PRODUCING WELLS
ACTIVE DRILLING RIGS
OIL & GAS PRODUCTION
OIL PRICE
ENHANCED OIL RECOVERY
ACTIVITY FORECAST
## Wells

<table>
<thead>
<tr>
<th>Category</th>
<th>Active Conventional</th>
<th>Bakken/Three Forks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active</td>
<td>15,344</td>
<td>1,959</td>
</tr>
<tr>
<td>Inactive</td>
<td>1,492</td>
<td>&gt; 1,363</td>
</tr>
<tr>
<td>Waiting on Completion</td>
<td>877</td>
<td>&gt; 959</td>
</tr>
<tr>
<td>Permitted</td>
<td>1,844</td>
<td>&gt; 1,872</td>
</tr>
<tr>
<td>Increase Density</td>
<td>13,451</td>
<td>&gt; 13,131</td>
</tr>
<tr>
<td>Total</td>
<td>32,177</td>
<td>&gt; 32,672</td>
</tr>
</tbody>
</table>

| Estimated Final               | 40,000 - 85,000     | 20 - 70 years      |
PRODUCING WELLS
ACTIVE DRILLING RIGS
OIL & GAS PRODUCTION
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ACTIVITY FORECAST
Record High: 218 Rigs
May 2012

Current: 68 Rigs
Well/rig/Mo
3X = 204
OIL & GAS PRODUCTIVITY

FRACTURING TECHNOLOGY

ENHANCED OIL RECOVERY
OIL & GAS PRODUCTIVITY

FRACTURING TECHNOLOGY

ENHANCED OIL RECOVERY
TYPICAL G1 HORIZONTAL OIL WELL

98 gallons cross link gel and 149 pounds sand per foot
TYPICAL G2 HORIZONTAL OIL WELL

236 gallons cross link gel and 154 pounds sand per foot
TYPICAL G3 HORIZONTAL OIL WELL

- 9 5/8” surface casing
- 7” production casing
- 4.5” liner & frac string
  - 30-40 swell packers
  - sliding sleeves

2009 – 2015 went from 28 to 50 stages

206 gallons slick water and 283 pounds sand per foot

Potable Waters

4.5” liner

Frac String

Cement

Packer

4.5” liner

Upper Bakken Shale

Middle Bakken 10,000’

Lower Bakken Shale
Potable Waters

60-80 stages, 2-6 perf clusters per stage, diveters, coarse & very fine sand
1,112 gallons slick water and 977 pounds sand per foot vary with rock properties
New Owner “Mothballs” GASFRAC’s Waterless LPG Technology

September 17, 2015 | Energy Services, GASFRAC, Hydraulic Fracturing, Industrywide Issues

In March MDN told you the sad story that Canadian waterless fracking company GASFRAC had been sold to an unnamed third party after going bankrupt (see Bankrupt Waterless Fracking Co GASFRAC Sold to “Third Party”). GASFRAC’s technology had been used to frack a Utica Shale well (for $22 million), and the results were, shall we say, less than stellar (see EVEP Reports Waterless Fracked OH Well is a Bust). We now know two new things about GASFRAC: (1) the company that purchased it out of bankruptcy is another Canadian company—STEP Energy; (2) STEP has mothballed GASFRAC’s waterless LPG fracking technology...
G1 to G3 Re-Frac
PRODUCING WELLS
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ACTIVITY FORECAST
All-time high
1,391,877 barrels/day
October 2018
North Dakota Oil Production Forecast

Assumes Current Technology – Enhanced Oil Recovery Not Included

Graph showing oil production forecast over time with cumulative production and BOPD data.
Oil & Gas Production

North Dakota Oil Production

- History
- Expected Case - Peak Production
- Current Revenue Forecast Production
- WTI Remains Below $55/Bbl
Oil & Gas Production

North Dakota Oil Production

- **History**
- **Expected Case - Peak Production**
- **Current Revenue Forecast**
- **WTI Remains Below $55/Barrel**
NDPA North Dakota Production Forecast Summary

Assumes Current Technology – Enhanced Oil Recovery Not Included
Solving the Flaring Challenge

Assumes Current Technology – Enhanced Oil Recovery Not Included

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)
Gas Processing Plants
2.14 BCFD in 2017 > 3.36 BCFD in 2020
World liquid fuels production and consumption balance
million barrels per day

Source: Short-Term Energy Outlook, December 2018
West Texas Intermediate (WTI) crude oil price

dollars per barrel

Source: Short-Term Energy Outlook, December 2018, and CME Group

West Texas Intermediate (WTI) spot price

STE0 forecast
NYMEX futures price
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Enhanced Oil Recovery (EOR)¹

- EOG is the 1st company to say it has significantly increased oil production from an unconventional play using gas injection.

- Field tests since program started in 2013:
  - The production increases on 15 wells indicated from 30-70% reserve gains.
  - A 32-well test in 2016 added 300,000 bbl of oil at $6/bbl finding cost.
  - Work is ongoing on 100 wells in six areas in 2017.
Enhanced Oil Recovery (EOR)¹

**Inputs and Outputs**

- Additional capital costs average about $1 million per well
- The process uses associated gas from its wells
- Production response is in 2-3 months
- $1 invested adds $2 to net present value

**It Works if:**

- The formation is able to contain high-pressure gas injection near the well.
- Wellbores contact the most productive rock.
- The completion maximizes the fractured area within a restricted zone around the wellbore.
Big Butte
Bear Creek
Red Wing Creek
Cedar Hills
Foreman Butte
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North Dakota Oil Industry Jobs

Year

Jobs

Prod jobs

Gathering jobs

Fracing jobs

Drilling jobs
Abandoned Well Plugging and Site Restoration

• Current fund balance $21 million
  – Plugging and Reclamation
    • 438 Total North Dakota wells plugged and reclaimed 2017-2019 biennium $32.3 million
    • 5 wells plugged and reclaimed by AWPSRF fund $369,000
    • Anticipate the same for 2019-2021 biennium
  – Legacy sites
    • $3.331 million reclamation 2017-2019 biennium
    • $100,000 anticipated 2019-2021 biennium
  – Brine Ponds
    • $980,000 research 2017-2019 biennium
    • $200,000 pilot project 2019-2021 biennium

• 2018 bankruptcy case
  – $2 million in bonds
  – 590 wells
    • 384 active, 116 abandoned, 51 inactive, 25 temp abandoned, 14 undrilled locations
    • $23 million liabilities
    • $39 million assets
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