Closing the Commercial Cost Gap:
A Revenue-Positive, Multi-Industry Federal Tax Credit for CO₂ Capture Technology for EOR

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Great Plains Institute

Presented to:
CO₂ for EOR as CCUS: Collaborative International Symposium among Universities, the Oil Industry and other CO₂-EOR Stakeholders
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Houston, Texas
About the Great Plains Institute

- Independent, non-partisan nonprofit organization based in North Dakota and Minnesota.
- Facilitate regional and national energy policy and technology initiatives with government and private stakeholders to foster advanced fossil technologies, greater efficiency, and renewables development.
- Organize overseas energy policy and technology delegations involving government, private sector and NGO leaders from the Northern Plains, Midwest and nationally.
- Convene National Enhanced Oil Recovery Initiative with C2ES:
  - Coalition of energy, industrial and technology companies, labor unions, environmental organizations, and state officials dedicated to expanding American oil production using CO₂ captured from industrial facilities and power plants.
• CO$_2$-EOR is the biggest proven commercial option for energy security and climate stewardship that most people have never heard of.
• CO2-EOR’s remarkable benefits provide the basis for a diverse, durable political coalition for new public policy.
• Federal revenue from new oil production can pay for incentives needed by a wide range of industries to capture and market CO$_2$ to the oil industry for EOR.
• The CCS research and demonstration agenda will not survive without significant commercial project deployment—and soon.
• Introduction of model U.S. federal CO$_2$-EOR incentive legislation to support that commercial CCS deployment is imminent.
CO₂-EOR is a fully proven and commercial strategy for domestic energy production and CO₂ storage.

- The CO₂-EOR industry has 40 years of commercial operational experience (beginning at significant scale in West Texas in 1972).

- As of early 2013, CO₂-EOR produces over 300,000 barrels of oil per day (110 million barrels annually), or about 5 percent of U.S. domestic production.

- To date, more than 1.5 billion barrels of oil have been recovered via CO₂-EOR.
Map of Current U.S. CO$_2$-EOR Activity

- Dakota Coal Gasification Plant
- LaBarge Gas Plant
- McElmo Dome
- Sheep Mountain
- Bravo Dome
- Encore Pipeline
- Lost Cabin Gas Plant
- Enid Fertilizer Plant
- Jackson Dome
- Val Verde Gas Plants
- Denbury/Green Pipeline

- **121** Number of CO$_2$-EOR Projects

- Green Circle: Natural CO$_2$ Source
- Pink Square: Industrial CO$_2$ Source
- Black Dashed Line: Existing CO$_2$ Pipeline
- Gray Dashed Line: CO$_2$ Pipeline Under Development

- Currently, 121 CO$_2$-EOR projects provide 282,000 B/D.

- New CO$_2$ pipelines - the 320 mile Green Pipeline and the 226 mile Encore Pipeline - are expanding CO$_2$-EOR to new oil fields and basins.

- The single largest constraint to increased use of CO$_2$-EOR is the lack of available, affordable CO$_2$ supplies.

Source: Advanced Resources International, Inc., based on Oil and Gas Journal, 2012 and other sources.
What makes the scale-up of CO₂-EOR a major priority?

**Energy Security**
- Can at least double U.S. reserves (20 billion barrels)
- 21.4 to 36.7 billion barrels with existing technology
- 63.3 to 79.3 billion barrels with next generation techniques

**Economic Opportunity**
- Job creation, increased tax revenues, reduced U.S. trade deficit (cumulatively) by $600 billion by 2030
- Almost half of U.S. states has EOR potential, while potentially any state could supply needed CO₂

**Environmental Protection**
- Reduce U.S. CO₂ emissions by 10-20 billion tons
- Drive innovation in carbon capture and storage technology
- Produce oil with less carbon intensity and environmental impact
Continental-Scale Opportunity: U.S. States with CO$_2$-EOR Potential

[Map of the United States indicating states with existing CO$_2$-EOR production (in red) and potential for CO$_2$-EOR production (in orange)].
Approximately 63 million tonnes of CO₂ are used in EOR annually, but only about 10 million tonnes come from man-made sources.

CO₂ can be captured and transported from a variety of man-made sources for use in EOR.

Over 4,000 miles of CO₂ pipelines are in operation today.

Yet, ironically, more CO₂ is needed to fulfill the potential . . .

Stationary Sources of CO₂ in North America

Coal and Coal-Based Generation
- Arch Coal
- Basin Electric Power Cooperative
- Summit Power Group
- Tenaska Energy

Industrial Suppliers of CO$_2$/Technology Vendors
- Air Products
- Alstom
- Archer Daniels Midland
- C12
- GE Energy
- Jupiter Oxygen
- Linde
- Praxair

Project Developers
- Leucadia Energy

Environmental NGOs
- Clean Air Task Force
- Natural Resources Defense Council
- Ohio Environmental Council
- Wyoming Outdoor Council

Labor
- AFL-CIO
- United Transportation Union

Academic Institutions
- Enhanced Oil Recovery Institute (U of WY)

Observers
- Oil and Gas Industry
  - Chaparral Energy
  - Core Energy
  - Tellus Operating Group
- Interstate Oil and Gas Compact Commission

State Officials
- Illinois, Indiana, Michigan, Mississippi, Montana, New Mexico, Texas and West Virginia

NEORI: A national coalition formed to help realize CO$_2$-EOR’s potential in the U.S.
NEORI’s Agenda

1. Demonstrate the need for federal action to reform and expand existing incentives for CO$_2$ capture for use in EOR.

2. Increase awareness nationally and in key states and regions of the economic and environmental benefits of CO$_2$-EOR.

3. Conduct analysis to better assess and communicate CO$_2$-EOR benefits to the economy and environment.

4. Develop and support implementation of federal and state policies that accelerate commercial deployment of EOR using CO$_2$ captured from industrial and power plant sources.
NEORI’s Legislative Objectives

- Secure introduction of bipartisan legislation to expand and reform existing U.S. Section 45Q Tax Credit for Carbon Sequestration.

- An expanded 45Q will create a federal incentive to drive substantial commercial CCS-EOR deployment.

- NEORI’s proposed 45Q expansion would also reform existing program to:
  - Increase certainty to CCS project developers seeking the credit.
  - Ensure that the program becomes revenue positive to the federal government within a 10-year window.
NEORI’s recommended expansion of the 45Q tax credit would...

- Bridge the cost gap between what CO₂-EOR operators are willing to pay for CO₂ and the cost of capture from a variety of man-made sources.
- Provide a tax credit to the party that captures CO₂, but only after the CO₂ is used for EOR.
- Generate new federal revenue to pay for the cost of new credits:
  - CO₂ captured with incentive
  - Incremental oil production
  - New sales revenue
  - New tax revenue (under existing tax treatment)

- Establish competitive bidding to allocate tax credits and ensure lowest cost
- Establish a certification process for winning bidders to provide financial certainty for private investment in projects
Design objectives:
- Minimize costs
- Drive innovation

Tax credit provisions:
- Allocated for 10 years per project
- $/ton of CO$_2$ used in EOR (determined by winning bid)
- Tranches for different CO$_2$ sources, so like capture technologies with similar costs compete with each other
- Adjustments to annual tax credit value based on oil price
Tranches for Allocating New Tax Credits through Competitive Bidding

- Electric power tranche

- Industrial tranche (with 2 sub-tranches)
  - Low cost industrial
    - Natural gas processing, fermentation, ammonia production and existing gasification of coal, petroleum residuals, biomass, and waste streams.
  - High cost industrial
    - New build gasification of coal, petroleum residuals, biomass and waste streams; refinery, cement, steel, and iron production; and hydrogen production.
Tranches for competitive bidding reflect significant differences in the cost of CO$_2$ capture by source . . .

<table>
<thead>
<tr>
<th>Power Plant Tranche</th>
<th>Core Scenario + Transp. Costs (A) ($/tonne)</th>
<th>CO$_2$ Market Price (*Starting 2013, Willingness To Pay) (B) ($/tonne)</th>
<th>Representative EOR Incentive (for illustration purpose) (A-B) ($/tonne)</th>
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<tbody>
<tr>
<td>Pioneer - First of a Kind Projects</td>
<td>$70</td>
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Annual Tax Credit Value Adjusted Based on Changes in Oil Price

- Protects developers of CO$_2$ capture projects from oil price risk
- When oil prices rise, tax credit value falls
  - Reduces federal support in favorable market conditions
- When oil prices fall, tax credit value rises
  - Provides project developer with sufficient incentive when CO$_2$ sales revenue falls
- Congressional budget scorekeepers assume oil prices will rise over time, so this provision could help with budget scoring
Adjusting annual tax credit value for oil price changes avoids windfall profits...

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<th>Oil Price ($ per barrel)</th>
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<td>- $0.88</td>
<td>- $15.05</td>
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</table>

Green = Value of Tax Credit Received
Red = Tax Credit Not Received
“Cost gap” analysis

Determined difference between willingness to pay by EOR operators and cost of carbon capture, storage and transportation.

“Revenue neutrality” analysis

Compared cost of CO$_2$ capture incentives with new direct federal revenue from additional EOR production from royalties on federal lands plus severance and corporate income taxes.

Results suggests “revenue neutrality” within 10-year window and significant net positive revenues over long term.
Most importantly, oil revenues exceed incentive costs over time...
Fiscally responsible: the credit more than pays for itself through federal revenue from new oil production enabled by the additional CO₂

Performance-based: a CO₂ capture project can only claim the credit if it successfully captures and injects CO₂ that results in oil production

Competitively-awarded: projects must bid the lowest cost to receive credits, so the program only provides the minimum incentive needed to achieve the desired outcome of more CO₂ capture and oil production

No windfall profits: the tax credit’s value is linked to the price of oil, so no project can benefit from rising oil prices at taxpayer expense

Financial certainty: while projects can only claim credits upon actual performance, they are allocated the tax credits up front to help attract private investment and achieve commercial operation.
“We have endorsed, for example, the National Enhanced Oil Recovery Initiative’s recommendation that Congress create a production tax credit for power companies that capture CO2 from power plants and send it to oil companies to use to free trapped crude from underground rock formations.”

- October 17, 2012
Thank You!

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