North Dakota Petroleum Council
Annual Meeting

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North Dakota Oil Differential

Based on EIA Data

- North Dakota-WTI Differential
- North Dakota-Brent Differential
North Dakota Drilling Activity

- Drilling Rigs & Spuds
- Spuds Per Rig Per Month

Legend:
- Spuds
- Drilling Rigs
- Spuds per Rig per Month
Continued Targeting of DUC Wells
North Dakota Spud to Initial Production

Median Spud to IP Days

Spuds Per Month

Spud Date

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Statewide Oil Performance

Average BKN/TF Well Performance Statewide (Minimum 1 bopd)
Statewide Gas Performance

Average BKN/TF Well Performance Statewide (Minimum 1 bopd)
North Dakota Well Completion Forecast
North Dakota Oil Production Forecast
North Dakota Forecast Activity Assumptions

The graph shows the forecasted number of new wells added per month from 2009 to 2035. The forecast includes two cases:

- **ND New Wells Case 1**: Indicates a steady increase in the number of new wells added per month, starting from a low in 2017.
- **ND New Wells Case 2**: Shows a more gradual increase in the number of new wells added per month, following the same trend as Case 1.

**NDPA Forecast**: The baseline forecast line shows the historical trend in new wells added per month, indicating a decline from a peak in 2014.

The graph highlights the differences in forecasted activity between the two cases and how they compare to historical data.
North Dakota Oil Production Forecast

- NDPA Oil Forecast: Case 1
- NDPA Oil Forecast: Case 2

North Dakota Pipeline Authority

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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.

220,000 BPD Upland Pipeline Dept. of State Review Paused (Request From Developer)

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

- ND Gas Case 1 - MMCFD
- ND Gas Case 2 - MMCFD
North Dakota Captured* NGL’s

*Non-flared NGL’s & Assumes 10 GPM
Major NGL Pipeline and Processing Infrastructure
NGL Takeaway Options Are Limited

- Northern Border (70 mbpd)
- Aux Sable Prairie Rose
- Alliance Tioga Lateral
- Purity Truck/Rail & Rail
- Case 1: All Captured NGLs
- WBI Transmission
- ONEOK Bakken NGL
- Vantage
- Northern Border Canadian NGLs
- Case 2: All Captured NGLs
Northern Border Pipeline* (2017)

Operational Capacity, MMBtu
Flow Past Glen Ullin
Flow Past Port Of Morgan

Available Capacity, Scheduled, MMBtu

Jan 1  Mar 1  May 1  Jul 1  Sep 1
Gas Day [2017]

*Data Source: Northern Border IPS
Northern Border Glen Ullin* (2017)

*Data Source: Northern Border IPS
Latest Figures
Estimated Williston Basin Oil Transportation

July 2017

- Pipeline Export: 76%
- Refined: 8%
- Truck to Canadian Pipelines: 6%
- Estimated Rail: 10%
Estimated Williston Basin Oil Transportation

- Estimated Rail
- Estimated Pipeline Export
- Refined
- Truck to Canadian Pipelines
- Brent - WTI Spread (EIA)

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Solving the Flaring Challenge

Statewide

88%

3%

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

July 2017 Data – Non-Confidential Wells
Solving the Flaring Challenge

- Total ND Gas Flaring Percent (Color Indicates Reason)
  - Flaring % From Wells Connected to Sales
  - Flaring % From Wells Not Connected to Sales
  - Total ND Gas Production

- ND Gas Production, MMCFD

- Data from September 2014 to July 2017
Solving the Flaring Challenge

- New Wells Selling Gas
- New Producing Wells
Bakken Refracs

Updated From Previous Refrac Work

185 Wells, Up From 142
List Cleaned Up With DMR Assistance
*While careful work was performed to discover as many non-confidential, modern refracs as possible, this data set is likely not all inclusive.*
Refrac Completion Year*

*While careful work was performed to discover as many non-confidential, modern refracs as possible, this data set is likely not all inclusive.
Example: Pre/Post Refrac Oil
Example: Pre/Post Refrac Oil
Example: Pre/Post Refrac Oil
Example: Pre/Post Refrac Oil
Performance Pre/Post Refrac

BOPD

BILLINGS

BURKE

DIVIDE

DUNN

MCKENZIE

MOUNTRAIN

WILLIAMS

Avg. Max Recompletion, BOPD

Avg. Max Recompletion, BOPD

Avg. Max Recompletion, BOPD

Avg. Max Recompletion, BOPD

Avg. Max Recompletion, BOPD

Avg. Max Recompletion, BOPD

Avg. Max Recompletion, BOPD

Avg. Max Recompletion, BOPD
Performance Pre/Post Refrac
Example: 209,000 BBLs of Incremental Production

- Incremental Production (Refrac)
- Original Decline
- Original Production

Production Month

BOPD
Example: 257,000 BBLs of Incremental Production
Example: 253,000 BBLS of Incremental Production
Refrac Candidates

• Refrac selection is based on a number of criteria, many of which are not available in the public domain

• Refracs have been performed with success on a wide range of well ages and performance

• Refracs are designed to address one or more reservoir level issues impacting well performance (e.g. scaling, embedment, proppant rearrangement, fines generation, etc)

• The following work is not intended to imply a well will be refraced, but rather that the wells fit a certain criteria that may make them a near term candidate for refrac.
Peak Month Minimum
200 BOPD

3,074 BKN Wells
Spud 2007-2011

Potential Near term
Refrac Candidates?
Proximity to High Performing Wells

- 2.5 Mile Historic Peak Month Buffer Zone
- 1,955 Wells Within the 800+ BOPD Buffer

**Buffer Zone**
- 1250
- 800

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Refrac Economics Methodology

Incremental Production Above Original Well Decline Profile
Assumes Refrac Decline Curve Profile Matches Original Well
Refrac Summary of $45 Wellhead Oil

Incremental Oil, BBL / Refrac Cost

After Tax IRR

Assumed Range of Minimum Acceptable Rate of Return

$2 MM $3 MM $4 MM $2 MM $3 MM $4 MM $2 MM $3 MM $4 MM $2 MM $3 MM $4 MM $2 MM $3 MM $4 MM
Refrac Breakeven Summary

Incremental Oil, BBL / Refrac Cost

Refrac Wellhead Price (AT IRR of 20%)

100,000 200,000 300,000 400,000 500,000 600,000

$0 $10 $20 $30 $40 $50 $60 $70 $80 $90 $100 $110

$2 MM $3 MM $4 MM $2 MM $3 MM $4 MM $2 MM $3 MM $4 MM $2 MM $3 MM $4 MM $2 MM $3 MM $4 MM $2 MM $3 MM $4 MM $2 MM $3 MM $4 MM $2 MM $3 MM $4 MM
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