



**EERC**<sup>SM</sup>



U N I V E R S I T Y O F  
**NORTH DAKOTA**<sup>®</sup>



Critical Challenges. Practical Solutions.



Energy & Environmental Research Center (EERC)

# NORTH DAKOTA GAS CAPTURE UPDATE

Interstate Oil and Gas Compact Commission  
2019 Annual Conference

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# **NORTH DAKOTA PRODUCTION**

# NORTH DAKOTA PRODUCTION DATA

61 drill rigs

15,700 producing wells

1.4 million barrels crude oil per day

2.9 billion cubic feet associated gas per day

## MONTHLY UPDATE

### JUNE 2019 PRODUCTION & TRANSPORTATION

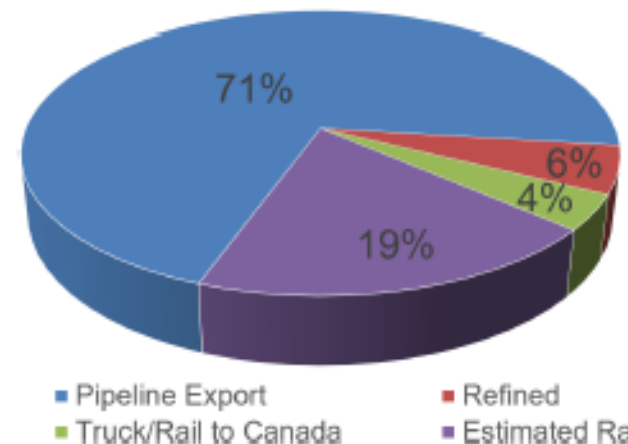
#### North Dakota Oil Production

Month	Monthly Total, BBL	Average, BOPD
May 2019 - Final	43,234,081	1,394,648
June 2019 - Prelim.	42,739,555	1,424,652

#### North Dakota Natural Gas Production

Month	Monthly Total, MCF	Average, MCFD
May 2019 - Final	87,402,741	2,819,443
June 2019 - Prelim.	86,300,660	2,876,689

Estimated Williston Basin Oil Transportation, June 2019



## CURRENT DRILLING ACTIVITY:

### NORTH DAKOTA<sup>1</sup>

61 Rigs

### EASTERN MONTANA<sup>2</sup>

0 Rigs

### SOUTH DAKOTA<sup>2</sup>

0 Rigs

### SOURCE (AUG. 15, 2019):

1. ND Oil & Gas Division
2. Baker Hughes

## PRICES:

Crude (WTI): \$54.32

Crude (Brent): \$58.09

NYMEX Gas: \$2.24

SOURCE: BLOOMBERG (AUG. 15, 2019)

## GAS STATS\*

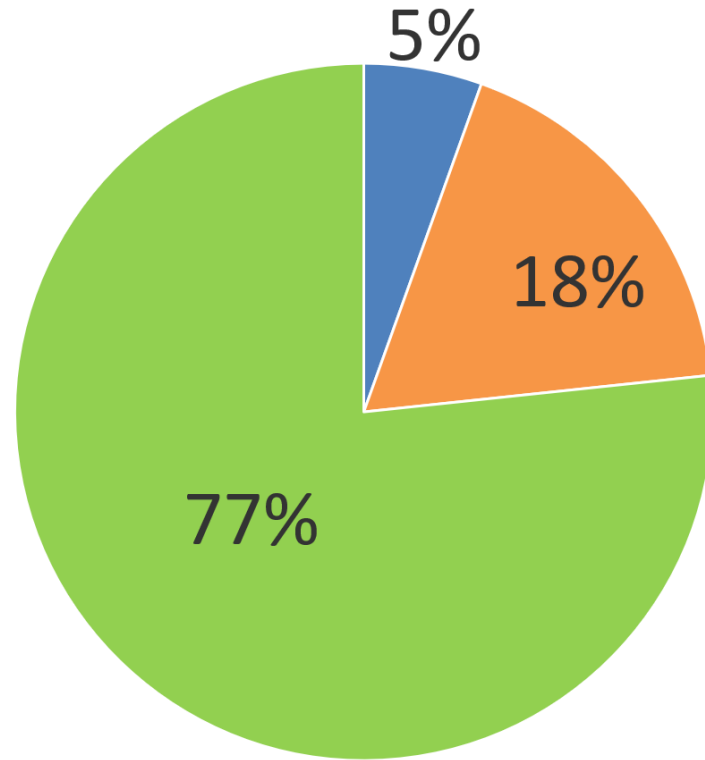
77% CAPTURED & SOLD

18% FLARED DUE TO CHALLENGES OR CONSTRAINTS ON EXISTING GATHERING SYSTEMS

5% FLARED FROM WELL WITH ZERO SALES

\*JUNE 2019 NON-CONF DATA

# Solving the Flaring Challenge



Statewide

**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

June 2019 Data – Non-Confidential Wells



# WHY DO WE FLARE GAS?

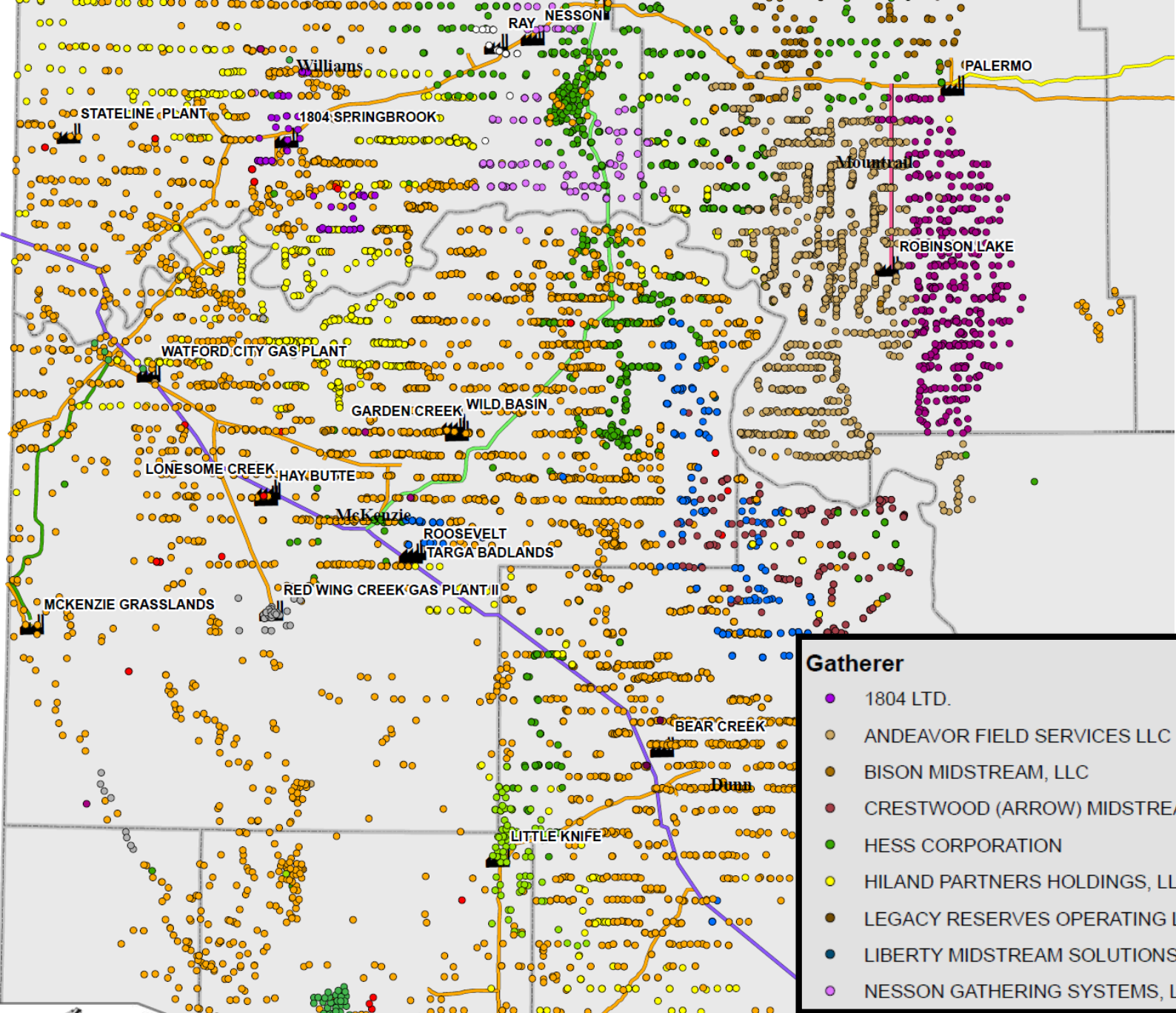
# FACTORS INFLUENCING FLARING IN NORTH DAKOTA TODAY

- No gas gathering pipeline and infrastructure
  - Currently 22% of flared gas in ND is due to stranded production
  - Pipeline is planned, but delayed (permitting, right-of-way approval, weather)
- Maintenance or process disruption
  - Short duration
  - Can be unplanned
  - High natural gas liquid (NGL) content, 8–12 gallons NGL/Mcf
- Gas gathering capacity constraints
  - Pipelines and gas plants take more time than wells
  - High initial production (IP) can exceed capacity during first months of production
  - Location and rate of production is constantly changing

# TECHNOLOGIES TO MITIGATE FLARING



# Natural Gas Gathering Network



Gatherer		PIPELINE	
●	NEXTERA	—	Gas Plant
●	1804 LTD.	—	Alliance
●	ANDEAVOR FIELD SERVICES LLC	—	Aux Sable
●	BISON MIDSTREAM, LLC	●	Bear Paw
●	CRESTWOOD (ARROW) MIDSTREAM	●	Hess
●	HESS CORPORATION	●	Northern Border
●	HILAND PARTNERS HOLDINGS, LLC	●	Whiting
●	LEGACY RESERVES OPERATING LP	●	WBIP
●	LIBERTY MIDSTREAM SOLUTIONS, LLC	●	
●	NESSON GATHERING SYSTEMS, LLC	●	
●	ONEOK ROCKIES MIDSTREAM	●	
●	OTHER	●	
●	PECAN PIPELINE (NORTH DAKOTA) INC	●	
●	PETRO-HUNT, L.L.C.	●	
●	TARGA BADLANDS LLC	●	
○	TRUE OIL LLC	●	
●	USG MIDSTREAM BAKKEN I LLC	●	
●	WESTERN GAS PROCESSORS	○	
○	WHITING OIL AND GAS CORPORATION		



# EERC REMOTE CAPTURE DATABASE

As of August 2019, the EERC's Flaring Solutions database contained 33 companies with technologies in the following categories:

- NGL recovery
- Power production
- CNG or LNG production
- Gas conversion to chemicals or fuels

Approximately 50% of these companies have had units deployed at some point in time.

The screenshot shows a web browser window with the URL [http://www.undeerc.org/flaring\\_solut](http://www.undeerc.org/flaring_solut). The page header includes the EERC logo and the text "Energy & Environmental Research Center". The main heading is "Flaring Solutions Technology – Search". Below this, there is a paragraph explaining the database's purpose: "In order to support Bakken oil producers, the Energy & Environmental Research Center (EERC), is providing this database containing vendor-supplied technical and economic information regarding gas utilization technologies." A disclaimer follows: "Information in the database was entered by vendors, and the EERC makes no claims as to the accuracy of the information. Please direct questions to [Flaring\\_Solutions@undeerc.org](mailto:Flaring_Solutions@undeerc.org)." Another paragraph states: "Information can be queried by technology type and sorted by column. Users can view/print individual records or select multiple records for viewing/printing. To view/print a vendor's uploaded documents, the user must open the document from the file link." The "Filter Results" section shows several checkboxes: "NGL Recovery", "Power Production", "CNG or LNG", "Other Technology", and "Economics", with a "Clear Filter" button. A "VIEW ALL SELECTIONS" button is also present. Below the filters is a table with the following data:

	COMPANY NAME	CONTACT PERSON	NGL	POWER	CNG	OTHER	ECONOMICS	DOCUMENTS
<input checked="" type="checkbox"/>	<a href="#">View</a> AmeriFlare	Wes Livingston	Complete	Complete	Complete	Complete	Complete	1
<input type="checkbox"/>	<a href="#">View</a> Bakken Frontier, LLC	Toby Schweitzer	Complete	Complete	Complete	Complete	Complete	4
<input type="checkbox"/>	<a href="#">View</a> Blaise Energy	Mark Wald	Complete	Complete	Complete	Complete	Complete	1
<input type="checkbox"/>	<a href="#">View</a> BluBox Energy	Jay nance	Complete	Complete	Complete	Complete	Complete	1

At the bottom of the screenshot, the URL [www.undeerc.org/flaring\\_solutions](http://www.undeerc.org/flaring_solutions) is displayed.

# NGL RECOVERY

- Multiple operating principles; 300–5000 Mcfd input capacity
  - Joule–Thomson cooling
  - Mechanical refrigeration
  - Membrane- or sorbent-based separation
- Recovery efficiency of 2–4 gallons NGL/Mcf gas observed in field operations
  - 30%–50% volume reduction, up to 60% reduction in energy content
  - NGLs recovered, stored as a pressurized liquid, and sold
- Residue gas available for power, or CNG/LNG delivery; excess residue gas flared

## Considerations

- Commercially available, mobile, capable of remote operation
- Extract highest-value hydrocarbons, reducing residue gas Btu content
- Increases product storage and truck traffic at production site

# POWER PRODUCTION

- Well site power
  - Generators sized from 100 kW to 5 MW
  - 1 MW power requires approximately 300 Mcfd gas
- Power for drilling rigs and well completions
  - Stranded gas can fuel generators used to power drilling and completions equipment
  - Bi-fuel (diesel and natural gas) and dedicated gas generators
- Companies with mobile data centers seeking low cost electricity
  - Mobilize skid mounted electrical generators and computing equipment
  - Scale of 1-10 MW power demand possible at a well site

## Considerations

- Provides fuel cost savings over diesel when grid power is unavailable
- Expansion of grid infrastructure is expected to displace on-site gas generation
- Low price for power makes economics of grid-interconnect challenging at the wellsite

# TRANSPORTATION FUEL

## CNG/LNG

Possible impact with 500,000-mile/day fleet

- 50,000 gallons diesel/day vs. 5600 Mcf gas/day
- \$90,000/day fuel savings over diesel (at \$2/gal diesel, \$2/Mcf gas)
- <1% reduction in overall flared volume for each 500,000 mile/day fleet

### Considerations

- Fuel cost savings compared to diesel
- Transportation engines require high-purity methane, not easily achievable at small scale.
- Very little infrastructure (refueling stations, fleets) to support natural gas transportation fuel.
- Refueling infrastructure and fleet investment needed

# GAS CONVERSION TO FUELS OR CHEMICALS

Small-scale conversion platforms capable of producing synthetic crude, alcohols, or ammonia-based fertilizer

- Nominal gas use of 25,000 Mcfd for 2500-bbl/day production
- Represents approximately 4% reduction in overall flared volume

## Considerations

- Improved value on energy basis
- Product selection based on regional markets, cost to transport
- Scale selected to match gas supply and product demand
- 2500-bbl/day production requires aggregation of gas from multiple production locations
- Plant footprint, operational staffing, and permitting need to be addressed for remote operation
- Process needs to be tolerant of variable gas quality and quantity

# OPPORTUNITIES FOR IMPROVEMENT

## Additional gas gathering infrastructure

- 28,000 miles of pipe installed since 2008, more planned

## Additional regional demand for gas and NGL

- Transportation fleet conversions
- Investment in petrochemical manufacture, gas conversion to higher value chemicals and fuels

## Advancements in small scale gas use technologies

- Increased efficiency

## Gas injection into geologic formations

- Gas storage
- Enhanced oil recovery from conventional reservoirs
- Pressure maintenance within the Bakken



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A wide-angle photograph of a university campus at sunset. The sun is low on the horizon, casting a warm glow over the scene. In the foreground, there are large trees with some yellowing leaves. In the background, there are several large, multi-story brick buildings, likely university halls or administrative buildings. A parking lot with several cars is visible in the middle ground.

**THANK YOU**

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