March 2017 – Bakken Economics Updated

Slides Available Online
North Dakota Drilling Activity

Spuds  Drilling Rigs  Spuds per Rig per Month


0  0.2  0.4  0.6  0.8  1  1.2  1.4  1.6  1.8  2  2.2

0  50  100  150  200  250  300

Drilling Rigs & Spuds

Spuds Per Rig Per Month
DUC’s* - Proximity to High Performing Wells

2.5 Mile Historic Peak Month Buffer Zone

Buffer Zone
- 1250
- 800

*Non-Confidential Only

Max. Buffer
- <800
- 800
- 1250
North Dakota Oil Differential

Based on EIA Data

- North Dakota-WTI Differential
- North Dakota-Brent Differential

Based on EIA Data
North Dakota Oil Production Forecast

Production forecast is for visual demonstration purposes only and should not be considered accurate for any near or long term planning.
Estimated Williston Basin Oil Transportation

- Pipeline Export: 58%
- Refined: 8%
- Truck to Canadian Pipelines: 7%
- Estimated Rail: 27%

March 2017
Estimated Williston Basin Oil Transportation

- Estimated Rail
- Estimated Pipeline Export
- Refined
- Truck to Canadian Pipelines
- Brent - WTI Spread (EIA)

Estimated Market Share vs. Brent - WTI Spread

Y-axis: Estimated Market Share
X-axis: Time (Mar-08 to Mar-17)

Source: JJ Kringstad - North Dakota Pipeline Authority
Estimated ND Rail Export Volumes
Data for Rail Destination Market Share Provided by the US Energy Information Administration
Major Rail Lines and Refineries

EIA March 2017 Refiner Acquisition Cost

- PADD I: $52.62
- PADD II: $46.76
- PADD III: $48.77
- PADD IV: $50.85
- PADD V: $44.87
Crude Oil Prices – June 1, 2017

Cushing $48.22

Brent $50.50
WTI + $2.28

Pricing Data: Bloomberg & CME (LLS-Argus)

LLS (Argus)
WTI + $2.13

Brent $50.50
WTI + $2.28
Production forecast is for visual demonstration purposes only and should not be considered accurate for any near or long term planning.

220,000 BPD Upland Pipeline Dept. of State Review Paused (Request From Developer)
TransCanada: Upland Pipeline

- Successful Open Season During 2014
- Initial Capacity 220,000 BOPD (Expandable to 300,000 BOPD)
- Proposed In-service Date: 2020 (Dept. of State Review Paused)
- Energy East Project Capacity 1.1 MMBOPD
NDPA ND Gas Production Forecast

Natural Gas Production, MMCFD


NDPA Forecast
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.

Mar 2017 Data – Non-Confidential Wells
North Dakota Captured* NGL’s

*Non-flared NGL’s & Assumes 10 GPM
Major NGL Pipeline and Processing Infrastructure
NGL Capacity Is Complicated…

Barrels Per Day

- Northern Border (70 mbpd)
- WBI Transmission
- Aux Sable Prairie Rose
- ONEOK Bakken NGL
- Alliance Tioga Lateral
- Vantage
- Purity Truck/Rail & Rail
- Additional Northern Border
- Case 1: All Captured NGLs
- Case 2: All Captured NGLs
Construction Update
North Dakota Pipeline Construction

- New Miles
- Year End Miles

<table>
<thead>
<tr>
<th>Year</th>
<th>New Miles of Pipe</th>
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<tbody>
<tr>
<td>2008</td>
<td>673</td>
</tr>
<tr>
<td>2009</td>
<td>1,355</td>
</tr>
<tr>
<td>2010</td>
<td>1,010</td>
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<tr>
<td>2011</td>
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<td>2012</td>
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<td>2014</td>
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<tr>
<td>2015</td>
<td>2,178</td>
</tr>
</tbody>
</table>

Total Miles of Pipe:
- 2008: 673
- 2009: 2,028
- 2010: 3,029
- 2011: 5,383
- 2012: 8,008
- 2013: 10,956
- 2014: 13,135
- 2015: 15,313

Sources: NDIC & PHMSA
Bakken Refracs
Refracs In the Bakken*

*While careful work was performed to discover as many non-confidential, modern refracs as possible, this data set is likely not all inclusive.
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Performance Pre/Post Refrac

![Graph showing BOPD and Max BOPD over production months.](image-url)
Performance Pre/Post Refrac

BOPD

Avg. BOPD

Max BOPD

Production Month
Performance Pre/Post Refrac

![Graph showing BOPD over Production Month with pre and post refrac data.]
Performance Pre/Post Refrac
Performance Pre/Post Refrac
Performance Pre/Post Refrac
209,000 Barrels of Incremental Production

- Incremental Production (Refrac)
- Original Decline
- Original Production

Production Month
257,000 Barrels of Incremental Production
253,000 Barrels of Incremental Production

![Barrel of Oil Production Graph]

- **Incremental Production (Refrac)**
- **Original Decline**
- **Original Production**
Refrac Candidates

- Refrac selection is based on a number of criteria, many of which are not available in the public domain
- Refracs have been performed with success on a wide range of well ages and performance
- Refracs are designed to address one or more reservoir level issues impacting well performance (e.g. scaling, embedment, proppant rearrangement, fines generation, etc)
- The following work is not intended to imply a well will be refraced, but rather that the wells fit a certain criteria that may make them a near term candidate for refrac.
Peak Month Minimum 200 BOPD

3,074 BKN Wells
Spud 2007-2011

Potential Near term Refrac Candidates?
Proximity to High Performing Wells

2.5 Mile Historic Peak Month Buffer Zone

1,955 Wells Within the 800+ BOPD Buffer

Buffer Zone
- 1250
- 800

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Total Depth of Previously Refraced Wells

- 10,000’-14,999’
- 15,000’-19,999’
- 20,000’+

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Total Depth & Buffer Zone of the 1,955 Wells

- **Total Depth**
  - 10,000’-14,999’
  - 15,000’-19,999’
  - 20,000’+

- **Buffer Zone**
  - 1250
  - 800

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Next Steps

• How does ND’s production profile shift if/when horsepower is added or reallocated to refracs?

• How do the economics of a refrac compare to a new drill and completion?

• How does ND’s midstream industry react to meet shifting production volumes? (Locally & Regionally)