Industrial Commission Update

Justin J Kringstad
Geological Engineer
Director
North Dakota Pipeline Authority
Natural Gas Capture

Production
- Technology
- Markets

Gathering
- Capacity
- Connections

Processing
- Capacity
- Location

Transmission
- Dry Gas
- Natural Gas Liquids
Natural Gas Capture

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Historic Bakken/Three Forks GOR
Statewide Bakken/Three Forks GOR

Avg. GOR

North Dakota Forecast Activity Assumptions

- ND New Wells Case 1
- ND New Wells Case 2

NDPA Forecast

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NDPA ND Gas Production Forecast

- ND Gas Case 1 - MMCFD
- ND Gas Case 2 - MMCFD
Natural Gas Capture

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  • Dry Gas
  • Natural Gas Liquids
Solving the Flaring Challenge

February 2018

(Wells Flaring 10+mcfd)
Solving the Flaring Challenge

February 2018*

Gas Sales Connection
- No
- Yes

Flared, MCFD

Produced, MCFD

*Non-Confidential Bakken/Three Forks/Sanish Only
Solving the Flaring Challenge

February 2018*

Gas Sales Connection

- No
- Yes

<table>
<thead>
<tr>
<th>Flared, MCFD</th>
<th>Fort Berthold</th>
<th>Non-Fort Berthold</th>
<th>Grand Total</th>
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<tbody>
<tr>
<td></td>
<td>35,082</td>
<td>143,269</td>
<td>24,491</td>
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<td>20,539</td>
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<td>1,645,887</td>
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*Non-Confidential Bakken/Three Forks/Sanish Only
Solving the Flaring Challenge

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

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

Feb 2018 Data – Non-Confidential Wells
Solving the Flaring Challenge

- Flaring % From Wells Connected to Sales
- Flaring % From Wells Not Connected to Sales
- Total ND Gas Production

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Days to Connect to Gas Gathering

First Gas Year

<table>
<thead>
<tr>
<th>Year</th>
<th>Avg. Days to Connection</th>
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<tr>
<td>2010</td>
<td>180.2</td>
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<tr>
<td>2011</td>
<td>183.8</td>
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<tr>
<td>2012</td>
<td>128.1</td>
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<td>2013</td>
<td>77.7</td>
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<td>2014</td>
<td>45.2</td>
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<td>2015</td>
<td>31.4</td>
</tr>
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<td>2016</td>
<td>14.6</td>
</tr>
<tr>
<td>2017</td>
<td>13.2</td>
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Wells Connected

- 2010: 700
- 2011: 1000
- 2012: 1500
- 2013: 1800
- 2014: 2000
- 2015: 1600
- 2016: 1200
- 2017: 1000
Solving the Flaring Challenge

- New Wells Selling Gas
- New Producing Wells

Number of Wells Per Month

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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)

91% Q4-20
88% Q4-18
85% Q4-16
80% Q2-16
77% Q1-15
74% Q4-14


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Solving the Flaring Challenge

- Suspended Plant Capacity
- Planned Plant Capacity
- Existing Plant Capacity
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- Historical Sold, MMCFD
- Historical Flared, MMCFD
- Targets Case 1 (Sold)
- Targets Case 1 (Flared)

91% Q4-20
Due to incomplete filing data, September 2017 data used in the chart.
Natural Gas Capture

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Natural Gas Processing – “Ethane Capture”

Raw Natural Gas (1400+ BTU) → Processing Plant

- Consumer Quality Dry Natural Gas “Residue Gas”
  - Methane 57.67%
  - Ethane 19.94%
  - Propane 11.33%
  - Butane 3.80%
  - Natural Gasoline 1.29%

NGL’S (8-12 gallons per 1,000 cubic feet of raw gas)
- Y-Grade or Fractionated
  - “Y-Grade” if NGL’S are left together in one mix for separation later
Natural Gas Processing – “Ethane Rejection”

Raw Natural Gas (1400+ BTU) → Processing Plant

Consumer Quality Dry Natural Gas “Residue Gas”

- Methane 57.67%
- Ethane 19.94%

NGL’S (8-12 gallons per 1,000 cubic feet of raw gas)
- Y-Grade or Fractionated
- “Y-Grade” if NGL’S are left together in one mix for separation later

- Propane 11.33%
- Butane 3.80%
- Natural Gasoline 1.29%
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
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 1.58-1.88 BCFD (from Nov-17) before Northern Border is 100% Bakken production. **BTU management becomes increasingly important for Bakken residue gas.**
Alliance Pipeline Open Season

**Project Highlights**

- Existing 36” Pipeline
- Existing ~1,600 MMCFD Capacity
- Proposing ~400 MMCFD of Additional Capacity to Canadian and US Shippers
- 2021 Proposed In-Service
- Dense Phase Gas Transportation to Chicago
Major NGL Pipeline and Processing Infrastructure
North Dakota Captured* NGL’s

*Non-flared NGL's & Assumes 10 GPM
NGL Pipeline Takeaway Options

- Northern Border (ND Prod.)
- Aux Sable Prairie Rose
- Alliance Tioga Lateral
- ONEOK Elk Creek
- WBI Transmission
- ONEOK Bakken NGL
- Vantage
- Elk Creek Expansion (Proposed)
- Case 1: All Captured NGLs
- Case 2: All Captured NGLs
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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