December 2016
Presentation Slides

Justin J Kringstad
Geological Engineer
Director
North Dakota Pipeline Authority
Presentation Outline

• Understanding current and future oil production
  – Activity
  – Drilling economics
  – Forecasts

• Williston Basin oil transportation dynamics
  – Interstate oil movements
  – Intrastate oil movements

• North Dakota natural gas production
  – Flaring and gas capture
  – Natural Gas Liquids
North Dakota Drilling Activity

Drilling Rigs & Spuds

Spuds Per Rig Per Month

- Spuds
- Drilling Rigs
- Spuds per Rig per Month

Oct-09 to Oct-16
Bakken IP Rates

Initial Production (IP) Year – 2016 YTD Non-Confidential
Improving Well Performance

Average BKN/TF Well Performance in Williams, McKenzie, Dunn, & Mountrail Counties (Minimum 1 bopd)

IP Year
- 2016
- 2015
- 2014
- 2013
- 2012
- 2011

JJ Kringstad - North Dakota Pipeline Authority
Average BKN/TF Well Performance in Williams, McKenzie, Dunn, & Mountrail Counties (Minimum 1 bopd)
A Quick Look at Bakken Drilling Economics…
North Dakota Oil Differential

Based on EIA Data

$2
$4
$6
$8
$10
$12
$14
$16
$18
$20
$22
$24
$26
$28
$30
$32
$34
$36
$38
$40


North Dakota-WTI Differential
North Dakota-Brent Differential

Based on EIA Data
Key Economic Assumptions

- $6-$8 Million Well Costs
- $45/BBL & $2.00/MCF Wellhead Pricing
- 1/6 Royalty
- Zero Flaring
- Assumed 10-20% IRR to drill (calculated after production taxes and royalties)
- No Tax Incentives Included
- Production rate is 30-day average
- All Bakken/Three Forks wells drilled in 2008+
Peak Month Minimum
400 BOPD

6,616 Wells

Peak Month Well Production, BOPD

Well Cost

400

6 MM

7 MM

8 MM

Breakeven Wellhead Price (AT IRR of 20%)

After Tax IRR

Peak Month BOPD / Well Cost

400

$45 Wellhead
Peak Month Minimum
500 BOPD

Peak Month BOPD / Well Cost

After Tax IRR

$45 Wellhead

© OpenStreetMap contributors

JJ Kringstad - North Dakota Pipeline Authority
Peak Month Minimum
600 BOPD

3,533 Wells

600 BOPD

3,533 Wells

Peak Month Well Production, BOPD

Well Cost

6 MM

600

7 MM

$45 Wellhead

8 MM

Breakeven Wellhead Price (AT IRR of 20%)

Peak Month BOPD / Well Cost

After Tax IRR

24%

22%

20%

18%

16%

14%

12%

10%

8%

6%

4%

2%

0%

© OpenStreetMap contributors

JJ Kringstad - North Dakota Pipeline Authority
Peak Month Minimum
700 BOPD

Peak Month BOPD / Well Cost

<table>
<thead>
<tr>
<th>Well Cost</th>
<th>After Tax IRR</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 MM</td>
<td>35%</td>
</tr>
<tr>
<td>7 MM</td>
<td>20%</td>
</tr>
<tr>
<td>8 MM</td>
<td>15%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Wellhead Price</th>
<th>6 MM</th>
<th>7 MM</th>
<th>8 MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0</td>
<td>$700</td>
<td>$700</td>
<td>$700</td>
</tr>
<tr>
<td>$5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$35</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$40</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$45</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$50</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

© OpenStreetMap contributors

JJ Kringstad - North Dakota Pipeline Authority

13
Peak Month Minimum
800 BOPD

Peak Month Well Production, BOPD
800

Well Cost
6 MM
7 MM
8 MM

$0 $5 $10 $15 $20 $25 $30 $35 $40 $45

Breakeven Wellhead Price (AT IRR of 20%)

Peak Month BOPD / Well Cost
800

After Tax IRR

$45 Wellhead

© OpenStreetMap contributors
Peak Month Minimum 900 BOPD

Peak Month BOPD / Well Cost

<table>
<thead>
<tr>
<th>Well Cost</th>
<th>After Tax IRR</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 MM</td>
<td>$45 Wellhead</td>
</tr>
<tr>
<td>7 MM</td>
<td>$45 Wellhead</td>
</tr>
<tr>
<td>8 MM</td>
<td>$45 Wellhead</td>
</tr>
</tbody>
</table>

Breakeven Wellhead Price (AT IRR of 20%)
Peak Month Minimum
1,000 BOPD

Peak Month Well Production, BOPD

<table>
<thead>
<tr>
<th>Well Cost</th>
<th>Peak Month Well Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 MM</td>
<td>1000</td>
</tr>
<tr>
<td>7 MM</td>
<td></td>
</tr>
<tr>
<td>8 MM</td>
<td></td>
</tr>
</tbody>
</table>

Breakeven Wellhead Price (AT IRR of 20%)

<table>
<thead>
<tr>
<th>Wellhead Price</th>
<th>6 MM</th>
<th>7 MM</th>
<th>8 MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$35</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$45 Wellhead

© OpenStreetMap contributors
Peak Month Minimum
1,200 BOPD

Peak Month Well Production, BOPD

Well Cost

6 MM
7 MM
8 MM

$0 $5 $10 $15 $20 $25 $30 $35

Breachen Wellhead Price (AT IRR of 20%)

Peak Month BOPD / Well Cost

1200

After Tax IRR

6 MM
7 MM
8 MM

$45 Wellhead

© OpenStreetMap contributors
Peak Month Minimum 1,500 BOPD

Peak Month Well Production, BOPD

Well Cost
- 6 MM
- 7 MM
- 8 MM

Breakeven Wellhead Price (AT IRR of 20%)

$0 $2 $4 $6 $8 $10 $12 $14 $16 $18 $20 $22 $24 $26 $28 $30

$45 Wellhead
Summary of $45 Wellhead Oil
Breakeven Summary

Peak Month Well Production, BOPD / Well Cost

Breakeven Wellhead Price (AT IRR of 20%)
Forecasting Future Activity…
US Crude Oil Storage (Excl. SPR)

Year
- 2016
- 2015
- 2014
- 2013
- 2012
- 2011
US Crude Oil Storage (Excl. SPR)
North Dakota Forecast Activity Assumptions

- JJ Kringstad - North Dakota Pipeline Authority
Base Production Declines*

*Non-Confidential Bakken/Three Forks Production Only*
Production forecast is for visual demonstration purposes only and should not be considered accurate for any near or long term planning.
Presentation Outline

- Understanding current and future oil production
  - Activity
  - Drilling economics
  - Forecasts

- Williston Basin oil transportation dynamics
  - Interstate oil movements
  - Intrastate oil movements

- North Dakota natural gas production
  - Flaring and gas capture
  - Natural Gas Liquids
Estimated Williston Basin Oil Transportation

- **Pipeline Export**: 61%
- **Refined**: 8%
- **Truck to Canadian Pipelines**: 29%
- **Estimated Rail**: 2%

September 2016

JJ Kringstad - North Dakota Pipeline Authority
Rail Destinations Market Share (Sep. 2016)

Data for Rail Destination Market Share Provided by the US Energy Information Administration
Major Rail Lines and Refineries

EIA September 2016
Refiner Acquisition Cost

PADD V
$44.21

PADD IV
$40.22

PADD II
$41.81

PADD I
$45.11

PADD III
$42.67

US Dept of State Ge
© 2013 Google
Image © 2013 TerraMetrics
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Crude Oil Prices – Dec 12, 2016

Cushing $53.71
Brent $56.47
WTI + $2.76

Pricing Data: Bloomberg

US Dept of State Geographer © 2013 Google
Image © 2013 TerraMetrics
Data SIO, NOAA, U.S. Navy, NGA, GFCO
Williston Basin Truck Imports and Exports with Canada

Data for truck imports/exports chart is provided by the US International Trade Commission
Production forecast is for visual demonstration purposes only and should not be considered accurate for any near or long term planning.
Evolution of Oil Gathering in ND Statewide Totals

- Estimated Piped, BOPD
  - 2012: 263,352
  - 2013: 410,629
  - 2015: 725,743
  - 2016: 718,177

- Estimated Trucked, BOPD
  - 2012: 485,966
  - 2013: 524,649
  - 2015: 441,644
  - 2016: 281,372
Estimated Loaded Oil Truckloads Per Day

April 2015 Data
220 bbls/Truck
Presentation Outline

• Understanding current and future oil production
  – Activity
  – Drilling economics
  – Forecasts

• Williston Basin oil transportation dynamics
  – Interstate oil movements
  – Intrastate oil movements

• North Dakota natural gas production
  – Flaring and gas capture
  – Natural Gas Liquids
Major Gas Pipeline and Processing Infrastructure
Solving the Flaring Challenge

**Simple Terms**
- **Blue** – Lack of pipelines
- **Orange** – Challenges on existing infrastructure

**GREEN** – % of gas captured and sold
**Blue** – % flared from zero sales wells
**Orange** – % flared from wells with at least one mcf sold.

Statewide

- 89%
- 8%
- 3%

Sep 2016 Data – Non-Confidential Wells
Capturing the 3% Faster Well Connections

- New Wells Selling Gas
- New Producing Wells

Number of Wells Per Month

Solving the Flaring Challenge

- Suspended Capacity
- Existing Plant Capacity
- NDPA Case 1 Forecast
- NDPA Case 2 Forecast
- Historical Sold, MMCFD
- Historical Flared, MMCFD
- Targets Case 1 (Sold)
- Targets Case 1 (Flared)

Jan-05  | Sep-05  | May-06  | Jan-07  | Sep-07  | May-08  | Jan-09  | Sep-09  | May-10  | Jan-11  | Sep-11  | May-12  | Jan-13  | Sep-13  | May-14  | Jan-15  | Sep-15  | May-16  | Jan-17  | Sep-17  | May-18  | Jan-19  | Sep-19  | May-20  | Jan-21  | Sep-21  

91-93% Q4-20
85% Q4-16
88% Q4-18
77% Q2-16
74% Q4-14

Wellhead Gas Capture – Locations
Wellhead Gas Capture – Intake Volume

Remote Gas Capture Intake Volumes

Total Intake, MMCFD

Wellhead Gas Capture – NGL Output

Remote Gas Capture NGL Output

<table>
<thead>
<tr>
<th>Month</th>
<th>Total Liquids, BPD</th>
</tr>
</thead>
<tbody>
<tr>
<td>February 2014</td>
<td></td>
</tr>
<tr>
<td>August 2014</td>
<td></td>
</tr>
<tr>
<td>February 2015</td>
<td></td>
</tr>
<tr>
<td>August 2015</td>
<td></td>
</tr>
<tr>
<td>February 2016</td>
<td></td>
</tr>
<tr>
<td>August 2016</td>
<td></td>
</tr>
</tbody>
</table>
Wellhead & Plant Gas Capture

Field Processing Units

Traditional Gas Plants

Total Intake, MMCFD

Wellhead & Plant Gas Capture

Field Unit

Field Processing Units

% of Total Intake, MMCFD

Traditional Gas Plants

% of Total Intake, MMCFD


2.7%

97.3%
Plant Natural Gas Liquids - (Aug. 2016)
Contact Information

Justin J. Kringstad, Director
North Dakota Pipeline Authority

600 E. Boulevard Ave. Dept. 405
Bismarck, ND 58505-0840

Phone: (701)220-6227
Fax: (701)328-2820
E-mail: jjkringstad@ndpipelines.com

Websites:
www.pipeline.nd.gov
www.northdakotapipelines.com