OCCIDENTAL PETROLEUM CORPORATION: LEADER IN CO₂ EOR & CCUS DEPLOYMENT

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Occidental Petroleum Corporation
Agenda

- Occidental Petroleum Permian EOR Operations Overview
- Overview of Federal Injection Requirements
- Occidental MRV Plans
  - Denver Unit
  - Hobbs
- 45Q Tax Credit
- Estimated Value of Potential Incentives on Large CO\textsubscript{2} Pipeline
- Summary
Permian EOR Operations

- 31 CO₂ Flood Units
  - ~1/3 of US Miscible Gas EOR Production
- 80 Waterflood Units
- Significant primary development acreage
- 12 Gas Processing Plants
  - 2.3 BCFPD of gas handled (~44 Mtpa)
  - 1.2 BCFPD of CO₂ Recycled (~23 Mtpa)
- 2 CO₂ Source Fields
  - 1.1 BCFPD CO₂ Purchased (~21 Mtpa)
World Leader in CO₂ Enhanced Oil Recovery

- Occidental is the largest handler of CO₂ in the Permian Basin
  - Injects >2.0 billion cubic feet a day
  - Operates 31 CO₂ EOR projects

Source: Oil & Gas Journal 2016 Biennial EOR Update
CO₂ EOR Process

CO₂ supplied from Pipeline

Injection

CO₂ Recycled from Gas Plant

Produced Gas

Separate Oil, Gas and Water

Gas & NGL Sales

Oil Sales

Producer Wellbore

Reservoir

Injector Wellbore

Drive Water CO₂

Water CO₂ Miscible Zone

Oil Bank

Additional Oil Recovery

Additional Oil Recovery

Additional Oil Recovery

Additional Oil Recovery

Additional Oil Recovery
Federal CO₂ Injection Requirement Flow Chart

Will CO₂ be injected?
- Yes: Are you injecting CO₂ for EOR?
  - Yes: Operate under Class II of the UIC program & proceed to GHG Reporting
  - No: Proceed
- No: No Further Action

Are you injecting CO₂ for EOR?
- Yes: Operate under Class VI of the UIC program & proceed to GHG Reporting
- No: Proceed

Proceed

Report under Subpart RR of the GHG Reporting Rules

Are you claiming credit for the CO₂ that is geologically sequestered?
- Yes: Report under Subpart RR of the GHG Reporting Rules
- No: Report under Subpart UU of the GHG Reporting Rules
<table>
<thead>
<tr>
<th></th>
<th>GHGs to be Reported</th>
<th>Subpart RR</th>
<th>Subpart UU</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mass of CO₂ received</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2</td>
<td>Mass of CO₂ injected into the subsurface</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>3</td>
<td>Mass of CO₂ produced</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>4</td>
<td>Mass of CO₂ emitted by surface leakage</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>5</td>
<td>Mass of CO₂ equipment leakage and vented CO₂ emissions from surface equipment located between the injection flow meter and the injection wellhead</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Mass of CO₂ equipment leakage and vented CO₂ emissions from surface equipment located between the production flow meter and the production wellhead</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Mass of CO₂ sequestered in subsurface geologic formations</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Cumulative mass of CO₂ reported as sequestered in subsurface geologic formations in all years since the facility became subject to reporting requirements under subpart RR</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>
Objective and Drivers for Monitoring, Reporting and Verification (MRV) Plan

- To enable CO₂ capturers to qualify for and receive 45Q Tax Credit

- To lead efforts in CCUS by developing first and subsequent MRV Plans

- Leverage our subsurface knowledge gained through decades of EOR experience and operating history to develop MRV plans that satisfy requirements in EPA’s GHG Reporting Program (GHGRP) Subpart RR
Key Elements to MRV Plans

- Suitable geology
- Existing facilities / infrastructure
- Injection operations
- Risk assessment
- Monitoring and control system
- Mass balance calculations
Plan Reporting Obligations

- Report inputs for mass determinations
  - CO₂ received, injected, produced, recovered
  - CO₂ lost to surface leakage, venting and fugitive emissions

- Annually report mass sequestered and cumulatively stored

- Retain records to meet IRS / EPA requirements

- Implement plan within 180 days of EPA approval

- Revise and submit for approval material changes to monitoring or operational parameters within 180 days
• Consistent with Subpart RR, Occidental may submit a request to discontinue reporting:
  – At the end of the Specified Period
  – Accompanied by a demonstration that the cumulative mass of CO\textsubscript{2} reported as sequestered during the Specified Period is not expected to migrate in the future in a manner likely to result in surface leakage

• It is expected that a demonstration can be made within two to three years after injection for the Specified Period ceases
Denver Unit Project Description

- Subdivision of the Wasson Field located in West Texas
- Established in 1960s to implement water flooding
- CO$_2$ flooding began in the Denver Unit in 1983
Injection Operations (Denver Unit)

- Projected storage through end of operations of 3,768 Bscf (200 MMMT)

- Historic and forecast CO₂ injection / production / storage

- Occidental designs & operates floods around an IWR of ~1

- Injected total of 4,035 Bscf of CO₂ (213 MMMT) by end of 2013. 84 MMMT produced and 129 MMMT stored.
Hobbs Project Description

- Discovered in 1928
- NW portion of the Central Basin Platform of Permian Basin
- Hobbs Field = North Hobbs Unit + South Hobbs Unit
- CO$_2$ Flooding NHU since 2003, SHU since 2015
- Proximity to town = added safeguards in tan area
Injection Operations (Hobbs)

- Projected storage through 2100 of 2,197 Bscf (118.8 MMT)

- Injected total of 579 Bscf of CO$_2$ (31.3 MMT) by end of 2015. 318 Bscf (17.2 MMT) produced and 261 Bscf (14.1 MMT) stored.
Hobbs / Denver Unit Comparison

• Similarities
  – Quality of formation and seals
  – Occidental operational procedures / fluid management based on modeling, controls, monitoring, maintenance
  – Conceptual approach to mass balance

• Differences
  – Structural control – Occidental controls all of NHU / SHU
  – Closer proximity to a town resulting in operation, construction, monitoring safeguards
  – CO$_2$ floods at Hobbs are less mature; will operate longer
  – Hobbs Recompression Facility functions like Denver Unit CO$_2$ Recovery Plant but less complex
  – Standard pressure in NM is 15.025 psi so conversion factor is larger
### House
**The Carbon Capture Act**

- **Specifications**
  - Keeps existing 45Q threshold in place for current projects
  - Credit for EOR and Saline increases to $35. There is only one credit
  - Ramps credit for 10 years
  - Reduces 500,000 threshold to 100,000 - Was 150,000
  - Includes stronger transferability provision from Senate bill
  - Authorizes programs for projects that commence construction within 7 years
  - Credit can be claimed for 15 years once placed in service
  - Adds language to allow Carbon Monoxide and Air capture to get the credit
  - Credit authorization language is changed to allow projects that “have never received 45Q tax credit before” (NRG/Petra Nova)

### Senate
**The Carbon Capture Utilization & Storage Act**

- **Specifications**
  - Keeps existing 45Q threshold in place for current projects
  - Credit for EOR increases to $35 and $50 for saline storage
  - Ramps credit over 10 years
  - Reduces 500,000 threshold to 100,000 for industrial and 25,000 threshold for non-EOR
  - Includes stronger transferability provision
  - Authorizes programs for projects that commence construction within 7 years
  - Credit can be claimed for 12 years once placed in service
  - Provides eligibility for new forms of CO₂ (algae, Biomass, alternative fuels, etc)
  - Adds language to allow Carbon Monoxide and Air capture to get the credit
  - Credit authorization language is changed to allow projects that “have never received 45Q tax credit before” (NRG/Petra Nova)
# Estimated Value of Potential Incentives on Large CO₂ Pipeline

<table>
<thead>
<tr>
<th>Potential Incentive</th>
<th>Description</th>
<th>Advantages</th>
<th>Disadvantages</th>
<th>Estimated Value (US$MM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ross / Navarro Infrastructure Tax Credit Proposal</td>
<td>82% tax credit on equity portion of capital, assuming 5:1 debt to equity</td>
<td>High value impact depending on debt to equity ratio</td>
<td>Requires legislation Depend on tax status of investor</td>
<td>$172</td>
</tr>
<tr>
<td>Accelerated Depreciation</td>
<td>MACRS5 schedule vs. MACRS15</td>
<td>Consistent with tax treatment of carbon capture / renewable energy</td>
<td>Requires legislation. Depend on tax status of investor</td>
<td>$115</td>
</tr>
<tr>
<td>Paul Ryan tax reform</td>
<td>• Full depreciation in Year 1 • 20% CIT</td>
<td>Additional benefit of 20% CIT</td>
<td>Requires legislation</td>
<td>$290</td>
</tr>
<tr>
<td>Private Activity Bonds</td>
<td>Enable CO₂ pipeline projects to utilize tax exempt bonds</td>
<td>Low cost to government</td>
<td>Interest rate discount only exists for short term bonds</td>
<td>$37</td>
</tr>
<tr>
<td>Federal Loans (LPO or TIFIA)</td>
<td>Allow CO₂ pipelines to qualify for existing federal loan programs</td>
<td>LPO programs exist, money already allocated.</td>
<td>TIFIA would need legislation. Requires DOE to apply “innovative” status to pipelines</td>
<td>$117</td>
</tr>
<tr>
<td>Direct Grant</td>
<td>$500 million direct grant</td>
<td>Lower capital of pipeline</td>
<td>Requires approval / government funds allocation</td>
<td>$348</td>
</tr>
</tbody>
</table>

DISCLAIMER: Subject to numerous assumptions and data from various sources.
Summary

• Occidental Petroleum Corporation is the world leader in CO₂ EOR

• Occidental has taken a leadership role by developing and gaining EPA approval for two MRV Plans

• Occidental is supportive of efforts that enable the rapid deployment of Carbon Capture, Utilization and Storage (CCUS)

• Occidental supports incentives that would accelerate CCUS
  • 45Q extension bills
  • CO₂ pipeline incentives