Liberty’s Stomping Horse Bakken EOR Pilot

Williston Basin Petroleum Conference

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C. Mark Pearson
The Size of the Bakken?

By all estimates... the size of the prize is massive!!

Bakken Petroleum System Total Oil in Place Reserve Estimates

Original Oil in Place Estimate
Technically recoverable Reserve Estimate

Slide Courtesy EERC
## Prior Bakken EOR Well Tests

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>#9660</td>
<td>Meridian</td>
<td>1994</td>
<td>500 bpd</td>
<td>5000 bhp</td>
<td>200 bpd</td>
<td>3000 bhp</td>
<td>UBS</td>
<td>13,082 bbl Water</td>
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<tr>
<td>#16713</td>
<td>EOG</td>
<td>2008</td>
<td>700 bpd</td>
<td>1500 sdp</td>
<td>580 bpd</td>
<td>1000 sdp</td>
<td>MB</td>
<td>30.7 MMscf CO₂</td>
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<td>#17170</td>
<td>EOG</td>
<td>2012</td>
<td>3000 bpd</td>
<td>4000 bhp</td>
<td>1500 bpd</td>
<td>1000 bhp</td>
<td>MB</td>
<td>38,177 bbl waterab</td>
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<tr>
<td>#16986</td>
<td>EOG</td>
<td>2014</td>
<td>1500 Mscfd</td>
<td>5000 bhp</td>
<td>1500 Mscfd</td>
<td>4500 bhp</td>
<td>MB</td>
<td>88.7 MMscf field gas</td>
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<tr>
<td>#24779c</td>
<td>Whiting</td>
<td>2014</td>
<td>31 gpm</td>
<td>3500 bhp</td>
<td>10.5 gpm</td>
<td>3500 bhp</td>
<td>MB</td>
<td>3.4 MMscf CO₂</td>
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<tr>
<td>#32937c</td>
<td>Hess</td>
<td>2017</td>
<td>227 Mscfd</td>
<td>5500 sdp</td>
<td>105 Mscfd</td>
<td>4000 sdp</td>
<td>MB</td>
<td>9.5 MMscf C₃H₈</td>
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<tr>
<td>#11413c</td>
<td>XTO</td>
<td>2017</td>
<td>12 gpm</td>
<td>9480 bhp</td>
<td>9 gpm</td>
<td>9400 bhp</td>
<td>MB</td>
<td>1.7 MMscf CO₂</td>
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<td>Burning Tree</td>
<td>Enerplus</td>
<td>2009</td>
<td>3000 Mscfd</td>
<td>1848 bhp</td>
<td>1000 Mscfd</td>
<td>NA</td>
<td>MB</td>
<td>45 MMscf CO₂</td>
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a Current operator is Burlington Resources.
b Includes values reported prior to reported test start.
c Vertical well.

bhp = bottomhole pressure
sdp = surface discharge pressure
gpm = gallons per minute
# Liberty’s Average Gas Composition

<table>
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<tr>
<th>Gas Component</th>
<th>Mole%</th>
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<tr>
<td>Methane</td>
<td>60%</td>
</tr>
<tr>
<td>Ethane</td>
<td>20%</td>
</tr>
<tr>
<td>Propane</td>
<td>10%</td>
</tr>
<tr>
<td>C4+</td>
<td>9.2%</td>
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<tr>
<td>CO2</td>
<td>0.80%</td>
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Bakken Produced Gas Has Favorable Miscibility

- Ethane in our lease gas is very effective at lowering MMP
Ethane is an effective solvent for oil recovery.
EOR Predictions from Reservoir Simulation & Lab Studies

- **Enhanced Oil Recovery**
  - Additional Recovery of 250,000 – 500,000 BO/Well

- **Primary Oil Recovery**
  - ~600,000 BO/Well

Single Well Production with EOR predicted from reservoir studies
- Rate and recovery trend increases with EOR Huff & Puff gas injection
Liberty’s NDIC Approved Rich Gas EOR Pilot

Proposed Injection Well – Operated Bakken pool well proposed for rich gas injection during EOR pilot.

Operated Bakken Pool Monitoring Well – Operated Bakken pool well collocated in the DSU to be used for monitoring purposes only.

Pilot Boundary Well – Operated Bakken pool well to be used for monitoring purposes only in order to provide a pilot boundary on the eastern and western edges of the DSU.
Leon Central Production Facility

- Handles production from 9 in-DSU wells and 8 offset-DSU wells.
- Liberty’s first Central Production Facility operating since February 2015
- Environmental benefit of four stages of gas capture
- Separate 3-phase metering of each well
Downhole Configuration - Minimal Cost of Service Conversion

No workover cost for injection conversion; artificial lift system designed for high gas-liquid ratios.

Normal Production Operation
- Hydraulic Jet Pump

![Diagram of Downhole Configuration]

- 4 ½" Hanger
- 7" 32# Casing
- 4 ½" 11.6# Liner

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Surveillance Plan

Surveillance includes production, bottom-hole pressure, and gas composition monitoring.

Surveillance Plan
- Oil, gas, and water rates will be monitored continuously from Liberty Operated Wells
- Oil and Water are measured using Coriolis meter, Gas is measured using orifice plate meters
- Data is gathered by a Scada system and is collected every 5 minutes
- The two wellbores immediately offset the injector well will be equipped with a gas chromatograph, or samples will be taken for GC
- The four wellbores immediately offset the injector (pattern allowing) will be equipped with bottom hole pressure gauges. Gauge data will be retrieved every two weeks at minimum.

Anticipated EOR Pilot Start Date – July 2018
“While each previous test offers some valuable learnings, none of them individually or as a whole should be considered to be representative of future Bakken EOR operations.”
The future is bright ……

…….. it is time for some EBOR !!!

(Enhanced Bakken Oil Recovery)

Thanks to:
- all our WIO partners
- EERC
- NDIC
- NDPC
- Liberty’s Engineering & Operations Teams
• An independent Denver-based E&P company with private-equity backing primarily from Riverstone Holdings; with industry leading expertise in developing tight-oil plays using advanced completion designs and reservoir technology.

• Operates in the Williston Basin (ND) and Powder River Basin (WY) with gross operated and net production of ~8,000 boepd.

• Liberty Midstream Solutions (LMS) operates the 30 MMSCFD capacity County Line Gas Plant near Tioga, and a 3-well PW disposal system with associated infrastructure.

• Team has been working the Bakken since 2009 and has already sold its assets once (Liberty Resources I) in mid-2013; and then re-entered the basin in 1Q 2014 with a $455 Million transaction as Liberty Resources II LLC.

• The company will be operating a one-rig program in the “North Nesson Anticline” area of the Williston Basin in 2018 where we have built our position to ~100,000 net acres.
2015 to 2017 Bakken Development (2890 Wells)

- Advanced Completions
- Drilling 3-mile laterals
Non-Core Wells Generating Competitive Returns at $50 WTI

The combination of drilling efficiencies and improved productivity from geoengineered Gen. 4 & 5 completion designs means that Liberty’s half-cycle well returns in 2017/18 at $50 WTI are better than what they were in 2013 at $90 WTI.