North Dakota Department of Mineral Resources

http://www.oilgas.nd.gov  http://www.state.nd.us/ndgs

600 East Boulevard Ave. - Dept 405
Bismarck, ND 58505-0840
(701) 328-8020 (701) 328-8000
Wells

14,457 active
  1,830 conventional
  12,627 Bakken/Three Forks

1,653 inactive
  916 waiting on completion
  1,888 permitted
13,451 increased density approved 04/17/18

32,022 total

55,000-65,000 estimated final
Impact Year End 2017

Wells drilled and completed - $100 billion > $330 billion to go
Wells drilled not yet completed - $11 billion > $1 billion
Natural Gas gathering and processing - $13 billion > $15 billion
Rail and rail transportation facilities - $1.25 billion
Crude Oil transmission pipelines - $2 billion > $2 billion

Total estimate - $127 billion > $348 billion to go = $475 billion

This does not include investments in housing and infrastructure made by private firms and state-local-federal government.
New-well oil production per rig
barrels/day

- **Anadarko**
  - March-2017: 300
  - March-2018: 300

- **Appalachia**
  - March-2017: 100
  - March-2018: 100

- **Bakken**
  - March-2017: 1000
  - March-2018: 1000

- **Eagle Ford**
  - March-2017: 1500
  - March-2018: 1500

- **Haynesville**
  - March-2017: 200
  - March-2018: 200

- **Niobrara**
  - March-2017: 1000
  - March-2018: 1000

- **Permian**
  - March-2017: 800
  - March-2018: 800
### ND Potential Unconventional Oil

17 Source Rock formations

- Spearfish 1
- Tyler 1
- Lodgepole 1 Bakken 2
- Birdbear 1
- Winnipegosis 1
- Red River 2
- Winnipeg 1
- Deadwood 1
- Charles 2
- Mission Canyon 2
- Duperow 1
- Stony Mountain 1

### Taxes

- Permian: 3.75% to 7.5%
- Anadarko: 7%
- Eagle Ford: 7.5%
- Appalachia: 0.2%
- Bakken: 10%
- Haynesville: 5% to 7.5%
- Niobrara: 3% to 6%

### Federal & Tribal Lands

- Permian: <2%
- Anadarko: <2%
- Eagle Ford: <2%
- Appalachia: <2%
- Bakken: 9% to 30%
- Haynesville: 2% to 9%
- Niobrara: 36% to 48%

### Drilling Rigs This Week

- Permian: 467
- Anadarko: 83
- Appalachia: 79
- Eagle Ford: 77
- Bakken: 65
- Haynesville: 54
- Niobrara: 24
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
44% Economic Area Increase 2017 to 2018

Peak 30-Day Production Level / Wellhead Breakeven Range (20% IRR)

- ~2018 YTD Range Square Miles: 11,824
- ~2017 Range Square Miles: 8,223
- ~2016 Range Square Miles: 5,474
65 rigs drilling – May 2018
North Dakota Forecast Activity Assumptions

- ND New Wells Added Per Month
- ND New Wells Case 1
- ND New Wells Case 2

JJ Kringstad - North Dakota Pipeline Authority
North Dakota Oil Production Forecast

ND Oil Production, BOPD

- NDPA Oil Forecast: Case 1
- NDPA Oil Forecast: Case 2
Production forecast is for visual demonstration purposes only and should not be considered accurate for any near or long term planning.
Statewide Bakken/Three Forks GOR

Avg. GOR

NDPA North Dakota Gas Production Forecast

Natural Gas Production, MMCFD

- ND Gas Case 1 - MMCFD
- ND Gas Case 2 - MMCFD
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)
Major Gas Pipeline and Processing Infrastructure
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
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.**
NGL Pipeline Takeaway Options

Barrels Per Day


- 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
North Dakota Oil Production

G1  G2  G3  G4  G5

Barrels per Day

History  Current ND Revenue Estimate  Peak Production Estimate  Current Production Limited-No Drilling  Rapid Recovery  Lower-Longer-Exhaust-Core

EOR?
+++
Evolution of Oil Gathering in ND Statewide Totals

<table>
<thead>
<tr>
<th>Year</th>
<th>Estimated Piped, BOPD</th>
<th>Estimated Trucked, BOPD</th>
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<tr>
<td>2012</td>
<td>263,352</td>
<td>465,966</td>
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<td>2013</td>
<td>410,629</td>
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<td>2015</td>
<td>725,743</td>
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<td>2016</td>
<td>718,177</td>
<td>281,372</td>
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<tr>
<td>2017</td>
<td>725,512</td>
<td>285,231</td>
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</table>
Evolution of Oil Gathering in ND
North Dakota Idle Wells

Idle Wells

$/Bbl ND Sweet


0 500 1,000 1,500 2,000 2,500

$0 $30 $60 $90 $120 $150
Forecasting Activity vs. Price

- EIA Forecast, Case 1 Wells
- EIA Forecast, Case 2 Wells
- Historical
New Miles and Activity Footprint

<table>
<thead>
<tr>
<th>Year</th>
<th>New Miles of Pipe</th>
<th>Square Miles</th>
<th>Well Completions</th>
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<tbody>
<tr>
<td>2008</td>
<td>6,262</td>
<td>6,493</td>
<td>8,584</td>
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<tr>
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<td>1,355</td>
<td>9,866</td>
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<td>2011</td>
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<td>2,828</td>
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<td>8,433</td>
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<tr>
<td>2015</td>
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<tr>
<td>2016</td>
<td>914</td>
<td>3,578</td>
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</tbody>
</table>

*2017 Forecasted

JJ Kringstad - North Dakota Pipeline Authority
North Dakota Pipeline Construction

- New Miles
- Year End Miles

Sources: NDIC & PHMSA