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NORTH DAKOTA NATURAL GAS
A DETAILED LOOK AT NATURAL GAS GATHERING

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NORTH DAKOTA NATURAL GAS
FLARING REGULATION

In an effort to conserve this resource and protect against waste, the Industrial Commission Oil and Gas Division, under the authority granted in section 38-88-04 of the North Dakota Century Code, implements and enforces rules and regulations to limit the production of oil produced from wells that are not yet connected to a gas-gathering system.

NORTH DAKOTA NATURAL GAS
A DETAILED LOOK AT NATURAL GAS GATHERING

This report is designed to be a factual look at natural gas gathering, processing, and flaring in North Dakota.

The Bakken – Three Forks Formations

The Bakken/Three Forks (Bakken) is the largest oil field (in square miles) in North America. It underlies approximately 15,000 square miles of North Dakota. The formation has been known about by geologists for decades, but it wasn’t until 2006 when the use of horizontal drilling combined with hydraulic fracturing that the Bakken was considered to be an economic play.

The Bakken formation produces both crude oil and associated natural gas. Oil is the primary energy resource contained in Bakken wells and is the principal economic driver for energy producing companies.

Natural Gas Flaring

Flaring occurs when natural gas is burned on location due to a lack of gathering pipeline infrastructure or economic alternatives. Flaring of natural gas is a much safer and more environmentally friendly method of handling the natural gas than simply venting into the atmosphere. By flaring the gas, it converts the methane to carbon dioxide (CO2) which has 20-23 times less impact on greenhouse gas emissions.

A gas gathering pipeline and processing plant are the conventional means to condition the natural gas for resale use. An economic analysis must be done to determine if it is even feasible to connect a well to an...
U.S. expected to be largest producer of petroleum and natural gas hydrocarbons in 2013

Source: U.S. Energy Information Administration
Note: Petroleum production includes crude oil, natural gas liquids, condensates, refinery processing gain, and other liquids, including biofuels. Barrels per day oil equivalent were calculated using a conversion factor of 1 barrel oil equivalent = 5.55 million British thermal units (Btu).
World Gas Flaring Estimates*

*Billion Cubic Meters

2007: 150
2008: 145
2009: 140
2010: 135
2011: 130

US Flaring: 5.1%

*The World Bank
U.S. Gas Flaring

0.7% of All US Natural Gas is Flared

Latest EIA Data: ND = 23.7% of Total U.S. Flaring
Bakken-Three Forks Formations
Natural Gas Flaring Facts/Challenges

Primary Challenges
- Size of resource
- Young age of development
- Harsh winter conditions
- Resource potential still being explored

Regulations
- Flaring regulated by the ND Industrial Commission/Oil & Gas Division with existing penalties and incentives in place to reduce flaring
Detailed Challenges to Reducing North Dakota Flaring

- Upfront Planning/Coordination
- Obtaining Easements
- Understanding Bakken Gas Quality
- Understanding Production Potential
- Properly Sizing New Gas Gathering Pipelines
- Enhancing Existing Gathering Pipelines
- Sufficient Gas Processing Capacity (Timing and Location Critical)
- Adequate Interstate Pipeline Capacity
- Ramping Up Flaring Alternatives (Short & Long Term)
Rich Natural Gas

Raw Natural Gas (1500+ BTU) → Processing Plant → Consumer Quality Dry Natural Gas → Methane

- Ethane 41.64%
- Propane 28.33%
- Butane 16.53%
- Natural Gasoline 13.51%

NGL’S (8-12 gpm) → Y-Grade or Fractionated

*Using NGL breakdown from the July 2012 BENTEK Natural Gas Study
North Dakota Natural Gas

North Dakota Natural Gas, MMCFD

North Dakota Natural Gas Case 1
North Dakota Natural Gas Case 2
Understanding Which Wells Are Flaring

<table>
<thead>
<tr>
<th></th>
<th>Number of Wells</th>
<th>August-13 Flaring %</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1 MCFD</td>
<td>666</td>
<td>0.04%</td>
</tr>
<tr>
<td>1.1-10 MCFD</td>
<td>1617</td>
<td>0.77%</td>
</tr>
<tr>
<td>10.1-100 MCFD</td>
<td>1688</td>
<td>6.77%</td>
</tr>
<tr>
<td>100.1-250 MCFD</td>
<td>438</td>
<td>7.35%</td>
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<tr>
<td>250.1-500 MCFD</td>
<td>163</td>
<td>6.01%</td>
</tr>
<tr>
<td>500.1-1000 MCFD</td>
<td>68</td>
<td>5.12%</td>
</tr>
<tr>
<td>1000.1-2600 MCFD</td>
<td>19</td>
<td>2.75%</td>
</tr>
</tbody>
</table>
Solving the Flaring Challenge

GREEN – % of gas captured and sold
Orange – % flared from wells with at least one mcf sold.
Blue – % flared from zero sales wells

Simple Terms
Orange – Challenges on existing infrastructure
Blue – Lack of pipelines

Statewide

August 2013 Data – Non-Confidential Wells
Conclusion 1: Getting the right wells connected quickly is moving in the right direction.
North Dakota Pipeline Miles

2,470 miles of new pipe in 2012
Roughly Distance from Los Angeles to New York City
Capturing the 13% Faster Well Connections

- New Wells Selling Gas
- New Producing Wells

Number of Wells Per Month

- 4/1/2005
- 9/1/2005
- 2/1/2006
- 7/1/2006
- 12/1/2006
- 5/1/2007
- 10/1/2007
- 3/1/2008
- 6/1/2008
- 11/1/2008
- 4/1/2009
- 9/1/2009
- 2/1/2010
- 7/1/2010
- 12/1/2010
- 5/1/2011
- 10/1/2011
- 3/1/2012
- 8/1/2013
ND Gas Gathering Statistics

- Wells With Gas Sales or Lease Use
- Wells Without Gas Sales
Capturing the 13%
Catching Early Production

Number of Wells

- Wells Connected in 2013
- Number of Wells Still Flaring

Year the Well Began Production

2008 2009 2010 2011 2012 2013*
Conclusion 2: Finding a way to quantify system enhancements would greatly assist in understanding the timeline.
Older, lower pressure wells connected to plant

New, high pressure well causes older wells to flare

Capturing the 16% Additional Compression
Capturing the 16%
Looping Existing Pipelines
Capturing the 16% Frequent Pigging

NGL buildup in gathering pipelines reduces area for gas to flow

More of an issue in winter months due to lower ground temperature causing more liquids to drop out
ND Gas Plant Capacity

Plant/conditioning capacity, MMCFD

- Aux Sable
- Caliber Midstream
- Hess
- Hiland
- ONEOK
- Petro Hunt
- Plains
- Sterling Energy
- Targa Resources
- True Oil
- USG Midstream
- Whiting
- XTO

Legend:
- Red: Upcoming Capacity
- Black: Existing Capacity
Open Capacity Leaving N. Dakota Is Tight

- Northern Border and Alliance Serve As the Primary Routes to Transport Gas From the Region.
- Each Have Limited Open Mainline Capacity to Carry Additional Williston Supply.
Flaring Alternatives

November 5, 2012 – EERC Associated Gas Use Study

December 18, 2012 – Natural Gas Flaring Alternatives (Company Presentations)

February 27, 2013 – EERC Use of Associated Gas to Power Drilling Rigs
Statewide Wellhead Recovery Estimates

Estimate Data/Assumptions: August 2013 Production

*Oil Price of $97.18/bbl, Natural Gas/NGL Wellhead Price of $8.00/MCF*
Strengthening Landowner Relations
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