Understanding North Dakota’s Natural Gas Production and Midstream Infrastructure

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May 24, 2016
28 Rigs and 690 NC Wells:
May 24, 2016 (Non Confidential NC Wells Only)
North Dakota Drilling Activity

Drilling Rigs & Spuds

Spuds Per Rig Per Month

Spuds
Drilling Rigs
Spuds per Rig per Month


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Understanding Current Production Dynamics

Non-Confidential Spud to Initial Production Timeline
North Dakota Forecast Activity Assumptions

Historic Rigs
Historic New Wells Per Month
Case 1 Wells Added Per Month
Case 2 Wells Added Per Month

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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.
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Solving the Flaring Challenge

Total ND Gas Flaring Percent (Color Indicates Reason)

- Orange: Flaring % From Wells Connected to Sales
- Blue: Flaring % From Wells Not Connected to Sales
- Gray: Total ND Gas Production

ND Gas Production, MMCFD

## Example Bakken Gas Quality

<table>
<thead>
<tr>
<th>Component</th>
<th>Mole %</th>
<th>GPM</th>
<th>% of Liquids</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen</td>
<td>5.21%</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>0.57%</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Hydrogen Sulfide</td>
<td>0.01%</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Methane</td>
<td>57.67%</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Ethane</td>
<td>19.94%</td>
<td>5.32</td>
<td>52.5%</td>
</tr>
<tr>
<td>Propane</td>
<td>11.33%</td>
<td>3.11</td>
<td>30.7%</td>
</tr>
<tr>
<td>Isobutane</td>
<td>0.97%</td>
<td>0.32</td>
<td>3.1%</td>
</tr>
<tr>
<td>Normal Butane</td>
<td>2.83%</td>
<td>0.89</td>
<td>8.8%</td>
</tr>
<tr>
<td>Isopentane</td>
<td>0.38%</td>
<td>0.14</td>
<td>1.4%</td>
</tr>
<tr>
<td>Normal Pentane</td>
<td>0.55%</td>
<td>0.20</td>
<td>2.0%</td>
</tr>
<tr>
<td>Hexane+</td>
<td>0.36%</td>
<td>0.16</td>
<td>1.5%</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>99.82%</strong></td>
<td><strong>10.14</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>

**Gas Stream BTU Value** | **1,399**

Mole % Source: Energy & Environmental Research Center (EERC)
North Dakota Captured* NGL’s

*Non-flared NGL’s & Assumes 10 GPM
Major Gas Pipeline and Processing Infrastructure
Dedicated NGL Pipelines

Vantage

Kinder Morgan

ONEOK
Vantage Ethane Pipeline

10”, 80 Mile Pipeline
Capacity: 68,000 BPD

Purity Ethane to Canada

Source: Tioga Gas Plant

Expanding to ONEOK Stateline Plants (Q3-16)
ONEOK Bakken NGL Pipeline Q1 2016 Flows: 116 mbpd (ONEOK May 2016 Presentation)

ONEOK Garden Creek, McKenzie, Lonesome Creek, and Stateline Plants. Additional 3rd Party Plant Connections.

Additional Barrels Received in Wyoming’s Powder River

Y-Grade Service

Current Capacity 135 mbpd
Plant Volumes Connected to Bakken NGL Pipeline

- **All NGLs (C2-C5), BPD**
  - October 2013: 20,000 BPD
  - April 2014: 40,000 BPD
  - October 2014: 60,000 BPD
  - April 2015: 80,000 BPD
  - October 2015: 100,000 BPD

- **Ethane, BPD**
  - 2014: 5,000 BPD
  - 2015: 10,000 BPD
  - 2016: 20,000 BPD

- **Propane, BPD**
  - October 2014: 40,000 BPD
  - April 2015: 60,000 BPD
  - October 2015: 80,000 BPD

- **Butane, BPD**
  - 2014: 10,000 BPD
  - 2015: 15,000 BPD
  - 2016: 20,000 BPD

- **Natural Gasoline, BPD**
  - 2014: 5,000 BPD
  - 2015: 10,000 BPD
  - 2016: 15,000 BPD
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
Northern Border Pipeline* (2016)

Flow Past Glen Ullin
Flow Past Port Of Morgan

*Data Source: Northern Border IPS
Northern Border Receipt Mix*

*Data Source: Northern Border
Northern Border Glen Ullin* (2016)

Data Source: Northern Border IPS
Foothills Pipeline

Map & Raw Data Source: TransCanada
• NDPA Estimates 130 mbpd of liquids capacity total for Northern Border @ 2.4 bcfd of flow (including liquids coming in from Canada)
• NDPA estimates ≈70 mbpd of liquids space for Bakken Production at current Port of Morgan Flows (Variable based on downstream markets and non-Bakken supply volume/quality)
Alliance Tioga Lateral Pipeline

12”, 80 Mile Pipeline Capacity: 126 MMCFD

2016 Scheduled Flows:
70,000-85,000 MMBTU
1,235 BTU Gas

2016 Available Capacity:
5,000-10,000 MMBTU
1,446 BTU Limit With Waiver

Gas Sources: Tioga Gas Plant

Expandable with Compression
Aux Sable Prairie Rose Pipeline

12”, 83 Mile Pipeline Capacity: 120 MMCFD

2016 Scheduled Flows:
125,000-140,000 MMBTU
1,330-1,400 BTU Gas

2016 Available Capacity:
15,000-25,000 MMBTU
1,550 BTU Limit With Waiver

Gas Sources: Robinson Lake Plant and 3rd Party Gathering

Palermo Truck Rack For NGL Deliveries: 5-10 MBPD
• WBI estimated to be delivering 10+ mbpd of ethane and propane regionally (Non-Northern Border deliveries)
• 1,130+ BTU Gas
WBI Transmission Storage

*Data Source: WBI Transmission*
TransCanada Bison Pipeline

- 302 Miles, 30” Pipeline
- 407 MMCFD Operational Capacity (Expandable to 1 BCFD)
- No Flows Since Nov 2015
- 2015 Flows of 140-170 MMBTU
- Very Dry Gas ≈975 BTUs
NGL Capacity Is Complicated…

Key Challenges

- Plant complexity varies
- Y-grade vs purity product
- Ethane capture equipment
- Scattered plant locations
- Market pricing
- Pipelines vary by type of product they can ship
- Uncertainty of Canadian and Wyoming volumes and quality
- Seasonal product demand
NGL Capacity Is Complicated…

Potential Solutions
- New, expanded, or repurposed pipeline systems
- Local consumption by new petrochemical industries
- Creative market solutions to manage plant NGL/BTUs
- Enhanced oil recovery
- Rail movements of excess products
Contact Information

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