Understanding North Dakota’s Petroleum Development and Transportation Dynamics

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Pipeline Authority

Industry

Policy Makers

Regulators

Public
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

Peak Month BOPD / Well Cost
- 200

After Tax IRR
- 20%
- 18%
- 16%
- 14%
- 12%
- 10%
- 8%
- 6%
- 4%
- 2%
- 0%

Well Cost
- 6 MM
- 7 MM
- 8 MM

Breakeven Wellhead Price (AT IRR of 20%)
- $63 Wellhead

Peak Month Well Production, BOPD
Peak Month Minimum - 400 BOPD

Three Forks
2,508 Wells

Bakken
5,247 Wells

Peak Month BOPD / Well Cost
$63 Wellhead

- 6 MM
- 7 MM
- 8 MM

Well Cost

Breakeven Wellhead Price (AT IRR of 20%)
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

Peak Month Well Production, BOPD

Well Cost
6 MM
7 MM
8 MM

$63 Wellhead
$63 Wellhead

Breakeven Wellhead Price (AT IRR of 20%)
Peak Month Minimum - 800 BOPD

Three Forks
666 Wells

Bakken
1,505 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

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

Three Forks
266 Wells

Bakken
706 Wells

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$63 Wellhead

Peak Month BOPD / Well Cost

After Tax IRR

0% 50% 100% 150% 200% 250%

6 MM 7 MM 8 MM

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Peak Month Well Production, BOPD

Well Cost

6 MM 7 MM 8 MM

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

Three Forks
107 Wells

Bakken
266 Wells

Peak Month BOPD / Well Cost

After Tax IRR

$63 Wellhead

Peak Month Well Production, BOPD

Well Cost

Peak Month Well Production, BOPD

Breakeven Wellhead Price (AT IRR of 20%)
Peak Month Minimum – 1,500 BOPD

Three Forks
36 Wells

Bakken
98 Wells

$63 Wellhead

$63 Wellhead Price (AT IRR of 20%)
Breakeven Summary

Peak Month Well Production, BOPD / Well Cost

Breakeven Wellhead Price (AT IRR of 20%)
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Drilling Activity – 65 Rigs (July 6, 2018)
Statewide Oil Performance

Cumulative Oil Production, BBL

Production Month

IP Year
- 2017
- 2016
- 2015
- 2014
- 2013
- 2012
- 2011
- 2010
- 2009
- 2008

22% Increase Over 2016
Estimated ND Rail Export Volumes
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Crude Oil Prices – July 6, 2018

Cushing $73.76
Brent $77.14
WTI + $3.38

Pricing Data:
Bloomberg & CME (LLS-Argus)

Brent $77.14
WTI + $3.38
LLS (Argus)
WTI + $3.14
North Dakota Impact of Smaller Discount

- 2016 Weighted Average Discount: $7.71
- June 2017 - April 2018 Wt. Average Discount: $4.66
- $3.05/BBL Improvement Post DAPL Commercial In-Service

- 376,694,561 Taxable Barrels In June 2017 - April 2018
- Wt. Avg. Tax Rate in June 2017 - April 2018: 9.74%

**Eleven Month Revenue Impact**
- 9.74% x 376,694,561 x $3.05 =

$111+ Million Additional State Revenue
When Compared to Avg. 2016 Discount

Does Not Include Royalty Owner and Industry Revenue Impact
Williston Basin Oil Production & Export Capacity, BOPD

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

Rail Capacity (Capped at 1 MMBOPD)
Pipelines/Refineries in Regulatory
Confirmed Pipelines/Refining
US Williston Basin - Case 1
US Williston Basin - Case 2

Barrels Per Day

Jan-07 May-08 Sep-09 Jan-11 May-12 Sep-13 Jan-15 May-16 Sep-17 Jan-19 May-20 Sep-21 Jan-23 May-24 Sep-25 Jan-27 May-28 Sep-29 Jan-31 May-32 Sep-33

JJ Kringstad - North Dakota Pipeline Authority
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Natural Gas Capture

Production
- Technology
- Markets

Gathering
- Capacity
- Connections

Processing
- Capacity
- Location

Transmission
- Dry Gas
- Natural Gas Liquids
Natural Gas Capture

- Production
  - Technology
  - Markets

- Gathering
  - Capacity
  - Connections

- Processing
  - Capacity
  - Location

- Transmission
  - Dry Gas
  - Natural Gas Liquids
Average BKN/TF Well Performance Statewide
NDPA North Dakota Gas Production Forecast

![Graph showing the forecast of natural gas production in North Dakota. The graph includes two lines, one for NDPA Gas Case 1 in red and another for NDPA Gas Case 2 in gray. The x-axis represents the years from 2009 to 2035, while the y-axis shows natural gas production in MMCFD. The graph indicates an increasing trend for both cases with NDPA Gas Case 1 showing a slightly higher production rate compared to NDPA Gas Case 2.](image-url)
Natural Gas Capture

Production
- Technology
- Markets

Gathering
- Capacity
- Connections

Processing
- Capacity
- Location

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

April 2018

Flared, MCFD
10
500
1,000
1,551

Gas Sales
- No
- Yes

Non-Confidential Bakken/Three Forks/Sanish Only (Wells Flaring 10+mcfd)

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Days to Connect to Gas Gathering

First Gas Year

Avg. Days to Connection

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<td>Days</td>
<td>180.2</td>
<td>183.8</td>
<td>128.1</td>
<td>77.7</td>
<td>45.2</td>
<td>31.4</td>
<td>14.6</td>
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Wells Connected

|------|------|------|------|------|------|------|------|------|
Natural Gas Capture

Production
• Technology
• Markets

Gathering
• Capacity
• Connections

Processing
• Capacity
• Location

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

- Suspended Plant Capacity
- 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)
Natural Gas Capture

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*
Simplified Example NB Calculations

Conclusion: **IF** no other gas export options open and all other deliveries on other pipelines stay static, ND gas production could increase 1.43-1.73 BCFD (from Apr-18) before Northern Border is 100% Bakken production. **BTU management becomes increasingly important for Bakken residue gas.**
Regional NGL Infrastructure
North Dakota Captured* NGL’s

*Non-flared NGL’s & Assumes 10 GPM
ONEOK Elk Creek NGL Pipeline

Project Highlights
• 900 Miles - 20” Pipeline
• $1.4 Billion
• 240,000 BPD Capacity
• Expandable to 400,000 BPD
• End of 2019 Proposed Completion
• Y-Grade Transportation
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North Dakota Pipeline Construction

- New Miles
- Year End Miles

Sources: NDIC & PHMSA
North Dakota Pipeline Construction

**Sources:** NDIC & PHMSA

### Gas Gathering
- **2011:** 917
- **2012:** 1,608
- **2013:** 910
- **2014:** 948
- **2015:** 659
- **2016:** 136

### Oil Gathering
- **2011:** 379
- **2012:** 965
- **2013:** 765
- **2014:** 538
- **2015:** 547
- **2016:** 180

### Produced Water
- **2011:** 248
- **2012:** 380
- **2013:** 485
- **2014:** 609
- **2015:** 661
- **2016:** 192

### Gas Transmission
- **2011:** 143
- **2012:** 313
- **2013:** 202
- **2014:** 591
- **2015:** 302
- **2016:** 203

### Petroleum Transmission
- **2011:** 0
- **2012:** 0
- **2013:** 77
- **2014:** 89
- **2015:** 0
- **2016:** 3

**Sources:** NDIC & PHMSA
Contact Information

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