“CO₂ For EOR in North America-History and Status”

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Topics Covered

• The base of opportunity and expertise
• Short history
• Current status
• What’s next
• Over the horizon
• Why substantial CO$_2$ could come from CCUS
The Base of Opportunity and Expertise

- Oil and gas industry mature and seasoned
- Resources well known
- Regional and Federal regulatory structures in place
- Infrastructure very robust and dynamic
US Conventional Oil and Gas Areas

Oil and Natural Gas Production in the United States
(Derived from Mast, et al. 1998)

Explanation
- Green: Oil Production
- Yellow: Mixed Production
- Red: Gas Production
- Gray: Dry Wells
Interstate Oil and Gas Compact Commission

Source: http://www.iogcc.org/member-states

Member States
Our membership is comprised of the governors of oil and gas producing states, as well as appointed representatives. Please visit our member states page for more information.

INTERNATIONAL AFFILIATES
» Alberta
» British Columbia
» Egypt
» Republic of Georgia
» New Brunswick
» Newfoundland and Labrador
» Nova Scotia
» Saskatchewan
» Venezuela
» Yukon

OTHER AFFILIATES
» U.S. Department of Energy
» U.S. Department of the Interior
» U.S. Environmental Protection Agency
» Federal Energy Regulatory Commission
» National Association of Regulatory Utility Commissioners
480,000 Miles of Natgas - Oil and HL Pipelines - Constantly Expanding
Short History

• The first patent for CO$_2$ EOR was granted in 1952
• Texas Railroad Commission reports the first three projects were initiated in Osage County, Oklahoma between 1958 and 1962.
• First large scale demonstrations in early 1970s: example–SACROC (1972)
• Oil Embargo of 1973 accelerated US developments and incentives
• Since then, projects implemented in multiple countries: Canada, Hungary, Turkey, Trinidad, France, Italy, China, Brazil etc.
• Under consideration for fields in North Sea, UAE, Indonesia, Saudi Arabia, Abu Dhabi, Venezuela, Egypt, Iran, etc.
• Current Status in US
  • ~120+ projects
  • Accounts for ~350,000 bbls of oil per day in production
  • CO$_2$ supply ~ 3 billion cubic feet per day
  • Significant growth in the Gulf Coast & Permian Basin
  • 42 Billion barrels of recoverable reserves in the US-conventional CO$_2$-EOR with ROZ in addition to this
• Future? CO$_2$-EOR in unconventional (shale) oil plays
Current Status

- Well understood immediate opportunities
- Robust and dynamic CO$_2$ infrastructure
- Seasoned players
- 40yrs of working practical experience
- CO$_2$ for EOR regulatory structure in prime production areas established
- Significant contribution to US domestic oil production
CO$_2$ EOR Project Growth

Oil & Gas Journal 4/2/12 & UTPB Petroleum Industry Alliance
CO₂ EOR Projects and Oil Production

US CO₂ EOR Projects
(April 2012 O&GJ)

Oil Production

Number of Projects
CO$_2$ Sales for EOR

http://www.uwyo.edu/eori/_files/docs/co2midland-2012-final.pdf
What’s Being Developed Now?

• Residual Oil Zone
• Steve Melzer and Bob Trentham will cover later
• Exactly how huge remains an open-ended question for now, but Bob Trentham adds that everyone agrees the numbers are very, very big. “The residual oil zones may contain 100 billion barrels of oil in place and 10 billion-30 billion barrels of recoverable oil, and some argue that it could be even larger,” he states, referencing the fact that the Permian Basin has cumulatively produced 30 billion barrels since the discovery well was drilled more than 80 years ago. “Every additional 1 percent increment of reserves that we can recover is an additional 1 billion barrels of oil. That is the size of the prize.”
Over the Horizon

• North Dakota’s Energy and Environment Research Center (EECR) is conducting current work on CO$_2$ for EOR in Bakken Shale
• Indications are likely favorable can also safely retain or store the CO$_2$ as well
CO\textsubscript{2}-EOR in Shale Oil/Bakken

**Ultimate Impact to North Dakota**

**Technologic & Economic Impact**

- ND Dept. of Mineral Resources estimates that OOIP for the Bakken and Three Forks combined in North Dakota is approximately 170 billion barrels (Bbbls).
- If the application of CO\textsubscript{2} for EOR can improve recovery by just 1.1%, that improvement would translate to an additional 1.87 Bbbls of oil production.
- Assuming an average oil price of $80/bbl, this would equate to approximately $150 billion worth of oil.
- CO\textsubscript{2} EOR could prolong the life of the Bakken oil fields by decades.
- Results may be applicable to tight oil plays across the United States in Texas, Montana, California, Mississippi, Ohio, etc.
US Shale Plays - Unconventional Oil & Gas
Why Substantial CO$_2$ Could Come From CCUS

- Some CO$_2$-EOR regions limited by supply
- New developments in ROZ and shale will push demand higher
- US coal resources very valuable and owners want to monetize this resource
- Export as a raw commodity or utilize domestically in the power generation, petrochemical, CTL or Syngas industries?
US Coal Resources

US CCUS-Power and Industrial Projects

- DOE’s John Lytinski will cover this later
States with CCUS Legislation

Questions & Thank You!

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