Natural Gas Capture

- Production:
  - Technology
  - Markets

- Gathering:
  - Capacity
  - Connections

- Processing:
  - Capacity
  - Location

- Transmission:
  - Dry Gas
  - Natural Gas Liquids

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Natural Gas Capture

Production
- Technology
- Markets

Gathering
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Processing
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Transmission
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- Natural Gas Liquids
Bakken Drilling Economics
Breakeven Summary

Peak Month Well Production, BOPD / Well Cost

Breakeven Wellhead Price (AT IRR of 20%)
Bakken Breakeven Price Range (20% IRR)

Bakken Breakeven Prices
$6 - $8 Million
Completed Wells Cost
- $58-$73
- $49-$61
- $43-$52
- $39-$48
- $36-$43
- $34-$40
- $32-$38
- $28-$33
- $26-$30

Background Map: Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community
Bakken and Three Forks Well Performance

Graph showing production and number of wells by month for Dunn, McKenzie, Mountrail, and Williams counties, with data points for 2013, 2014, 2015, 2016, and 2017.
Bakken and Three Forks Gas Oil Ratio

DUNN  |  MCKENZIE  |  MOUNTRAIL  |  WILLIAMS

GOR

Middle Bakken
Three Forks

Number of Wells

Production Month
Forecasting Activity vs. Price

- EIA Forecast, Case 1 Wells
- EIA Forecast, Case 2 Wells
- Historical
North Dakota Forecast Activity Assumptions

North Dakota Pipeline Authority
NDPA North Dakota Gas Production Forecast

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

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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

Mar 2018 Data – Non-Confidential Wells
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

May-15 to Mar-18
Solving the Flaring Challenge

- New Wells Selling Gas
- New Producing Wells

Number of Wells Per Month

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Days to Connect to Gas Gathering

First Gas Year

Avg. Days to Connection

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Wells Connected

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<th>Wells Connected</th>
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<tbody>
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North Dakota Petroleum Pipeline Construction

- New Miles
- Year End Miles

Sources: NDIC & PHMSA
New Miles and Well Completions
Natural Gas Capture

Production
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- Markets

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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
Solving the Flaring Challenge

- Suspended Plant Capacity
- Planned Plant Capacity
- Existing Plant Capacity
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JJ Kringstad - North Dakota Pipeline Authority
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
Northern Border Pipeline

*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 1.56-1.86 BCFD (from Mar-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 1.56-1.86 BCFD (from Mar-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?
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
Regional NGL Infrastructure

- Vantage (Ethane)
- Alliance Tioga Lateral
- Prairie Rose
- Alliance (Dense Phase Gas)
- Northern Border (High CO2%)

Kinder

ONEOK (Y-Grade)

JJ Kringstad - North Dakota Pipeline Authority
North Dakota Captured* NGL’s

*Non-flared NGL’s & Assumes 10 GPM
Contact Information

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