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
Western North Dakota

- 1,100 to 2,700 wells/year = 2,000 expected
  - 100-225 rigs = 12,000 – 27,000 jobs = 12,000 – 27,000 jobs
  - Another 10,000 jobs operating wells and building infrastructure
  - 225 rigs can drill the 5,000 wells needed to secure leases in 2.5 years
  - 225 rigs can drill the 28,000 wells needed to develop spacing units in 14 years
  - 33,000 new wells = 30,000-35,000 long term jobs
North Dakota Oil Production and Price

2,650  Bakken and Three Forks wells drilled and completed
33,000  more new wells possible in thermal mature area

P90=5 BBO – P50=7 BBO – P10=11 BBO (billion barrels of oil)
North Dakota Monthly Gas Produced and Price

$ per MCF

MCF GAS PRODUCED

- - $ per MCF

MCF GAS PRODUCED
ND Oil & Gas Development Efficiency

95.7% Economic Value Captured
4.3% Economic Value Flared

July 2011 Production Data, Oil Price of $91.79/bbl, Natural Gas/NGL Wellhead Price of $12.00/MCF
38-08-06.4. FLARING OF GAS RESTRICTED - IMPOSITION OF TAX - PAYMENT OF ROYALTIES - INDUSTRIAL COMMISSION AUTHORITY.

As permitted under rules of the industrial commission, gas produced with crude oil from an oil well may be flared during a one-year period from the date of first production from the well. Thereafter, flaring of gas from the well must cease and the well must be capped, connected to a gas gathering line, or equipped with an electrical generator that consumes at least seventy-five percent of the gas from the well. An electrical generator and its attachment units to produce electricity from gas must be considered to be personal property for all purposes. For a well operated in violation of this section, the producer shall pay royalties to royalty owners upon the value of the flared gas and shall also pay gross production tax on the flared gas at the rate imposed under section 57-51-02.2. The industrial commission may enforce this section and, for each well operator found to be in violation of this section, may determine the value of flared gas for purposes of payment of royalties under this section and its determination is final. A producer may obtain an exemption from this section from the industrial commission upon application and a showing that connection of the well to a natural gas gathering line is economically infeasible at the time of the application or in the foreseeable future or that a market for the gas is not available and that equipping the well with an electrical generator to produce electricity from gas is economically infeasible.

Source: N.D. Century Code.
IT IS THEREFORE ORDERED:

(58) All wells in the Banks-Bakken Pool shall be allowed to produce at a maximum efficient rate for a period of 60 days commencing on the first day oil is produced through well-head equipment into tanks from the ultimate producing interval after casing has been run; after that, oil production from such wells shall not exceed an average of 200 barrels per day for a period of 60 days; after that, oil production from such wells shall not exceed an average of 150 barrels per day for a period of 60 days, thereafter, oil production from such wells shall not exceed an average of 100 barrels of oil per day; if and when such wells are connected to a gas gathering and processing facility the foregoing restrictions shall be removed, and the wells shall be allowed to produce at a maximum efficient rate. The Director is authorized to issue an administrative order allowing unrestricted production at a maximum efficient rate for a period not to exceed 120 days, commencing on the first day oil is produced through well-head equipment into tanks from the ultimate producing interval after casing has been run, if the necessity therefor can be demonstrated to his satisfaction.

Case No. 15689
Order No. 17944
New or Expanding Gas Plants
Contract No. G-020-043
“Flare Gas – Power Generation Commercial Viability Pilot”
Submitted by Blaise Energy, Inc.
Principal Investigator: Pascal Boudreau
PARTICIPANTS
Sponsor Cost Share
Blaise Energy $6,740,000
Blaise Energy (in-kind) $360,000
North Dakota Industrial Commission $375,000
Total Project Cost $7,475,000
“Wellhead Gas Capture Via CNG Technologies”
Applicant: Bakken Express, LLC

BUDGET

Request for $873,300 NDIC OGRP funding; Total Project Cost: $2,108,200

<table>
<thead>
<tr>
<th>WELLSITE GAS CAPTURE &amp; TRANSPORT</th>
<th>12 Month Project: Capture &amp; Transport Gas from 5 Wells with Peak Rate 2500 mcfpd</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Expense Type</strong></td>
<td><strong>Total</strong></td>
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<tr>
<td>Well Skids Capital</td>
<td>$1,500,000</td>
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<tr>
<td>Tube Trailer Leasing</td>
<td>$220,000</td>
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<tr>
<td>Discharge Facility Leasing</td>
<td>$26,000</td>
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<tr>
<td>Operator &amp; Maintenance</td>
<td>$69,400</td>
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<tr>
<td>Supervisory, Engineering and Mgmt Consult</td>
<td>$61,800</td>
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<tr>
<td>Principals</td>
<td>$230,400</td>
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<tr>
<td>TOTAL</td>
<td>$2,108,200</td>
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</tbody>
</table>

Bakken Express, LLC will secure their portion of funding ($1,004k in cash, $230k in-kind) through contract financing and collateral bank loans.

The capital investment is the well compression/dehydration skids. The CNG tube trailers and discharge facility can be leased for a 12 month term.
A project is under way in North Dakota to test using flare gas instead of diesel fuel to power drilling rigs, said the state's top oil and gas regulator.

Gas flaring is a widely used practice for the disposal of natural gas in petroleum-producing areas where there is no infrastructure to make use of the gas.

"We have been pouring money into every kind of project that we can think of to capture that gas and use it. The newest one is we're going to test this fall, is using it to power drilling rigs instead of using diesel fuel. It looks like there's a lot of potential," said Lynn Helms, Bismarck, director of the North Dakota Department of Mineral Resources.
Natural Gas Flaring and North Dakota

Trisha Curtis
Research Analyst, Energy Policy Research Foundation, Inc. (EPRINC)
North Dakota Pipeline Authority Webinar
November 10th, 2011
Introduction

Who is EPRINC? What do we do?

Presentation

- What is natural gas flaring and why is it an issue?
- What is going on in North Dakota
- What is the perception of this flaring outside of North Dakota and why does it matter?
- What the articles are missing
Natural Gas Flaring

- **Flaring** (and or venting) is typically used in modern oil and gas facilities either for safety and pressure reasons or for the disposal of associated gas (natural gas produced as a byproduct of oil production) due to the lack of capturing and processing facilities for the natural gas.
- Safety. It is necessary to have the option to flare for safety purposes in case there is a power outage or risk of explosion.
- Flaring is most commonly seen in countries like Russia and Nigeria due to lack of enforced regulation or incentive to capture the gas.
- Unlike oil, gas cannot be trucked or railed out, it must be captured, processed, and piped to consumers.
- It is an issue for health and environmental reasons. Flaring produces mainly CO2 emissions and venting produces mainly methane emissions. Methane is thought to be significantly more harmful to the environment than CO2 in terms of emissions.
- Nigerian crude has higher GHG emissions than Canadian oil sands.
Top Gas Flaring Countries 2006 and 2007

U.S. Natural Gas Prices, Production, and Consumption

Source: EIA Data
North Dakota and US Flaring

<table>
<thead>
<tr>
<th>Year</th>
<th>North Dakota Natural Gas Gross Withdrawals (MMcf)</th>
<th>North Dakota Natural Gas Gross Withdrawals from Gas Wells (MMcf)</th>
<th>North Dakota Natural Gas Vented and Flared (MMcf)</th>
<th>North Dakota Natural Gas Marketed Production (MMcf)</th>
<th>U.S. Natural Gas Vented and Flared (MMcf)</th>
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</table>

Source: EIA Data
US Homes Heated with ND Bakken and Three Forks Natural Gas

Assumes Avg Home Uses 72.4 Million BTU’s Per Year - Source: AGA
Bakken and Three Forks Natural Gas

Assumes Avg Home Uses 72.4 Million BTU’s Per Year - Source: AGA
**North Dakota Natural Gas Use**

**U.S. natural gas use in 2010:**
- Electrical Power 31%
- Industrial 27%
- Residential 21%
- Commercial 13%
- Oil and Gas Industry Operations 6%
- Pipeline Fuel 3%
- Vehicle Fuel <1%

Source: EIA Data
What is Happening Outside of North Dakota?

In North Dakota, Flames of Wasted Natural Gas Light the Prairie

Sep 27, 2011
N. Dakota gas flaring raises energy, pollution concerns

Green
A Blog About Energy and the Environment
September 27, 2011, 7:34 AM
Flames Light the Prairie and Warm the Planet
By CLIFFORD KRAUSS

Natural Gas is a Burning Issue
Wasting gas when we are energy starved
Ken Silverstein | Oct 05, 2011
Oil and gas industry at the center of controversy...Gulf spill, pipeline leaks, GHG emissions, Keystone XL and oil sands “dirty oil”

Purposed ozone rules on fracking postponed and in comment period, but flaring part of regulations

Significant legislation on GHG emissions regarding Cap and Trade did not pass, no massive oil spill legislation, all out battle on Keystone XL
What the New York Times article did *not* mention....What needs to be explained...

1. **Feasibility and economic viability of immediately getting gas to market.** Most of these wells will in time will be hooked up to gas processing facilities; however, there are some wells in North Dakota that are decades old and so far from any other existing well or facility that it may never be feasible to capture the gas from that single well.

2. **Severe weather limitations in North Dakota**

3. **Size and Maturity of the Play.** New play with rapid development (partially because of leasing requirements) and spread across over 15,000 sq. miles.

4. **VALUALBLE natural gas that is high in NGLs.**

5. **Over $3 billion is being invested by the industry for gathering and processing in the next few years.** *Significant gathering and processing growth* has taken place over the past several years, but has simply been unable to keep up with such strong production growth.
Understanding how natural gas is captured and processed is also something the articles have missed. Unlike crude oil which can be transported via rail in tank cars, by truck, or by pipeline, natural gas must be transported via pipeline and then sent to a proper facility to separate the products in the natural gas. Plant capacity construction is currently keeping up with production, but....

- Building gathering capabilities is not done by the producer, but rather by a third party and requires manpower, capital investment, and compliance with regulatory requirements.

Associated gas with Bakken oil is rich in NGLs and therefore more valuable than current Henry Hub nat gas prices. But this gas must be connected and processed to separate and sell the different components in the NGL stream.
North Dakota Pipeline Authority Flaring Webinar

November 10, 2011
What We’ll Cover

Key Points

• ONEOK Partners is a diversified, midstream natural gas and natural gas liquids company
  – Large existing gathering and processing presence
  – Strong commitment to expand infrastructure

• Why is natural gas flaring?

• Our $1.5 - $1.8 billion in growth projects will accommodate prolific supply growth
  – Natural gas gathering infrastructure
  – Natural gas processing plants
  – New NGL pipeline and related infrastructure expansions
ONEOK Partners Bakken Presence

**Strategic Fit**

- Nearly 5,000 miles of gathering pipelines
- 1 large processing plant (95 MMcfd) and 3 small satellite plants
- 3 large (100 MMcfd) plants under construction
- Long term presence
  - Knowledgeable workforce and contractors in place
  - Strong producer relationships
- 1.8 million acres dedicated
- Integrated value chain with NGL segment
- 50% interest in Northern Border residue natural gas pipeline
Garden Creek Plant – 100 MMcfd

Expected to be operational by the end of 2011
Why is Gas Flaring?

- Dramatic surge in drilling rigs, wells drilled and gas produced
  - Improved well-completion techniques increasing initial production rates
  - Strong producer economics driven by crude oil prices
- Low pressure gas that must be processed for removal of NGLs
- Lag in construction of necessary natural gas gathering, compression and processing infrastructure
Why Does Infrastructure Lag Drilling?

ONEOK Gas Gathering and Processing Facilities

- Widely scattered wells
  - Large area
  - Drilling to hold leases
- Existing facilities designed for smaller volume wells
- Time needed to design, permit and construct new facilities
- Manpower, equipment and housing shortages
- Weather challenges
- Difficulties in obtaining rights-of-way
Stateline 1 and 2 Plants – 200 MMcfd

Operational by 3rd qtr 2012 and 1st half of 2013, respectively
## ONEOK Compression Projects

*Approved and in various stages of construction*

<table>
<thead>
<tr>
<th>Facility</th>
<th>Location</th>
<th>Capacity</th>
<th>In-Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Garden Creek Compressor Station</td>
<td>McKenzie County</td>
<td>30 MMcfd</td>
<td>In Service</td>
</tr>
<tr>
<td>Stateline Compressor Station</td>
<td>Williams County</td>
<td>25 MMcfd</td>
<td>In Service</td>
</tr>
<tr>
<td>Lodgepole/16” Trunkline</td>
<td>Dunn/Stark Counties</td>
<td>10 MMcfd</td>
<td>In Service</td>
</tr>
<tr>
<td>Blue Buttes Units 5&amp;6</td>
<td>McKenzie County</td>
<td>10 MMcfd</td>
<td>October 2011</td>
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<tr>
<td>Alexander Booster Expansion</td>
<td>McKenzie County</td>
<td>5 MMcfd</td>
<td>October 2011</td>
</tr>
<tr>
<td>Charlson Compressor Station</td>
<td>McKenzie County</td>
<td>30 MMcfd</td>
<td>November 2011</td>
</tr>
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<td>Cherry Creek Compressor Station</td>
<td>McKenzie County</td>
<td>30 MMcfd</td>
<td>December 2011</td>
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<tr>
<td>Epping Compressor Station</td>
<td>Williams County</td>
<td>15 MMcfd</td>
<td>January 2012</td>
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<td>Twin Valley Compressor Station</td>
<td>McKenzie County</td>
<td>30 MMcfd</td>
<td>March 2012</td>
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<td>Epping Station Expansion</td>
<td>Williams County</td>
<td>15 MMcfd</td>
<td>2Q 2012</td>
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<td>Cooperstown Station Expansion</td>
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<td>2Q 2012</td>
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<td>Tree Top Station Expansion</td>
<td>Billings County</td>
<td>5 MMcfd</td>
<td>3Q 2012</td>
</tr>
<tr>
<td>Bear Den Compressor Station</td>
<td>McKenzie County</td>
<td>30 MMcfd</td>
<td>3Q 2012</td>
</tr>
<tr>
<td>Alamo Compressor Station</td>
<td>Williams County</td>
<td>15 MMcfd</td>
<td>3Q 2012</td>
</tr>
</tbody>
</table>

**Total Capacity of Field Compression Expansions:** 260 MMcfd
Natural Gas Liquids Investments

- **Bakken Pipeline**
  - $450-$550 million
  - 12” diameter NGL pipeline from Bakken Shale to Overland Pass Pipeline
  - Initial capacity to transport 60,000 bpd of unfractionated NGLs, expandable to 110,000 bpd with more pumps

- **Overland Pass Pipeline expansion**
  - $35-$40 million (50% interest)
  - Expansion of existing pump stations
  - Additional pump stations

- **Fractionator expansion at Bushtont**
  - $110-$140 million
  - Increase capacity to 210,000 bpd from 150,000 bpd

- **Additional NGL pipeline from Mid-Continent to Gulf Coast**
  - Sterling III

- **Mt. Belvieu fractionator expansion**
  - MB-2

*Project amount not included in total on slide*
Recap of ONEOK Growth Projects

- Gathering and Processing
  - Expansion of Grasslands from 55 to 95 MMcfd (completed in 2009)
  - ~$1.0 billion in new projects
    - Garden Creek
    - Stateline 1 and 2
    - Compression, pipelines, well-connects

- Natural Gas Liquids
  - Approximately $700 million
    - Construct Bakken Pipeline
    - Overland Pass Pipeline expansion
    - Expand Bushton fractionator
  - Additional infrastructure to Mt. Belvieu (not included in total)

Approximately $1.5 to $1.8 Billion
Questions
Mission

The Mission of the Oil and Gas Research Program is to promote the growth of the oil and gas industry through research and education.
About Us

- State-Industry Program established by the legislature in 2003
- Funded from the state share of the oil and gas production tax and oil extraction tax
- Two percent, up to $4 Million is available each biennium for research & educational grants
Highlighted Projects

- EERC
- Bakken Express
- Blaise Energy
Environmental Energy Research Center (EERC)

- Project will explore, identify, and demonstrate technologies for utilizing wellhead gas. Results will provide producers with a technical evaluation of gas fired biofuel (firing of natural gas and diesel fuel simultaneously in a diesel engine)diesel power for drilling operations, a demonstration of compressed natural gas (CNG) transport and delivery, and expanded markets for Bakken Formation associated gas.

- Program Funding: $750,000

- Total Project Costs: $1,900,000
Bakken Express

- Evaluation of compressed natural gas (CNG) technologies as an economic method to capture and transport produced natural gas and gas liquids to market.

- Program Funding: $873,300

- Total Project Costs: $2,108,200
Blaise Energy

- To demonstrate the commercial viability of using otherwise wasted associated gas as fuel for on-site electrical power generation and its subsequent sale to the grid of the electricity as an alternative to flaring.

- Program Funding: $375,000

- Total Project Costs: $7,475,000
Gas Capturing Summary

3 Research Grants

- Program Funding: $1,998,300
- Total Project Costs: $11,483,200
Process: Wellsites To Pipeline

Well 1
- Compression Skid
- Tube Transport

Well 2
- Compression Skid
- Tube Transport

Well 3
- Compression Skid
- Tube Transport

Discharge Station
- Gas Plant
- Gathering Pipeline
- Discharge Skid

Nov 10, 2011
Gathering Station To Pipeline

Gathering Station

Compression Skids

Flare

Gathering Pipeline

Tube Transports

Gathering Station

Discharge Station

Discharge Skid

Gas Plant

Gathering Pipeline
Delivering Compressor Skid
First Three Skids Operating
Loading Tube Containers
Unloading Tube Containers
Selling Gas To Pipeliner
Open Season Project

- **Project #2 Scope**
  - Total of 95 compressor skids to capture 66 mmscfpd

- **Fee Structure**
  - No upfront capital
  - In-kind fee based on term

- **Non-Binding Period**
  - Expressions of Interest due by Dec 15, 2011

- **Contact**
  - Tim Maloney
  - tmaloney@bakkenxpress.com
  - 701-347-1602
  - bakkenexpress.com/openseason
Agenda:

- Blaise Energy Solution
- Resolving Challenges
- Data Collection
- Moving Forward
- Partners
The Blaise Solution

Overview:

- Flare Gas to Electricity
- No Cost Alternative to Flaring
  - Market Based solution
  - Carrot vs. Stick
- No Cost & Easy way to reduce waste
- Complete Outsourced Solution:
  - All work performed and paid by Blaise
- Use as much of the flare gas as possible
- Gas Monetization Options
- Significant emission reduction
  - Proactive Environmental Stewardship
- Proactive Self Regulation
The Blaise Solution

- Small “Clean” Footprint
- 1st in North America using Flared Gas in the Recycled Energy category generating Renewable Energy Credits (RECs)
- Easy Installation – 2 connections:
  1. “T” off flare line with any unused gas going to flare
  2. Electrical connection to on-site utility power
The Blaise Solution
Resolving Challenges

• Creating 1st time boilerplates
  • WAPA, Basin, Burke-Divide Electric Coop, Dept of Health

• Varying gas flow & composition

• Unknown Market for Grid Power

• Grid Connectivity

• North Dakota electric price

• WAPA approval is longest pole in the tent

• H2S
Improving the Design:

- Scalable Power Modules (85kW, 125kW & 200 kW)
- Mass production engine
- Stack in Parallel Operation
- Sized to available amount of associated gas
- Automatic air/fuel ratio adjustments for minimum emissions
Skid Mounted:

- Paralleling capability
  - 32 Modules
- Scalable
  - Gas Decline
- Easily Transportable
- Enhanced Redundancy
The Blaise Solution

• Grid Power or Site Power
• Reduction or elimination of flare gas and emissions
• Leveraging available on-site fuel
  • Propane as backup (with priority to Associated Gas)
• Seamless transition and blending of fuels
The Blaise Solution

- Piloting proven GM Vortec Engine
  - Low cost / kW
  - Low Maintenance
- Advanced fuel control
- Remote Monitoring
Data Collection for Workshops

- **Fuel Consumption**
  - To better assess future potential and Operator monetization

- **Maintenance Costs**
  - To better assess service long term viability in North Dakota

- **Emission Reduction**
  - To better assess Environmental benefits and positive impact
Blaise Energy *Snapshot*

- Headquartered in North Dakota
- Classified as “Recycled Energy” in North Dakota
- Public / Private Partnership
- Testing new Ideas
- Putting a Dent in Flaring:
  - 4 MW of grid connected agreements
  - 15 MW of active target sites
    - Power ~15,000 Homes
    - Emission reduction (compared to flaring)
      - CO2e ~3600 tons per year
        - Equivalent to taking ~600 cars off the road
Thank You!

- ND Oil & Gas Research Council
- ND Industrial Commission
  - Dept Mineral Resources
- Member Coops
- NDPC
  - Member Operators
Questions?

Mark@BlaiseEnergy.com
701.390.7543