

Balancing the Rising Distress in the CO₂ EOR Industry with CCUS and EOR in Horizontally Depressured Reservoirs

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Outline (20 Minute Version)

- Let's Start with a Premise: CO₂ EOR is the Largest & Richest Job Pathway to Successful CCS
- CO₂ EOR in Distress – Does That Threaten CCS?
- Is it Just Another Oil Price Cycle or Something Different this Time?
- Why is EOR Hurting: What Kind of New Oil Projects are Most Affected?
- The Rise of Private Equity Funding and Time Frames of Investing
- Innovation & New Areas of CO₂ EOR Excitement (More on this Later – Time Permitting)
- Where Sits the New U.S. Administration?
- CCUS & CO₂ EOR's Future
- New Developments: Reservoir Depressuring and EOR

Cont'd Outline (with - 15 additional Minutes?)

Advances in Residual Oil Zone (ROZ) Understanding and Field Projects

- Quick Review of ROZ Science
- Myths about ROZs
- Two Ways of Producing ROZs
 - EOR
 - Depressuring Gassy Residual Oil
- Case Histories

The Premise: CO₂ EOR As a Pathway to CCS

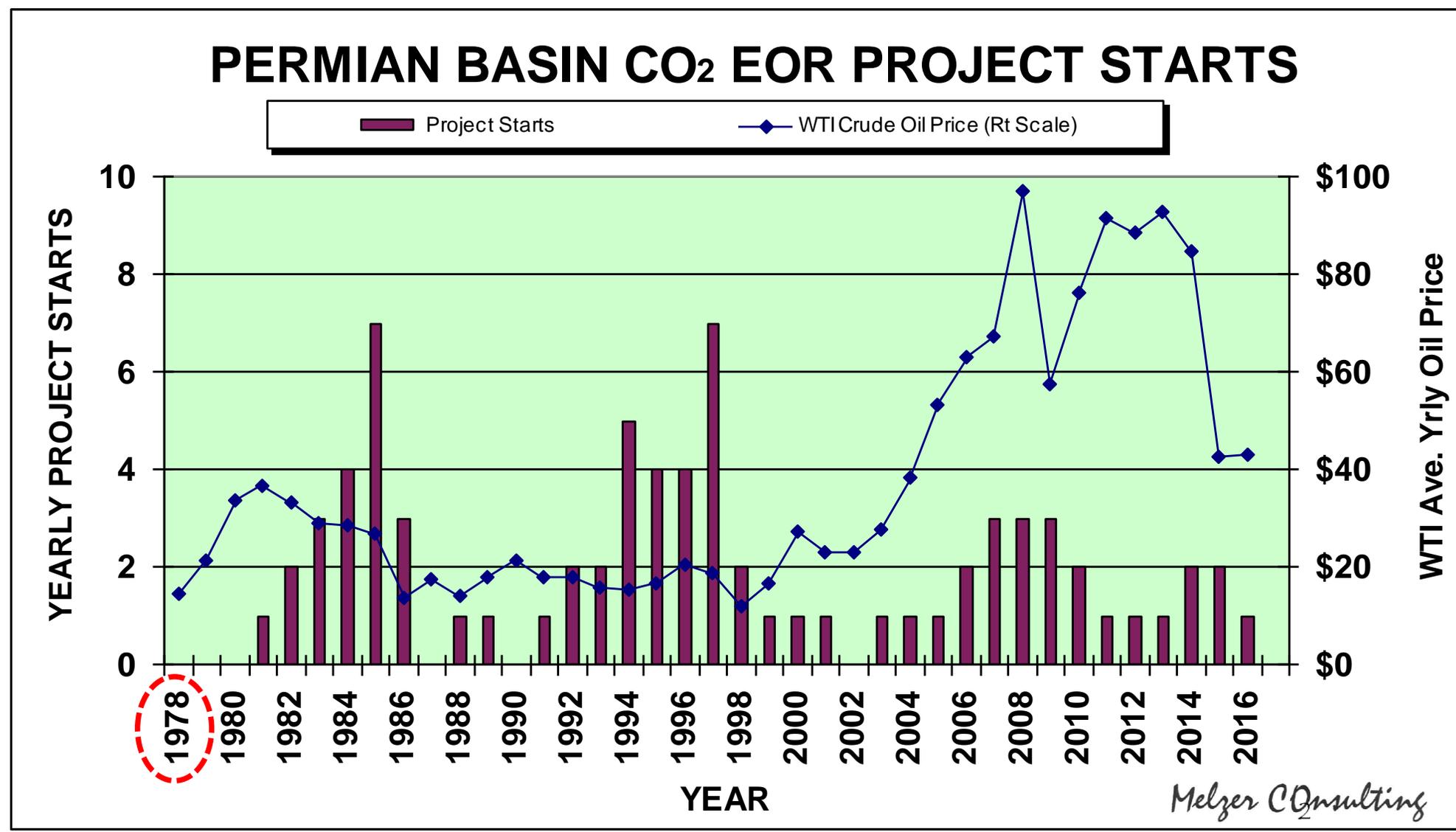
- Established Technology – Storing 60 million tons CO₂ / Yr
- Established Expertise – 40 Companies Safely Handling New and Recycled CO₂
- Producing 300,000 BPD Which Supports 1 Million Jobs each Year*
- Supports Diversity of Energy Sources
- Huge Expandability; Given Affordable and Reliable CO₂ Sources

* Texas RRC Formula of 17 jobs per \$1 Million Rev / Yr

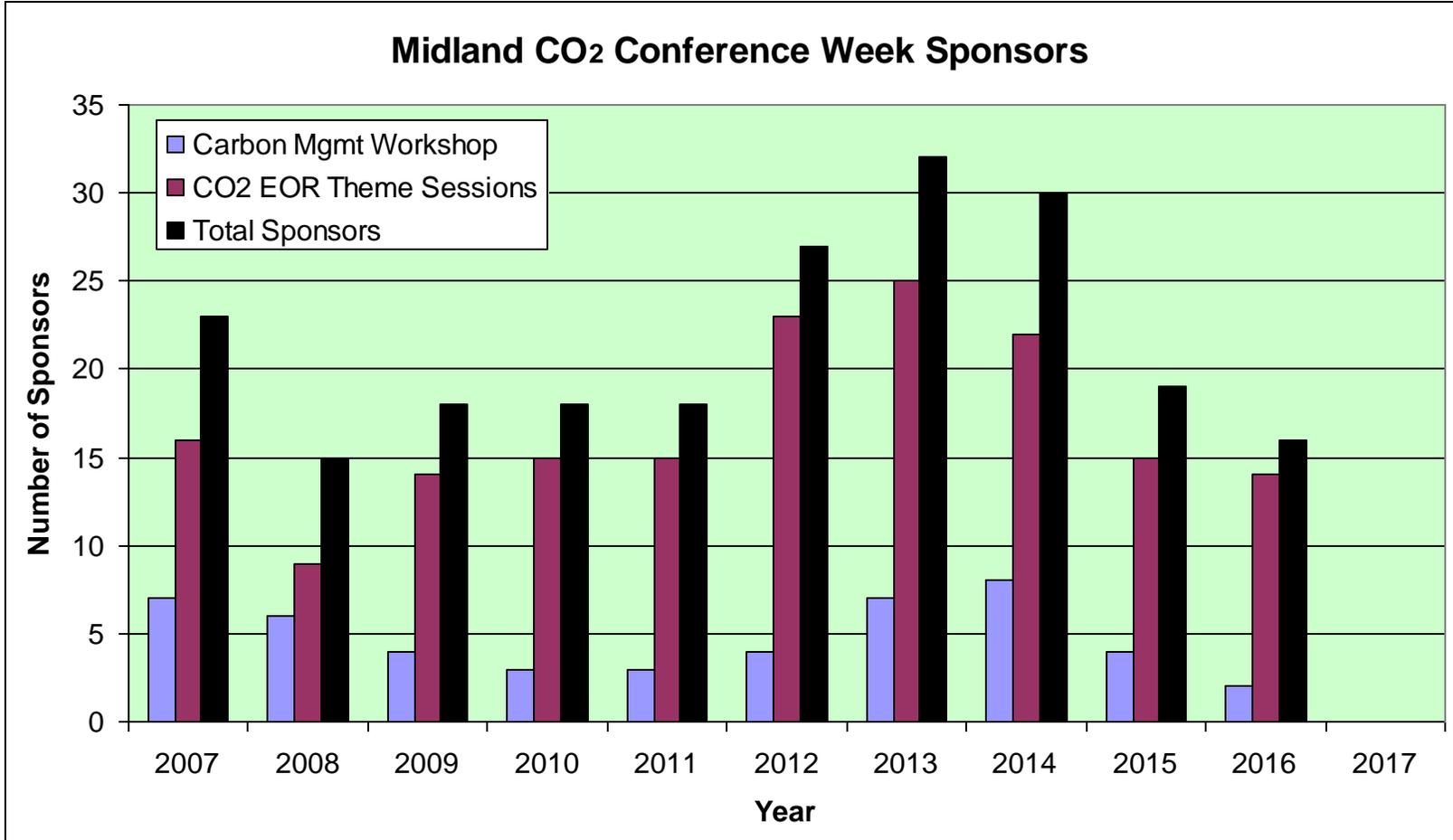
But What are the Current CO₂ EOR Trends?

We'll use the Permian Basin as our
Reference Basin

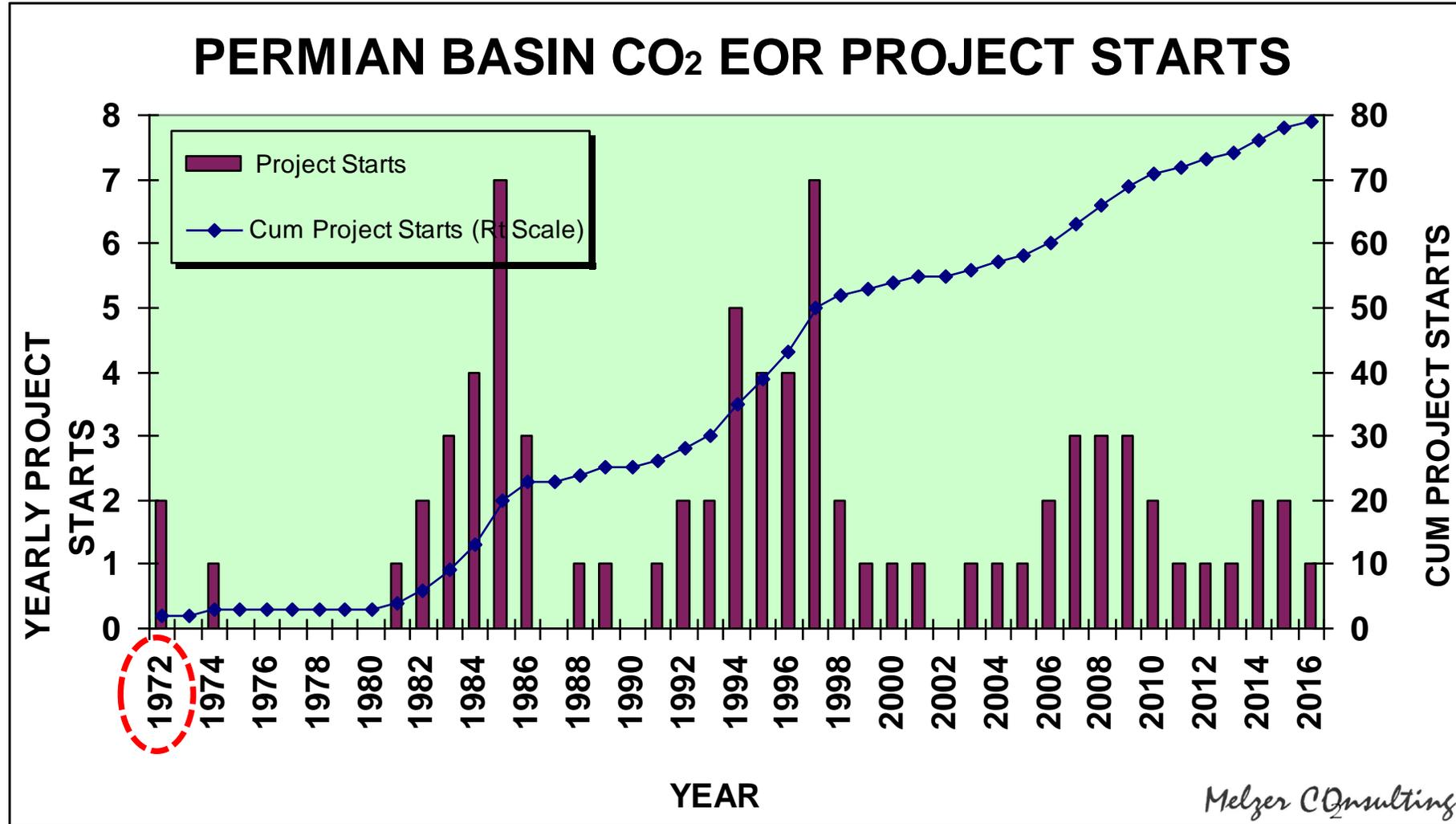
CO₂ EOR Implementation Rates (PB)



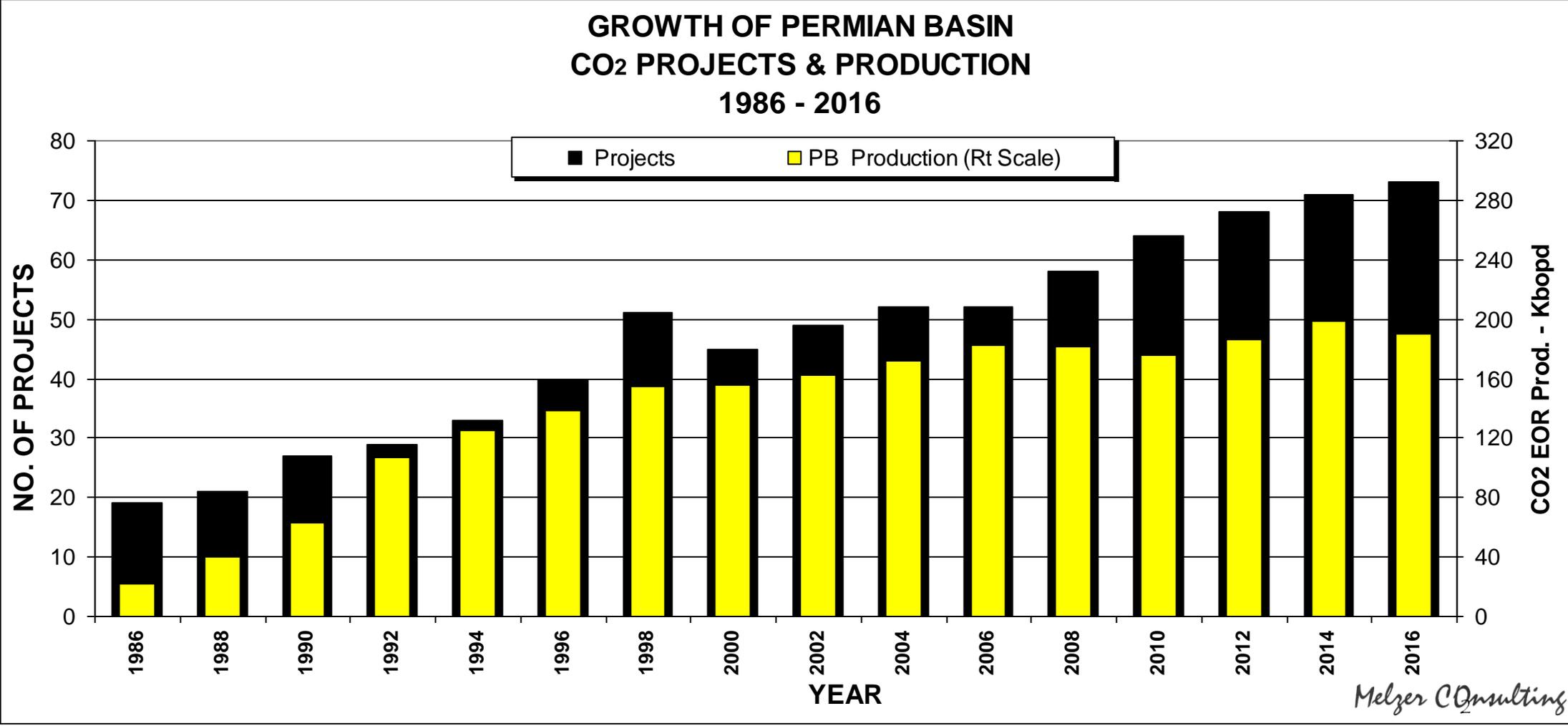
A Disturbing? Business Metric: The Number of CO₂ Conference Sponsors in Midland



A Longer Look at Implementation Rates



Long Term Growth – Projects & Production



But Changes are Underway

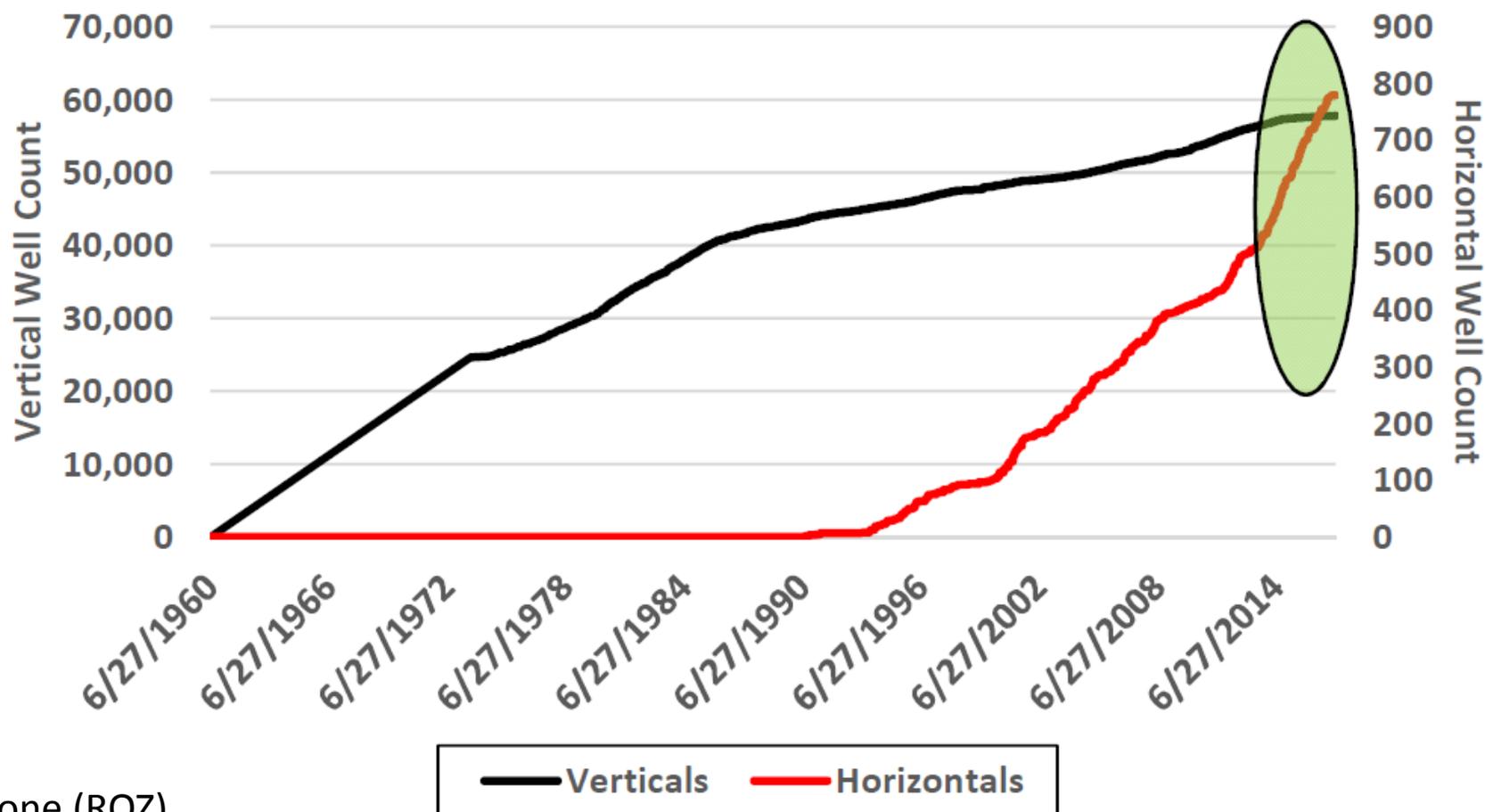
Where Are the Oil Investments Going?

The Rising Status of Horizontal Wells

Shales are the News but it is Even in our Conventional Reservoirs

Data supplied by IHS

The Formation Isolated Here is the San Andres: Home to 70 Active CO₂ Floods and the ROZ* Horizontals



* Residual Oil Zone (ROZ)

We are All Familiar With Commodity Price Cycles

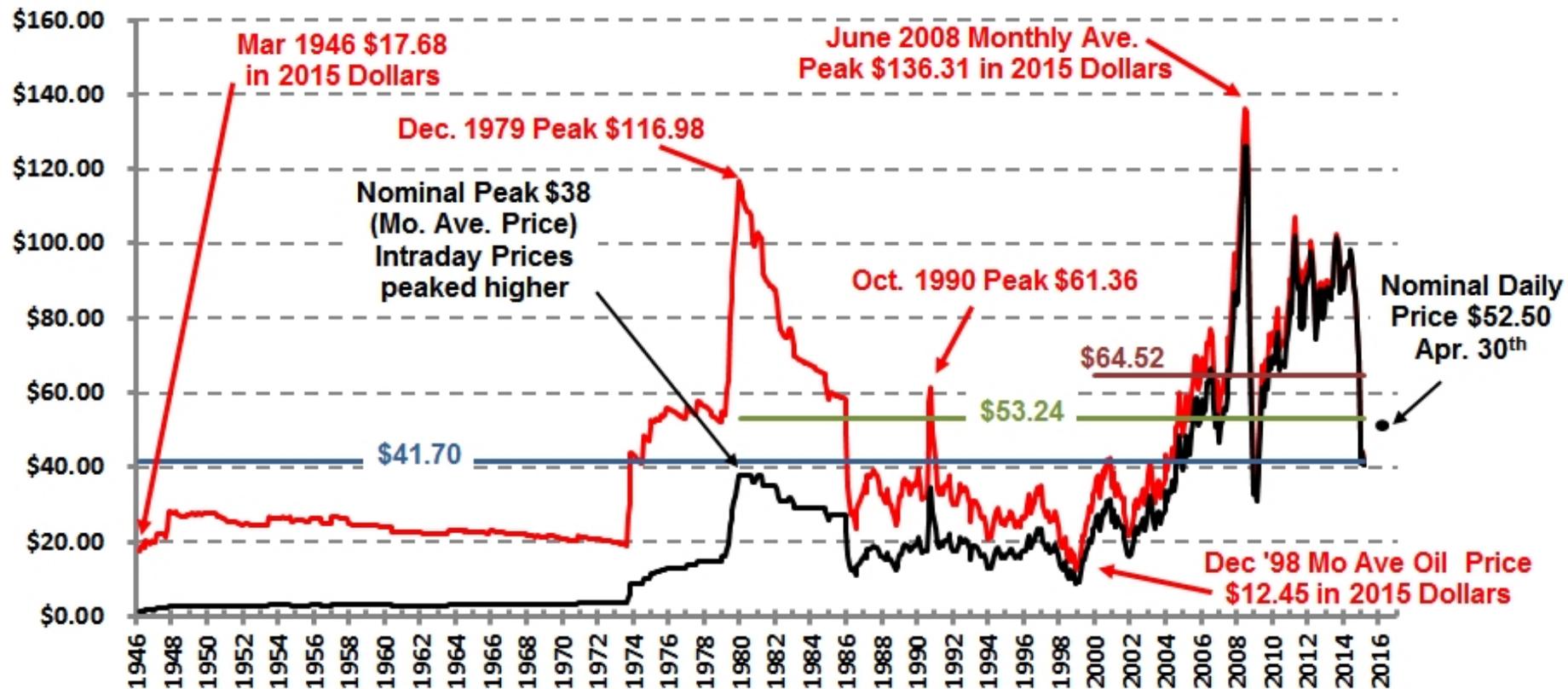
Inflation Adjusted Monthly Average CRUDE OIL PRICES

(1946-Present) In March 2015 Dollars

© www.InflationData.com

Updated 4/30/2015

- Inf. Adj. Oil Price
- Nominal Oil Price
- Ave. Since 2000
- Ave. Since 1980
- Ave. since 1946



The World Keeps Changing

Another Set of Perspectives on Where New Oil Capital Goes

Some Key Factors to Consider

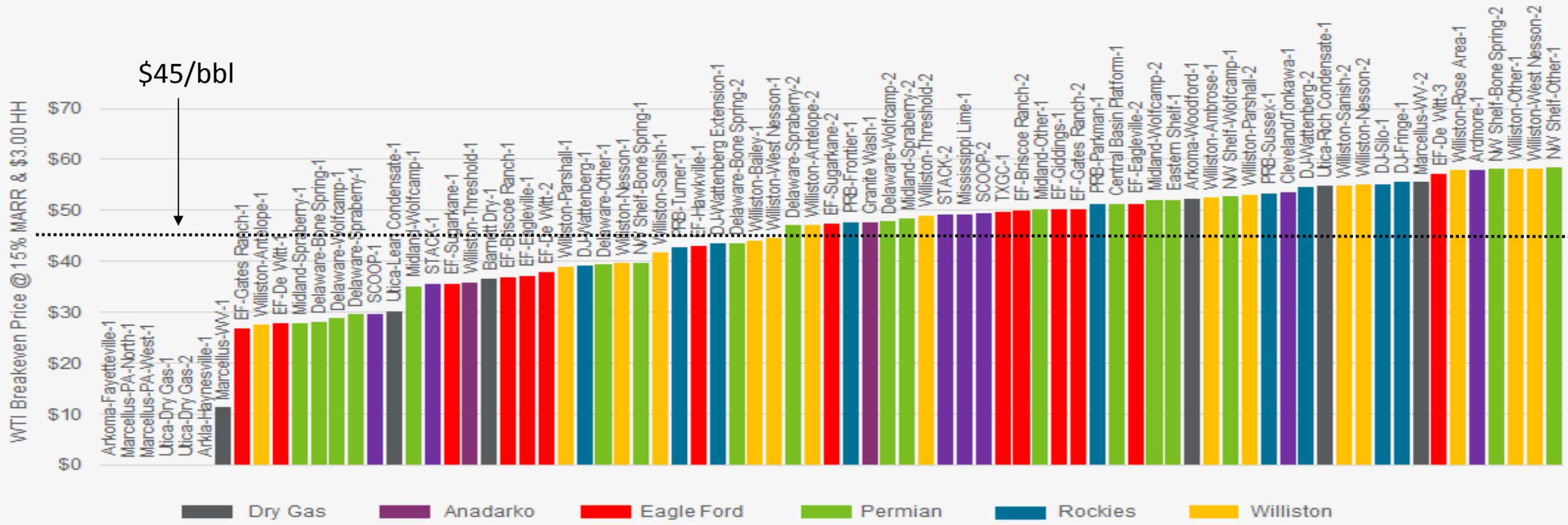
- Energy Scarcity Factor Gone
Did Advanced Recovery Need Energy Scarcity?
- Environmental Overhang
Does Long Term Investing Make Sense with Anti-Fossil Policies?
- Quick Return on Investment
*With their Quick Returns Does Horizontal Drilling **Trump** Long Term Investments?*
- The Rise of Private Equity Funding

US Crude Oil Production, January 1986 to December 2014



Source: My top ten energy charts of the year for 2014, Mark J. Perry, American Enterprise Institute, January 5, 2015

US Production: Economics Support Increased Horizontal Drilling Activity



Source: DI ProdCast

Source: The New Normal(ization): Market Intelligence: FundamentalEdge Outlook, Bernadette Johnson, August 2017



But Maybe All The News for CO₂ EOR Isn't Bad....

Innovation and New Areas of Excitement

- CCS and the Need for Reservoir CO₂ Sinks
- EOR in the Shales? **Unconventional Reservoirs, Conventional Oils**
- EOR in the ROZs? **Conventional Reservoirs, Unconventional Oils**

Where Sit the Politics?

- Left Side: Climate Change, Emission Reductions, and Hydrocarbon Combustion Avoidance
- Right Side: Energy Scarcity & Reliability Worries / A “Rising Energy Tide Lifts All Boats”
- If CO₂ Capture and CO₂ EOR are in the Middle Aisle, Why no Progress?

Trump's path to global coal dominance picks up at UN

by John Siciliano | Oct 2, 2017, 12:01 AM



George Dethlefsen, left, CEO of Corsa Coal, speaks with a miner in a coal pit in Friedens, Pa., on June 7. Corsa Coal Corp. says the mine will create 70 to 100 new jobs and produce some 400,000 tons of metallurgical coal a year. President Trump has referred to the mine's opening during speeches announcing his intent to withdraw from the Paris climate accords. (AP Photo/Duke Kang)

The Trump administration may gain an ally at the United Nations for its pro-fossil fuel agenda to build cleaner coal power plants globally.

President Trump often touts his support for clean coal technology, and even though he is withdrawing the U.S. from the Paris climate change agreement, his administration still wants to use the U.N. in ways that help implement its agenda to export more U.S. energy and expertise abroad.

Story (Cont'd)

One of the more supportive areas is the U.N. Economic Council on Europe's Committee on Sustainable Energy, which is looking for ways to support electricity from fossil fuels through its Cleaner Electricity Production from Fossil Fuels working group.

The clean electricity group looks for ways to make coal plants more efficient and push technologies that reduce greenhouse gas emissions. It is committed to keeping fossil fuels in the global energy mix, recognizing that coal and other fossil fuels make up more than half of the energy consumed in Europe alone.

Most of the U.N. group's goals would dovetail surprisingly well with Trump's agenda for coal. Energy Secretary Rick Perry talked up the administration's support for carbon capture technology last week at clean energy conferences around Washington, saying the goal is to export U.S. innovation abroad and expand the market for American coal expertise.

The administration is "aware of this effort within the [United Nations]," said Barry Worthington, chairman of the U.N. Cleaner Electricity Production working group. "I would say the Department of Energy is very engaged" with the U.N. Economic Council on Europe's sustainability committee.

Worthington is also the executive director of the U.S. Energy Association, a large umbrella group that represents the energy industry on the World Energy Council. The group serves as a bipartisan advisory organization representing 150 members across the U.S. energy sector, from large Fortune 500 companies to small energy consulting firms.

Worthington is gearing up for this month's 13th annual meeting of the Group of Experts on Cleaner Electricity Production from Fossil Fuels in Geneva.

"It's a group of experts on clean power production and we're going to make an effort in the next month, or so, to develop recommendations or criteria for consideration by financial institutions looking at financing coal and other fossil facilities," Worthington told the Washington Examiner.

The criteria will assist in getting large financial groups such as the World Bank or the European Bank for Reconstruction and Development to consider coal plants in the list of power plants it will support, Worthington said. The World Bank has had a bias against coal plants at the Obama administration's insistence, which the Trump administration has been trying to reverse.

"This is a complete turnaround from the previous guidance that precluded U.S. support for overseas coal financing and implemented a key section of former President Obama's Climate Action Plan," Popovich said in a statement to the Washington Examiner.

Worthington said the Trump administration is also making U.S. agencies that handle overseas energy investments more supportive of coal, including the Overseas Private Investment Corporation, the Export-Import Bank, U.S. Trade and Development Agency, and others.

"Then at the same time, the United States would use our role in the international finance institutions to cause them to also reverse their ban, or prohibition, or bias, against financing coal plants," he said. "That would be the World Bank, the whole World Bank Group, the European Bank for Reconstruction and Development, the African Development Bank, Inter-American Development Bank, and so forth."

The Asian Development Bank "never developed an anti-coal, anti-fossil policy. They continue to finance coal plants," Worthington pointed out. The U.S. and China will hold a joint clean coal meeting in West Virginia in November to share notes on carbon capture and other clean coal technologies that both countries have been funding for years.

The Trump administration also wants to use its standing in the U.N.'s Green Climate Fund, since the Obama administration sent \$1 billion to the fund before Trump announced June 1 the U.S. would withdraw. The fund is meant to collect money from large developed nations to help fund projects in poorer nations affected by global warming.

Many scientists blame fossil fuels for changing the temperature of the Earth, resulting in potentially catastrophic consequences such as ocean acidification and more severe drought.

Obstacles Remain

Regulatory Approach?

‘Worst Case’ Rules?



CO2 Capture Project report looks at CO2-EOR transition to CO2 storage

Oct 01 2017

The CCP (CO2 Capture Project) report provides an in-depth review of the regulatory pathways for transitioning a pure CO2 EOR (Enhanced Oil Recovery) project into a CO2 storage operation in two key jurisdictions – Texas, USA, and Alberta, Canada.

A CCP overview study of the subject in 2016 identified that although there are no technological barriers to be overcome, there are a number of legal, regulatory and economic challenges across jurisdictions which must be addressed to allow EOR projects to serve as CCS projects.

Alberta and Texas were chosen for specific focus in this new report as they are particularly favourable locations for potential CCS projects, resulting from a history of CO2 injection for EOR and/or existing CCS infrastructure.

The new report – CCP4: Review of CO2 EOR Transitioning to CCS in Texas and Alberta – looks at each of the jurisdictions through two lenses – firstly, the existing regulatory pathway for CCS permitting without EOR; and then, what is needed for a CO2-EOR scheme to gain credit as CCS and where regulation may be a barrier to that transition. Each key project stage is covered, from planning and permitting, through to operation, decommissioning and closure. Case studies from each jurisdiction are also provided.

Arthur Lee, CCP Policy & Incentives Team Lead, commented, "This report takes the results from our work last year and moves them a stage further on, providing real detail in two key geographies. We find that, even in two relatively advanced EOR/CCS areas like Texas and Alberta, there are still gaps and uncertainties in the regulatory frameworks that need to be addressed for CO2 EOR projects to transition successfully to CCS."

[Download the report](#)

[Previous: Statoil, Shell and Total enter CO2 storage partnership](#) [Next: CO2 Solutions' first commercial project on track in Quebec](#)

We Seem Incapable
of Understanding...

Certain Geologies
Minimize Risk and
Rules Should Reflect
that Reality

Thank you

Time for Questions?