force majeure," accounting and/or reporting errors)

Tax equity investors, in particular, need some understanding of the potential risks associated with long-term credit value.

How will “commence construction” be established?

Issues to consider:

- Physical Work Test
- Five Percent Safe Harbor
- Continuous Construction Safe Harbor Deadline
  - Does the “continuous construction requirement” need to be lengthened for large complex projects?
- Scope of the carbon capture project relative to a large industrial complex/CCS system

Other Issues of Concern with 45Q Impact on Deployment of Geologic Storage

- **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 12/31/2023 deadline achievable for large, complex (e.g., power generation or direct air capture) projects?**
- **What impact will CCS have on electricity dispatch?**
  - Capture raises costs, reducing dispatch
  - Credits can provide a “bounty,” offsetting the cost increase, and thus increasing dispatch.

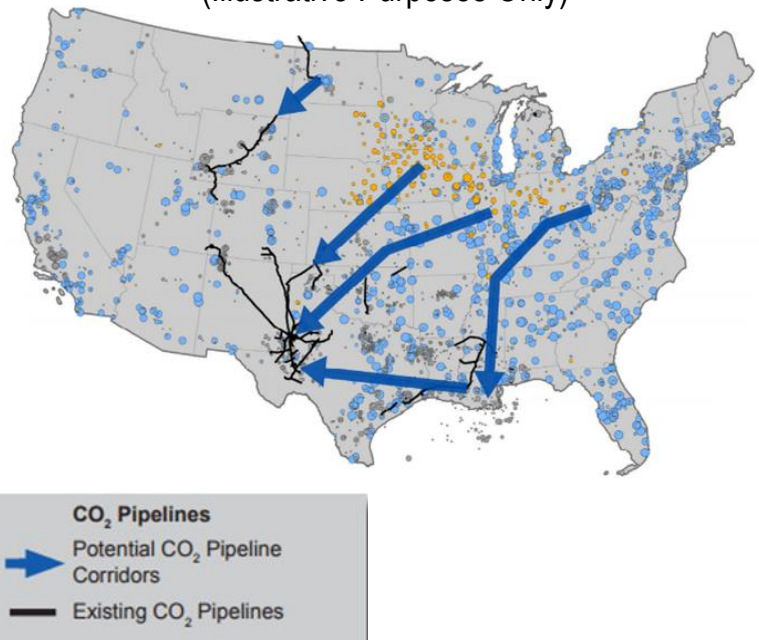
Are the 45Q Enhancements Enough?

- **Continued RD&D to reduce costs of CO_2 capture**
- **Continued RD&D on "next generation" CO_2-EOR; especially targeting "carbon negative oil"**
- **Further incentives beyond 45Q?**
  - Tax-exempt private activity bonds
  - Master limited partnerships
  - Incentives for CO_2 pipelines/pipeline expansions/buildout
  - Ensuring Parity for Carbon Capture in the Power Sector
    - E.g., CCS included in "Clean Energy" Portfolio Standards
  - State incentives

Support for CO_2 Pipeline Infrastructure

- **Regional Initiative co-convened by Governors of Wyoming and Montana.**
- **Launched in 2015:**
  - Officials from 15 states*
  - With industry and NGO stakeholders and experts
- **Objectives:**
  - Help policymakers better understand states' potential for CCS, CO_2-EOR and utilization
  - Recommend state and federal strategies and policies
- **Support implementation of policy recommendations for pipeline project deployment.**
- **Support other policies to compliment 45Q**

Potential Regional CO_2 Pipeline Corridors
(Illustrative Purposes Only)



*State participation varies and includes governors' staff, cabinet secretaries, utility commissioners and agency and commission staff.

U.S. Regulatory Experience – Class VI

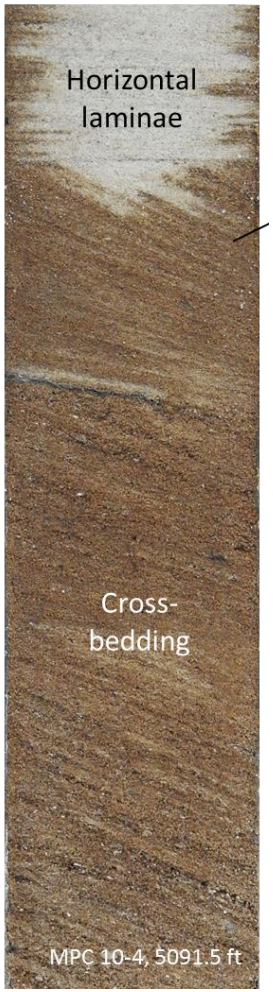
- **From 15 years' worth of R&D, a significant foundation of experience regarding injection and CO_2 storage established.**
  - Mostly with CO_2-EOR, but also with some deep saline storage
- **In 2010, USEPA promulgated Underground Injection Control (UIC) well (Class VI) requirements for non-EOR geologic storage.**
  - Little experience existed at the time the Class VI regs were issued.
  - EPA recognized that adaptations may be warranted as more research is conducted, data are acquired, and experience is gained.
  - Preamble states that the Class VI requirements will be reviewed in 6 years; eight years have passed without a review.
- **EPA guidance confirms that CO_2-EOR can result in stored CO_2; conversion to Class VI is not required for assuring storage.**
- **Concerns remain that legal and regulatory obstacles exist to allow CO_2-EOR to be viable source for CO_2 emissions reduction.**

U.S. Regulatory Experience – Class VI

- **To date, the timeline for obtaining Class VI permits approval has been too long – as much as four years or more.**
  - Prior to final Class VI rule, permitting for other well classes also took a long time; processes hindered while Class VI regs were being developed.
- **50-year "default" for post-injection site care (PISC) hinders possible CCS project financing**
- **EPA's inconsistent application of financial responsibility instruments is hindering permitting and deployment.**
- **The process for allowing states to acquire primacy for Class VI well permitting has been very slow.**
  - North Dakota primacy application approved after years in review.
- **Greater Class VI regulatory certainty is necessary to encourage new Class VI projects.**

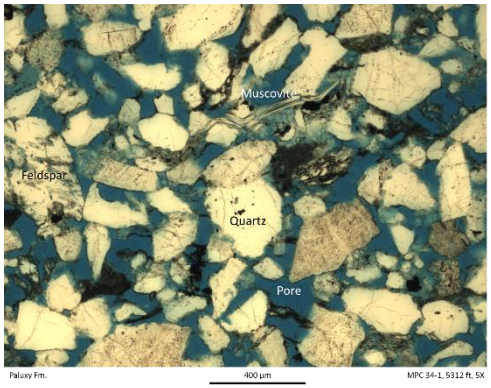
Project ECO$_2$S Storage Zone Properties

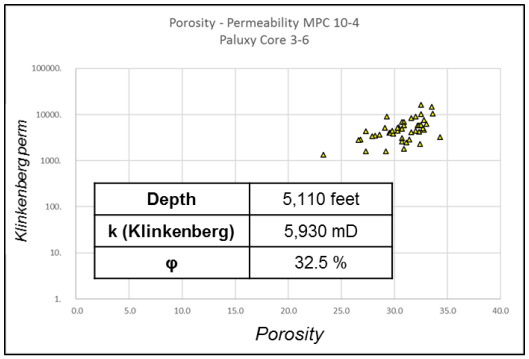
Paluxy sandstone



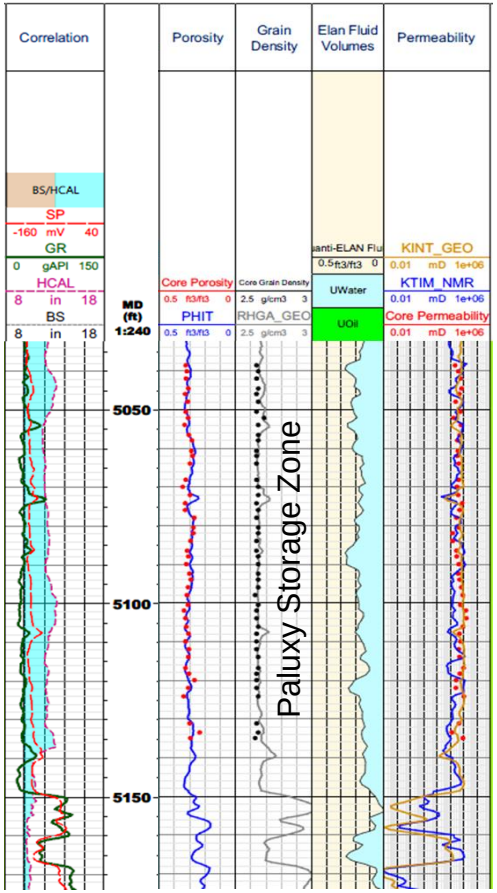
- **Goal: Demonstrate the subsurface at Kemper can safely/permanently store commercial volumes of CO_2**
- Abundant stacked saline sandstone bodies in Paluxy, Wash-Fred, and lower Tuscaloosa.
- 350 meters of net sand. Logs and core show sandstone average porosity of 30%(!!)
- Core analysis indicates all sandstones water-saturated
- Darcy-class permeability common (up to 16 Darcies)

High-porosity sandstone in Paluxy Formation





Elemental Log Analysis (ELAN) interpretation*



**ELAN is a mark of Schlumberger*

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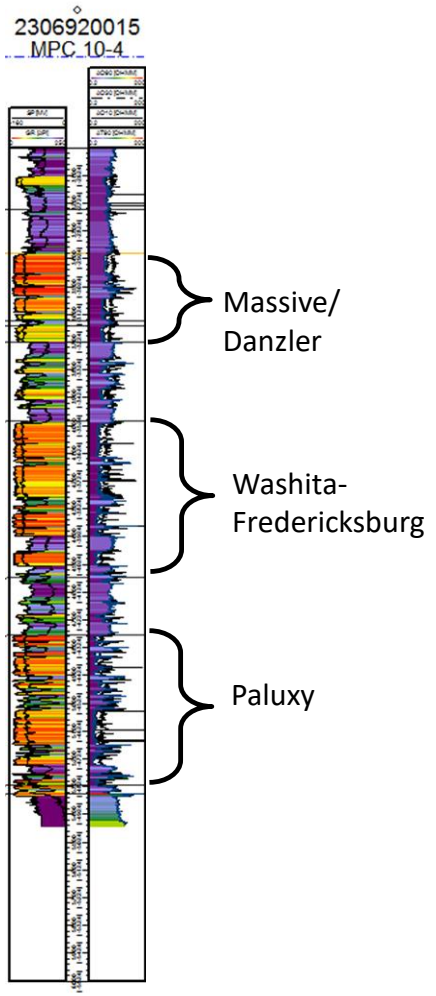
Storage Complex Capacity

- Each of the three potential storage zones have commercial capacity
- Together the three storage zones result in a gigatonne capacity storage complex that has the potential to act as a regional hub

CO_2 Storage Reservoir	P_{10} Capacity (MMmt)	P_{50} Capacity (MMmt)	P_{90} Capacity (MMmt)
Massive/Dantzler	60	120	200
Wash.-Fred.	280	540	920
Paluxy	160	310	530

DOE methodology for site-specific saline storage efficiency calculation based on fluid displacement factors for clastic reservoirs where net pay, net thickness and net porosity are known of 7.4% (P_{10}), 14% (P_{50}) and 24% (P_{90}) (Goodman et al., 2011)



- Low-cost storage options occur beneath the energy facility -- $2.00 - $4.00 USD per metric ton depending on volume of CO_2 captured (*after DOE investment*)
- Drives the value proposition where existing infrastructure could be utilized for CO_2 capture, compression, transportation and storage

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 clear IRS guidance on the features 45Q.
  - Uncertainty/anxiety concerning the requirements for "certifying and quantifying" volumes stored
  - Lack of a track record for expediting approval for CO_2 storage projects.
  - 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.**

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