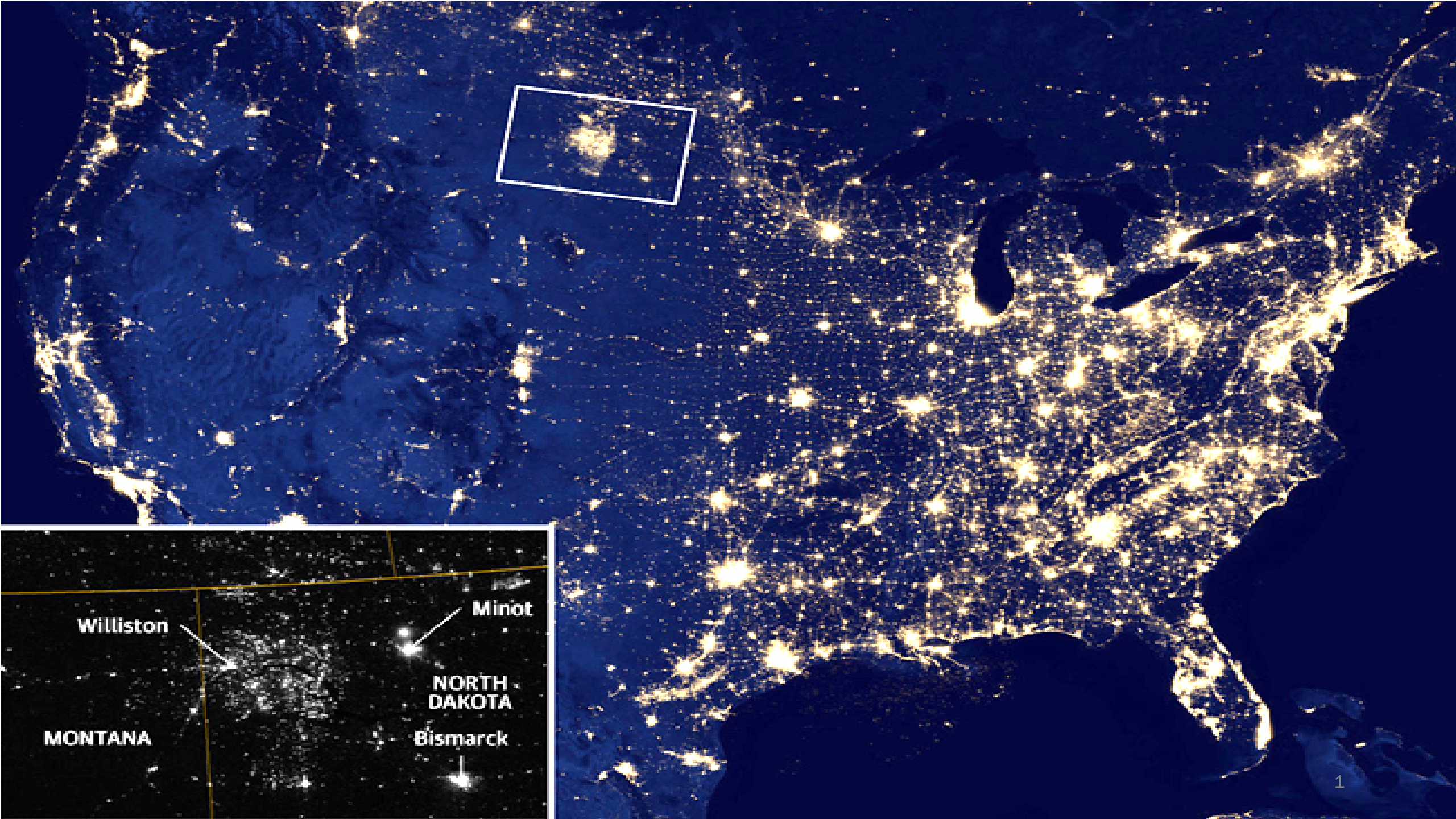

Williston
Minot
NORTH DAKOTA
MONTANA
Bismarck

Bakken Flaring Heats Up

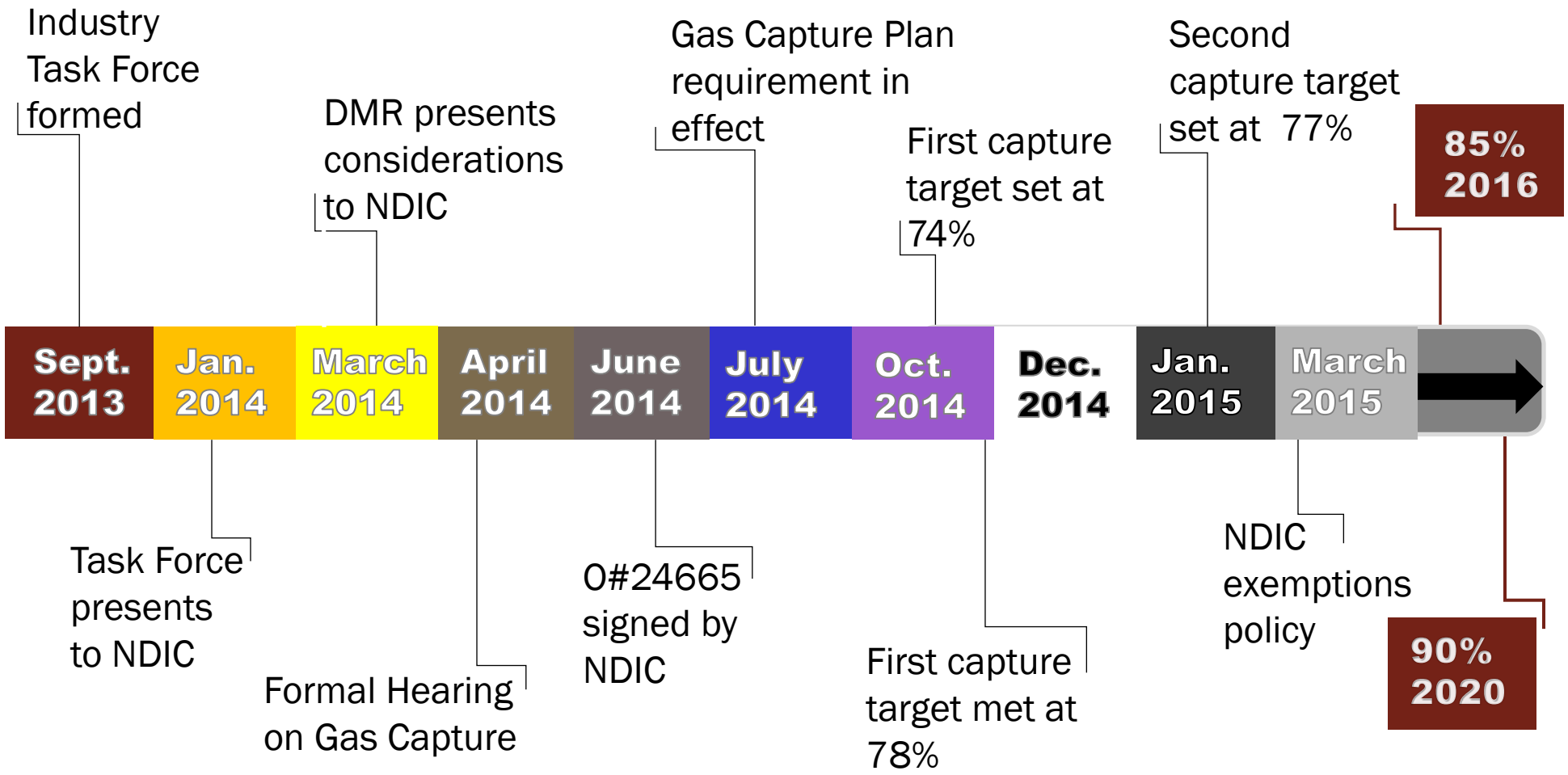
Media Coverage Presses Flaring Issue

- Extensive Media coverage of flaring
  - *2011 – NYT, In North Dakota, Flames of Wasted Natural Gas Light the Prairie*
  - *2012 – WP, Flares on the Horizon*
  - *2013 – NYT Magazine, mentions ND flaring*

  - *2013 – Climate Progress - Report: Emissions From North Dakota Flaring Equivalent To One Million Cars Per Year*

  - *2014 - Industry in North Dakota to Cut Flared Natural Gas*

A Brief History of Everything



Bakken: Venting and Flaring Case Study

February 2016

Woodlands, TX

Eric Dillé

Director of Government Relations

EOG Resources

Overview

- Bakken Resource Play
- Bakken Flaring Information
- Industry Proposed Solution
- Remote Capture Technologies
- IPAA Office of Management and Budget (OMB) meeting
- BLM MT/ND Action
- EPA Action in ND
- What's Next?
- Questions

Bakken Resource Play

The Bakken

- Western North Dakota, northeastern Montana, Saskatchewan and Manitoba
- 15,000 square miles – largest continuous crude oil accumulation in US
- Some companies estimate 24 billion boe potentially recoverable
  - 20 billion barrels oil, 4 billion barrels natural gas
  - USGS estimates 7 billion potentially recoverable boe
- Horizontal drilling and hydraulic fracturing started 2003, refined since
- October 2015 production
  - approximately 1.2 MMbopd oil, 1.7 MMcfd gas


Regina
1
Winnipeg
SASKATCHEWAN
39
MANITOBA
Bakken Formation
Williston
N
Minot A.F.B.
Minot
Glasgow
Grand Forks
NORTH DAKOTA
Sidney
Beulah
Glendive
Bismark
Jamestown
94
Dickinson
Fargo
Williston Basin
Miles City
Missouri River
MONTANA
SOUTH DAKOTA
81
SOURCE: U.S. Bureau of Land
0
mile
100

Bakken Flaring Information

ND Flaring Statistics

- North Dakota Pipeline Authority data
- Entire State
  - Nov 2013 capturing 71% of state gas production, flaring 306 MMCFD
    - 60% is from 216 well sites of 10,000 producing wells
  - Nov 2015 capturing 84%, flaring 266 MMCFD
    - 13,077 producing wells

Key Factors for Flaring

- Shale oil production profile – high surge of initial production followed by steep declines
- Unique Liquids-Rich Gas
- Time Needed to Build Infrastructure & Weather Constraints
- Lateral extent of the Bakken
- Technology Outpaced Production Expectations
- Obtaining easements and ROWs difficult to get pipe to wellhead

Delays to Gas Connection

- **<u>Single Biggest Challenge to connect gas</u>**
  - Securing landowner permission for connection activities – **up to 180 days or longer**
- **Biggest obstacles and time delays**
  - Delays in zoning by counties and townships for midstream facilities
  - Short construction season/weather
  - Limited number of available construction crews
  - Review of permits for natural gas fueled equipment
  - Federal ROW permits

Industry Infrastructure Investment

- Infrastructure investment to capture natural gas
  - Gas gathering – wellhead to plant
  - Plant Processing – stand alone
  - Export capacity for residue gas and natural gas liquids (NGLs)

- <u>2006-2013 $6 Billion, by 2015 over $13 Billion</u>

18,000 miles of gas gathering pipelines

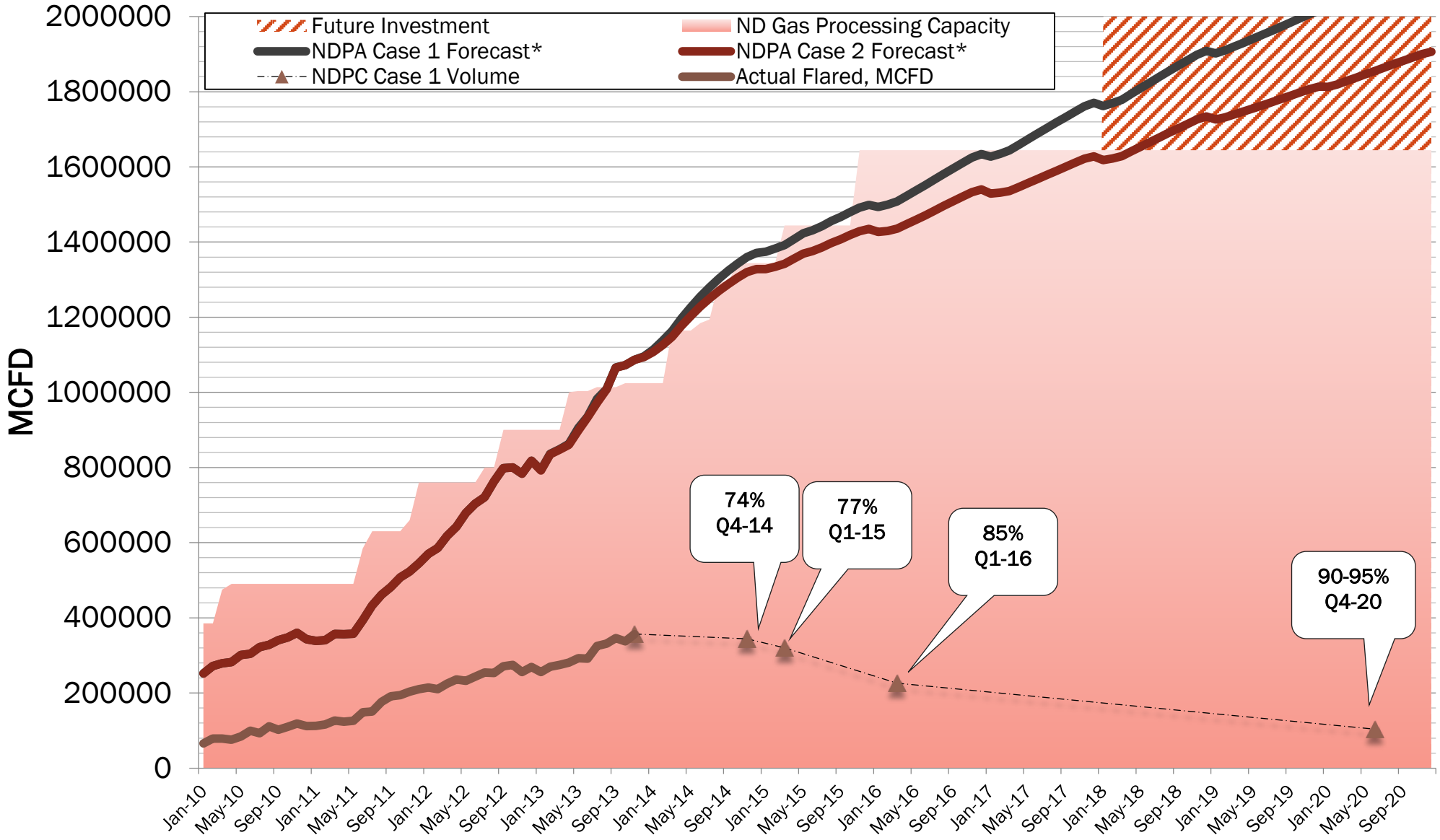
2.0 BCFD of gas processing

3.0 BCFD – residue gas 2.0+ BCFD, NGLs – 150,000 bbls/day

Industry Proposed Solution

Industry Proposed Solution

- ***Voluntary*** gas capture targets based on Midstream build out
  - **Capture 74% by 4th Qtr. 2014**
  - **Capture 77% by 1st Qtr. 2015**
  - **Capture 85% by 1st Qtr. 2016 – 10 month extension to Nov 2016**
  - **Capture 90% by 2020 – need support from all stakeholders to get 95%**
- Gas Capture Plan with every APD to front load gas planning
- Regulate at the state level
- Federal lands – need to be addressed! ROW, BIA, BLM approval times
- Require Midstream pre- and post-construction season update
- Evaluate Remote Capture Technologies - effectiveness, economics



** NDPA Production forecast is for visual demonstration purposes only and should not be considered accurate for any near or long term planning*

New Permit Requirement

- **Gas Capture Plan (GCP)**
  - Forces gas capture planning prior to drilling
  - GCP may include at the discretion of NDIC:
    - Location map gathering system connection, processing plant(s) identified
    - Flowback strategy (rate, duration, plan for multi-well start up)
    - Current system capacity and utilization
    - Time period for connection

Industry Proposed Regulatory Consequences

- <u>At the discretion of NDIC</u>, penalty for failure to comply
  - Failure to submit GCP
    - New wells – suspension or denial of permit
    - Existing wells – curtail production where no detriment to well or reservoir

- <u>Failure to comply with GCP</u>
  - Curtail production
  - Not meeting flowback strategy
  - Mitigating circumstances may allow extension (i.e., economic evaluation, operator's overall capture rate, ROW, safety, weather, work crews, etc.)

IPAA
INDEPENDENT PETROLEUM ASSOCIATION OF AMERICA

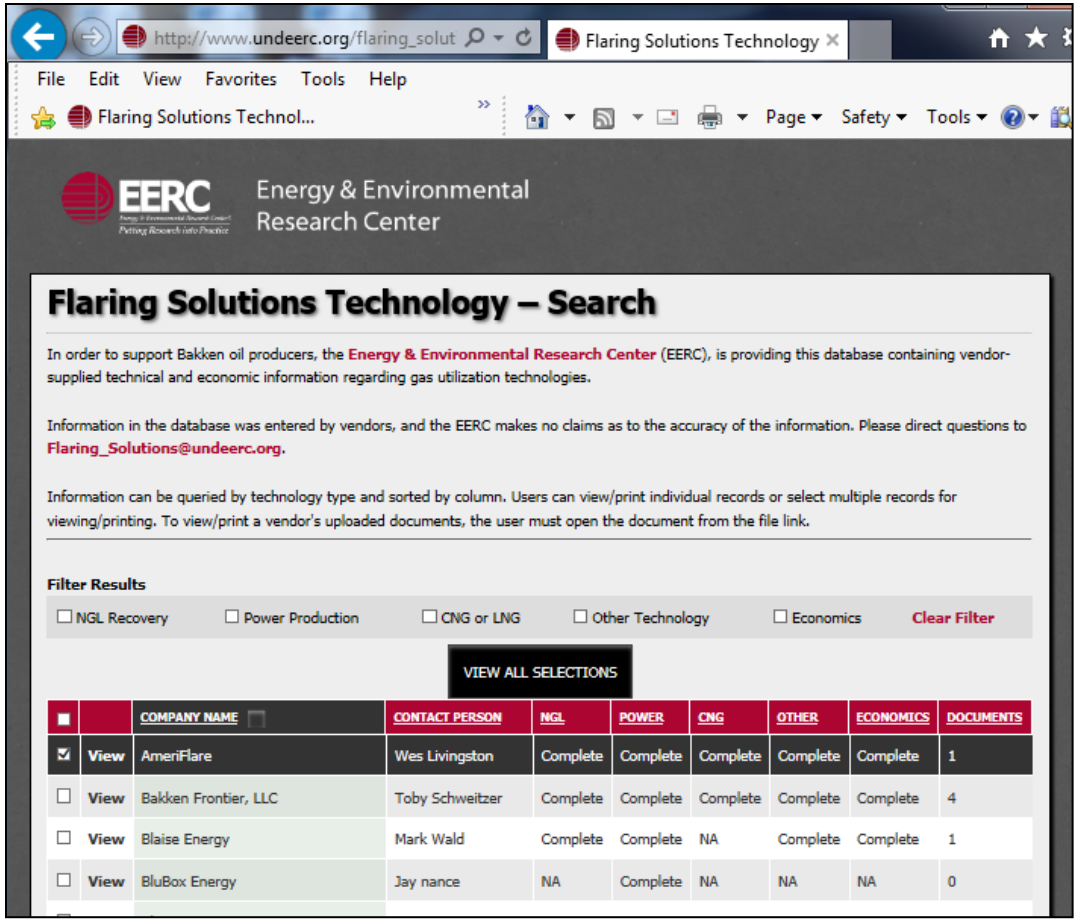
Remote Capture Technologies

Remote Capture Technology Database

As of August 2015, the EERC's Flaring Solutions database contains 63 companies:

- 24 NGL recovery
- 12 power production
- 13 CNG or LNG production for transportation of diesel alternative
- 14 gas conversion to chemicals or fuels

20% of these companies have deployed units



		COMPANY NAME	CONTACT PERSON	NGL	POWER	CNG	OTHER	ECONOMICS	DOCUMENTS
☑	View	AmeriFlare	Wes Livingston	Complete	Complete	Complete	Complete	Complete	1
☐	View	Bakken Frontier, LLC	Toby Schweitzer	Complete	Complete	Complete	Complete	Complete	4
☐	View	Blaise Energy	Mark Wald	Complete	Complete	NA	Complete	Complete	1
☐	View	BluBox Energy	Jay nance	NA	Complete	NA	NA	NA	0

Remote Capture Survey Results

- Survey results based on 75% response from ND operators
- 47 remote capture units operating or being delivered:
  - Nameplate capacity: 92 mmcfd
  - Theoretical capacity: 80 mmcfd (assuming 100% run time)
  - Average run time: 75%–95%
  - Winter run time: 30%+
- Breakeven economics (or better) reported only on larger systems with minimal mobilizations:
  - Capacity of 1000 mcfd or larger
  - Duration longer than 12 months
- Variable and transient gas available for remote capture; secondary to pipeline sales
- Increased land use needed to meet setback requirements
- Frequent equipment mobilization often needed (two or more per year)
- Poor run time reported during cold winter months
- Electrical generators:
  - 242 natural gas generators, 52,000 kW (15,000 mcfd gas use)
  - 268 diesel generators, 70,000 kW (potential 20,000 mcfd gas use)

Remote Capture Impact on Flaring

Remote capture capacity in ND approaching 100 mmcfd, accounting for approximately 6% of total gas production:

- NGL recovery at the wellsite:
  - 60%–80% of remote capture accomplished via NGL recovery
- Power production for site power:
  - 15 mmcfd consumed with gas generators
  - 20 mmcfd consumption achievable by replacing diesel generators
- Few CNG technologies have been deployed in ND; enable off-site delivery of gas to power equipment (drilling rigs, stationary power)
- No gas conversion technologies have been deployed in ND; converting wellhead gas to chemicals or fuels

State's Subsequent Rulemaking

- Public hearing to collect information from all stakeholders
- Developed rule
  - Proposed voluntary capture targets – adopted as fixed limits
  - Proposed regulating at state level – adopted at the company level
  - Gas Capture Plan required
  - CURTAIL PRODUCTION if a ***company*** fails to meet capture targets
    - 200 bopd, then 100 bopd

Feds Get in the Game

- BLM updates multiple Onshore Orders (3,4,5, and 9)
  - No. 9 – Venting and Flaring
    - *"Waste Prevention, Production Subject to Royalties, and Resource Conservation"*
    - Limiting routine gas flaring
    - Pre-Drilling Planning for gas capture
    - Detecting leaks
    - Reducing venting
    - Clarifying and revising royalty rates
- EPA issues rules on OOOO, NSPS, ozone standard

IPAA Meeting with OMB

IPAA Visit to OMB

- IPAA-OMB pre-draft rule meeting February 2, 2015
  - IPAA staff – Lee Fuller, Dan Naatz, Mallori Miller
  - OMB staff and the BLM staffer writing the rule
  - Scheduled 30 mins, went almost 60 mins – OMB was interested
- BLM lacking knowledge of how Industry works – surprising, huh?
  - Shutting in a well – just like a "light switch"
    - No understanding of the complexity of shutting in a well
    - OMB – how many shut in wells never come back, how many 50%, 10%, etc.
  - On location LNG processing is economic
    - Environmental organization says it's economic???
      - If market is within 25 mile trucking radius!!!??
    - BLM had "heard" 50 companies in ND were already doing onsite LNG

BLM ND/MT Action

BLM ND/MT Action on Flaring

- Flaring on BLM jurisdiction lands (includes Tribal lands) becomes a problem
  - Industry submits approximately 1200 flaring sundries using NTL-4A form
  - Sundry asks BLM for a flaring extension
  - BLM stops processing sundries because no royalty payment policy
- Pressure from Tribes to be paid royalties for flared gas
- Pressure on BLM from opposition groups to stop flaring
- BLM ND/MT field office unilaterally writes flaring policy
  - Rule out of ND/MT contradicts NTL-4A, gives BLM authority not authorized by existing regulation
    - BLM can make “avoidable”, “unavoidable” determination and require royalty payment
  - Industry challenged via State Director Review
  - State Director Review due January 19, still pending. May result in withdrawal of the Decision Record or further appeals

EPA Action in North Dakota

EPA Action on Venting in ND

- EPA's National Enforcement Action
  - Issues Section 114 Data Requests to six ND operators
  - Storage Tank Initiative
    - EPA alleges that tanks ordered by companies were incorrectly designed
  - EPA using a FLIR and flawed air model – very conservative, venting model shows much higher venting volumes
  - EPA wants Consent Decree settlement
    - threatening large fines and penalties

EPA Example Settlement

- Noble Energy settlement in Colorado
  - Total cost approx. $73 million for 2382 tanks systems
    - Injunctive Relief ($60 million)
    - Mitigation Measures ($4.5 million)
    - Supplemental Environmental Projects (SEPs) ($4 million)
    - Civil Penalty ($4.95 million)

What's Next?

- BLM and EPA converge on air emissions
- Continued pressure on Industry to get to "zero" emissions
  - Methane rule on existing wells before Administration leaves
- Additional federal venting and flaring requirements on federal APDs
  - Quantification of vented and flared gas - meters
- Royalty payments on flared and vented (?) gas
- EPA Next Generation initiative
  - Shifts burden to regulated entity – information gathering, modeling
  - Remote monitoring – FLIR, handhelds
  - Independent 3rd party verification
  - Posting of data and information for public viewing

Questions?

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