NDPA Bulk Slides

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August 30, 2018
Presentation Outline

• Economics
  • Current Activity and oil transportation dynamics
  • Understanding current and future oil production
    • Pricing update
    • Activity
    • Oil forecasts
  • North Dakota natural gas production
    • Flaring and gas capture
    • Natural gas liquids
  • Pipeline construction update
Objective
Define where the Bakken/Three Forks system may be economic in the current oil price environment.

Method
Analyze past well performance across the region and estimate well economics for various production levels.

Disclaimer
The goal of this work is not to imply individual company actions or intentions. All view expressed are strictly that of Justin J. Kringstad.

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Key Economic Assumptions

• $6-$8 Million Well Costs
• $63/BBL & $6.00/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 - 200 BOPD

Three Forks
3,755 Wells

Bakken
7,062 Wells

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Peak Month BOPD / Well Cost

200

After Tax IRR

20% 18% 16% 14% 12% 10% 8% 6% 4% 2% 0%

6 MM 7 MM 8 MM
$63 Wellhead

6 MM
7 MM
8 MM

Peak Month Well Production, BOPD

Breakeven Wellhead Price (AT IRR of 20%)

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Peak Month Minimum - 400 BOPD

Three Forks
2,508 Wells

Bakken
5,247 Wells

Peak Month BOPD / Well Cost

Three Forks
5,247 Wells

Bakken
5,247 Wells

$63 Wellhead

Peak Month Well Production, BOPD

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Peak Month Minimum - 600 BOPD

Three Forks
1,371 Wells

Bakken
3,097 Wells

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Peak Month BOPD / Well Cost

After Tax IRR
80%
70%
60%
50%
40%
30%
20%
10%
0%

$63 Wellhead

6 MM
7 MM
8 MM

Well Cost

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

Breakeven Wellhead Price (AT IRR of 20%)

Peak Month Well Production, BOPD

600

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Peak Month Minimum - 800 BOPD

Three Forks
666 Wells

Bakken
1,505 Wells

Peak Month BOPD / Well Cost

$63 Wellhead

After Tax IRR

20%
0%
60%
80%
100%
120%
140%
160%

6 MM
7 MM
8 MM

Peak Month Well Production, BOPD

(Note: The image contains maps of Three Forks and Bakken regions with well counts and a chart showing after-tax IRR and peak month BOPD/Well Cost.)
Peak Month Minimum – 1,000 BOPD

Three Forks
266 Wells

Bakken
706 Wells

Peak Month BOPD / Well Cost

<table>
<thead>
<tr>
<th>Well Cost</th>
<th>After Tax IRR</th>
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<tbody>
<tr>
<td>6 MM</td>
<td>250%</td>
</tr>
<tr>
<td>7 MM</td>
<td>200%</td>
</tr>
<tr>
<td>8 MM</td>
<td>150%</td>
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</table>

$63 Wellhead

$63 Wellhead

Breakeven Wellhead Price (AT IRR of 20%)
Peak Month Minimum – 1,250 BOPD

Three Forks
107 Wells

Bakken
266 Wells

$63 Wellhead

Peak Month BOPD / Well Cost

<table>
<thead>
<tr>
<th>$63 Wellhead</th>
<th>6 MM</th>
<th>7 MM</th>
<th>8 MM</th>
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<tbody>
<tr>
<td>After Tax IRR</td>
<td>0%</td>
<td>50%</td>
<td>100%</td>
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Peak Month Well Production, BOPD

Well Cost

<table>
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<tr>
<th>$0</th>
<th>$2</th>
<th>$4</th>
<th>$6</th>
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<th>$18</th>
<th>$20</th>
<th>$22</th>
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<td>6 MM</td>
<td>1250</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 MM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 MM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Peak Month Minimum – 1,500 BOPD

Three Forks
36 Wells

Bakken
98 Wells

Peak Month BOPD / Well Cost

After Tax IRR

$63 Wellhead

6 MM
7 MM
8 MM

Peak Month Well Production, BOPD

Well Cost
6 MM
7 MM
8 MM

Break-even Wellhead Price (AT IRR of 20%)
Understanding North Dakota’s Bakken/Three Forks Potential*

*Version 1.1

Updates & Modifications to Follow

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Key Assumptions & Considerations

• Two mile production zone buffers are set by an individual well’s “peak month minimum” performance. Not all existing wells within a production zone have performed at the zone's “peak month minimum” for a variety of reasons.

• High degree of uncertainty surrounding the future development patterns of the middle and lower Three Forks “Benches”.

• High degree of economic uncertainty as infill development intensifies and deeper Three Forks benches are developed.

• This work will be updated as new information becomes available.
Bakken Drilling Economics

www.northdakotapielines.com
Past Well Performance – Bakken Formation

Production Zone

Existing Wells

Area, SqMi

1280 Spacing Units (Est.)

- 100-200 bopd Bakken Fm.
- 200-300 bopd Bakken Fm.
- 300-400 bopd Bakken Fm.
- 400-500 bopd Bakken Fm.
- 500-600 bopd Bakken Fm.
- 600-700 bopd Bakken Fm.
- 700-800 bopd Bakken Fm.
- 800-900 bopd Bakken Fm.
- 900-1000 bopd Bakken Fm.
- 1000-1250 bopd Bakken Fm.
- 1250-1500 bopd Bakken Fm.
- 1500 PLUS bopd Bakken Fm.

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Remaining Wells* – Bakken Formation

*Well Density Assumptions

Low Case = 4 Wells In Bakken Formation
High Case = 8 Wells In Bakken Formation
Past Well Performance – Three Forks Formation

Production Zone

Existing Wells

Area, SqMi

1280 Spacing Units (Est.)

- 100-200 bopd Three Forks
- 200-300 bopd Three Forks
- 300-400 bopd Three Forks
- 400-500 bopd Three Forks
- 500-600 bopd Three Forks
- 600-700 bopd Three Forks
- 700-800 bopd Three Forks
- 800-900 bopd Three Forks
- 900-1000 bopd Three Forks
- 1000-1250 bopd Three Forks
- 1250-1500 bopd Three Forks
- 1500+ bopd Three Forks

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Tim Nesheim (NDGS) Three Forks Work
Past Well Performance – Three Forks Tier 1

Production Zone

Existing Wells

Area, SqMi

1280 Spacing Units (Est.)

Dickinson

- 100-200 bopd Three Forks
- 200-300 bopd Three Forks
- 300-400 bopd Three Forks
- 400-500 bopd Three Forks
- 500-600 bopd Three Forks
- 600-700 bopd Three Forks
- 700-800 bopd Three Forks
- 800-900 bopd Three Forks
- 900-1000 bopd Three Forks
- 1000-1250 bopd Three Forks
- 1250-1500 bopd Three Forks
- 1500 PLUS bopd Three Forks

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Past Well Performance – Three Forks Tier 2

Production Zone

Existing Wells

Area, SqMi

1280 Spacing Units (Est.)
Past Well Performance – Three Forks Tier 3

Production Zone

Existing Wells

Area, SqMi

1280 Spacing Units (Est.)

- 100-200 bopd Three Forks
- 200-300 bopd Three Forks
- 300-400 bopd Three Forks
- 400-500 bopd Three Forks
- 500-600 bopd Three Forks
- 600-700 bopd Three Forks
- 700-800 bopd Three Forks
- 800-900 bopd Three Forks
- 900-1000 bopd Three Forks
- 1000-1250 bopd Three Forks
- 1250-1500 bopd Three Forks
- 1500 PLUS bopd Three Forks

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“Empty” Three Forks Tier 1 & 2

All Empty Regions Were Removed From Estimates/Calculations
Remaining Wells* – Three Forks Tier 1

*Well Density Assumptions
Low Case = 4 Three Forks Wells Per DSU
High Case = 10 Three Forks Wells Per DSU
Remaining Wells* – Three Forks Tier 2

*Well Density Assumptions
Low Case = 2 Three Forks Wells Per DSU
High Case = 6 Three Forks Wells Per DSU
Remaining Wells* – Three Forks Tier 3

*Well Density Assumptions
Low Case = 0 Three Forks Wells Per DSU
High Case = 4 Three Forks Wells Per DSU
Remaining Wells – All Bakken and Three Forks Tiers

Production Zone

<table>
<thead>
<tr>
<th>Production Zone</th>
<th>Remaining Wells Low Case</th>
<th>Remaining Wells High Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>100-200</td>
<td>2,637</td>
<td>8,189</td>
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<tr>
<td>200-300</td>
<td>4,618</td>
<td>13,130</td>
</tr>
<tr>
<td>300-400</td>
<td>4,201</td>
<td>11,891</td>
</tr>
<tr>
<td>400-500</td>
<td>4,211</td>
<td>11,673</td>
</tr>
<tr>
<td>500-600</td>
<td>3,119</td>
<td>8,603</td>
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<tr>
<td>600-700</td>
<td>3,414</td>
<td>9,001</td>
</tr>
<tr>
<td>700-800</td>
<td>2,862</td>
<td>7,868</td>
</tr>
<tr>
<td>800-900</td>
<td>2,325</td>
<td>6,578</td>
</tr>
<tr>
<td>900-1000</td>
<td>1,914</td>
<td>5,801</td>
</tr>
<tr>
<td>1000-1250</td>
<td>3,465</td>
<td>10,113</td>
</tr>
<tr>
<td>1250-1500</td>
<td>2,019</td>
<td>6,430</td>
</tr>
<tr>
<td>1500 Plus</td>
<td>2,292</td>
<td>7,178</td>
</tr>
</tbody>
</table>
Cumulative Remaining Wells – Peak Month Minimum BOPD

Production Zone

Remaining Wells Low Case Cumulative

- 100-200: 37,077
- 200-300: 34,440
- 300-400: 29,622
- 400-500: 25,621
- 500-600: 21,410
- 600-700: 18,291
- 700-800: 14,877
- 800-900: 12,015
- 900-1,000: 9,690
- 1,000-1,250: 7,776
- 1,250-1,500: 4,311
- 1,500 Plus: 2,292

Remaining Wells High Case Cumulative

- 100-200: 106,455
- 200-300: 98,266
- 300-400: 85,136
- 400-500: 73,245
- 500-600: 61,572
- 600-700: 52,969
- 700-800: 43,968
- 800-900: 36,100
- 900-1,000: 29,522
- 1,000-1,250: 23,721
- 1,250-1,500: 13,608
- 1,500 Plus: 7,178
Years Remaining* / Minimum Wellhead Oil Price

*Assumes 1,200 Completions Per Year and $7MM Well Costs (20% After Tax IRR)
Presentation Outline

• Economics
• **Current Activity and oil transportation dynamics**
  • Understanding current and future oil production
    • Pricing update
    • Activity
    • Oil forecasts
• North Dakota natural gas production
  • Flaring and gas capture
  • Natural gas liquids
• Pipeline construction update
Estimated Williston Basin Oil Transportation

- Pipeline Export: 70%
- Refined: 7%
- Truck to Canadian Pipelines: 4%
- Estimated Rail: 19%

June 2018

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Estimated ND Rail Export Volumes
Rail Destinations Market Share (May 2018)

Data for Rail Destination Market Share Provided by the US Energy Information Administration
Crude Oil Prices – August 29, 2018

Cushing $69.62

Brent $77.24

WTI + $7.62

Pricing Data: Bloomberg & CME (LLS-Argus)

Brent $77.24

WTI + $7.62

LLS (Argus)

WTI + $4.72
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North Dakota Oil Differential* to WTI

*DATA: EIA First Purchaser
Statewide Oil Performance

~13% Improvement Over 2017
DOE-EIA Forecasted Oil Price

WTI ($/bbl)

- EIA Forecast
- Historical

2010 2015 2020 2025 2030 2035

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North Dakota Forecast Activity Assumptions

- ND New Wells Case 1
- ND New Wells Case 2
North Dakota Oil Production Forecast

The graph shows the forecasted oil production for North Dakota, with two cases:
- **NDPA Oil Forecast: Case 1**
- **NDPA Oil Forecast: Case 2**

The production data is presented in barrels per day (BOPD), with years ranging from 2009 to 2035.
Production forecast is for visual demonstration purposes only and should not be considered accurate for any near or long term planning.
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• Pipeline construction update
Natural Gas Update

Production
- Technology
- Markets

Gathering
- Capacity
- Connections

Processing
- Capacity
- Location

Transmission
- Dry Gas
- Natural Gas Liquids
Natural Gas Update

Production
- Technology
- Markets

Gathering
- Capacity
- Connections

Processing
- Capacity
- Location

Transmission
- Dry Gas
- Natural Gas Liquids
Statewide Gas Performance

~16% Improvement Over 2017
Bakken and Three Forks Well Performance

Diagram showing the performance of wells in Dunn, McKenzie, Mountrail, and Williams counties from 2013 to 2017. The x-axis represents production months, and the y-axis represents average MCFD (thousand cubic feet per day) and number of wells.
NDPA North Dakota Gas Production Forecast

Natural Gas Production, MMCFD

- ND Gas Case 1 - MMCFD
- ND Gas Case 2 - MMCFD

NDPA Forecast
Natural Gas Update

Production
- Technology
- Markets

Gathering
- Capacity
- Connections

Processing
- Capacity
- Location

Transmission
- Dry Gas
- Natural Gas Liquids
Solving the Flaring Challenge

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

June 2018 Data – Non-Confidential Wells

**GREEN** – % of gas captured and sold

- 83%

**Blue** – % flared from zero sales wells

- 14%

**Orange** – % flared from wells with at least one mcf sold.

- 3%
Days to Connect to Gas Gathering

First Gas Year

<table>
<thead>
<tr>
<th>Year</th>
<th>Avg. Days to Connection</th>
<th>Wells Connected</th>
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</thead>
<tbody>
<tr>
<td>2010</td>
<td>130.2</td>
<td>800</td>
</tr>
<tr>
<td>2011</td>
<td>125.8</td>
<td>750</td>
</tr>
<tr>
<td>2012</td>
<td>128.1</td>
<td>700</td>
</tr>
<tr>
<td>2013</td>
<td>77.7</td>
<td>650</td>
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<tr>
<td>2014</td>
<td>45.2</td>
<td>600</td>
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<td>2015</td>
<td>31.4</td>
<td>550</td>
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<tr>
<td>2016</td>
<td>14.6</td>
<td>500</td>
</tr>
<tr>
<td>2017</td>
<td>13.2</td>
<td>450</td>
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Natural Gas Update

Production
- Technology
- Markets

Gathering
- Capacity
- Connections

Processing
- Capacity
- Location

Transmission
- Dry Gas
- Natural Gas Liquids
Solving the Flaring Challenge

- Planned Plant 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)

Key Points:
- 91% Q4-20
- 88% Q4-18
- 85% Q4-16
- 80% Q2-16
- 77% Q2-15
- 74% Q4-14

Timeline:
- Jan-05 to Jun-25
Natural Gas Update

Production
- Technology
- Markets

Gathering
- Capacity
- Connections

Processing
- Capacity
- Location

Transmission
- Dry Gas
- Natural Gas Liquids
Major Gas Pipeline and Processing Infrastructure
Northern Border Pipeline

- 42” Pipeline
- Carries Canadian (Port of Morgan) and Domestic Gas
- Receives Gas From ND Plants, WBI Transmission Interconnections, and WY Pipelines (Bison & Grasslands)
- Midcontinent Deliveries

*Data Source: Northern Border IPS*
Northern Border Pipeline

*Data Source: Northern Border IPS*
Conclusion: **IF** no other gas export options open and all other deliveries on other pipelines stay static, ND gas production could increase 1.38-1.68 BCFD (from June-18) before Northern Border is 100% Bakken production. **BTU management becomes increasingly important for Bakken residue gas.**
Conclusion: **IF** no other gas export options open and all other deliveries on other pipelines stay static, ND gas production could increase 1.38-1.68 BCFD (from June-18) before Northern Border is 100% Bakken production. *BTU management becomes increasingly important for Bakken residue gas.*

- **Gas Plants With C2+ Capture**
  ~1,010+ BTU Residue Gas
- **Gas Plants With C3+ Capture**
  ~1,150+ BTU Residue Gas
Now What?
Presentation Outline

• Economics
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  • Oil forecasts
• North Dakota natural gas production
  • Flaring and gas capture
  • Natural gas liquids
• Pipeline construction update
North Dakota Pipeline Construction

- New Miles
- Year End Miles

Sources: NDIC & PHMSA

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North Dakota Pipeline Construction

Gathering
- New Miles
  - Gas Gathering
  - Oil Gathering
  - Produced Water
  - Gas Transmission
  - Petroleum Transmission

Transmission
- New Miles
  - Gas Gathering
  - Oil Gathering
  - Produced Water
  - Gas Transmission
  - Petroleum Transmission

Sources: NDIC & PHMSA

North Dakota Pipeline Authority

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