INDUSTRIAL COMMISSION OF NORTH DAKOTA

OIL AND GAS RESEARCH COUNCIL

Brent Brannan, Director
brentbrannan@auroraenergyllc.com

Governor
Kelly Armstrong
Attorney General
Drew Wrigley
Agriculture Commissioner
Doug Goehring

Oil and Gas Research Council
November 9, 2026 – 9 am to 2 pm CT
Department of Mineral Resources, Three Forks Conference Room
1000 East Calgary, Bismarck, ND
or Microsoft Teams
Join the meeting now
Meeting ID: 263 213 652 214 634
Passcode: pK9nH2ne

I. Call to Order & Introductions – Ryan Kopseng

II. Roll Call and Determination of Quorum

III. Consideration of Oct. 17, 2025, Meeting Minutes

IV. North Dakota Pipeline Authority – Justin Kringstad

V. Oil and Gas Research Program Financial Report – Jordan Kannianen

VI. Conflict of Interest Disclosure

VII. Consideration of OGRP Grant Round 63 Applications:

A. **G-63-D: North Dakota Petroleum Foundation Education and Outreach Program;** Submitted by North Dakota Petroleum Foundation; Principal Investigator: Eric Delzer; Project Duration: 23 months; Total Project Cost: $2,906,434; Request for: $1,211,217
1. Technical Peer Reviewers' Ratings/Comments and Applicant's Response
2. OGRP Director's Presentation and Recommendation – Brent Brannan
3. Applicant's Presentation

B. **G-63-B: IPIPE (Intelligent Pipeline Integrity Program)**; Submitted by University of North Dakota Energy & Environmental Research Center; Principal Investigator: Darren Schmidt; Project Duration: 24 Months; Total Project Cost: $6,000,000; Request for: $3,000,000
1. Technical Peer Reviewers' Ratings/Comments and Applicant's Response
2. OGRP Director's Presentation and Recommendation – Brent Brannan
3. Applicant's Presentation

Zac Weis Neil Messer Steve Holen Ryan Kopseng Nathan Anderson
Preston Page David Greef Ron Ness Clint Boyd

C. **G-63-E: Starbuck Thermal-Assisted Waterflooding: Field Research and Demonstration for Broader North Dakota Application;** Submitted by Empire North Dakota, LLC; Principal Investigator: Reinaldo Figuera, M.Sc. Project Duration: 18 months; Total Project Cost: $2,200,000; Total Project Cost: $1,100,000
   1. Technical Peer Reviewers' Ratings/Comments and Applicant's Response
   2. OGRP Director's Presentation and Recommendation – Brent Brannan
   3. Applicant's Presentation

D. **G-63-H: Rewriting the Bakken Playbook: Orthogonal Infill Well Drilling and Diagnostics-Guided Completions to Boost Stimulated Reservoir Volume and Recovery in the Bakken;** Submitted by: SOGC; Principal Investigator: Lee Bartholomew; Project Duration: 24 months; Total Project Costs: $59,974,528; Request for: $6,614,528
   1. Technical Peer Reviewers' Ratings/Comments and Applicant's Response
   2. OGRP Director's Presentation and Recommendation – Brent Brannan
   3. Applicant's Presentation

E. **G-63-L: Extending Well Life and Increasing Oil Production via Casing Gas Recovery;** Submitted by: University of North Dakota Energy & Environmental Research Center; Principal Investigator: Darren Schmidt; Project Duration: 12 Months; Total Project Costs: $877,000; Request for: $438,500
   1. Technical Peer Reviewers' Ratings/Comments and Applicant's Response
   2. OGRP Director's Presentation and Recommendation – Brent Brannan
   3. Applicant's Presentation

F. **G-63-M: Multi-Well Demonstration of Natural Gas Liquids (NGL) Huff-and-Puff Enhanced Oil Recovery in the Bakken Petroleum System;** Submitted by: Energy Transformed (ET4); Principal Investigator: David Szabo; Project Duration: 24 Months; Total Project Costs: $24,600,000; Request for: $4,850,000
   1. Technical Peer Reviewers' Ratings/Comments and Applicant's Response
   2. OGRP Director's Presentation and Recommendation – Brent Brannan
   3. Applicant's Presentation

G. **G-63-N: Maximizing Primary Recovery from Mission Canyon Horizontal Wells Through Selective Inflow Control Technology;** Submitted by: Browning Oil Company; Principal Investigator: Kelly Blackwood; Project Duration: 20 Months; Total Project Costs: $1,344,000; Request for: $672,000
   1. Technical Peer Reviewers' Ratings/Comments and Applicant's Response
   2. OGRP Director's Presentation and Recommendation – Brent Brannan
   3. Applicant's Presentation

H. **G-63-P: Verification and Demonstration of Extiel's Absolute Pyrolysis Technology (APT): Local Production of Sequestration-Ready CO2 for Bakken Enhanced Oil Recovery and Low Carbon-Intensity Hydrogen for Ammonia and Urea from North Dakota Natural Gas and Lignite;**
Submitted by Extiel Technologies; Principal Investigator: Michael O'Brien;
Project Duration: 18 Months; Total Project Costs: $6,000,000;
Request for: $3,000,000
1. Technical Peer Reviewers' Ratings/Comments and Applicant's Response
2. OGRP Director's Presentation and Recommendation – Brent Brannan
3. Applicant's Presentation

VIII. Administration

A. Next NDIC meeting: November 23, 2026
B. Next OGRC Grant Deadline: June 1, 2027

IX. Adjournment

Minutes of a Meeting of the Industrial Commission of North Dakota
OIL AND GAS RESEARCH PROGRAM

Held Oct. 17, 2025, beginning at 9:30 a.m.
Department of Mineral Resources, Bismarck, ND

Voting Members Present
- Neal Messer
- Brent Lohnes
- Preston Page
- Zac Weis
- Steve Holen
- Ron Ness

Non-Voting Members Present
- Nathan Anderson
- Ed Murphy

Also Present
- Chairman Brent Brannen
- Deputy Executive Director Jordan Kannianen
- Brenna Jessen
- Carmen Devney

Others Present: This meeting was open on Microsoft TEAMS, so all other attendees are unknown. Some included Alison Ritter, Matt Belobraydic, Brady Pelton, Dale Patten, Eric Delzer, John Hamling, Tyler Hamman, Joseph Harris, Justin Kringstad, Kevin Black, Nikki Krueger, Kayla Lemieux, Timothy Nesheim, Nick Pysz, Reva Kautz, RKS, Grace Rodwell, Tyler Neether, Nathan Wilkens.

A quorum was present.

Chairman Zac Weis called the meeting of the Oil and Gas Research Council to order at 9:36 a.m. to discuss Grant Round 62.

Ms. Carmen Devney took roll call.

Mr. Eric Gustafson, Senior Policy Advisor for Sen. John Hoeven, gave an overview on ND's energy development and significance. Current efforts are focused on accessing remaining oil reserves in the Bakken, using enhanced oil recovery (EOR) techniques. Chairman Weis thanked Mr. Gustafson and Sen. Hoeven for lobbying for incentives and supporting the state and producers' efforts.

Mr. Kyle Haustveit, Assistant Secretary of Fossil Energy, U.S. Department of Energy, provided remarks about commonsense mandates that will produce more oil and gas in the Bakken, and ultimately produce affordable and reliable energy. Partnering with the State and U.S. Department of Energy to support scalable pilot projects is the key to extracting more from the Bakken.

Mr. Jordan Kannianen gave a presentation of the Oil and Gas Research Program Financial and Project Management Report. The cash balance as of Oct. 17, 2025, was $23,667,315.77, and the uncommitted cash funding is $7,658,493.86. Within the Industrial Commission budget, Senate Bill 2014 authorized $25,000,000 to be earmarked for EOR, so the total amount of uncommitted funds currently available is more than $32 million. There are currently 12 active projects with $15 million committed.

Mr. Brent Brannan reported Grant Round 62 was extremely competitive. The following grants, all of which proposed EOR pilot projects, were considered.

1. **G-062-I entitled, "Bakken Production Optimization Program (BPOP) 5.0,"** was submitted by the Energy and Environmental Research Center (EERC). The EERC project continues the research and success of former pilot projects to optimize petroleum production in North Dakota. BPOP-5.0 is a collaborative effort among the State of North Dakota, the petroleum industry, and the United States. James Sorensen, Director of Subsurface Research and Development for EERC, provided a high-level overview. The term of the project is two years. The Total Project Cost is $12,030,206. The grant request is $6,000,000.

   The project was previously reviewed by Technical Reviewers. At the discretion of the Director, it was recommended to fund the project in the amount of $4,000,000.

2. **G-062-L entitled, "Large-Scale Hydrocarbon Gas Injection EOR Pilot to Inform Future CO_2 EOR in the Bakken,"** was submitted by Chord Energy, in partnership with the EERC. Chord's project objective is to demonstrate a pathway toward commercial-scale deployment of Bakken EOR for hydrocarbon and CO_2 injectates. Arvo Buck provided a high-level overview. The term of the project is two years. The Total Project Cost is $38,632,967. The grant request is $13,998,200.

   The project was previously reviewed by Technical Reviewers. At the discretion of the Director, it was recommended to fund the project in the amount of $13,298,290.

3. **G-062-O: "Proposal for Surfactant-Based EOR Pilot Testing Program, Bakken-Three Forks Fms., Williston Basin, ND,"** was submitted by Devon Energy Corporation. Devon's project objective is to increase oil recovery by mobilizing residual hydrocarbons, optimize operational parameters, and provide a scalable blueprint for broader EOR deployment in North Dakota. Brad Musgrove, Williston Basin Asset Manager, provided a high-level overview. The term of the project is two years. The Total Project Cost: $3,370,000. The grant request is for $1,535,000.

The project was previously reviewed by Technical Reviewers. At the discretion of the Director, it was recommended to fund the project in the amount of $1,458,250.

4. **G-062-H: "Enhanced Oil Recovery and Advanced Completion Design for Tight Carbonate Reservoirs in Western North Dakota,"** was submitted by Cobra Oil & Gas Corporation. The project objective is to investigate and demonstrate EOR potential of the Stoneview-Stonewall Unit, increase oil recovery, and provide baseline operational EOR and completion strategies for oil production from tight carbonate reservoirs. Kyle Gardner, Vice President of Cobra, presented a high-level overview. The term of the project is 21 months. The Total Project Cost: $10,000,000. The grant request is for $5,000,000.

   The project was previously reviewed by Technical Reviewers. At the discretion of the Director, it was recommended to fund the project in the amount of $4,000,000.

5. **G-062-N: "A Multi-Well, Multi-Zone Enhanced Oil Recovery Project Utilizing Produced Natural Gas in Williams County- Durant Pad,"** was submitted by Continental Resources. The project objective is to evaluate the potential of Intermittent Gas Injection EOR to unlock resources remaining in the Bakken and Three Forks formation after primary development. Dave Ratcliff presented a high-level overview. The term of the project is two to four years. The Total Project Cost is $29,918,810. The grant request is $9,836,905.

   The project was previously reviewed by Technical Reviewers. At the discretion of the Director, it was recommended to fund the project in the amount of $9,345,059.75

6. **G-062-M: "Williston Basin Resource Optimization: Large-Scale Miscible Gas Huff n Puff EOR Pilot in Continental's Dunn County Acreage - Roadrunner/Clover Pad,"** was submitted by Continental Resources. The project's objective is to evaluate and optimize gas cyclic gas injection, and, if necessary, test innovative technologies such as gas-foam cycling, to enhance gas injection conformance. Dr. Jose Jaghloul, reservoir engineering advisor, presented a high-level overview. The term of the project is 42 months. The Total Project Cost is $26,889,228. The grant request is $8,771,905.

   The project was previously reviewed by Technical Reviewers. At the discretion of the Director, it was recommended to fund the project in the amount of $8,333,905.

The North Dakota Industria Commission received 14 grant applications for this grant cycle. The six grants that were moved forward to Council review focused on EOR. The members discussed the remaining grant applications and funding available for a future cycle.

A motion was made by Mr. Ron Ness to approve the funding of the projects in the amounts requested, based on the expectation by industry and the EERC that federal funds from the Department of Energy may be received by April 1, 2026, with a contingent plan that if federal funding is not available by that time, project G-062-I (BPOP) would receive a reduction in

funding of $1,000,000, and the remaining five grant applications would receive a five-percent reduction in funding. Mr. Neil Messer seconded the motion.

G-062-I: "Bakken Production Optimization Program (BPOP) 5.0" EERC: $6,000,000

G-062-L: "Large-Scale Hydrocarbon Gas Injection EOR Pilot to Inform Future CO2 EOR in the Bakken" Chord Energy: $13,998,200

G-062-O: "Proposal for Surfactant-Based EOR Pilot Testing Program, Bakken – Three Forks Formations, Williston Basin, ND" Devon: $1,535,000

G-062-H: "Enhanced Oil Recovery and Advanced Completion Design for Tight Carbonate Reservoirs in Western North Dakota" Cobra Oil & Gas Corp.: $5,000,000

G-062-N: "A Multi-Well, Multi-Zone Enhanced Oil Recovery Project Utilizing Produced Natural Gas in Williams County – Durant Pad" Continental Resources: $9,836,905

G-062-M: "Williston Basin Resources Optimization: Large-Scale Miscible Gas Huff n Puff EOR Pilot in Continental's Dunn County Acreage – Roadrunner/Clover Pad" Continental Resources: $8,771,905

Mr. Steve Holen stated the six pilot projects presented were the best projects the Council has seen to this point, and it is justifiable to invest at this high level.

Conflict of Interest forms were distributed. A few members disclosed potential conflicts. A motion was made to allow them to vote. Members abstained or voted, and the motion carried.

On a roll call vote to fund the six grant projects, all Council members voted a unanimous "Aye," and the motion passed. The projects will be moved forward for consideration at the meeting of the North Dakota Industrial Commission, scheduled for Monday, Oct. 27, 2025.

With no further business, Chairman Brent Brannan adjourned the meeting at 2:35 p.m.

Carmen Devney, Recording Secretary

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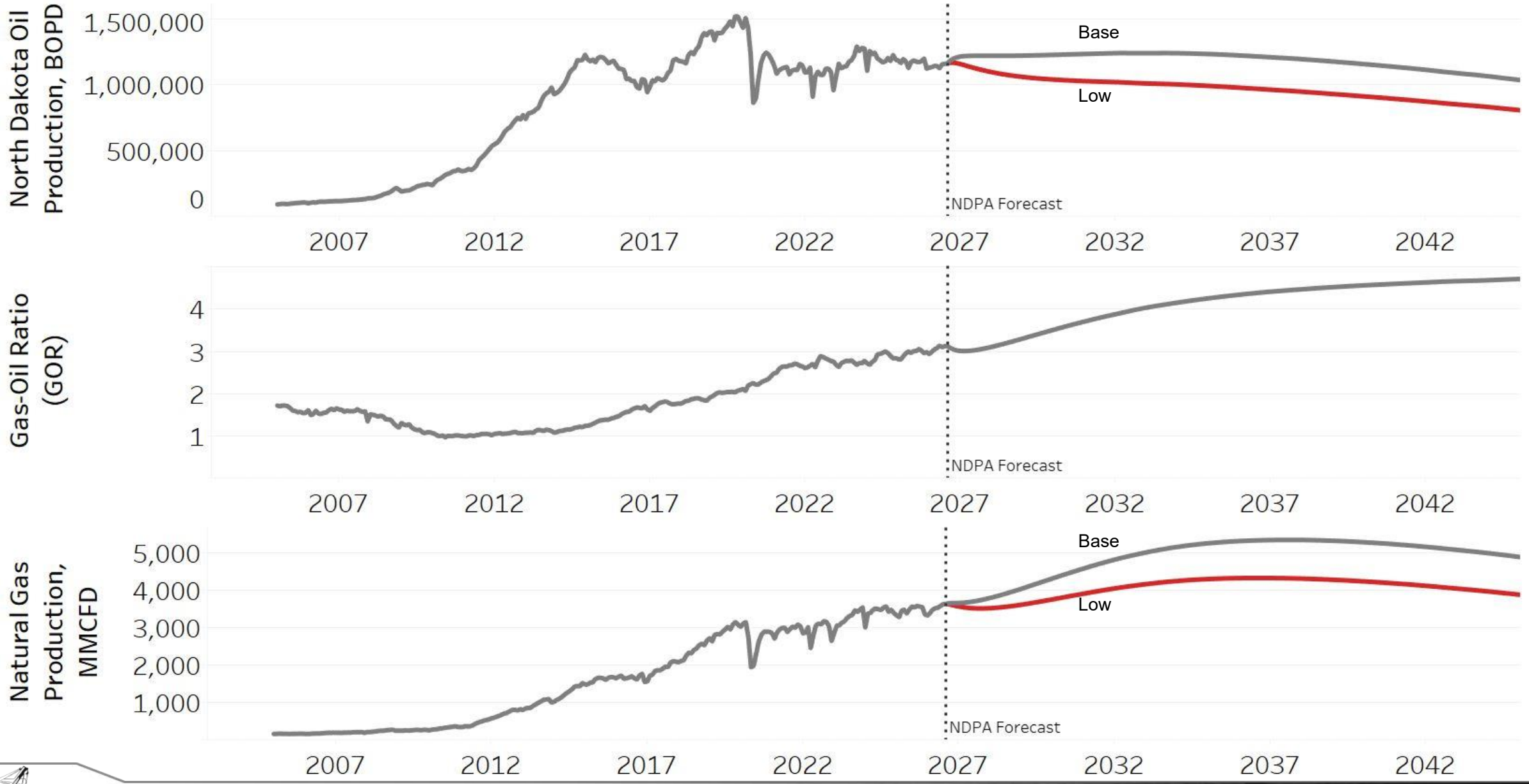
Brent Brannan, Program Director

North Dakota Midstream Update

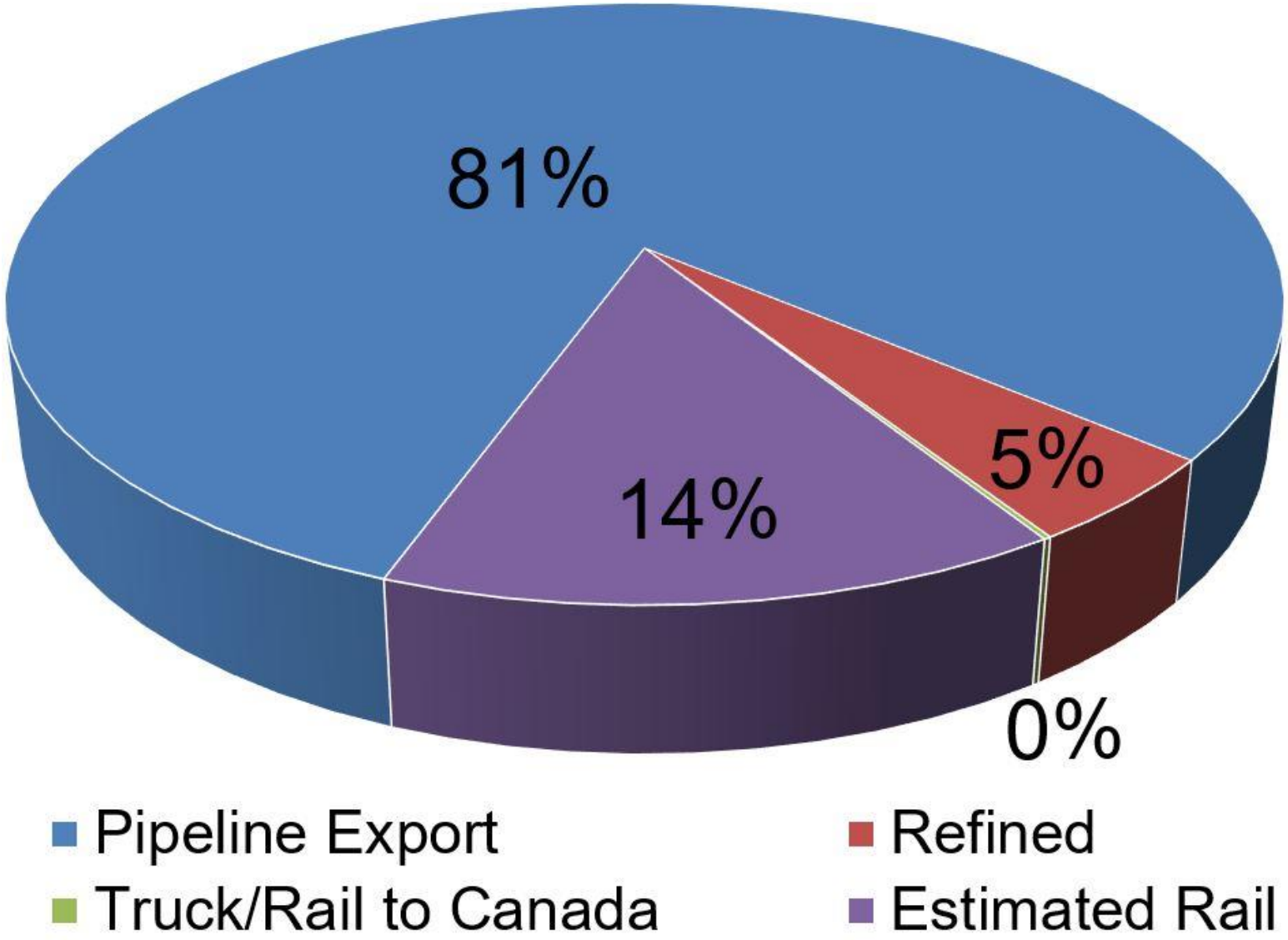


Image: Library of Congress

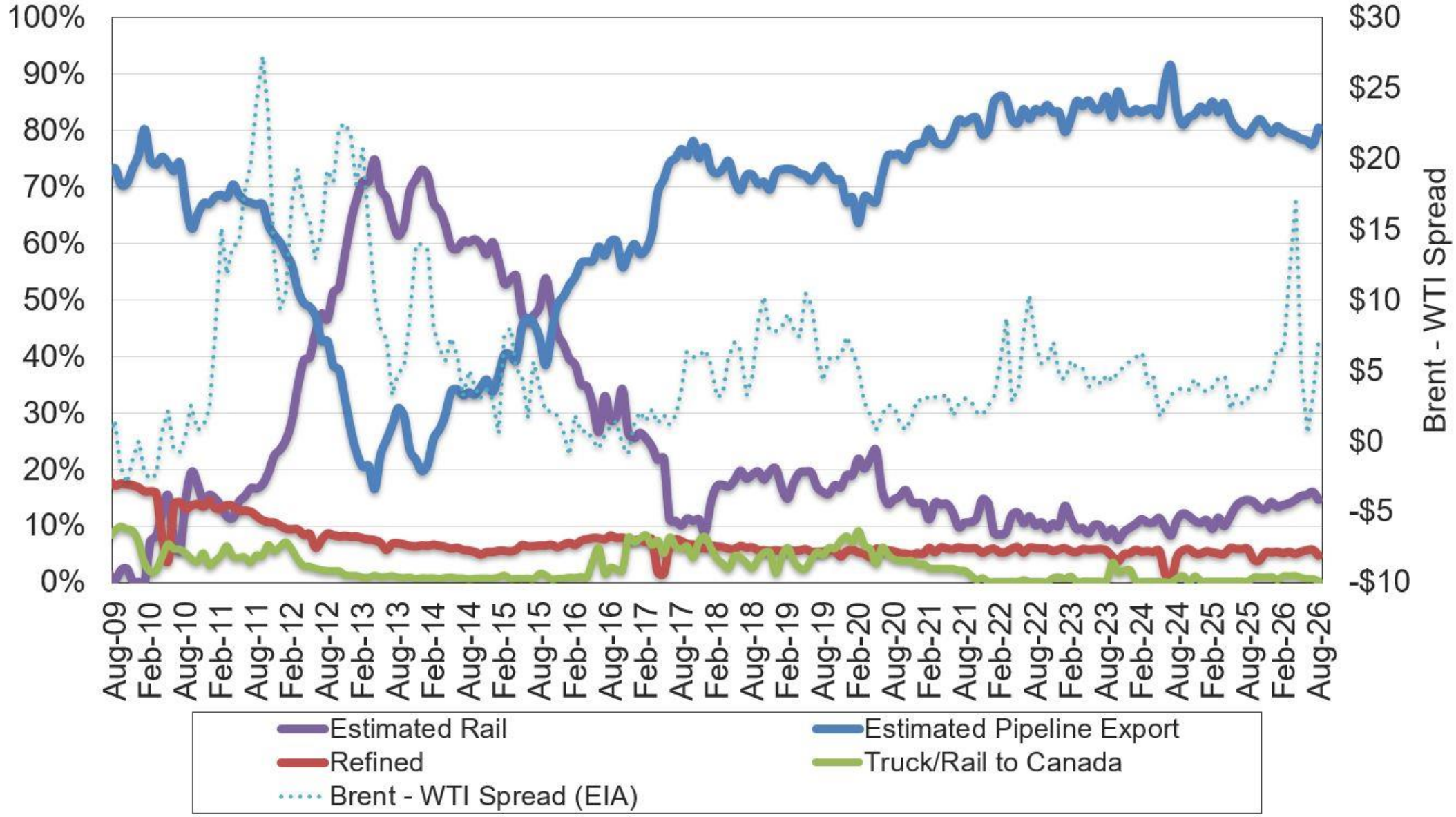
ND Production Forecast: EIA Price Deck



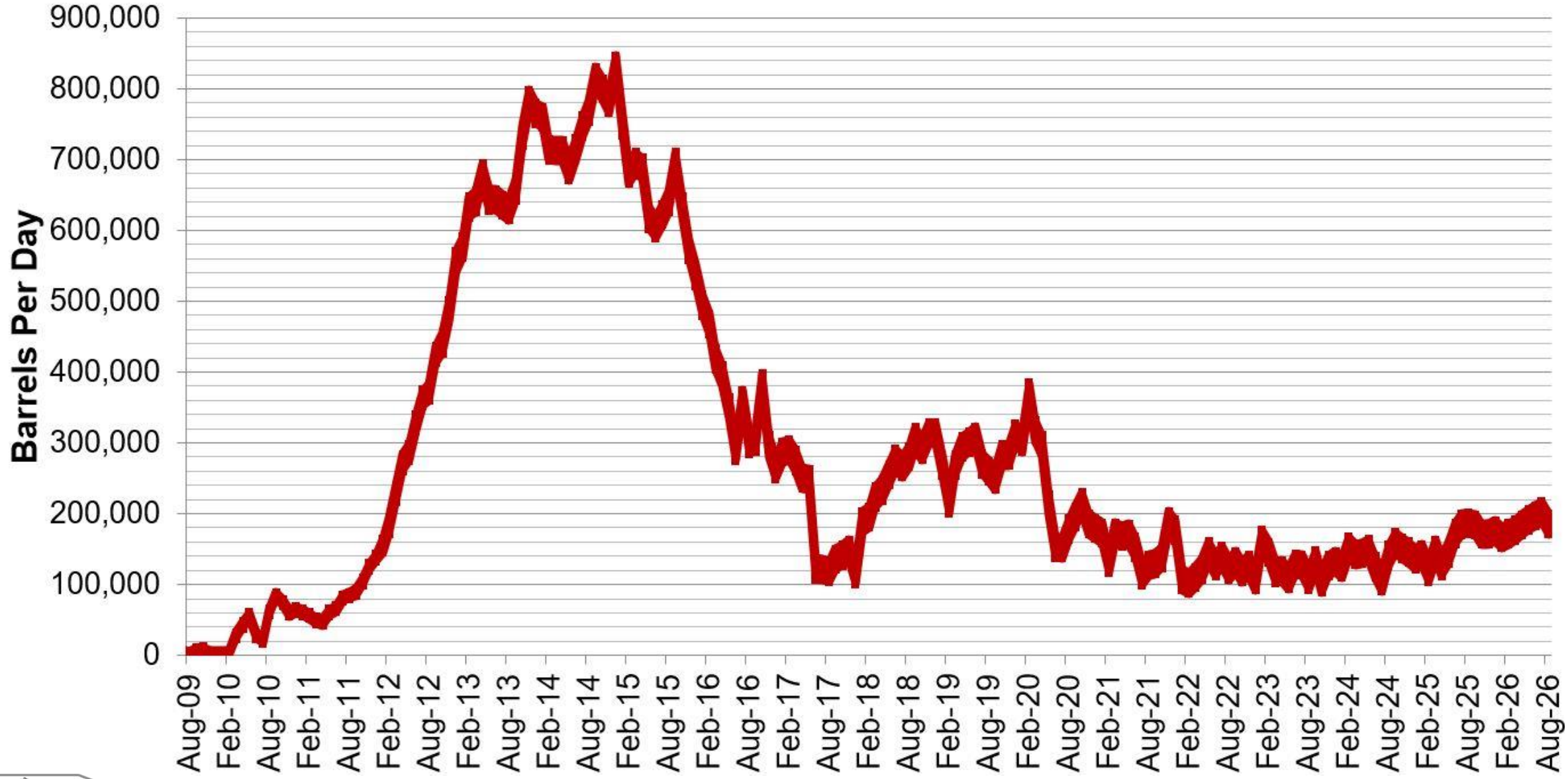
Estimated Williston Basin Oil Transportation



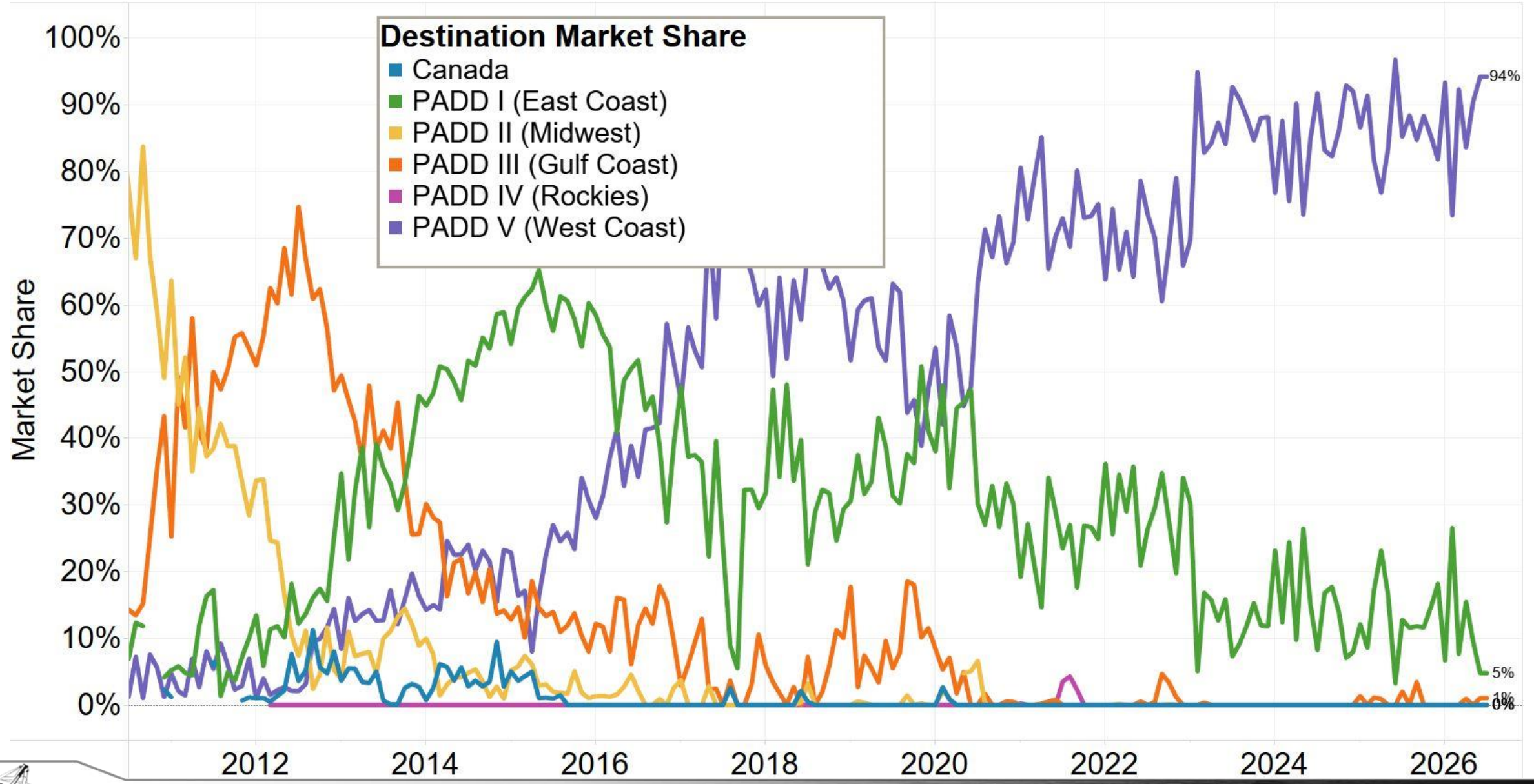
Estimated Williston Basin Oil Transportation



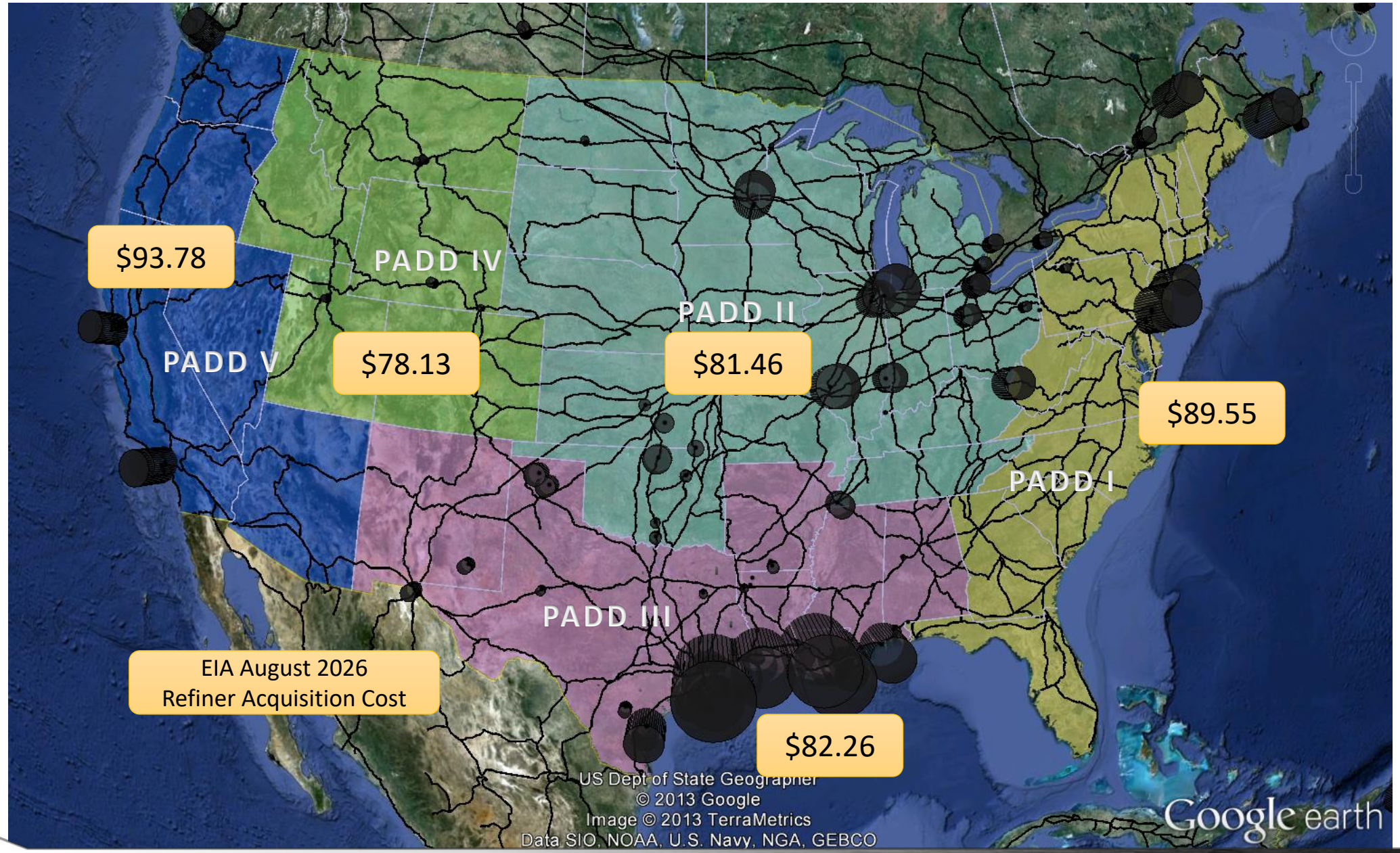
Estimated ND Rail Export Volumes



Rail Destinations Market Share (July 2026)



Major Rail Lines and Refineries



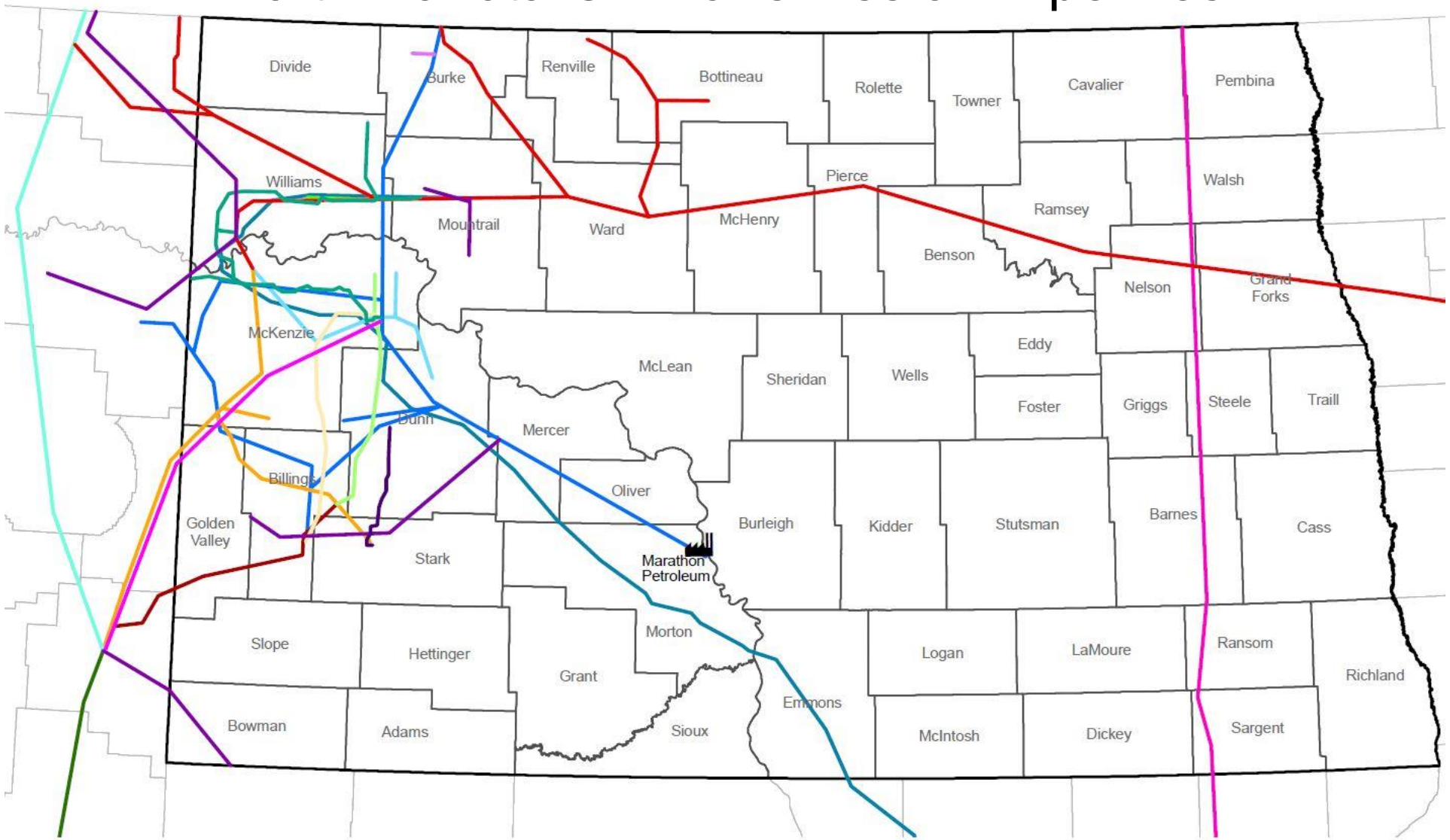
Average North Dakota Oil “Discount” to WTI



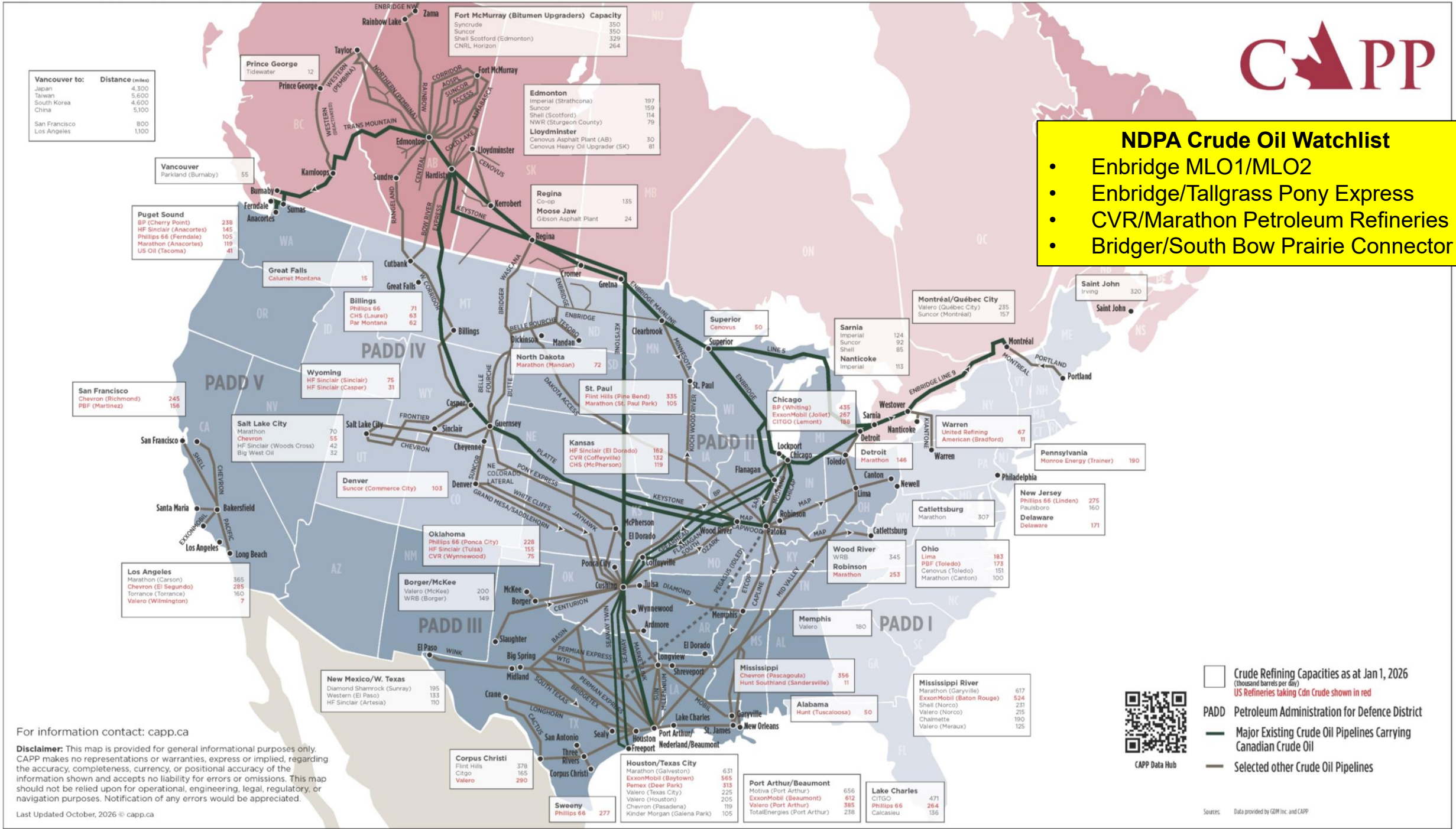
Last Five Years Annual Average



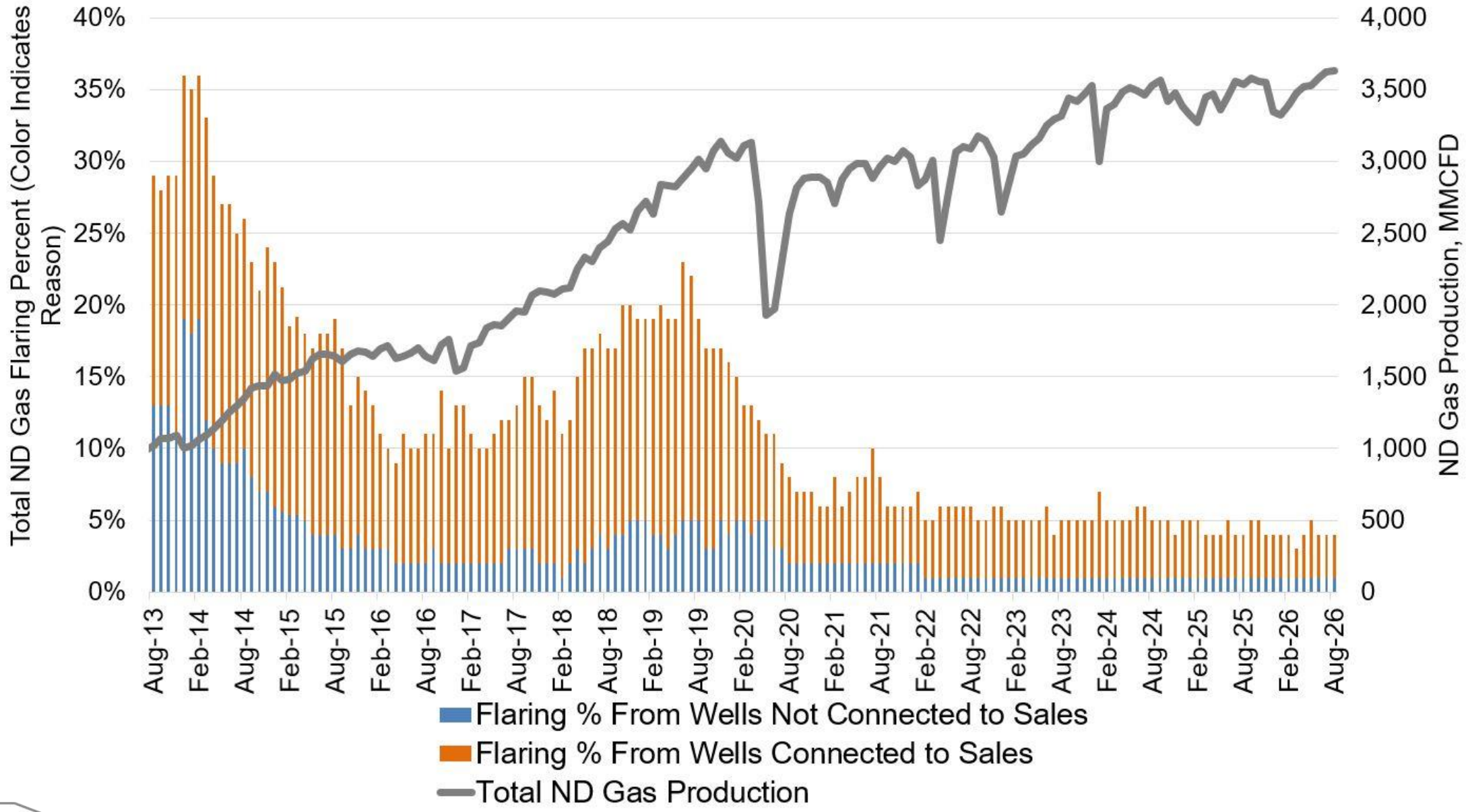
North Dakota Oil Transmission Pipelines



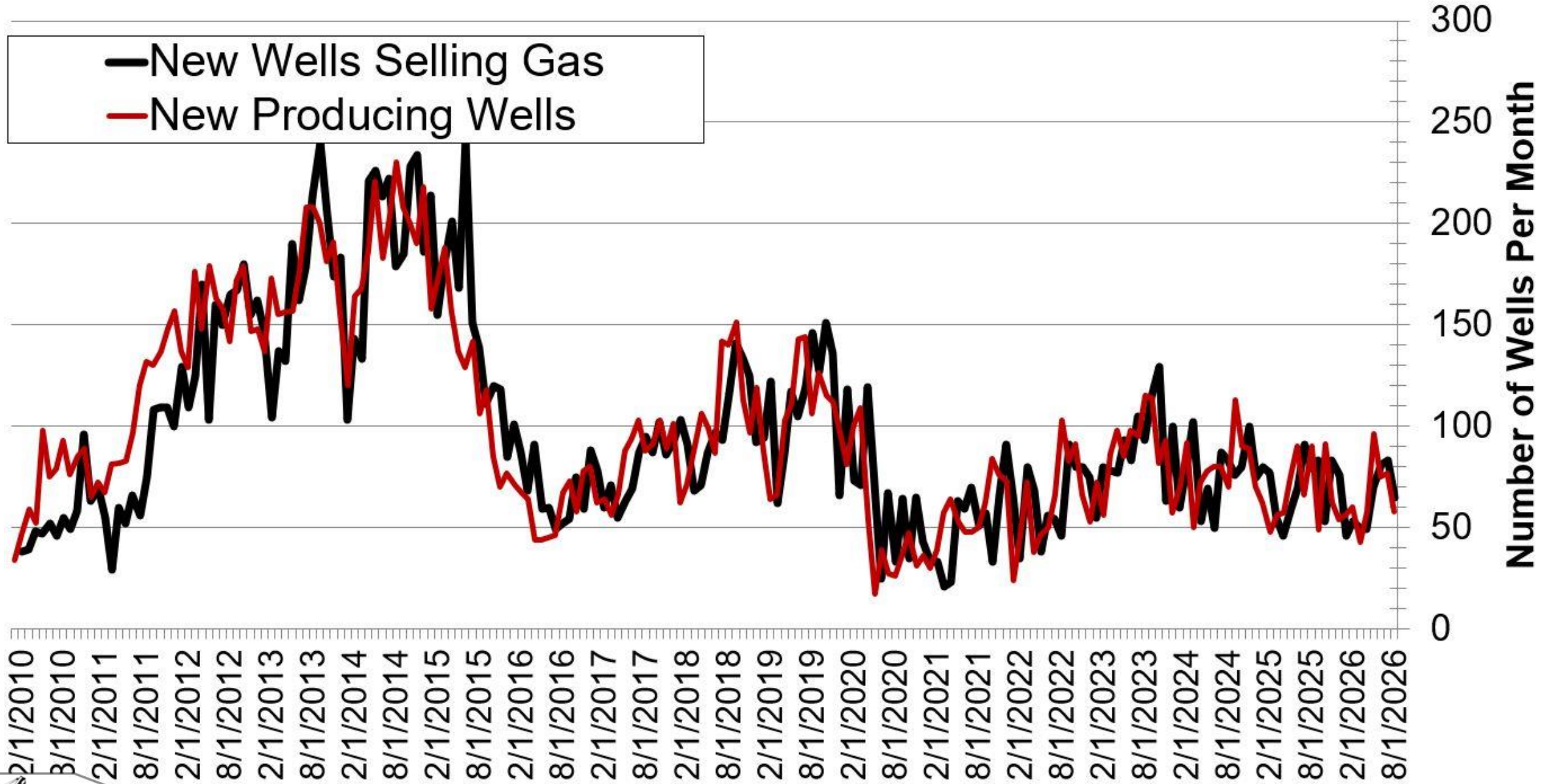
CANADIAN AND U.S. CRUDE OIL PIPELINES AND REFINERIES 2026



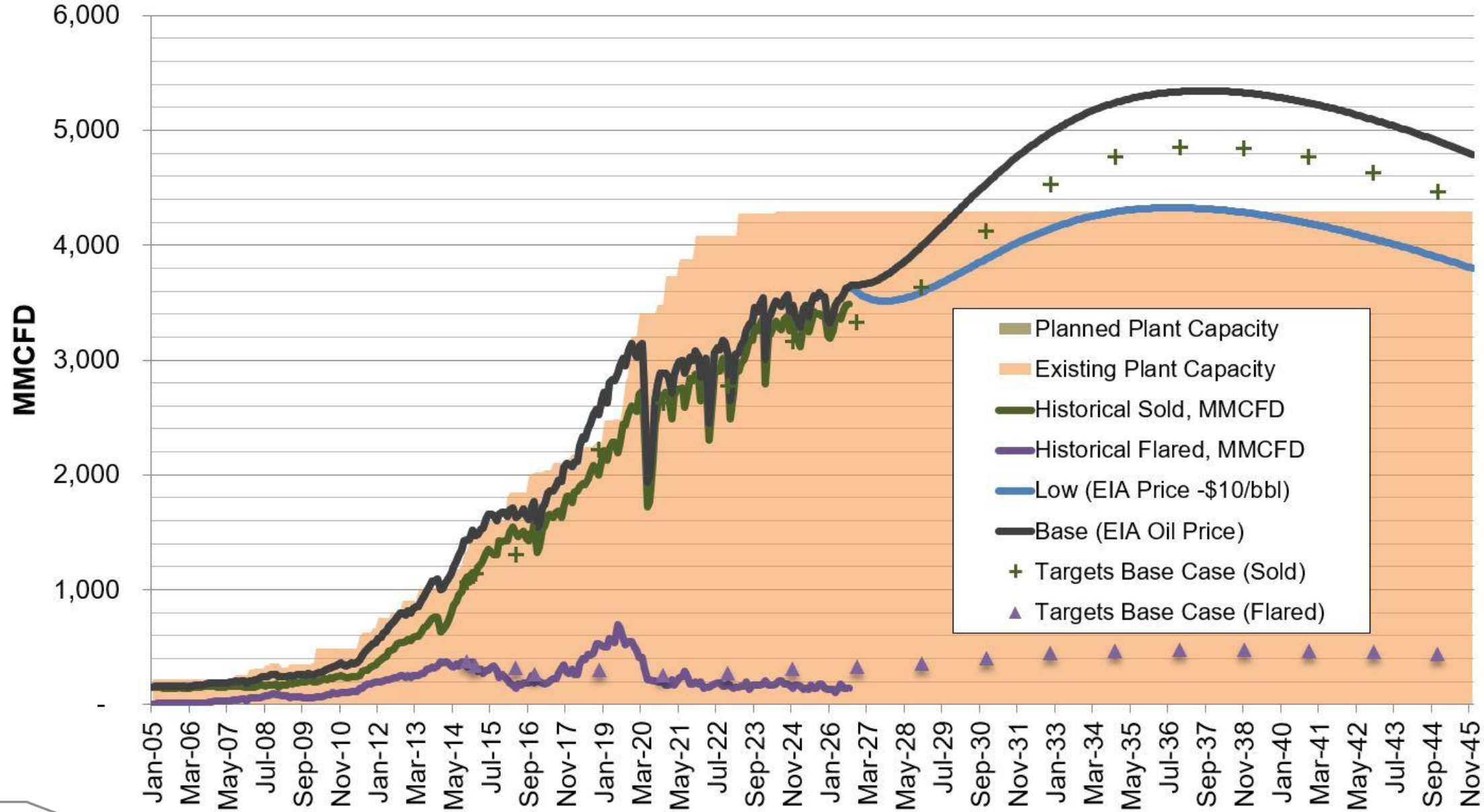
Solving the Flaring Challenge



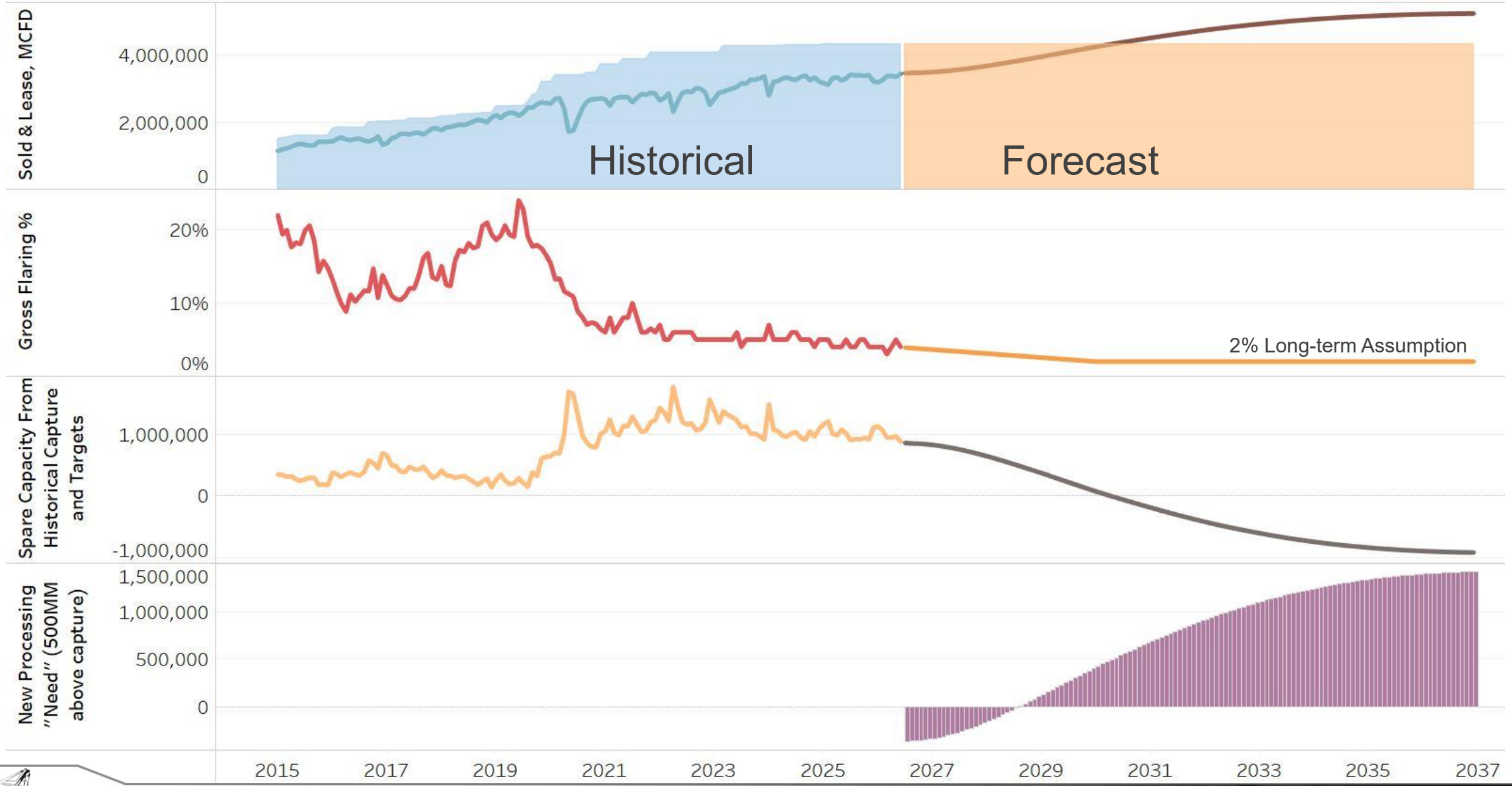
Solving the Flaring Challenge



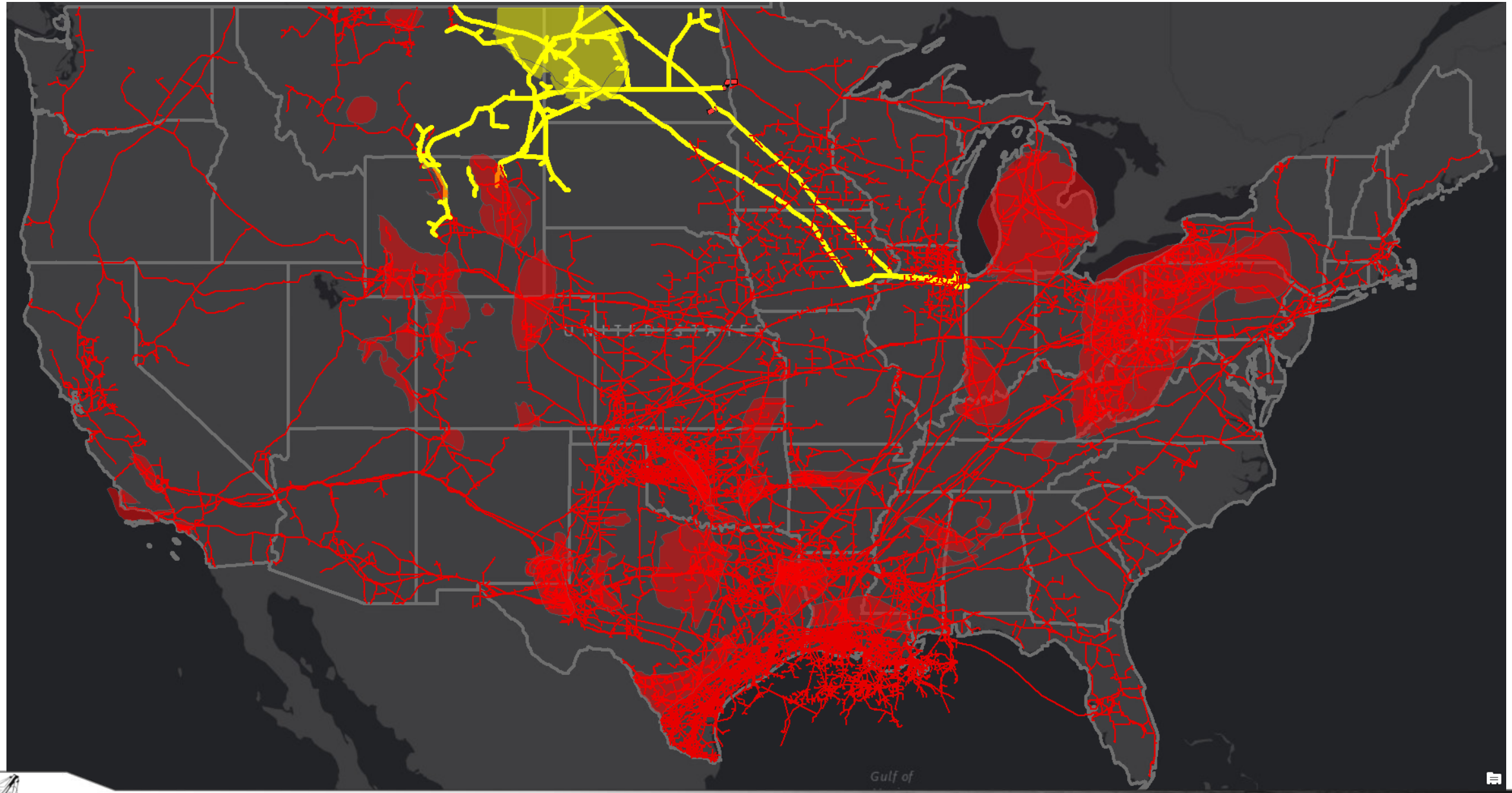
North Dakota Gas Processing Outlook



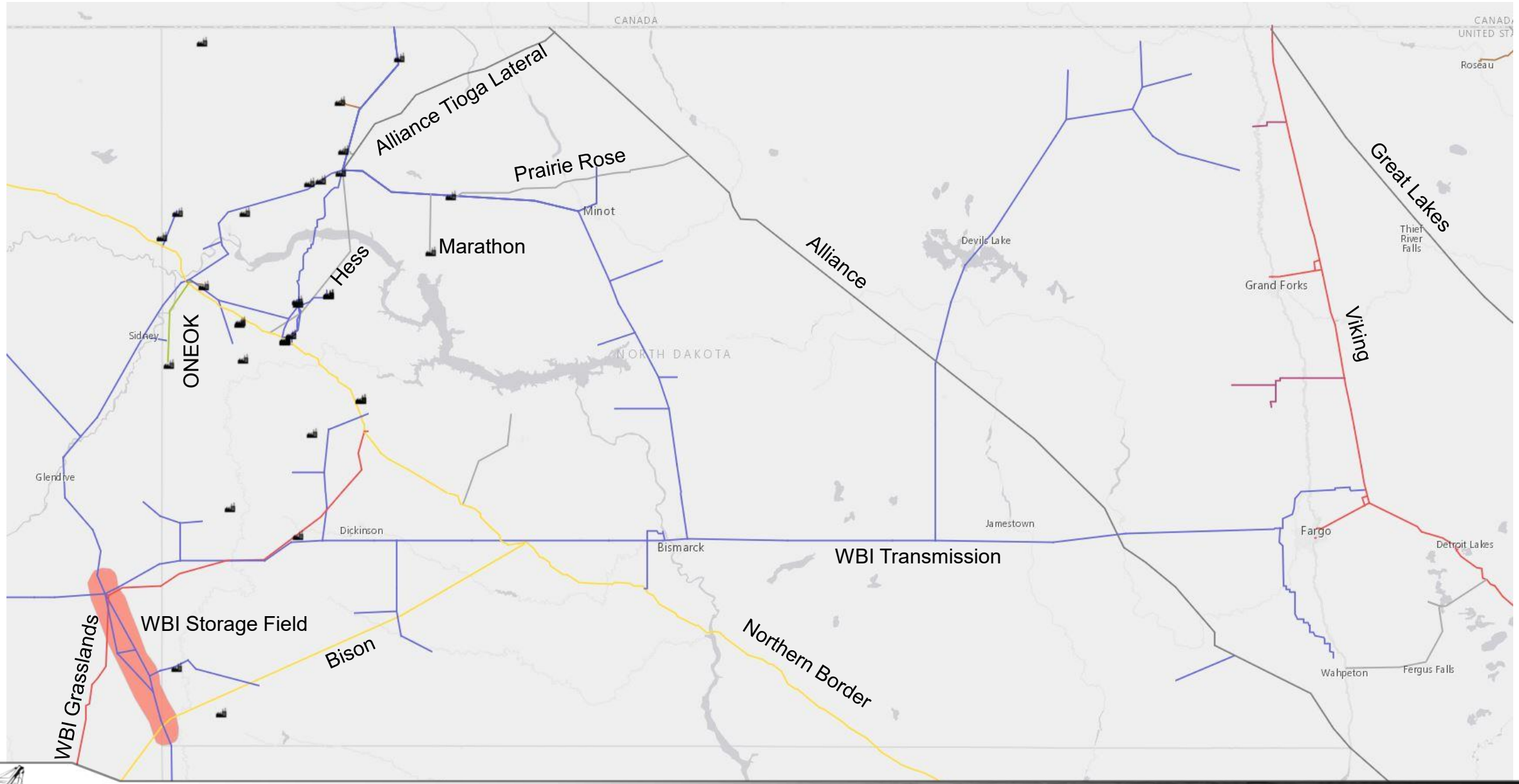
Gas Processing Capacity & Spare Capacity*



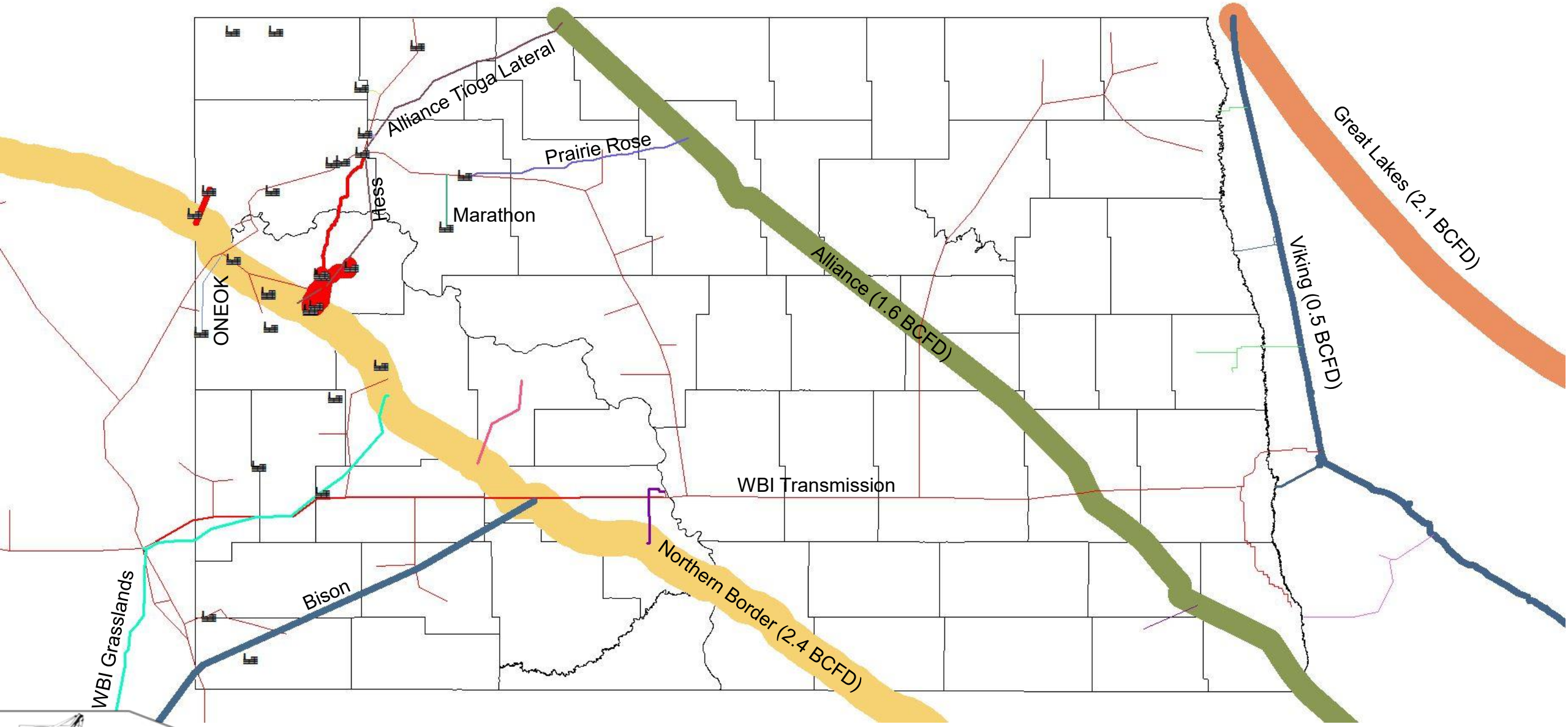
Bakken Natural Gas Infrastructure



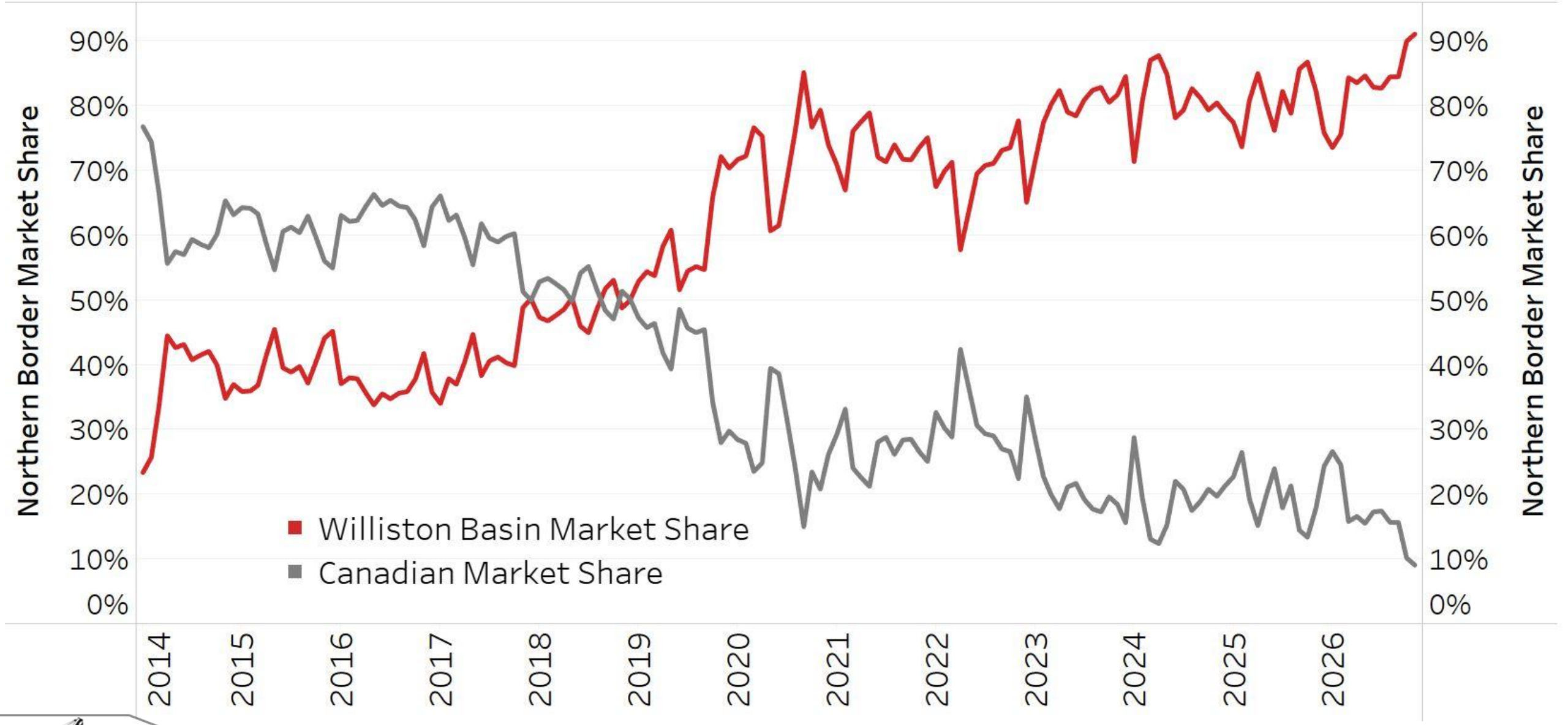
Major Residue Gas Pipeline Infrastructure



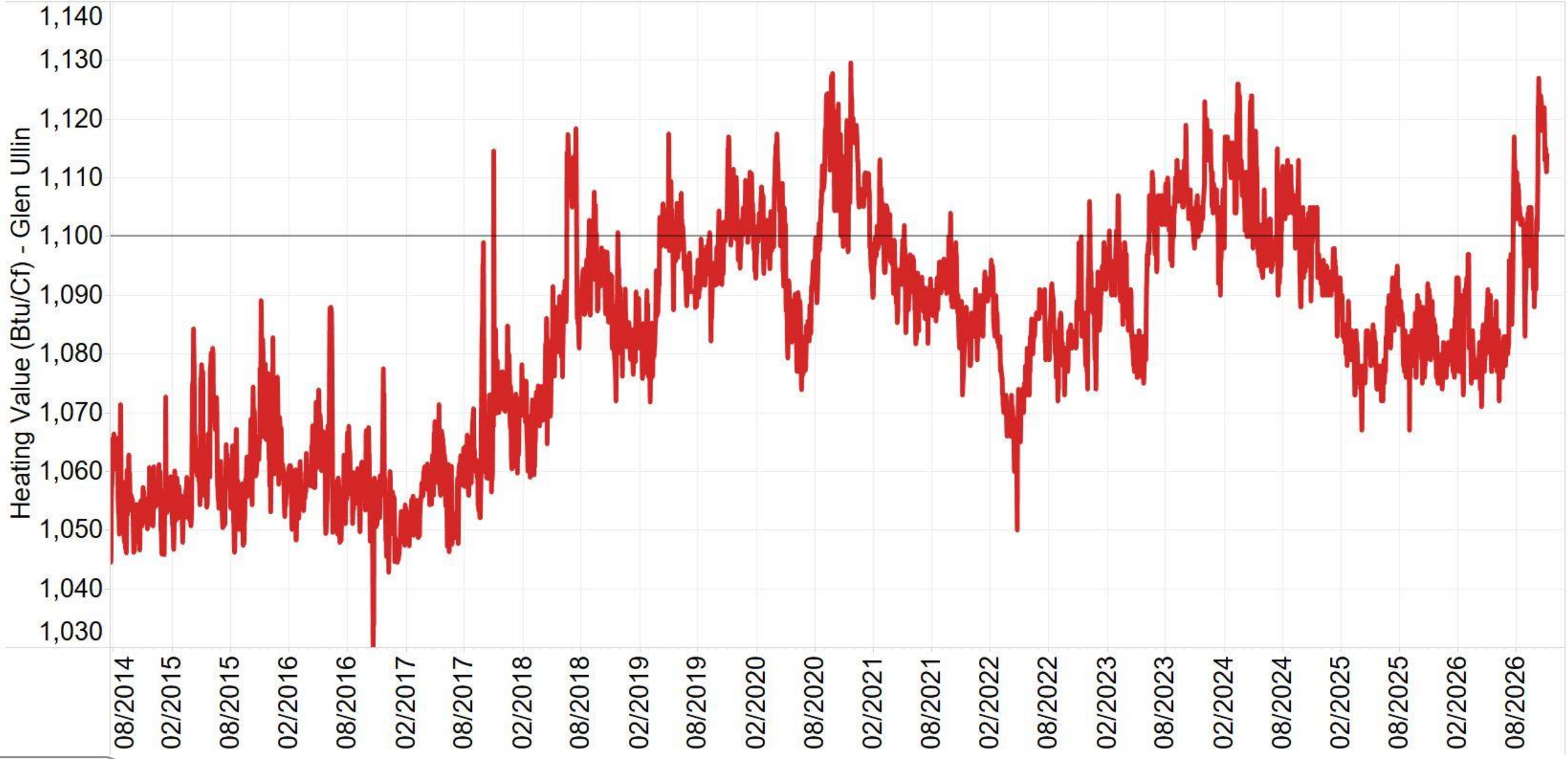
Residue Gas Pipeline Capacity Visualization



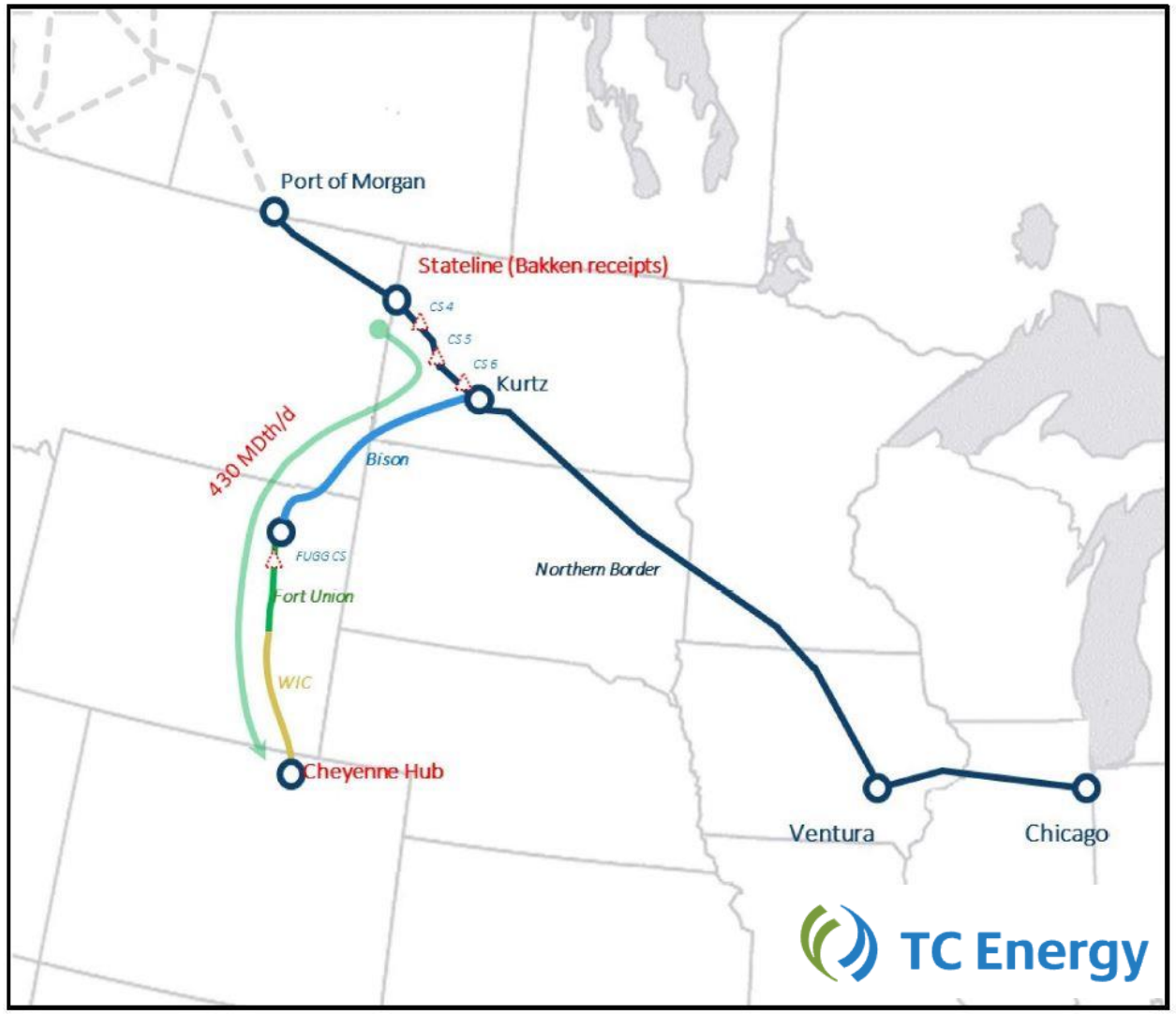
Northern Border Pipeline Market Share



Northern Border BTU at Glen Ullin, ND



TC Energy / Kinder Morgan: Bakken xPress Project



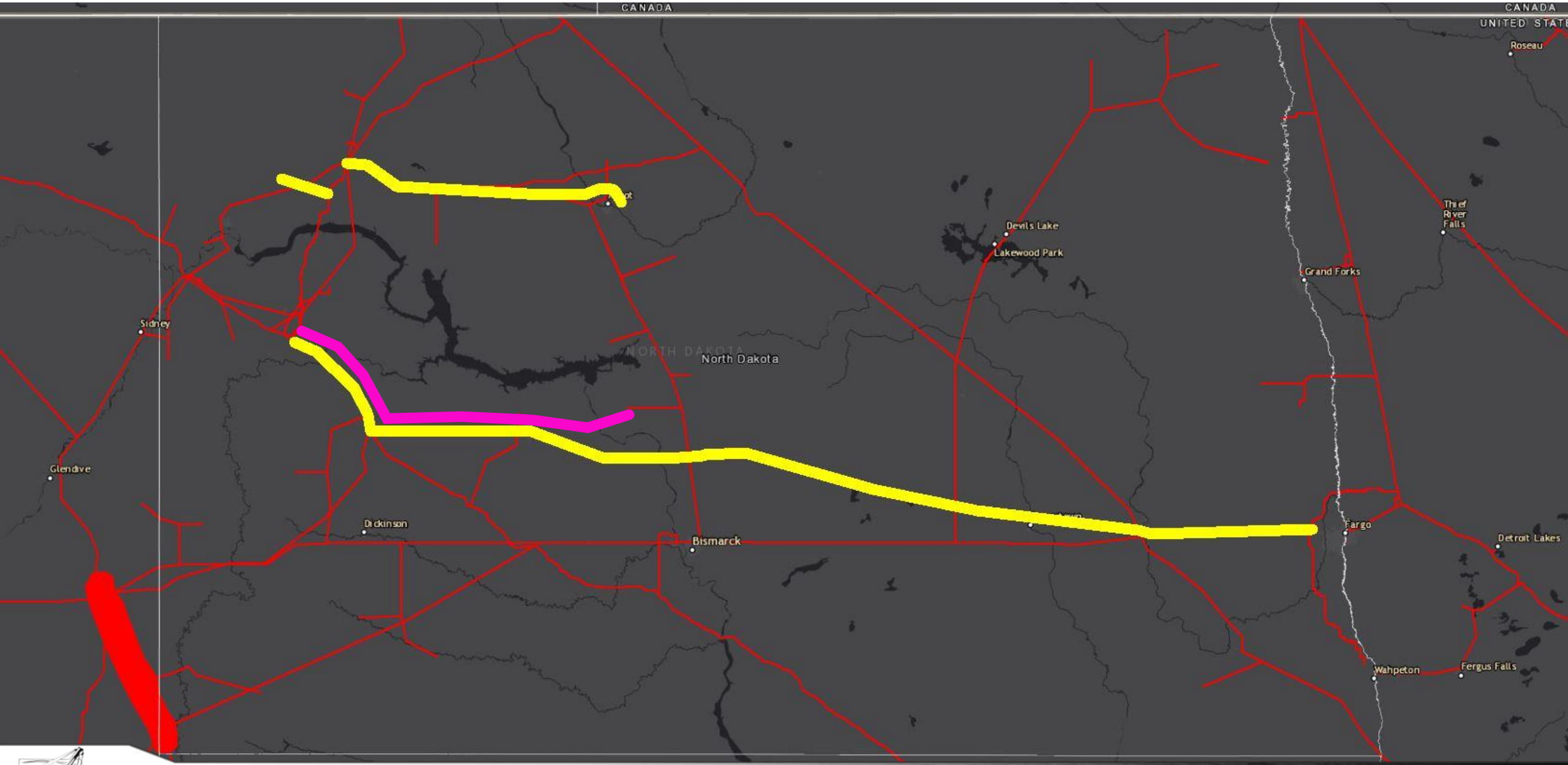
Project Highlights

- Non-binding open season April 4 - May 6, 2022
- Binding Open Season: June 1-30, 2023
- Three compressor upgrades in North Dakota
- Reverse the idle Bison Pipeline (30” – 302 Mile)
- Capacity 300,000 Dth/Day (430,000 Offered)
- May 2026 targeted in-service date **(DELAYED)**
- Fort Union Gas Gathering and Wyoming Interstate Company provide further transport to Cheyenne hub.
- Seeking commitments 10yrs or Longer
- $555 million: $347 Replacement/$208 Expansion

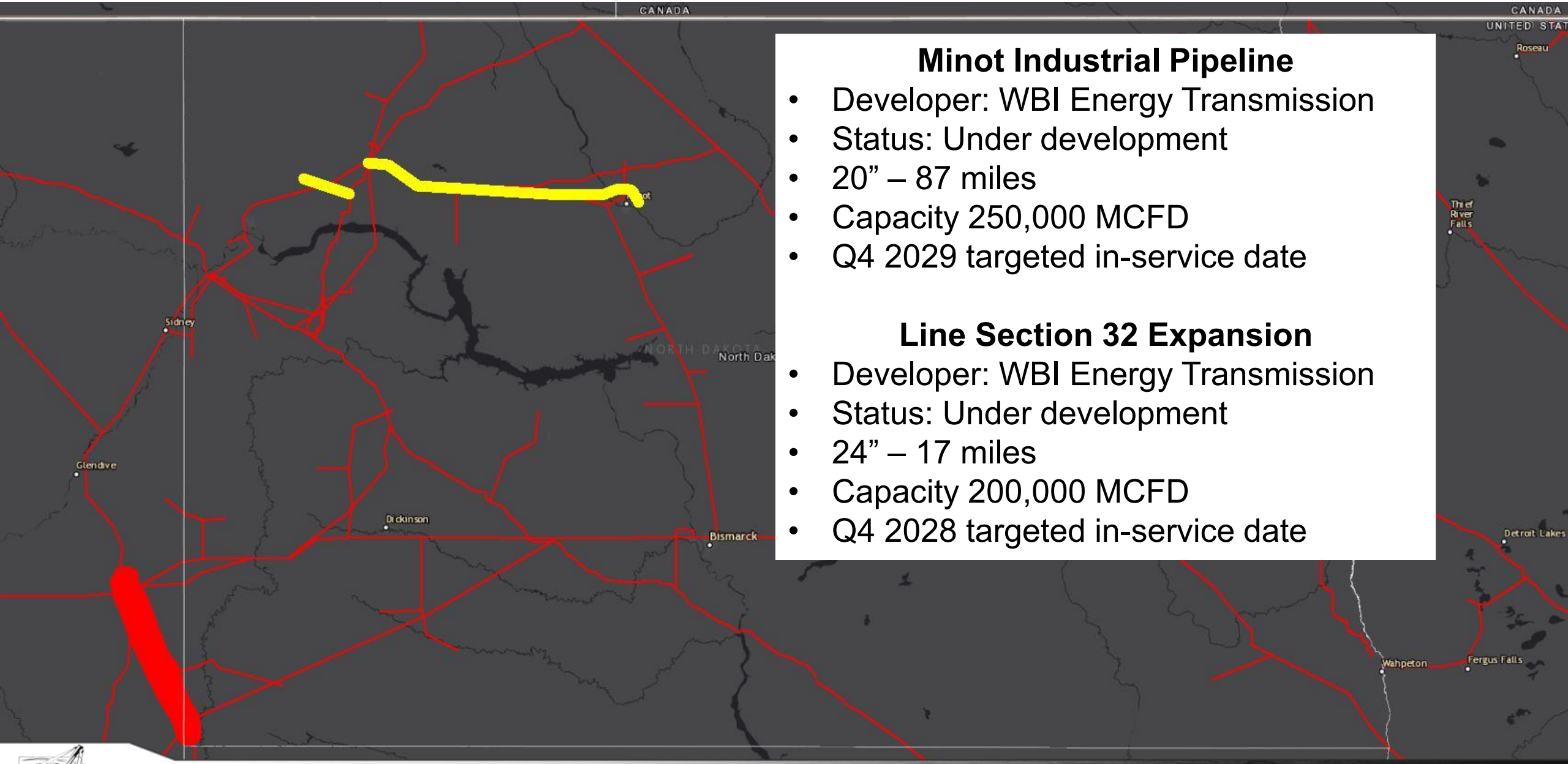
Proposed Rates

- NBPL/Bison $0.45/Dth + Fuel/Elec to WIC/FUG Interconnect
- WIC/FUG to Cheyenne $0.30/Dth + Fuel/Elec

Beyond 2026: Gas Transmission Projects



Beyond 2026: Gas Transmission Projects



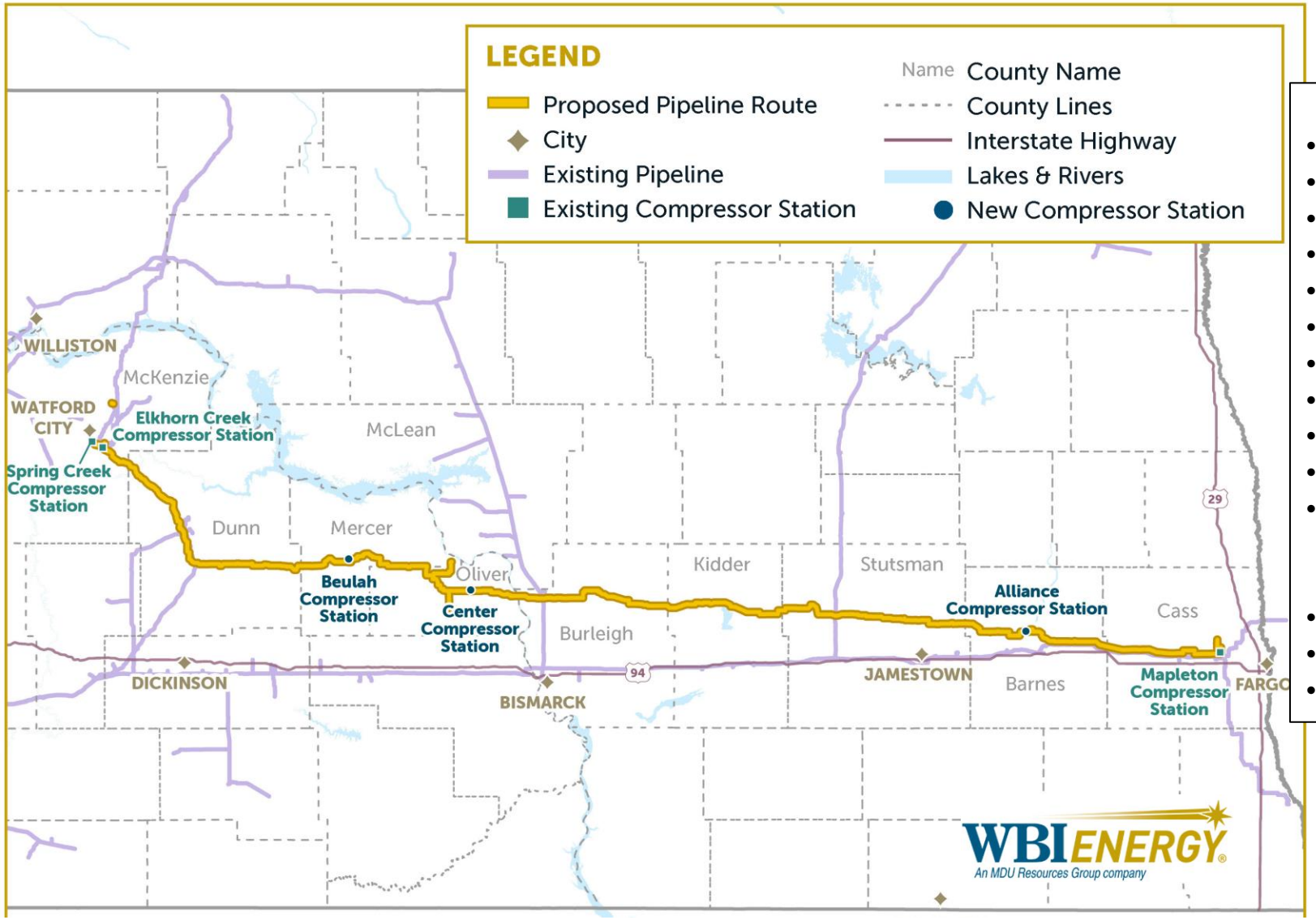
Minot Industrial Pipeline

- Developer: WBI Energy Transmission
- Status: Under development
- 20” – 87 miles
- Capacity 250,000 MCFD
- Q4 2029 targeted in-service date

Line Section 32 Expansion

- Developer: WBI Energy Transmission
- Status: Under development
- 24” – 17 miles
- Capacity 200,000 MCFD
- Q4 2028 targeted in-service date

WBI Energy: Proposed Bakken East Project



Natural Gas Pipeline Project Highlights

- Non-binding open season Dec 16 – Jan 31, 2025
- Binding open season Feb 2 – Mar 12, 2026
- 134 Miles: 42” Pipe
- 162 Miles: 36” Pipe
- 57 Miles: 30” Pipe
- 20 Miles: 20”-30” Pipe (Laterals)
- Compression: ~89,000 HP
- Proposed Capacity 1,400,000 Dth/Day
- Phase 1 (West) : Nov 2029 targeted in-service
- Phase 2 (East) : Nov 2030 targeted in-service
- Seeking commitments 20yrs or Longer

Estimated Rates

- $0.85 to $0.90/Dth + Fuel/Electric/Commodity
- Anchor Shipper Minimum: 100,000 Dth/Day
- Foundation Shipper Minimum: 250,000 Dth/Day

WBI Energy: Fourteen Open House Events

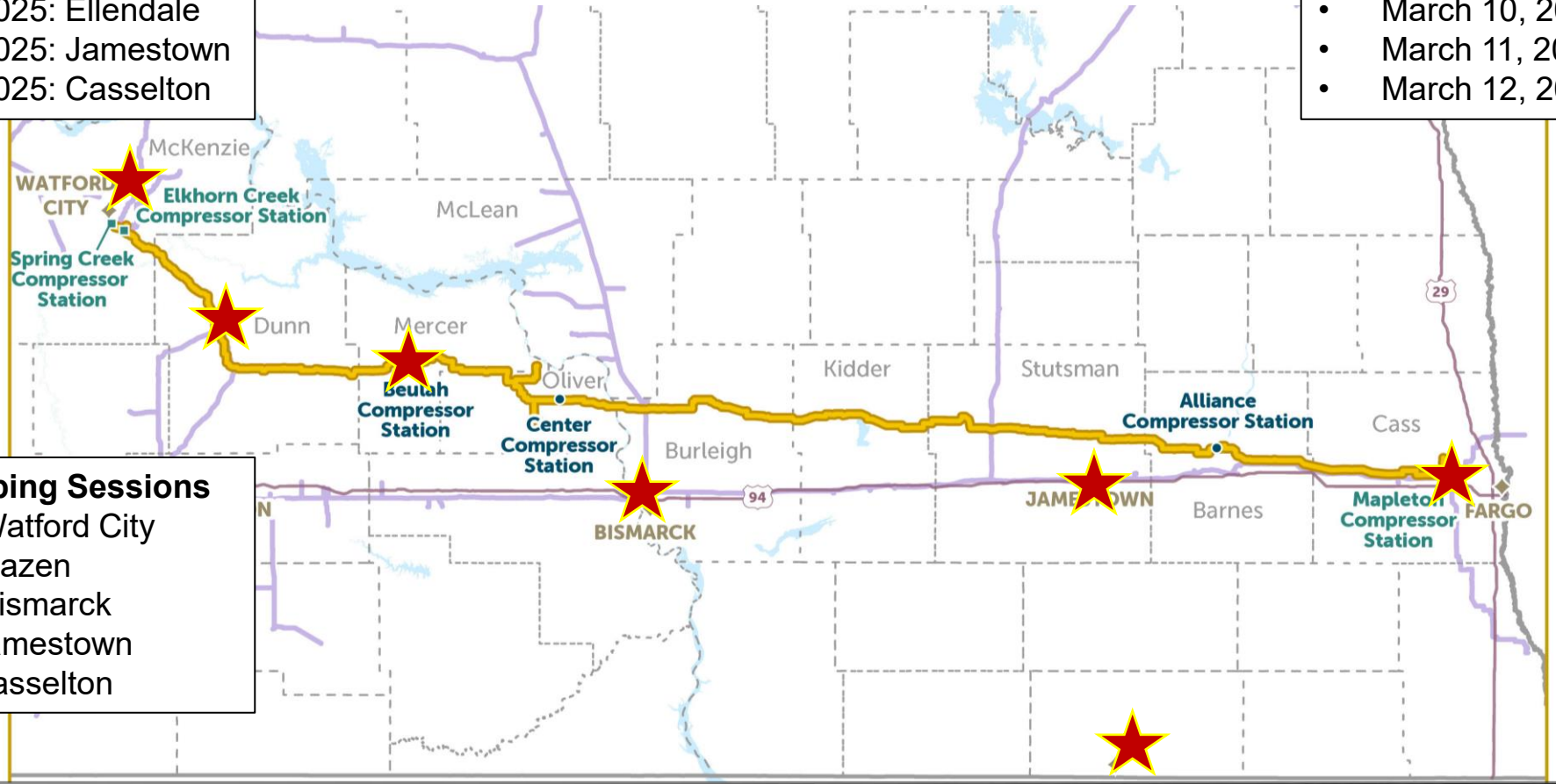
Five FERC Public Scoping Sessions

WBI Landowner Meetings

- November 3, 2025: Watford City
- November 4, 2025: Killdeer
- November 5, 2025: Beulah
- November 17, 2025: Bismarck
- November 18, 2025: Ellendale
- November 19, 2025: Jamestown
- November 20, 2025: Casselton

WBI Public Open Houses

- February 23, 2026: Casselton
  February 24, 2026: Ellendale
- February 25, 2026: Jamestown
- February 26, 2026: Bismarck
- March 10, 2026: Beulah
- March 11, 2026: Killdeer
- March 12, 2026: Watford City



FERC Public Scoping Sessions

- May 19, 2026: Watford City
- May 20, 2026: Hazen
- May 21, 2026: Bismarck
- June 2, 2026: Jamestown
- June 4, 2026: Casselton



Bakken East – Preliminary Work*

- 97% permission to survey received for 350 mile mainline

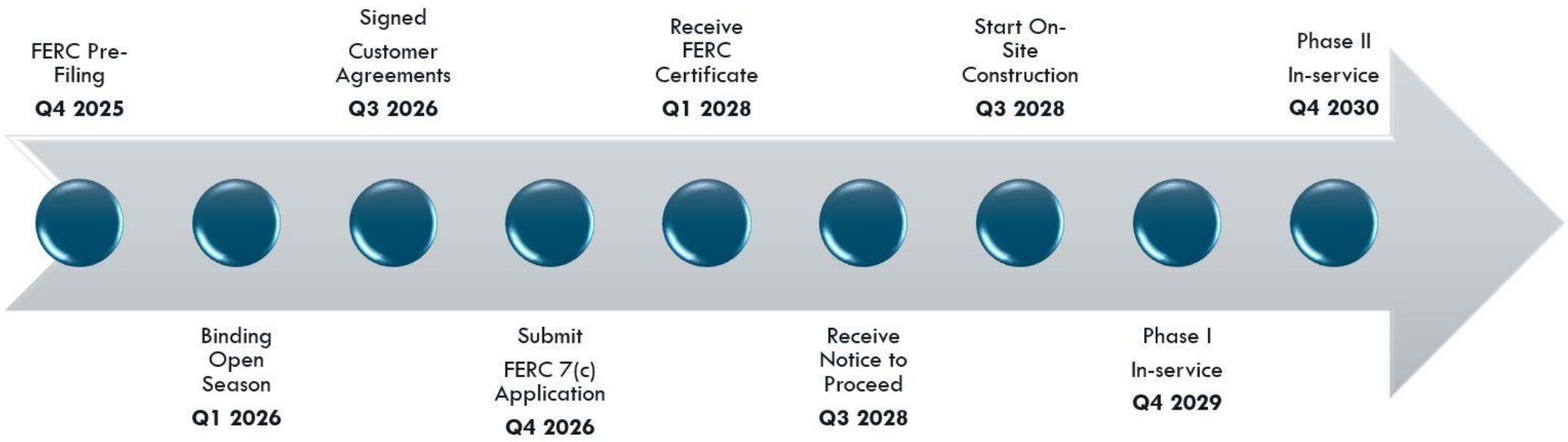
- 89% permission to survey received for 25 miles of laterals

- 86% of wetland and general habitat surveys completed
- 44% of cultural surveys and staging yards completed
- 81% of special status species surveys completed

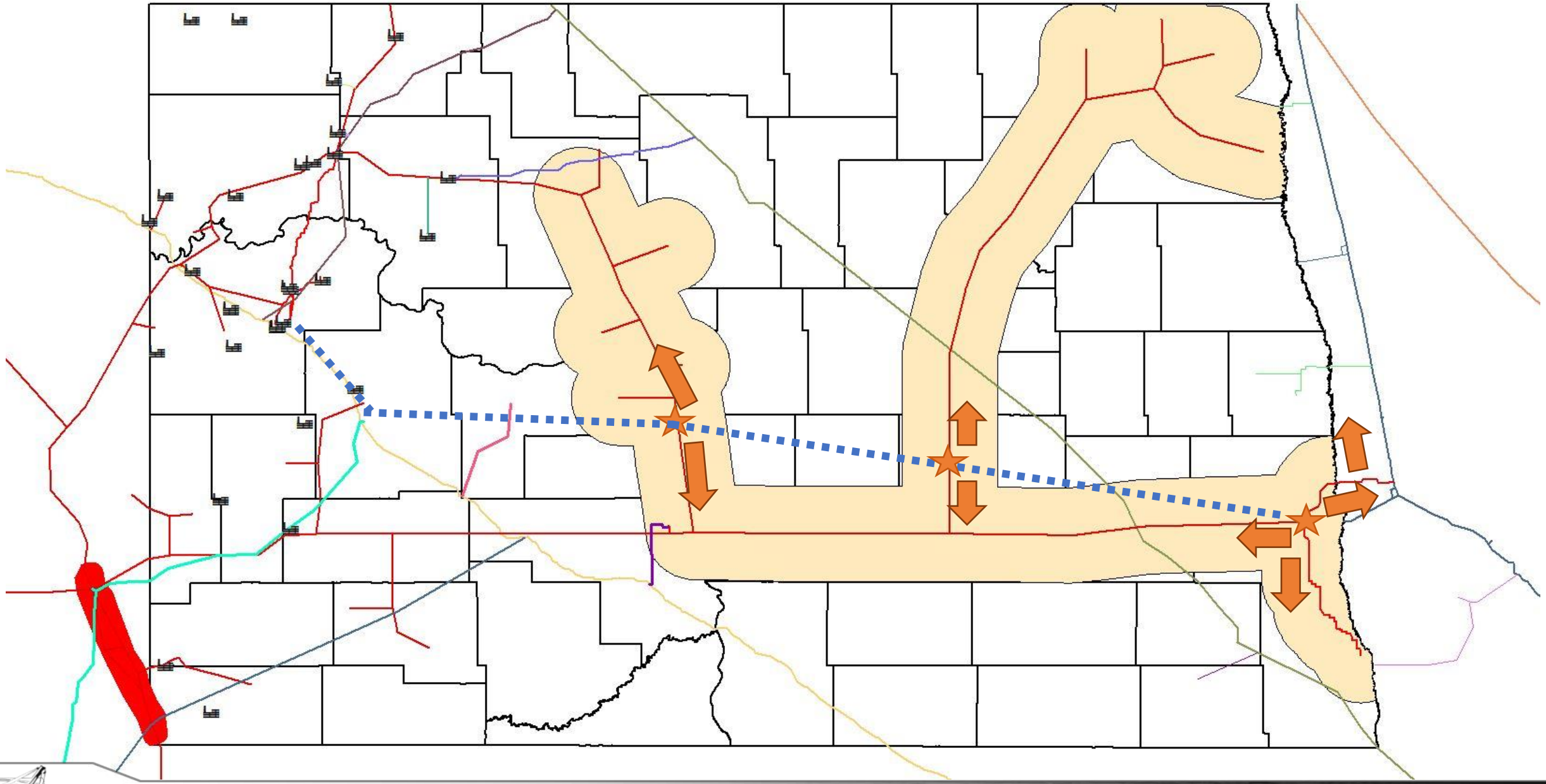
*Updated as of September 15, 2026

WBI ENERGY
An MDU Resources Group company

Bakken East Major Milestone Schedule



Going East: Statewide Benefits of Interconnections



Signing Up For Pipeline Capacity

Shippers Types



Producers/Midstream



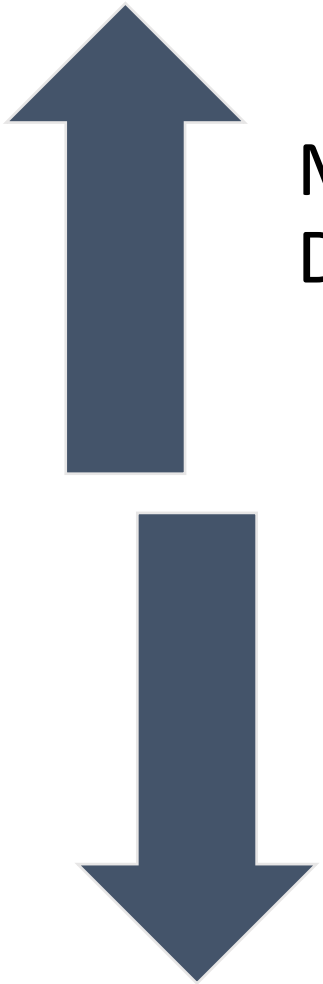
Marketing Firms



Industrial Consumers/LDC

State of North Dakota* (PA/IC)

How Will NDPA Manage Contracted Capacity?



Most Desirable

Least Desirable

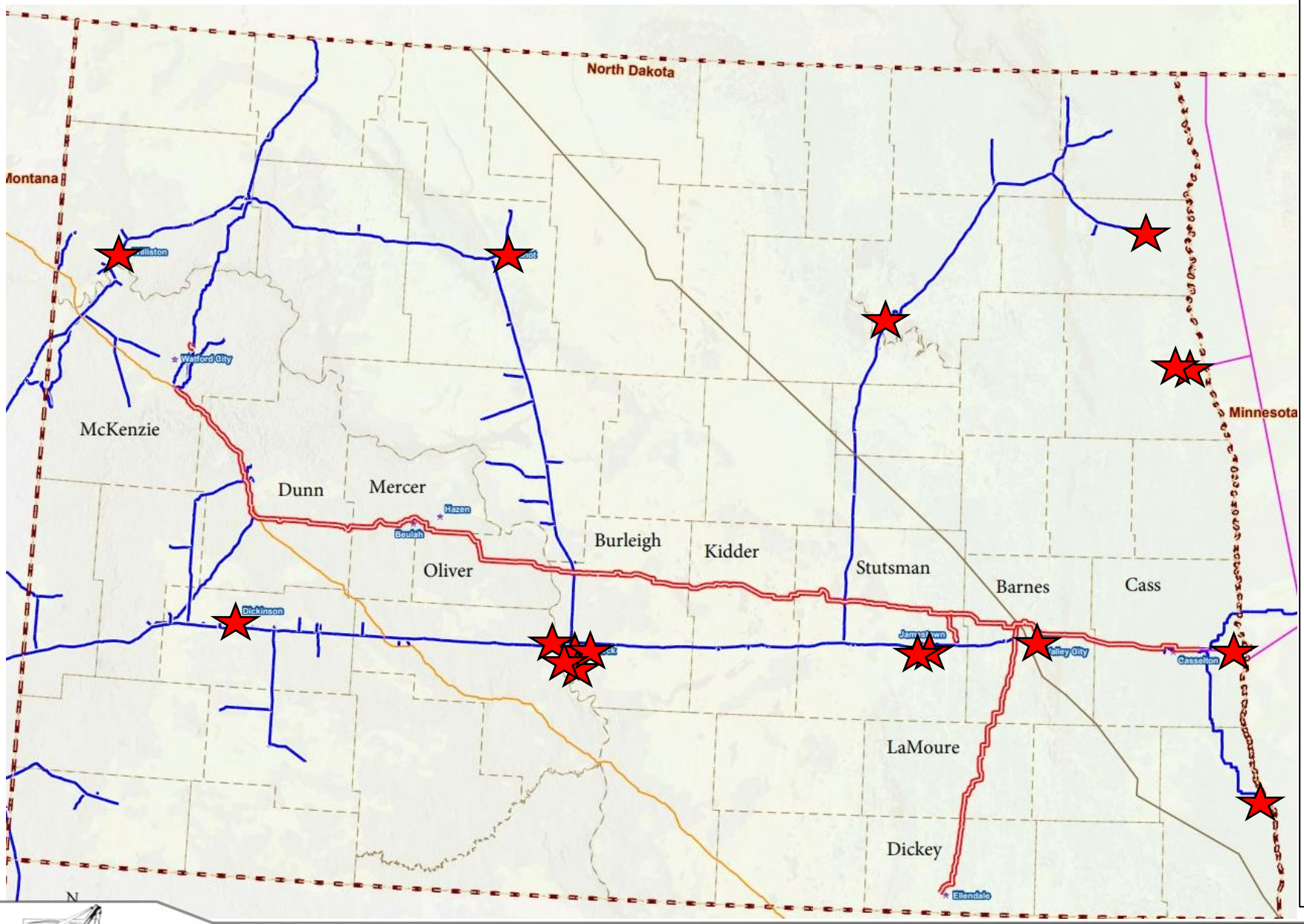
Release capacity to replacement shipper(s) in increments greater than one year at FERC required rate structure

Release capacity to replacement shipper(s) in increments less than one year at bid rates *(Limited by 54-17.7-04 Subsection 3)*

Release of capacity to an asset manager for an appropriate term length

Pay obligated precedent agreement rates until a release or asset management agreement is established

Potential to Coordinate Gas Supply North Dakota Institutions



Key State-Owned Facilities

- University campuses (especially UND, NDSU as first targets)
- State Hospital – Jamestown
- Capitol Complex – Bismarck
- State prisons
- North Dakota Mill – Grand Forks

Existing Gas Agreements

- In 2020, UND started a 6,000 Dth/d gas pipeline capacity agreement with Viking Pipeline. Daily management handled by private gas marketing firm. Contract expires June 30, 2030.
- NDSU currently working with a private gas marketing firm for gas delivery off Viking Pipeline. Capacity is owned by marketing firm.

Key Considerations

- Significant potential cost savings.
- State obligation for gas pipeline capacity used efficiently instead of paying twice for transportation.
- Ability to aggregate multiple large facilities into a single, cost-efficient gas delivery program.

Intensity Infrastructure Partners Proposed Pipeline



Phase 1 Project Highlights

- Non-binding open season Feb 3 – Mar 7, 2025
- 136 Miles: 36” Pipe
- Proposed Capacity 1,100,000 Dth/Day
- July 2029 targeted in-service
- Seeking commitments 10yrs or Longer

Phase 1 Estimated Rates

- Sub-$0.40/Dth + Fuel/Electric/Commodity
- Anchor Shipper Minimum: 100,000 Dth/Day
- Foundation Shipper Minimum: 250,000 Dth/Day

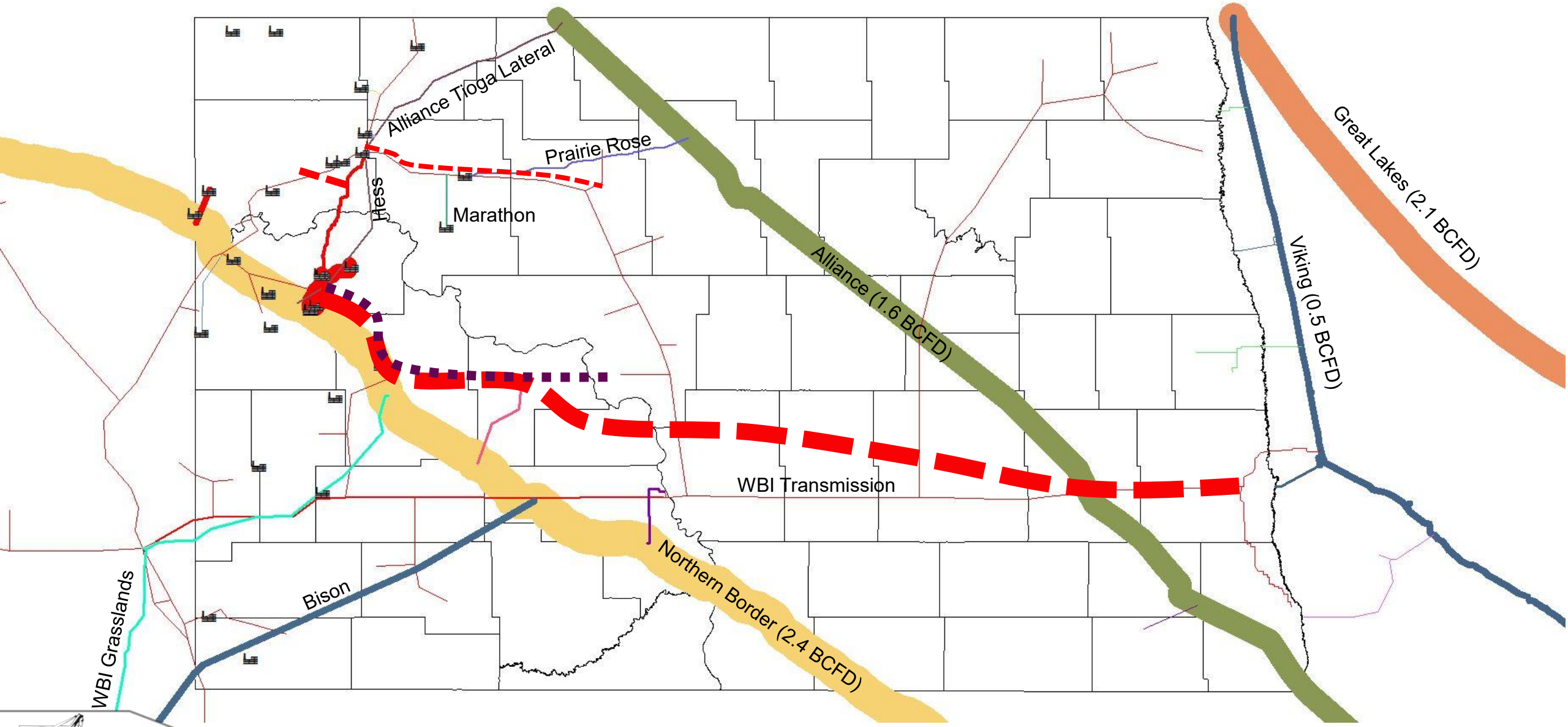
Phase 2 Project Highlights

- Non-binding open season Apr 17 – May 23, 2025
- 208 Miles: 30” Pipe
- Proposed Capacity 430,000 Dth/Day
- January 2030 targeted in-service
- Seeking commitments 10yrs or Longer

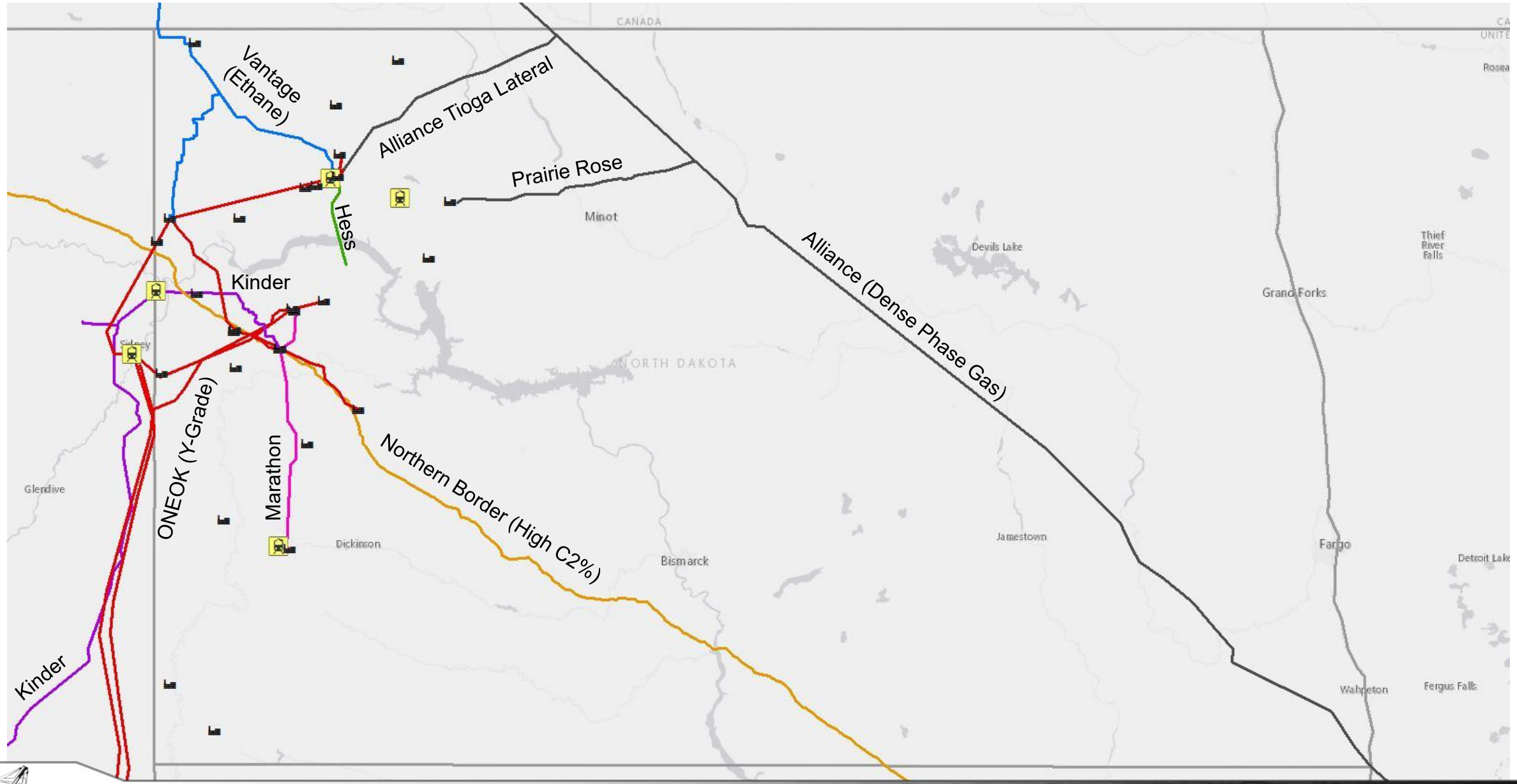
Phase 2 Estimated Rates

- $0.80/Dth + Fuel/Electric/Commodity
- Anchor Shipper Minimum: 100,000 Dth/Day
- Foundation Shipper Minimum: 250,000 Dth/Day

Residue Gas Pipeline Capacity Visualization



Regional NGL Infrastructure



Contact Information

Justin J. Kringstad, Director

North Dakota Pipeline Authority

600 E. Boulevard Ave. Dept. 405
Bismarck, ND 58505-0840

Phone: (701)220-6227
E-mail: jjkringstad@ndpipelines.com

811 Know what's below. Call before you dig.

Website:

www.northdakotapipelines.com



OIL AND GAS RESEARCH PROGRAM PROJECT MANAGEMENT REPORT

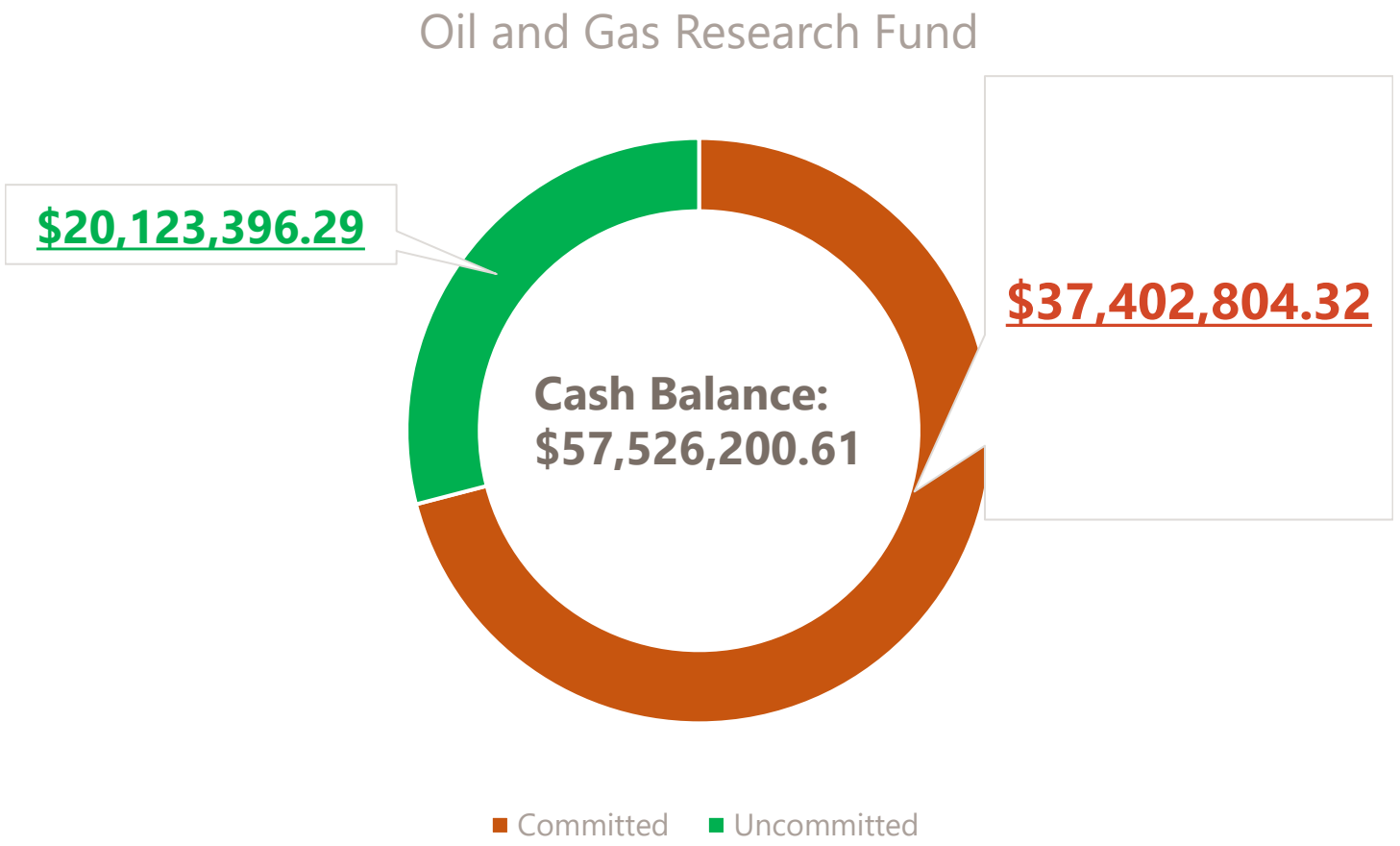
Jordan Kannianen, Deputy Executive Director, NDIC

November 2026

NORTH Dakota

Be Legendary.™

OIL AND GAS RESEARCH FUND BALANCE NOVEMBER 2026



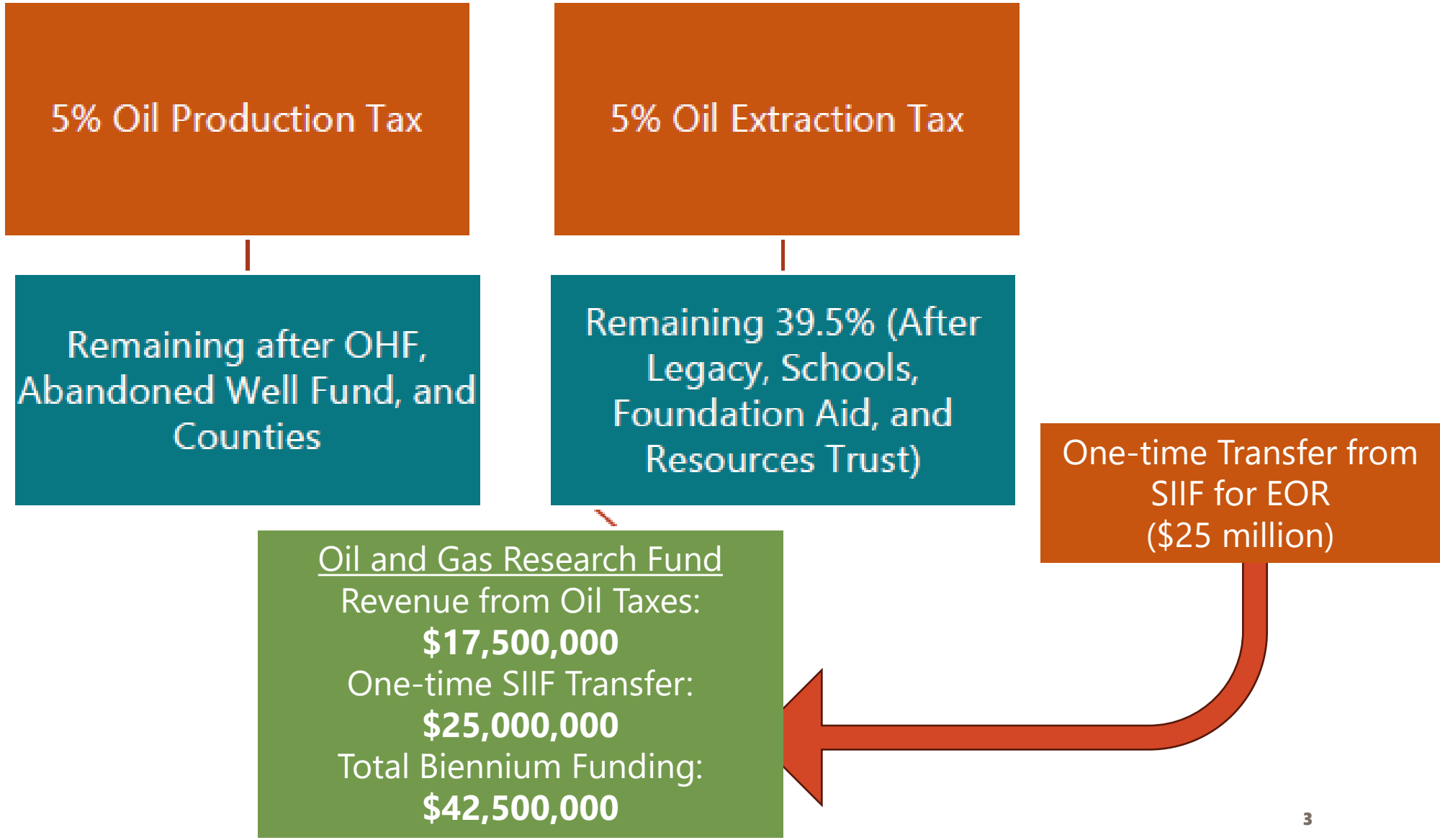
Funding Source:
- $17.5 million oil production and extraction tax
- $25 million SIIF for EOR

135 Cumulative Projects

11 Active Projects

Cumulative Value:
- $145.19 million granted
- $665.62 million project value

2025-2027 BIENNIUM FUNDING:



Oil and Gas Research Program
Grant Round 63 Abstract Summaries

G-63-D North Dakota Petroleum Foundation Education and Outreach Program by North Dakota Petroleum Foundation

Project Description: The Foundation will continue to pursue its mission through public outreach, education, messaging, and informational opportunities, developing online materials that are scalable, relatable to targeted audiences, and deployable across multiple channels. Each initiative operates with the support and oversight of NDPC staff. Our biennial Public Perception Survey, last completed in January 2026, shows 87% of North Dakotans favor oil and gas development and 92% believe the state should increase production (42%) or keep it the same (50%).

Objective: To administer and continue its education and outreach programs. The mission of the Foundation is to provide and support education and outreach opportunities related to the petroleum industry, develop and advance quality-of-life initiatives, and promote and enhance the conservation heritage of North Dakota.

Expected Results: Applicant has been building on education, outreach, conservation, and awareness initiatives for several years. Public opinion surveys guide messages and show effectiveness. These programs become more critical each year as the oil and gas industry strives to provide the information that North Dakotans want and need.

Duration: 23 months

Budget: The total cost is $2,906,434. The grant request from OGRP is $1,211,217.

BUDGET

Project Associated Expense	NDIC's Share	Applicant's Share (Cash)	Applicant's Share (In-Kind)	Other Project Sponsor's Share
Outreach[3]	$20,121.00	$20,121.00	$6,000.00	$86,000.00
Education				
ND Energy Education[4]	$246,847.00	$246,847.00		$260,000.00
Teacher Seminar[5]	$26,898.00	$26,898.00	$28,000.00	$74,000.00
Promotion, Marketing & Measurement[6]				
Advertising	$572,588.00	$572,588.00		
Administration & Consulting	$46,925.00	$46,925.00	$10,000.00	
Sponsorships & Programs	$125,947.00	$125,947.00		
Publication, Printing & Web	$1,803.00	$1,803.00		
Economic Impact Study	$15,793.00	$15,793.00		
Statewide Oil Distribution Study	$10,000.00	$10,000.00		$20,000.00
Public Perception Study	$26,495.00	$26,495.00		
New Initiatives	$117,800.00	$117,800.00		
TOTAL	**$1,211,217.00**	**$1,211,217.00**	$44,000.00	$440,000.00

Participants: The North Dakota Petroleum Council, NDPC member-companies, Western Dakota Energy Association (WDEA), Department of Mineral Resources (DMR), North Dakota Department of Transportation (NDDOT), North Dakota Highway Patrol (NDHP), UND's Energy and Environmental Research Center (EERC), the North Dakota Pipeline Authority (NDPA), North Dakota State Land Department (NDSLD), North Dakota Safety Council (NDSC), and civic and community groups, among others.

DIRECTOR'S COMMENTS
G-63-D
North Dakota Petroleum Foundation
Principal Investigator: Eric Delzer
Request for: $1,211,217
Total Project Costs: $2,906,434
Duration: 24 Months

Description of the Project:
The Foundation will continue to pursue its mission through public outreach, education, messaging, and informational opportunities, developing online materials that are scalable, relatable to targeted audiences, and deployable across multiple channels. Each initiative operates with the support and oversight of NDPC staff. Our biennial Public Perception Survey, last completed in January 2026, shows 87% of North Dakotans favor oil and gas development and 92% believe the state should increase production (42%) or keep it the same (50%).

Objective:
To administer and continue its education and outreach programs. The mission of the Foundation is to provide and support education and outreach opportunities related to the petroleum industry, develop and advance quality-of-life initiatives, and promote and enhance the conservation heritage of North Dakota.

Statement	Weighting Factor	G-63-D1	G-63-D2	G-63-D3
1. Objective	9	45	36	45
2. Achievability	7	28	28	35
3. Methodology	8	40	40	32
4. Contribution	8	24	32	32
5. Awareness/Background	5	25	20	20
6. Project Management	3	12	9	12
7. Equipment/Facilities	2	10	6	10
8. Value/Industry-Budget	4	16	12	16
9. Financial Match – Budget	4	16	16	20
Average Weighted Score		216	199	222
	Total: 50		250 possible points	
Overall Recommendation:				
Fund		X	X	X
Funding May Be Considered				
Do Not Fund				

Technical Reviewers' Comments

Reviewer G-63-D1
I recommend funding the application.

North Dakota has decades of oil and gas development and production ahead and should continue positioning itself as a national and world leader in responsible energy development. It would be unwise to overlook the importance of a successful education program such as this, particularly given how quickly public perception and attitudes toward the industry can change. Maintaining an informed public will remain important to the industry's long-term success in North Dakota.
What has really set these efforts apart is the remarkable level of collaboration among the various industry and community partners. Anyone who has attended events such as CookFest or the T4 Summits can quickly appreciate the value these programs bring to the communities and individuals, they reach. These efforts play an important role in maintaining public understanding, building trust, and supporting the industry's social license to operate.
Recommendation: Fund

Reviewer G-63-D2
The proposed project appears to align well with the goals of the Oil and Gas Research Council and offers potential benefits to North Dakota's energy industry. The objectives and approach appear reasonable, and the project merits consideration for funding.
Recommendation: Fund

Reviewer G-63-D3
The North Dakota Petroleum Foundation has submitted a strong education and outreach proposal that is consistent with the goals of the Oil and Gas Research Council. The project builds upon established government agencies, and other stakeholders. The application clearly defines the Foundation's education and outreach mission and provides specific programs to accomplish its objectives. The Foundation also has established methods for measuring participation, public perception, digital engagement, and program feedback.
Overall, the application presents established programs, experienced management, significant stakeholder participation, and a strong financial commitment from sources outside the Commission. The project provides substantial educational and public outreach benefits related to North Dakota's oil and gas industry.
Recommendation: Fund

Director's Recommendation: Fund for $1,211,217



NORTH DAKOTA
PETROLEUM
FOUNDATION

NORTH DAKOTA PETROLEUM FOUNDATION

2027-2028 Grant Application

www.NDPetroleumFoundation.org

NORTH DAKOTA
PETROLEUM
FOUNDATION



MISSION STATEMENT

To provide and support education and outreach opportunities related to the petroleum industry, develop and advance quality of life initiatives, and promote and enhance the conservation heritage of North Dakota.

OUR INITIATIVES



OUTREACH

Bakken Rocks CookFest
Public Educational Sessions
Partnerships



EDUCATION

Teacher Education
Seminar
T4 Summits & North
Dakota Energy Education



PROMOTION & MARKETING

Paid Awareness
Research and Studies
Distribution

OGRC GRANT

2025-26 GRANT

Concludes Jan. 31, 2027

Total Awarded: $930,245.00

OGRC Expended: $806,518.59

Remaining: $123,726.41

Unmatched Spending: $93,007.00

Eligible costs above the award ceiling — about $46,500 of match left unclaimed.



2027-2028 REQUEST

Project Associated Expense	NDIC's Share	Applicant's Share (Cash)	Applicant's Share (In-Kind)	Other Project Sponsor's Share
Outreach	**$20,121.00**	**$20,121.00**	**$6,000.00**	**$86,000.00**
CookFest & Info Sessions	$20,121.00	$20,121.00		
NDPC Salaries			$6,000.00	
Donated Food				$86,000.00
Education	**$273,745.00**	**$273,745.00**	**$28,000.00**	**$334,000.00**
ND Energy Education / T4	$246,847.00	$246,847.00		$260,000.00
Teacher Seminar	$26,898.00	$26,898.00	$28,000.00	$74,000.00
Promotion, Marketing & Measurement	**$917,351.00**	**$917,351.00**	**$10,000.00**	**$20,000.00**
Advertising	$572,588.00	$572,588.00		
Studies	$52,288.00	$52,288.00		$20,000.00
Sponsorships & Programs	$125,947.00	$125,947.00		
Publication, Printing & Web	$1,803.00	$1,803.00		
Administration and Consulting	$46,925.00	$46,925.00		
New Initiatives	$117,800.00	$117,800.00		
NDPC Salaries			$10,000.00	
TOTAL	**$1,211,217.00**	**$1,211,217.00**	**$44,000.00**	**$440,000.00**

Grant Term

Feb. 1, 2027 – Dec. 31, 2028

GRAND TOTAL

= $2,906,434

NDIC Share: 42% Foundation's Share: 58%

Bakken Rocks CookFests



Established in 2009 & hosted in 28 communities.

July 2025: Alexander, ND

July 2026: Powers Lake, ND

July 2027: Twin Buttes, ND

July 2028: Town in Northwest ND

2-4 p.m. Bakken Basics Educational Session

Drilling Basics

Oil and Gas Update from DMR

Transportation by ND Pipeline Authority

ND Energy Tax Revenues by Western Dakota Energy Association

4-7 p.m. Free BBQ, Music, Games & Activities for Kids, plus Educational Exhibits

SAFETY & ENVIRONMENT

The Foundation partners with communities and organizations to work on common interests and goals.

Past partners include (but are not limited to):

- Mule Deer Foundation
- Pick Up the Patch
- Theodore Roosevelt Medora Foundation
- North Dakota Safety Council
- Vision Zero
- Truckers Against Trafficking
- Dream Center


Pick Up the Patch



MDF Workday


Tree Planting


Safety

Teacher Education Seminar



The seminar covers all aspects of the oil and gas industry.

50 teachers are invited to participate in a 30-hour seminar.

Teachers have the opportunity to go on field tours, which could include a drilling site, a refinery, or a gas plant.





ND ENERGY EDUCATION

Premier Youth Workforce Development

T4 Summits

T4 Tools Trades Torque Tech



Two-day summits featuring hands-on activities or demonstrations in STEM and the trades.

Companies, trade associations, local organizations, and colleges/universities facilitate over 20 sessions for students in grades 6 - 12.

T4 Summits reach over **6,500** students per school year.







2027 T4 Summit SCHEDULE

Bismarck

Feb 24-25, 2027

Minot

Mar 31-Apr 1, 2027

Watford City

April 28-29, 2027

NEW Mini-T4 Summits for Middle Schoolers in Bismarck

2026 T4 Summits have already occurred in Dickinson, Stanley, and Bottineau.

INDUSTRY FIELD TOURS





- Teacher Education Seminar
- Elected officials and candidates
- University students
- Leadership cohorts
- Ag Associations and business leaders



Advancing the Possibilities Campaign







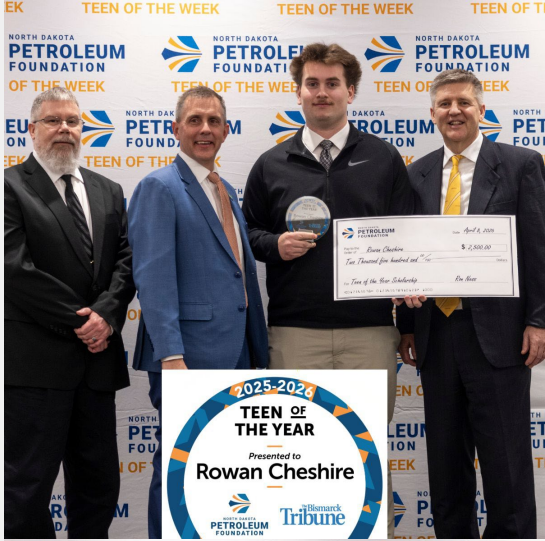
NORTH DAKOTA PETROLEUM FOUNDATION

TEEN OF THE WEEK

ADVANCING THE POSSIBILITIES



Each Teen of the Year was awarded a $2,500 Scholarship.





Oil Industry Economic Impact & Tax Revenue Distribution Studies

Goal:

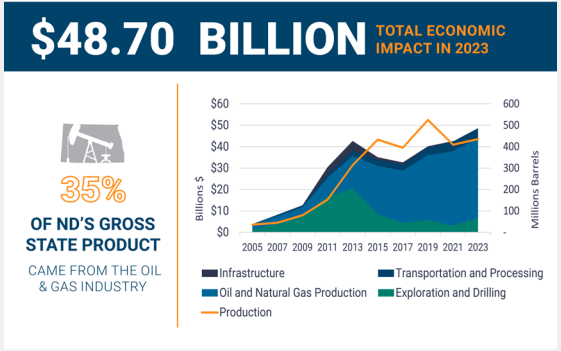
Measure the impact on jobs, the economy, salaries and wages, and tax revenues, as well as how those taxes are distributed in our state.

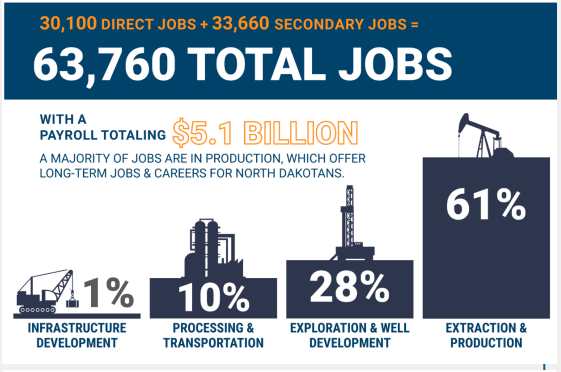
Timeline:

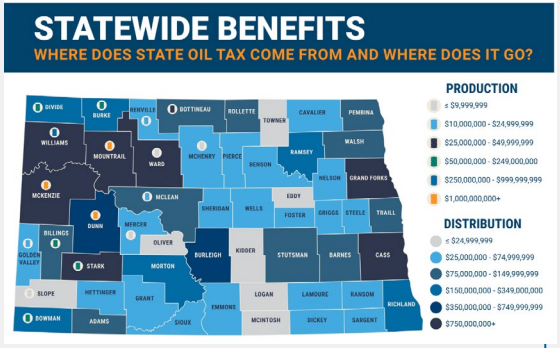
Data collection begins in the fall with the release of the study every other year.
The next study will be released in March 2027.
This request funds data collection for the 2029 studies.

Distribution:

Results are shared via News Conferences, news releases, our Advancing the Possibilities Campaigns, our website, and collateral that is passed out at events.







Public Perception Survey



- It gauges public perception of the oil and natural gas industry and development in North Dakota
- It helps us determine if any changes in perception have taken place by comparing current findings to those from previous years
- **The next survey will be released in February 2028.**

Thank You!



Contact:
Reva Kautz
Communications Director
701.223.6380
rkautz@ndoil.org

www.NDPetroleumFoundation.org

Oil and Gas Research Program
Grant Round 63 Abstract Summaries

G-63-B iPIPE 4.0 by UND EERC

Project Description: The intelligent Pipeline Integrity Program (iPIPE) was created in 2018 to eliminate pipeline leaks through innovation. The investment from the North Dakota Industrial Commission (NDIC) matched 1:1 with industry has brought new technology to North Dakota pipelines and enabled the prevention and mitigation of pipeline releases that was not previously possible. iPIPE's investment in satellite technology has enabled commercial monitoring of over 1500 miles2 of pipeline in North Dakota annually. Satellite algorithms provide alerts to the operator that result in the discovery of pinhole leaks that were previously undetectable. This is made possible by constant monitoring of the vegetation health in the pipeline right-of-way (ROW). The training of this satellite artificial intelligence was enabled by iPIPE projects. Presently, finding these issues early is preventing any noticeable impact and mitigating the loss of product. iPIPE has funded work advancing computational pipeline monitoring (CPM) leak detection. Although a common technology used for oil and gas pipelines, the implementation has lagged for produced water lines. A project demonstrating advanced leak detection algorithms on a produced water pipeline resulted, so far, in the deployment of the technology on six produced water systems in North Dakota encompassing 252 miles.3 The iPIPE program is presently working on leak prevention by advancing in-line inspection (ILI) technology. Various types of stress corrosion cracking can lead to pipe failures in which ILI technologies are used to detect. Where circumferential cracks are more readily detected, axial stress corrosion cracking has been elusive. iPIPE is supporting the development and testing of the first ILI device that includes the capability to detect axial corrosion cracking. iPIPE is also advancing methane detection with three manned aircraft projects that address methane quantification and enable detection over snow cover. The consortium wants to continue with iPIPE 4.0 to advance technology and implement new innovations in North Dakota that improve pipeline performance and integrity.

Objective: To advance technologies that reduce the frequency and duration of pipeline releases.

Expected Results: iPIPE is finding what was previously undetectable and stopping leaks early to prevent large releases. This has been accomplished with the early adoption of satellite technology, advanced sensor-based leak locating, new technology on produced water pipelines, and enhanced methane detection. iPIPE ensures that North Dakota is at the forefront of pipeline integrity practices. iPIPE 4.0 will continue to scout and conduct

technology projects that advance leak detection and prevention. Projects are anticipated to include prevention through in-line-inspection (ILI), external sensors, computational pipeline monitoring, and remote monitoring such as aerial and satellite surveillance. iPIPE conducts an annual forum and monthly meetings that engage members in collaboration. Reports are delivered by the Energy & Environmental Research Center (EERC) to the Oil and Gas Research Program (OGRP) and iPIPE members. iPIPE's members wish to continue the iPIPE collaboration that puts North Dakota first.

iPIPE 4.0 will build on ILI prevention technologies from the previous program and further the technology for use.

Duration: 24 months

Budget: The total cost is $6,000,000. The grant request from OGRP is $3,000,000. Cost share is provided by iPIPE members totaling $1,050,000 cash and in-kind support from technology suppliers of $1,950,000. In-kind cost share will occur on behalf of technology suppliers and from member support provided for technology demonstration.

Table 4. iPIPE 4.0 Budget

Project-Associated Expense	NDIC Share (Cash & In-Kind)	Technology Providers Share (In-Kind)	Member Share (Cash)	Total Project
Labor	$599,647	$0	$189,305	$788,952
Travel	$22,630	$0	$8,882	$31,512
Supplies	$885	$0	$315	$1,200
Subcontractor – Technology Provider #1	$0	$0	$355,000	$355,000
Subcontracto – Technology Provider #2	$0	$0	$355,000	$355,000
Subcontractor – Technology Provider #3	$490,000	$0	$0	$490,000
Subcontractor – Technology Provider #4	$490,000	$0	$0	$490,000
Subcontractor – Technology Provider #5	$490,000	$0	$0	$490,000
Subcontractor – Technology Provider #6	$489,000	$0	$0	$489,000
Communications	$261	$0	$79	$340
Printing and Duplicating	$258	$0	$78	$336
Food	$3,440	$0	$100	$3,540
Freight	$381	$0	$119	$500
Laboratory Fees and Services				
Document Production Service (Graphics, Editing, and Workflow)	$11,493	$0	$3,900	$15,393
Software Solution Services	$1,411	$0	$500	$1,911
Field Safety Fee	$15,223	$0	$5,000	$20,223
Total Direct Costs	$2,614,629	$0	$918,278	$3,532,907
Facilities and Administration	$385,371	$0	$131,722	$517,093
Total Cash Requested	$3,000,000	$0	$1,050,000	$4,050,000
In-Kind Cost Share				
Technology Providers	$0	$1,950,000	$0	$1,950,000
Total In-Kind Cost Share	$0	$1,950,000	$0	$1,950,000
Total Project Costs	$3,000,000	$1,950,000	$1,050,000	$6,000,000

If less funding is available than requested, the project's objectives may be delayed.

Participants: EERC; Chevron Corporation; Oneok, Inc.; Energy Transfer; TC Energy Corporation; Marathon Petroleum Logistics (MPLx); Enbridge, and South Bow. Industry members operate pipelines and include interstate assets.

DIRECTOR'S COMMENTS
G-63-B
iPIPE 4.0
Submitted by: UND EERC
Principal Investigator: Darren D. Schmidt
Request for: $3,000,000
Total Project Costs: $6,000,000
Duration: 24 Months

Description of the Project:
The intelligent Pipeline Integrity Program (iPIPE) was created in 2018 to eliminate pipeline leaks through innovation. The investment from the North Dakota Industrial Commission (NDIC) matched 1:1 with industry has brought new technology to North Dakota pipelines and enabled the prevention and mitigation of pipeline releases that was not previously possible. iPIPE's investment in satellite technology has enabled commercial monitoring of over 1500 miles2 of pipeline in North Dakota annually. Satellite algorithms provide alerts to the operator that result in the discovery of pinhole leaks that were previously undetectable. This is made possible by constant monitoring of the vegetation health in the pipeline right-of-way (ROW). The training of this satellite artificial intelligence was enabled by iPIPE projects. Presently, finding these issues early is preventing any noticeable impact and mitigating the loss of product. iPIPE has funded work advancing computational pipeline monitoring (CPM) leak detection. Although a common technology used for oil and gas pipelines, the implementation has lagged for produced water lines. A project demonstrating advanced leak detection algorithms on a produced water pipeline resulted, so far, in the deployment of the technology on six produced water systems in North Dakota encompassing 252 miles.3 The iPIPE program is presently working on leak prevention by advancing in-line inspection (ILI) technology. Various types of stress corrosion cracking can lead to pipe failures in which ILI technologies are used to detect. Where circumferential cracks are more readily detected, axial stress corrosion cracking has been elusive. iPIPE is supporting the development and testing of the first ILI device that includes the capability to detect axial corrosion cracking. iPIPE is also advancing methane detection with three manned aircraft projects that address methane quantification and enable detection over snow cover. The consortium wants to continue with iPIPE 4.0 to advance technology and implement new innovations in North Dakota that improve pipeline performance and integrity.

Objective: To advance technologies that reduce the frequency and duration of pipeline releases.

Statement	Weighting Factor	G-63-B1	G-63-B2
1. Objective	9	27	36
2. Achievability	7	21	28
3. Methodology	8	24	40
4. Contribution	8	32	32
5. Awareness/Background	5	25	25
6. Project Management	3	9	12
7. Equipment/Facilities	2	10	10
8. Value/Industry-Budget	4	16	16
9. Financial Match – Budget	4	16	12
Average Weighted Score		180	211
	Total: 50		250 possible points
Overall Recommendation:			
Fund			X
Funding May Be Considered		X	
Do Not Fund			

Technical Reviewers' Comments

Reviewer G-63-B1

My assessment is that iPIPE 4.0 has a credible basis for funding, but the application would benefit from additional technical and financial safeguards before the full award is approved. Therefore, my recommendation is that funding be considered. The application's merits are an exceptional, experienced research institution, established industry participation, access to operating pipelines, a history of technology development and a clear relationship to North Dakota's oil and gas research priorities. The program's technology-demonstration model also provides a reasonable route toward commercial deployment. **Recommendation: Funding May Be Considered**

Reviewer G-63-B2

Since the beginning of the shale revolution, a number of high-profile pipeline release incidents occurring around the United States, including in North Dakota, have created an unofficial societal expectation to continue striving for ways to improve pipeline safety. The iPIPE program has shown itself to be a high-value program that brings together leading industry stakeholders and cutting-edgetechnology providers with a common goal of continual improvement. The unique technology selection process has proven effective and provides a strong foundation for the next phase of the program.My recommendation is to fund the application, as it aligns very well with a number of OGRP goals and iPIPE has a demonstrated track record of success.**Recommendation: Fund**

Director's Recommendation: Fund for $1,000,000

Energy & Environmental Research Center (EERC)

Intelligent Pipeline Integrity Program 4.0

North Dakota Oil and Gas Research Program

November 9, 2026

Darren Schmidt, P.E.

© 2025 University of North Dakota Energy & Environmental Research Center.

iPIPE™

INTELLIGENT PIPELINE INTEGRITY PROGRAM

PEOPLE
TECHNOLOGY
COLLABORATION
A STRONGER
NORTH DAKOTA

“The holy grail of leak detection.” iPIPE is finding what we could not see.

170+ Technologies Evaluated

19 Projects Advanced

Deployed by North Dakota Operators

CLEANER ENERGY | STRONGER COMMUNITIES
BRIGHTER TOMORROWS

WHAT WE SEE
is only part of the story.

WHAT WE DON’T SEE
can still be detected and prevented.



Pinhole leaks

Small indications. Big consequences if undetected.



Early-stage corrosion

Detecting degradation before it progresses.



Axial cracking

Identifying cracks beyond routine inspection capability.



Produced water releases

Finding issues early on produced water systems.



Methane emissions

Detect, quantify, and repair.



Right-of-way threats

Monitoring changes that may indicate pipeline impacts.

North Dakota Is Operating Operating Some of the Most Advanced Pipeline Detection Detection and Prevention Technologies in the Nation Through iPIPE.

UND | EERC

Energy & Environmental Research Center
University of North Dakota

Critical Challenges. Practical Solutions.

From Research to Deployment

North Dakota's Investment is Delivering Technology in the Field

Real problems, Real solutions, Real impact for North Dakota.

iPIPE™
INTELLIGENT PIPELINE INTEGRITY PROGRAM
PEOPLE
TECHNDLOOY
COLLABORATION
A STRONGER
NORTH DAKOTA

INNOVATION
DEPLOYMENT
STRONGER
NORTH DAKOTA

INVEST — Seate suppert, indastry partnership.

DEVELOP — Tam Ideas into solutions.

DEMONSTRATE — Prove value in North Dakota.

DEPLOY — Real-world use. Real results.



SATELLITE DETECTION & ALERTING

16–18%

of North Dakota's oil-producing assets are monitored using satellite-based detection and alerting technologies advanced through IPIPE.

Pinhole Detection



PRODUCED WATER ANALYTICS

6 Operators

are using advanced leak detection analytics for computational pipeline monitoring developed through IPIPE.

Produced Water



AIRCRAFT-BASED METHANE DETECTION

Routine Use

by IPIPE member operators of aircraft methane detection and quantification technologies.

Keeping Gas in the Pipe



SNOW-COVER METHANE DETECTION

Commercially Available

Aircraft-based methane detection was advanced through IPIPE to succeed over snow cover and is now commercially available.

Targeted for ND



SMALL-DIAMETER INLINE INSPECTION

4-Inch CMFL Tool

is now commercially available because of technology advanced through IPIPE.

ILI for Smaller Pipe



ADVANCED DETECTION & PREVENTION

1 Hz → 20 Hz

High-speed pressure sensing systems developed through IPIPE increased data collection rates from 1 Hz to 20 Hz.

Improved locating

The success of iPIPE is measured by adoption and commercialization.

UND | EERC Energy & Environmental Research Center University of North Dakota

Critical Challenges. Practical Solutions.

Members for iPIPE 4.0

- Enbridge
- MPLx
- Oneok
- Energy Transfer
- Chevron
- South Bow

Industry committed cost share to the project is **$900,000**



iPIPE members operate over 10,000 miles of pipelines in ND – source Enverus

iPIPE 4.0 Proposal

- Objective – Advance technologies that reduce the frequency and duration of pipeline releases.

- Building on 3.0 success (7-projects)
  - 2 new ILI technologies (axial feature detection, 4-inch CMFL commercialized)
  - 3 matured aerial methane technologies (snow-cover, quantification, 2-commercialized)
  - Reduced cost for mass deployment of external sensors in HCAs – commercialized
  - High speed pressure sensing & coupling with CPM, increased leak localization. commercialized

iPIPE 4.0 Proposal

- Technology scouting
- Program promotion
- Annual forums
- Monthly meetings
- NDIC reporting
- Focus - build on ILI technology success, non-metallic pipe, AI detection

- 2-year timeline

The membership is eager to embark on the next round of projects and will hit the ground running.

Darren Schmidt, P.E.
Distinguished Petroleum Engineer
eercinfo@undeerc.org
701.777.5000

Energy & Environmental Research Center
University of North Dakota
15 North 23rd Street, Stop 9018
Grand Forks, ND 58202-9018

www.undeerc.org
701.777.5000



THANK YOU

Critical Challenges. Practical Solutions.

Oil and Gas Research Program
Grant Round 63 Abstract Summaries

G-63-E Starbuck Thermal-Assisted Waterflooding: Field Research and Demonstration for Broader North Dakota Application by Empire North Dakota LLC

Project Description: This demonstration project at the Starbuck Field will evaluate, optimize and document thermal-assisted waterflooding in a mature conventional North Dakota reservoir. Thermal injection has operated at Starbuck since late 2024, providing an existing field-scale platform for controlled evaluation, data acquisition, performance analysis and development of knowledge that can be transferred beyond the project area. Sustaining that platform reliably is the operating problem the project addresses.

North Dakota's conventional fields are a large, stranded and declining resource. Non-Bakken production is approximately 29,300 barrels per day, about 2.6 percent of state output, and roughly 10,250 stripper wells, 52 percent of the state's wells, deliver about 15 percent of production. The shallow, paraffin-prone Spearfish and Madison fields of the Bottineau–Renville legacy area, roughly 3,000 feet deep, approximately 36 degrees API, with original oil in place on the order of 13 million barrels per section, are the Starbuck-type play. Low reservoir temperature makes wax the operating constraint, and no field-validated method presently exists for screening or applying thermal-assisted waterflooding to them.

Starbuck is the demonstration; the deliverable is the method. The demonstration area is representative of that trend, and the operating conditions, water quality specifications, heat delivery relationships and production response indicators established here are intended to be applied directly to other Spearfish and Madison fields across the Bottineau–Renville area and to mature conventional reservoirs throughout North Dakota.

Objective: To assess thermal-assisted waterflooding as an integrated process in which reservoir characteristics, fluid behavior, feedwater chemistry, thermal generation and injection performance, and surface facility reliability collectively influence production response and incremental oil recovery. Field oil rate averaged approximately 558 barrels per day from October 2025 through January 2026 with the thermal units in service, and approximately 387 barrels per day from February through June 2026 with the units substantially out of service and water passing cold to the wellhead, across an unchanged producing well count and a higher injection rate. The difference of approximately 171 barrels per day is the measured response to loss of heat delivery, and is a lower bound because the decline had not stabilized by June. The project target is approximately 380

barrels per day of incremental oil with all three units operating in optimized mode. These observations establish a measurable response but not the controlling mechanisms, sustainable operating conditions or transferability of the process. Under controlled and measurable operating conditions, the project will generate an integrated dataset incorporating water chemistry, treatment performance, injection rate, temperature, pressure, equipment availability, scaling and maintenance history, downtime and production response. Analysis will define a sustainable thermal operating envelope that balances heat delivery and production response against water-related scaling tendency and equipment reliability.

Expected Results: The findings will be translated into a field-validated screening and applicability framework for other mature conventional North Dakota fields.

The project is expected to generate both operational improvements at Starbuck and research products with broader value to North Dakota. Expected results include improved feedwater quality, reduced scaling and acid cleanout frequency, increased thermal equipment availability, more consistent heat delivery, and definition of a sustainable operating window that balances temperature, injection conditions, scaling tendency, reliability and production response.

Duration: 18 months

Budget: The total cost is $2,200,000. The grant request from OGRP is $1,100,000. Cost share is $1,100,000 Empire North Dakota LLC cash match. The Energy & Environmental Research Center will perform $271,043 of research scope as a subcontractor.

Project-Associated Expense	NDIC Share (USD)	Empire Cash (USD)	Total Project (USD)
Labor & Technical Support			
Labor – Engineering & Field	$ 100,000	$ 100,000	$ 200,000
Engineering & Technical Support	$ 125,000	$ 125,000	$ 250,000
Surveillance & Testing			
Monitoring and Surveillance	$ 70,000	$ 70,000	$ 140,000
Fluid Characterization and Testing	$ 25,000	$ 25,000	$ 50,000
Reservoir Characterization and Screening Framework	$ 30,000	$ 30,000	$ 60,000
Facilities & Equipment			
Water Treatment System & Enhanced Heater	$ 750,000	$ 750,000	$ 1,500,000
Total Project (USD)	**$ 1,100,000**	**$ 1,100,000**	**$ 2,200,000**

Participants: Empire North Dakota LLC and UND EERC.

DIRECTOR'S COMMENTS
G-63-E
Empire North Dakota, LLC
Starbuck Thermal-Assisted Waterflooding
Principal Investigator: Reinaldo Figuera, M.Sc
Request for: $1,100,000
Total Project Costs: $2,200,000
Duration: 18 Months

Description of the Project:
Project Description: This demonstration project at the Starbuck Field will evaluate, optimize and document thermal-assisted waterflooding in a mature conventional North Dakota reservoir. Thermal injection has operated at Starbuck since late 2024, providing an existing field-scale platform for controlled evaluation, data acquisition, performance analysis and development of knowledge that can be transferred beyond the project area. Sustaining that platform reliably is the operating problem the project addresses.

North Dakota's conventional fields are a large, stranded and declining resource. Non- Bakken production is approximately 29,300 barrels per day, about 2.6 percent of state output, and roughly 10,250 stripper wells, 52 percent of the state's wells, deliver about 15 percent of production. The shallow, paraffin-prone Spearfish and Madison fields of the Bottineau–Renville legacy area, roughly 3,000 feet deep, approximately 36 degrees API, with original oil in place on the order of 13 million barrels per section, are the Starbuck-type play. Low reservoir temperature makes wax the operating constraint, and no field-validated method presently exists for screening or applying thermal-assisted waterflooding to them. Starbuck is the demonstration; the deliverable is the method. The demonstration area is representative of that trend, and the operating conditions, water quality specifications, heat delivery relationships and production response indicators established here are intended to be applied directly to other Spearfish and Madison fields across the Bottineau– Renville area and to mature conventional reservoirs throughout North Dakota.

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Statement	Weighting Factor	G-63-E1	G-63-E2
1. Objective	9	27	27
2. Achievability	7	28	21
3. Methodology	8	40	24
4. Contribution	8	24	16
5. Awareness/Background	5	20	20
6. Project Management	3	12	9
7. Equipment/Facilities	2	6	8
8. Value/Industry-Budget	4	16	12
9. Financial Match – Budget	4	16	12
Average Weighted Score		189	149
	Total: 50		250 possible points
Overall Recommendation:			
Fund		X	
Funding May Be Considered			X
Do Not Fund			

Technical Reviewers' Comments

Reviewer G-63-E1

Recommend to fund with cost share changes If this project succeeds results will be applicable to other EOR projects in Bottineau and Renville Counties. The significant involvement of EERC in all phases of the project makes achievement of project objectives likely. Data from a successful project could have a significant positive impact on conventional reservoir EOR in Bottineau and Renville Counties.
The background of the investigator team is exceptional. The plan includes well defined milestones.
The proposal doesn't provide a hypothesis for how hot water injection will improve oil recovery. Producing formation data such as bottom hole temperature and pressure, oil analysis data such as paraffin content and pour point, or water analysis data such as calcium concentration and scaling tendency should be requested. The potential project scope reduction options offered in the Methodology section indicate potential significant shortfalls could occur. The facility design, equipment specifications, and vendor selection are currently undefined, but are included as Phase 3 work of EERC.

Recommendation: Fund

Reviewer G-63-E2

It would be easy to look at this project as simply a creative way to finance the purchase of needed production equipment to implement an enhance oil recovery project, but it does have a true research potential to increase the oil and gas industry knowledge of operating a thermally enhanced waterflooding operation. I recommend funding this project if the OGRP has ample funding available.

Recommendation: Funding May Be Considered

Director's Recommendation: Fund for $1,100,000

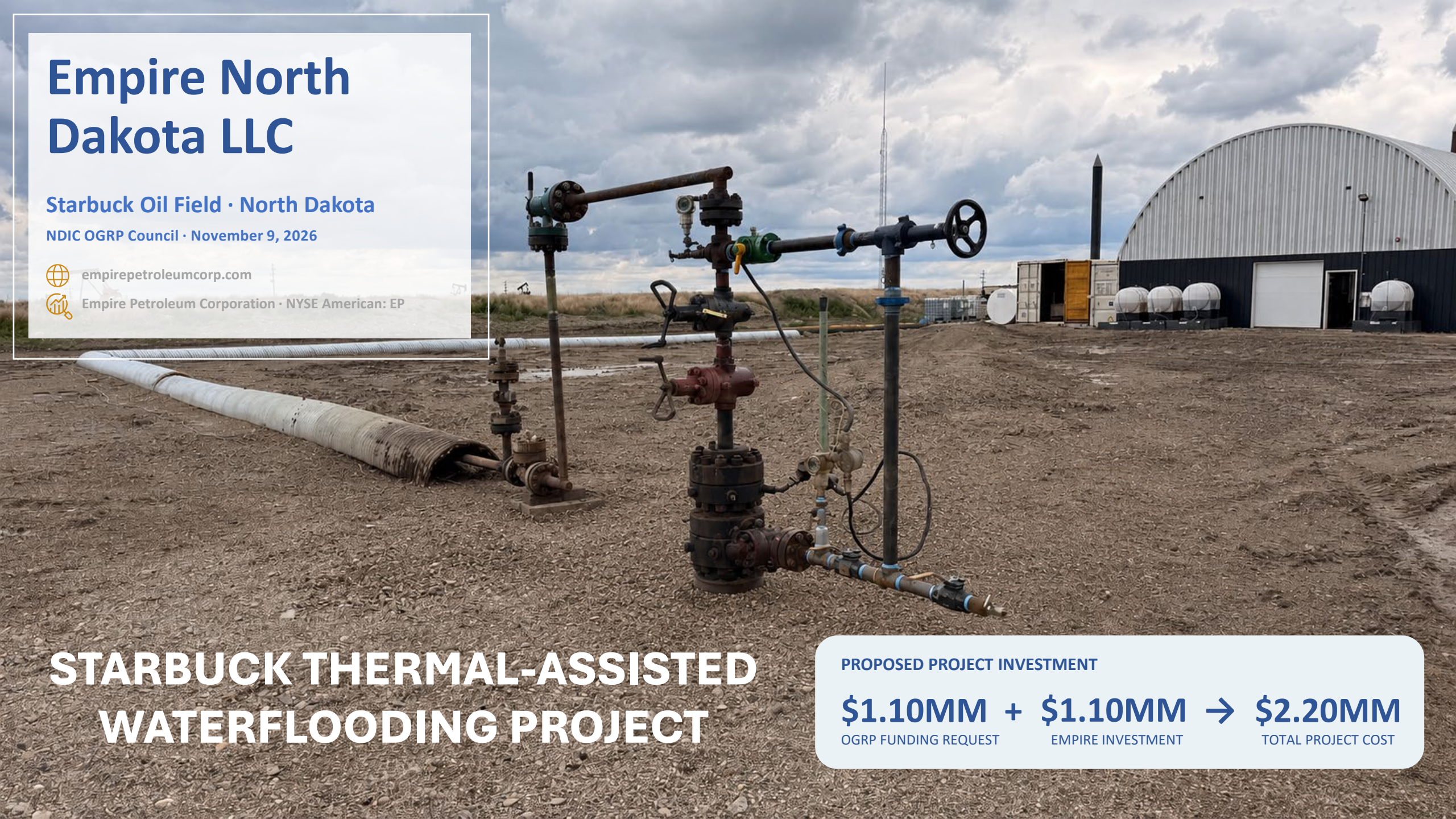
Empire North Dakota LLC

Starbuck Oil Field · North Dakota

NDIC OGRP Council · November 9, 2026

empirepetroleumcorp.com

Empire Petroleum Corporation · NYSE American: EP



STARBUCK THERMAL-ASSISTED WATERFLOODING PROJECT

PROPOSED PROJECT INVESTMENT

$1.10MM	+	$1.10MM	→	$2.20MM
OGRP FUNDING REQUEST		EMPIRE INVESTMENT		TOTAL PROJECT COST

Who we are?

Empire North Dakota LLC operates mature conventional oil assets across North Dakota and western Montana.

243 GROSS WELLS

118 net wells across North Dakota and western Montana.

~24,200 ACRES

Gross operated footprint across North Dakota and western Montana.

DEVELOPMENT PROGRAM

13 Upper Charles development wells and five vertical pilot wells at Starbuck.

THERMAL SINCE 2024

Existing injection operations, field surveillance and performance data.

Established North Dakota operator → Existing infrastructure, local expertise and operating data support the OGRP demonstration.

What this project is, in plain words?

Heat the water we already inject, keep the system running, and prove how much more oil a cold, waxy field gives up.

THE OIL

Shallow, cold reservoir about 3,000 feet down, and waxy crude. The wax stiffens like candle wax in a cold pipe.

WHAT HEAT DOES

Warming the injected water keeps the wax mobile, so the same thermal waterflood recovers more oil.

ALREADY PROVEN

Empire built and has run hot-water injection at Starbuck at its own cost. When the units went down, oil fell 31%.

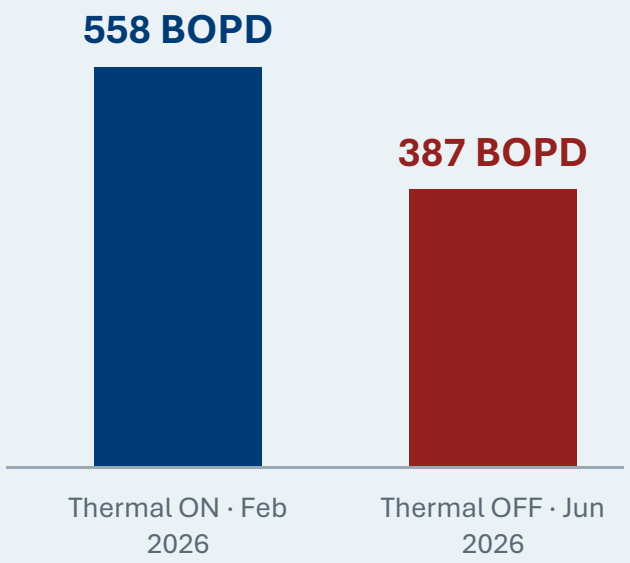
WHY OGRP

The heaters scale and shut down. OGRP funds treat the water, measure the reservoir response and document the method.

“Turning a proven field installation into a scalable, replicable solution to revitalize North Dakota’s mature oil fields”

The evidence: what happened when the heat stopped?

February to June 2026: the thermal units were down while water injection continued. Oil fell 31 percent.



Oil: 171 BOPD (−31%)

558 → 387 BOPD with the thermal units down, February to June 2026.

Injection +28%

1,024 → 1,314 BWIPD over the same window, voidage cannot explain the loss.

Wells flat at 19–21

Producing well count unchanged. About 25,600 bbl of oil deferred over the five months.

Empire built and ran this at its own cost. Delivering the heat reliably is what the Program funds.

Starbuck Challenges & EOR Opportunities

- **RESEARCH & INNOVATION**
  Advance and validate Thermal EOR for scalable application across North Dakota's mature fields

- **FEEDWATER QUALITY & SCALING**
  Optimize water quality, reduce coil scaling, cleanouts and downtime

- **RELIABLE THERMAL INJECTION**
  Overcome heat-transfer limits to sustain injection temperature and uptime

- **ENHANCED OIL RECOVERY**
  Sustained reservoir heating promotes oil mobilization and incremental recovery

Practical deployment

Build on existing Starbuck infrastructure to test, optimize and document performance.



Whooping Crane Thermal Unit

Integrated technical solution

1 WATER SUPPLY

Evaluate supplemental freshwater supply and integrate it with existing water infrastructure.

2 WATER QUALITY

Use laboratory-guided blending, treatment and routine chemistry monitoring.

3 HEATER DESIGN & INJECTION OPTIMIZATION

Joint Empire–EERC research and engineering to advance heater efficiency, injection optimization, and oil recovery.

4 FIELD DEMONSTRATION

Commission, measure performance and refine operating practices.

5 SCREENING FRAMEWORK

The reservoir, water-quality, facility and economic conditions under which the method transfers to other North Dakota fields.

Measurable Project Success

Reliability and maintenance

Track heater uptime, coil cleanout frequency, maintenance days and associated operating costs.

Feedwater management

Measure salinity, scaling tendency, treatment performance and freshwater supply reliability.

Injection performance

Record daily injection volume, pressure and temperature; document operating stability

Reservoir response

Track offset-well production trends and incremental oil recovery against baseline.

CONTROLLED COMPARISON:

Complete a thermal on → off → on sequence and measure the oil response against the thermal-off baseline.

Execution roadmap | 18 months

01 Baseline & Design

Water sampling, field review, performance baseline and final engineering.

02 Procure & Build

Equipment and material procurement, fabrication, and infrastructure development.

03 Commission

Complete installation, safety checks, system testing and controlled startup.

04 Validate & Report

Optimize operations; evaluate reliability, injection and production response.

All months are measured from execution of the resulting contract with the Commission. No calendar dates are proposed, so the schedule is unaffected by the timing of the Commission's decision and of contract execution.

Project Budget

Project Component	Estimated Cost (USD)
Labor & Technical Support	
Labor – Engineering & Field	$ 200,000
Engineering & Technical Support	$ 250,000
Surveillance & Testing	
Monitoring and Surveillance	$ 140,000
Fluid Characterization and Testing	$ 50,000
Reservoir Characterization & Screening	$ 60,000
Facilities & Equipment	
Water Treatment System & Enhanced Heater	$ 1,500,000
Total Project (USD)	**$ 2,200,000**

Budget Philosophy

- Focus on field facilities improvements to optimize thermal EOR performance.
- Balance targeted engineering with practical field implementation.
- Refine budget allocation through field evaluation, preliminary engineering and final equipment definition.

Funding Structure

- 50/50 cost-share: NDIC OGRP funds 50% of the total.
- Empire provides the remaining 50%.
- **Estimated Total Project Cost: $2.20M — every line split 50/50**
- EERC subcontract $271,043 is carried within the technical support and screening framework lines.

Project Team & Accountability

Empire North Dakota LLC

Primary executor and 50% cash contributor

Principal Investigator: Reinaldo Figuera

Procurement, facilities, operations and reporting

Field execution and cost documentation

EERC technical subcontract

Engineering and subsurface evaluation

Principal Investigator: Joshua R. Strege

Monitoring, technical validation and findings

Included budget: $271,043

Technical and financial controls: stage-gated design, documented testing, vendor oversight and milestone reporting.

Value to North Dakota

Public benefit extends beyond one operator and one field.

Mature-field recovery

Test whether more reliable thermal injection can increase recovery from existing conventional wells.

Water and operating efficiency

Document practical treatment requirements, scaling control, maintenance and heat delivery.

Economic potential

Thermal unit downtime (Q1 & Q2 - 2026) reduced oil production from 558 to 387 BOPD. This project aims to boost recovery.

Technical knowledge transfer

With EERC, report performance data, engineering lessons and screening criteria subject to disclosure terms.

Replication criteria

Identify the reservoir, water-quality, facility and economic conditions required for use in other ND fields.

“A successful demonstration could extend the productive life of North Dakota’s mature conventional oil fields through cost-effective incremental oil recovery, while providing a scalable approach for other fields across the state”

OGRP Reviewer Feedback & Responses

Reviewer Comments

- Observations
- Technical concerns
- Recommendations

EMPIRE / EERC Response

- Technical clarifications
- Risk mitigation measures
- Field validation approach

Empire’s field experience and EERC’s technical expertise provide a strong foundation for structured research, risk mitigation, and field validation.

Oil and Gas Research Program
Grant Round 63 Abstract Summaries

G-63-H Rewriting the Bakken Playbook: Orthogonal Infill Well Drilling and Diagnostics-Guided Completions to Boost Stimulated Reservoir Volume and Recovery in the Bakken by SOGC, LLC

Project Description: This project seeks to demonstrate the first diagnostics-guided redevelopment of a mature Bakken drilling unit using orthogonally oriented infill wells (east-west well azimuth) designed to intersect underdrained reservoir compartments and create new stimulated reservoir volume between existing wells (north to south well azimuth). The hypothesis is that strategically placed orthogonal wells can access remaining oil that is poorly contacted by existing wellbores and fracture networks, thereby increasing reservoir drainage efficiency and ultimate recovery. This project will integrate well diagnostics, laboratory analyses, fracture modeling, completion engineering, and reservoir simulation to optimize orthogonal well placement and stimulation design.

The project will focus on the Martens Drill Spacing Unit (DSU) in the Sanish Field of Mountrail County, where twelve existing horizontal wells completed between 2010 and 2017 provide an ideal test case for evaluating this innovative redevelopment approach. These wells represent a generation of Bakken development that predated many of the completion innovations now being applied successfully across the basin. A key element of the project is the acquisition of new diagnostic information from mature wells. Field investigations will be conducted to evaluate wellbore conditions, identify potential restrictions to production, and gather data that can improve understanding of reservoir depletion and well performance.

Objective: To develop and demonstrate an innovative redevelopment strategy for mature Bakken drilling units using orthogonally oriented infill wells combined with advanced well diagnostics, reservoir characterization, engineering analysis, and optimized completion designs.

The hypothesis of this project is that orthogonal wells drilled transverse to existing well orientations can access underdeveloped reservoir compartments, establish new flow pathways, improve communication with previously bypassed rock volumes, and increase stimulated reservoir volume (SRV). By fundamentally changing the geometry of reservoir drainage within a mature drilling unit, orthogonal well development has the potential to significantly increase estimated ultimate recovery (EUR) compared with conventional redevelopment approaches.

Expected Results: To generate a comprehensive, field-validated methodology for evaluating mature Bakken wells and designing more effective redevelopment programs. The integration of production analysis, well diagnostics, laboratory testing, geologic modeling, and reservoir simulation will improve understanding of reservoir depletion, remaining oil distribution, wellbore conditions, and factors limiting production performance. These results will reduce uncertainty in future development planning and provide operators with actionable data for selecting redevelopment targets and optimizing completion designs. The project is also expected to demonstrate how modern completion technologies, including longer laterals and higher-intensity stimulation designs, can increase stimulated reservoir volume and improve recovery efficiency compared with legacy development practices. The final deliverables will provide operators and stakeholders with redevelopment recommendations based on diagnostics-guided completion design, oil production forecasts, and a practical workflow for evaluating and redeveloping mature Bakken drilling units across North Dakota. Successful implementation will help extend the productive life of existing assets, increase oil recovery, and improve the economic value of mature Bakken developments.

Duration: 24 months

Budget: The total cost is $59,997,528. The grant request from OGRP is $6,614,528. Cost share is provided by SOGC and UND EERC.

Project Associated Expense	NDIC Share (OGRP)	SOGC & Partners Share (Cash)	Total Expense
Drilling & completing 5 new wells (DCF)		$ 53,000,000	$ 53,000,000
Well Pad Construction		$ 360,000	$ 360,000
Cleanout of 11 Existing wells	$ 5,225,000		$ 5,225,000
Subcontractor - EERC	$ 1,389,528		$ 1,389,528
Total Project Cost	$ 6,614,528	$ 53,360,000	$ 59,974,528
Requested funds % of total			11%

Participants: SOGC, LLC and their working interest Partners and UND EERC.

DIRECTOR'S COMMENTS
G-63-H
SOGC, LLC
Rewriting the Bakken Playbook: Orthogonal Infill Well Drilling and Diagnostics-Guided Completions to Boost Stimulated Reservoir Volume and Recovery in the Bakken
Principal Investigator: Lee Bartholomew
Request for: $6,614,528
Total Project Costs: $59,974,528
Duration: 24 Months

Description of the Project:
This project seeks to demonstrate the first diagnostics-guided redevelopment of a mature Bakken drilling unit using orthogonally oriented infill wells (east-west well azimuth) designed to intersect underdrained reservoir compartments and create new stimulated reservoir volume between existing wells (north to south well azimuth). The hypothesis is that strategically placed orthogonal wells can access remaining oil that is poorly contacted by existing wellbores and fracture networks, thereby increasing reservoir drainage eU̇iciency and ultimate recovery. This project will integrate well diagnostics, laboratory analyses, fracture modeling, completion engineering, and reservoir simulation to optimize orthogonal well placement and stimulation design. The project will focus on the Martens Drill Spacing Unit (DSU) in the Sanish Field of Mountrail County, where twelve existing horizontal wells completed between 2010 and 2017 provide an ideal test case for evaluating this innovative redevelopment approach. These wells represent a generation of Bakken development that predated many of the completion innovations now being applied successfully across the basin. A key element of the project is the acquisition of new diagnostic information from mature wells. Field investigations will be conducted to evaluate wellbore conditions, identify potential restrictions to production, and gather data that can improve understanding of reservoir depletion and well performance.

Objective:
To develop and demonstrate an innovative redevelopment strategy for mature Bakken drilling units using orthogonally oriented infill wells combined with advanced well diagnostics, reservoir characterization, engineering analysis, and optimized completion designs. The hypothesis of this project is that orthogonal wells drilled transverse to existing well orientations can access underdeveloped reservoir compartments, establish new flow pathways, improve communication with previously bypassed rock volumes, and increase stimulated reservoir volume (SRV). By fundamentally changing the geometry of reservoir drainage within a mature drilling unit, orthogonal well development has the potential to significantly increase estimated ultimate recovery (EUR) compared with conventional redevelopment approaches.

Statement	Weighting Factor	G-63-H1	G-63-H2
1. Objective	9	36	18
2. Achievability	7	21	14
3. Methodology	8	40	24
4. Contribution	8	32	16
5. Awareness/Background	5	20	15

6. Project Management	3	12	9
7. Equipment/Facilities	2	10	4
8. Value/Industry-Budget	4	20	20
9. Financial Match – Budget	4	20	20
Average Weighted Score		211	140
	Total: 50		250 possible points
Overall Recommendation:			
Fund		X	
Funding May Be Considered			X
Do Not Fund			

Technical Reviewers' Comments

Reviewer G-63-H1

If this project succeeds results will be applicable to a large portion of the currently developed Bakken oil field and the background of the investigator team is exceptional.
The plan includes well defined milestones.
The significant involvement of EERC in all phases of the project makes achievement of project objectives likely.
Data from a successful project could have a significant positive impact on redevelopment and ultimate recovery from the Bakken reservoir.
Recommendation: Fund

Reviewer G-63-H2

Careful consideration should be made for this proposal in regards to the potential issues it may present for future EOR projects, if successful and considered for large scale implementation in the Bakken formation across the entire Williston basin. It may need to be limited to those areas that might be considered poor candidate regions for EOR injection. The potential for increased primary oil and natural gas recovery, for those regions deemed poor EOR candidates, would make cross-cutting wellbores an attractive option for operators, even for inclusion as part of potential unitization rules.
Recommendation: Funding May Be Considered

Director's Recommendation: Fund for $4,000,000

Martens 3-mile Waffle 2027 OGRP Proposal



November 9th, 2026

SOGC Team



Lee Bartholomew – Subsurface Manager

16 years industry. Wellbore Placement, Geology and Asset Leadership

B.S. Weber State University; M.S. Geology, Bowling Green State University



Kate Klossner - VP Government Relations & Communications

13 years industry. Policy, Government and Public Affairs

B.S. Rochester Institute of Technology; M.S. Organizational Leadership, Mercyhurst University



Dave French - President

35 years industry, Production and Reservoir Engineering, Partner, Executive Leadership

B.S. Mechanical Engineering, Rice University; M.B.A. Harvard Business School

Energy & Environmental Research Center, University of North Dakota

Collaborating on production, reservoir and frac modeling

Rewriting the Bakken Playbook:

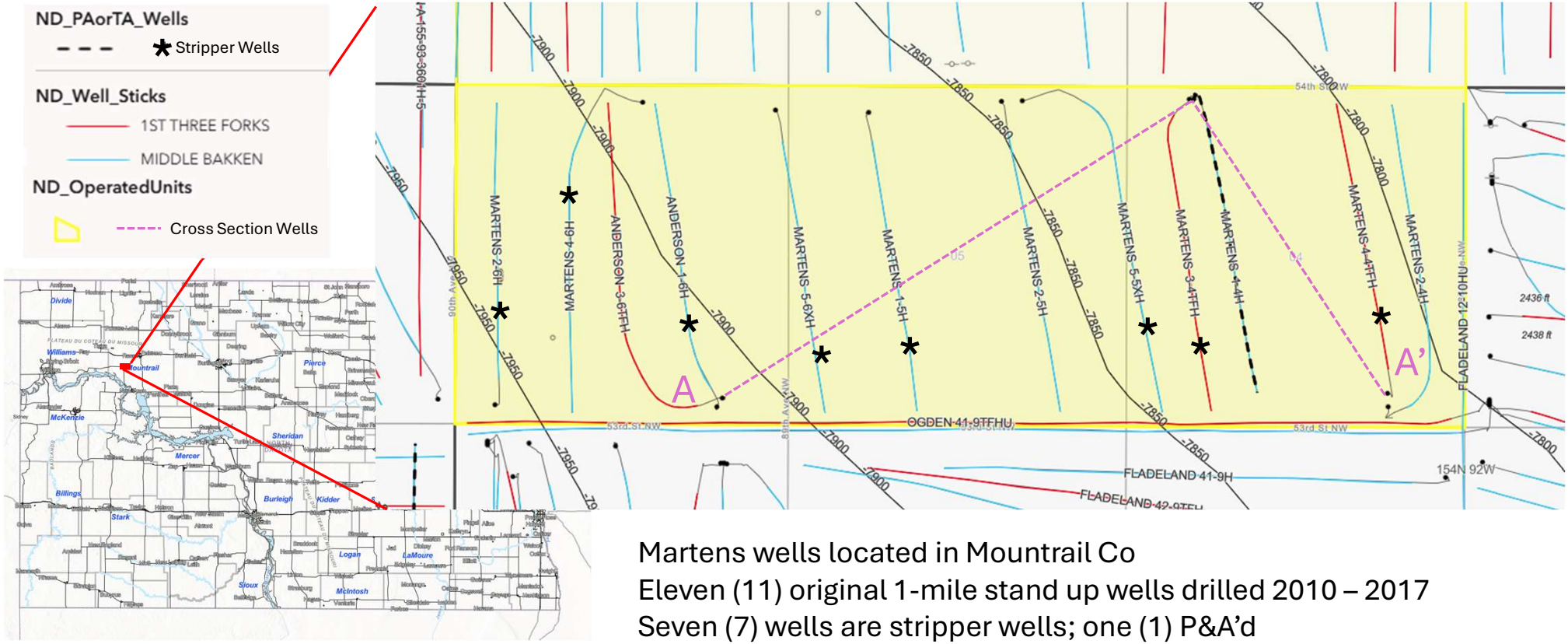
Orthogonal Infill Well Drilling and Diagnostics-Guided Completions to Boost Stimulated Reservoir Volume and Recovery in the Bakken

WHAT:	• Innovative strategy for mature Bakken drilling units using a **waffle-design** • **Crosses five new wells transversely** under eight existing Middle Bakken wells using wellbore cleanout, reservoir diagnostics, and advanced completion design
WHY:	• **Significant volumes of oil likely remain** undrained and inadequately contacted • New wells can access underdeveloped reservoir compartments and establish new flow pathways • Increased oil recovery from new wells while **restoring/enhancing production** from mature wells • **Revive stripper wells** that would otherwise be considered for P&A
WHAT IT MEANS TO NORTH DAKOTA:	• **Scalable pathway** for extending the productive life of thousands of mature wells in the Bakken • Increased oil recovery in older technology units, units with stripper wells nearing end of life, with a well and frac design that is achievable for small and mid-size operators

$6.6MM Request is 11% of Project Investment

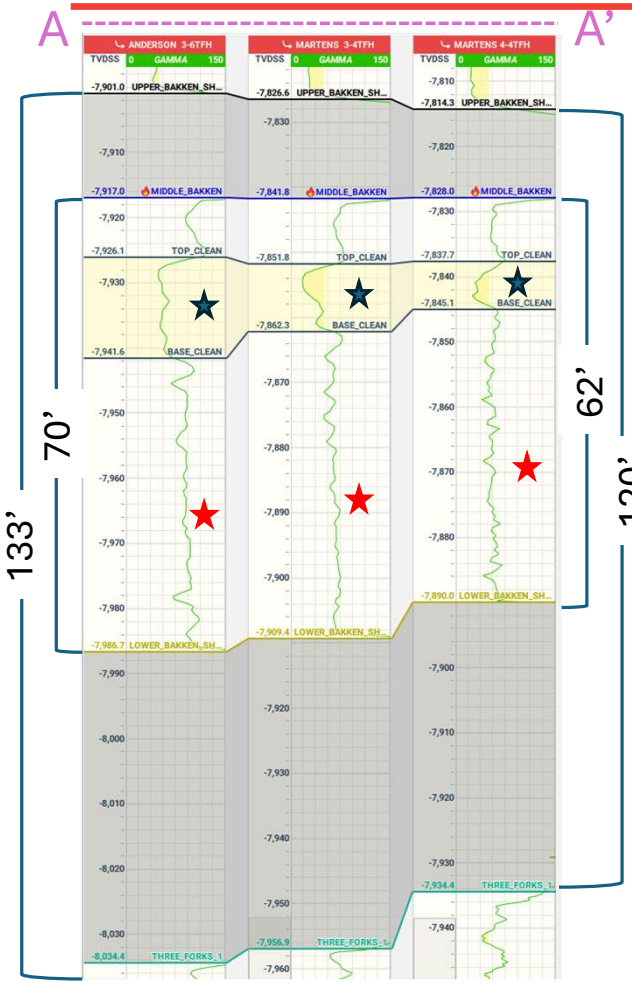
Project Associated Expense	OGRP Grant Request	SOGC & Partners	Total Expense
Drilling & Completing 5 New Wells		$53,000,000	$53,000,000
Well Pad Construction		$360,000	$360,000
Cleanout of 11 Existing Wells	$5,225,000		$5,225,000
Subcontractor- EERC	$1,389,528		$1,389,528
Total Project Costs	**$6,614,528**	**$53,360,000**	**$59,974,528**

Existing Infrastructure Approaching Economic Limit



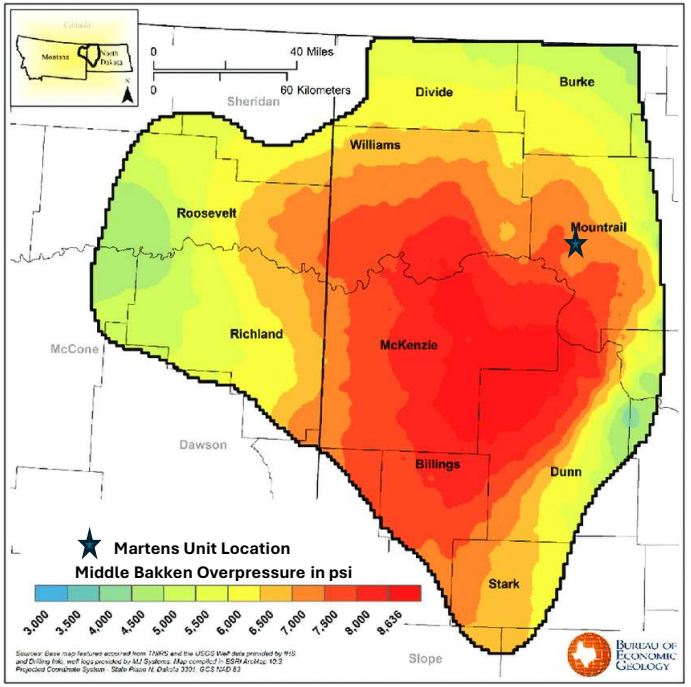
Martens wells located in Mountrail Co
Eleven (11) original 1-mile stand up wells drilled 2010 – 2017
Seven (7) wells are stripper wells; one (1) P&A'd

Development Potential Remains Significant



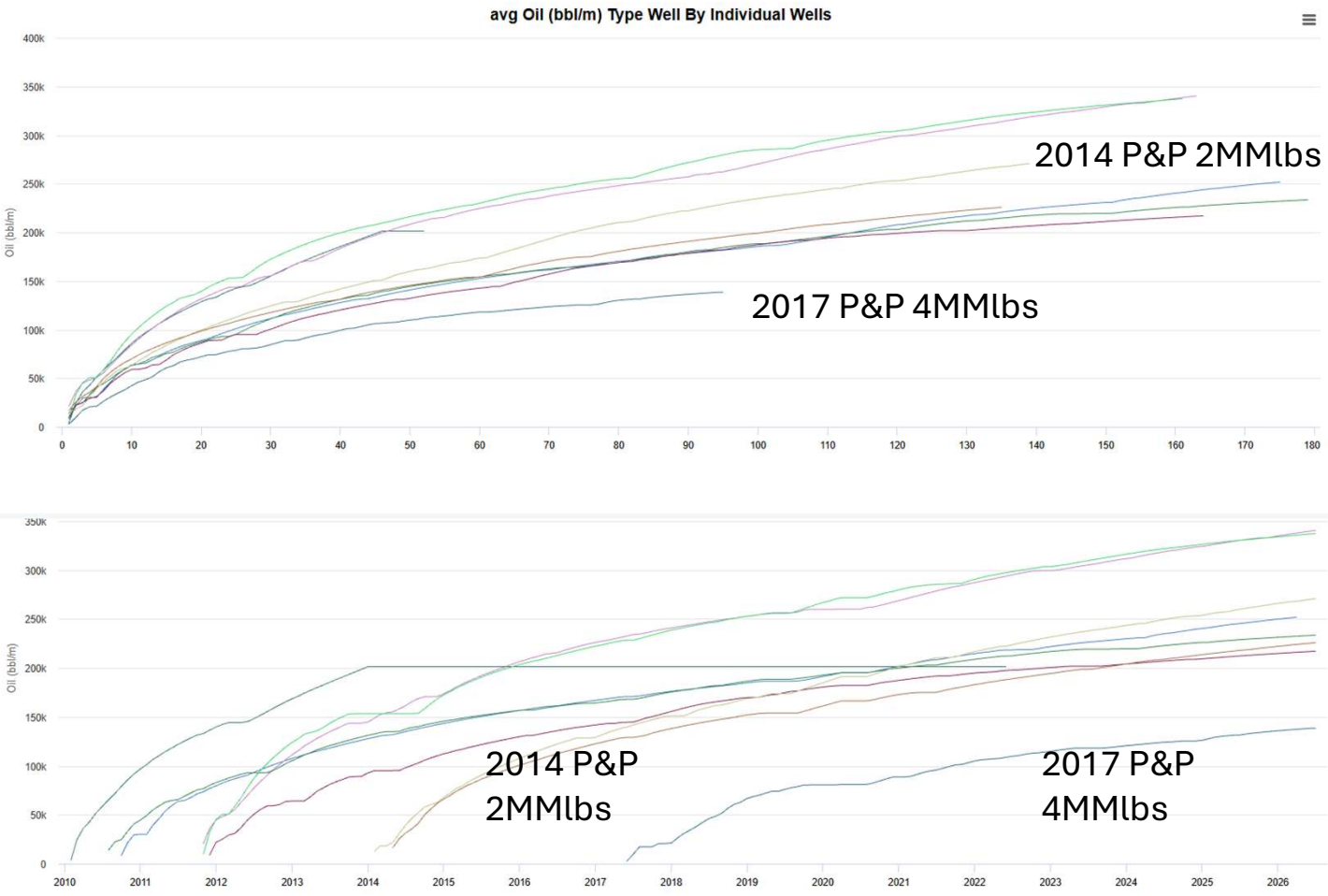
- Thick source and reservoir rocks
- Existing wells targeted the sandstone interval ★
- New wells Targeting Lower Middle Bakken ★
- Initial reservoir pressure 7,500 psi.
- Current wellbore reservoir pressures of approximately 545-820 psi
- The volume of fluid required to draw down the pressure in the Bakken Petroleum system 7000psi far exceeds the volumes extracted thus far.
- Pressure and hydrocarbon depletion is likely localized around stimulated reservoir volume rather than representative of unit-wide depletion
- Suggests significant remaining development potential

Middle Bakken Original Overpressure



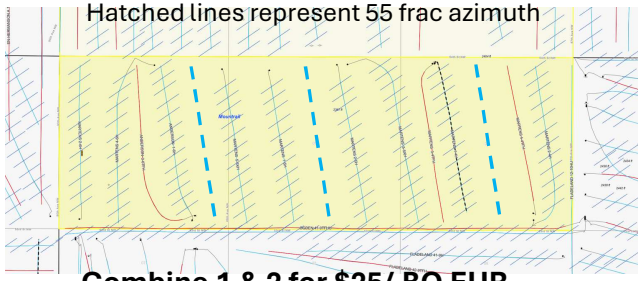
Gherabati, s & Hamlin, H. & Smye, Katie & Eastwood, Raymond & McDaid, Guinevere. (2019). Evaluating hydrocarbon-in-place and recovery factor in a hybrid petroleum system: Case of Bakken and three forks in North Dakota. Interpretation. 7. T607-T624. 10.1190/int-2018-0213.1.

Alternate Development Strategies Needed for Unrecovered Hydrocarbons

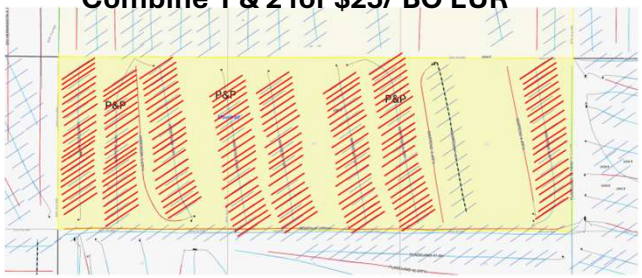


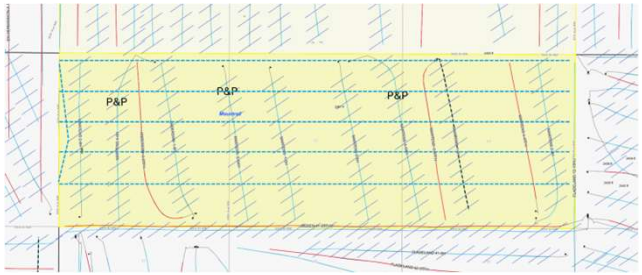
- >2.2 MMBO recovered from nine existing Middle Bakken wells
- Less than 5% of original oil in place has been produced
- Substantial remaining resource presents meaningful upside potential
- Alternative development designs may unlock additional reserves and improve project value
- Demonstrating success here would accelerate value creation across a broad portfolio of under-recovered Bakken assets

Waffle Delivers the Highest Return



Combine 1 & 2 for $25/ BO EUR





Combine 3 & 3a for $15/ BO EUR

Scenario 1: Infill Drilling

- Infill 3 wells between existing wellbores
- Low apparent reservoir engagement suggests significant bypassed hydrocarbons remain
- $27 invested / BO EUR increase

Scenario 2: Refracture Existing Wells

- Re-frac candidate inventory of 8 Middle Bakken wells
- Opportunity to re-stimulate under-contacted rock at a fraction of new-well cost
- Utilizes existing wellbores and infrastructure, reducing capital requirements
- $23 invested/ BO EUR increase

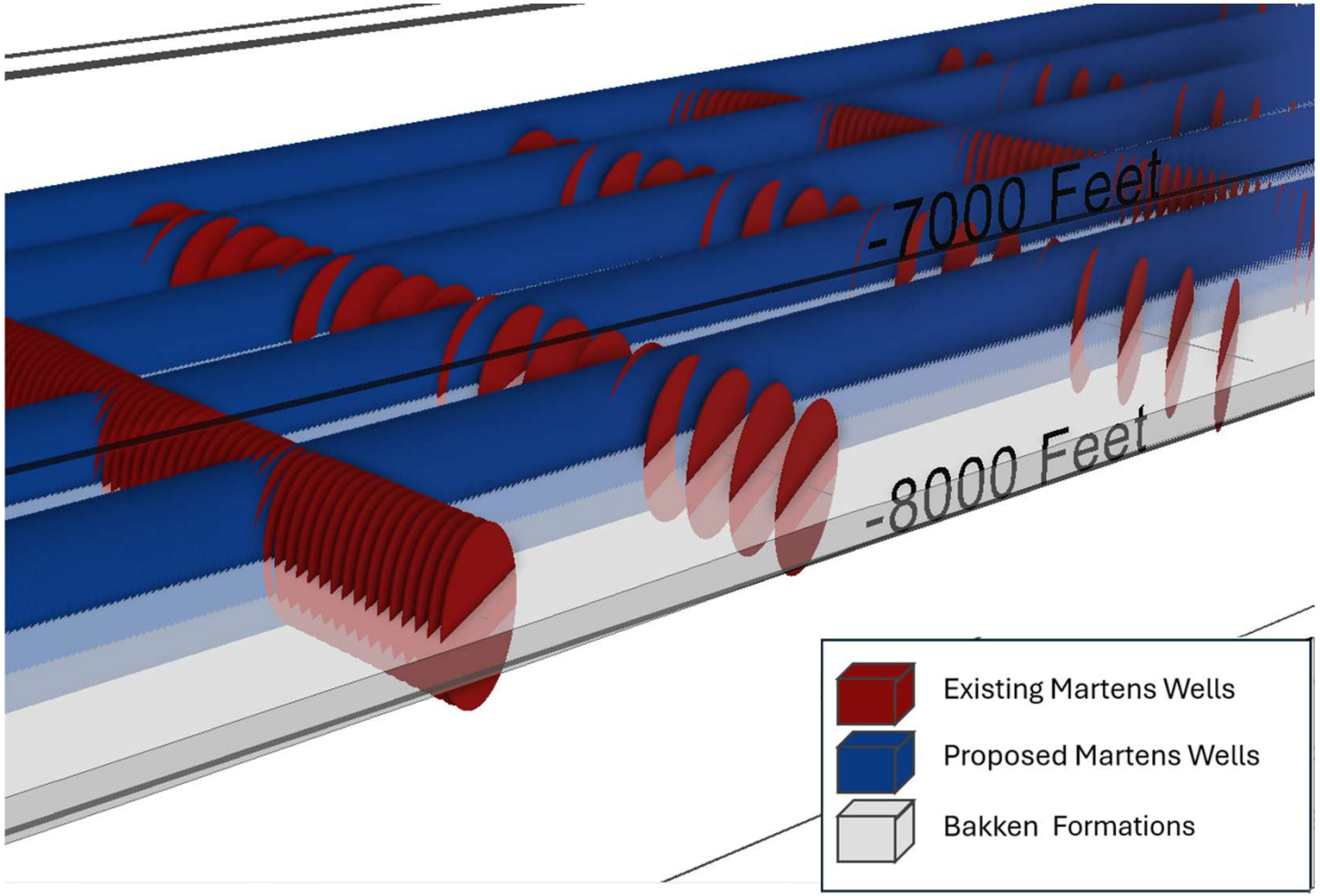
Scenario 3: New Long-Lateral Cross-Cutting (Waffle) Development

- Longer laterals increase reservoir exposure and contacted rock volume
- Modern completions improves fracture distribution and reservoir access
- $16 invested / BO EUR increase

Scenario 3a: Cleanout Existing Wells

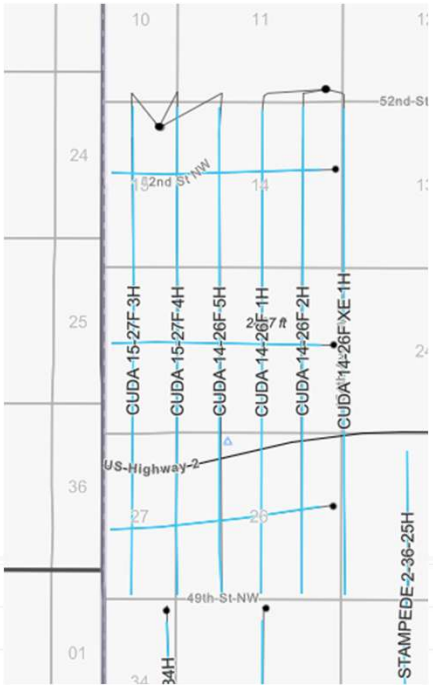
- $10 invested / BO EUR increase

Unstimulated Rock Creates Significant Opportunity

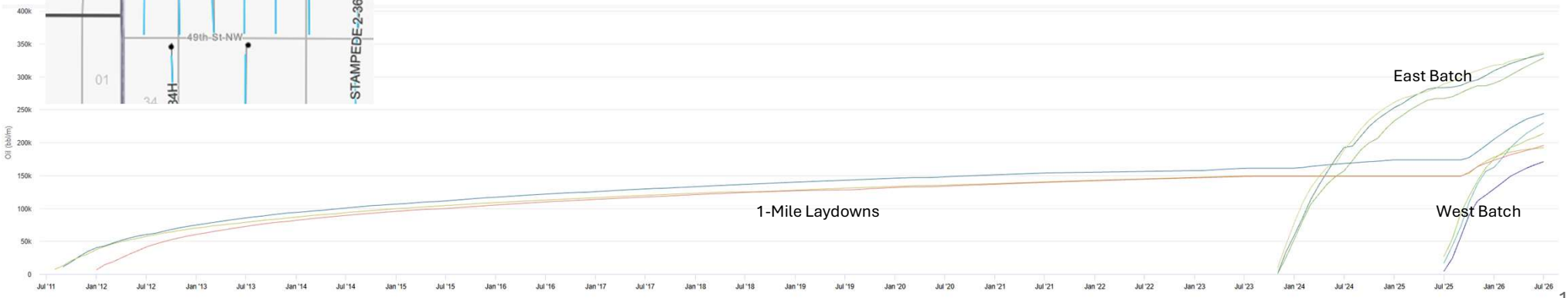


- SOGC has partnered with the EERC to model reservoir, frac and production to design the best possible outcome
- Each disk represents a single frac
- Grey horizontal layer is the productive Bakken Petroleum System
- Early wells accessed only a fraction of the reservoir
- Modern completion technology dramatically improves reservoir contact
- **Large volumes of unstimulated rock remain undeveloped**
- Fracture reach is limited (~500 ft), creating significant remaining development opportunity.

Analog Unit Shows Promising Results

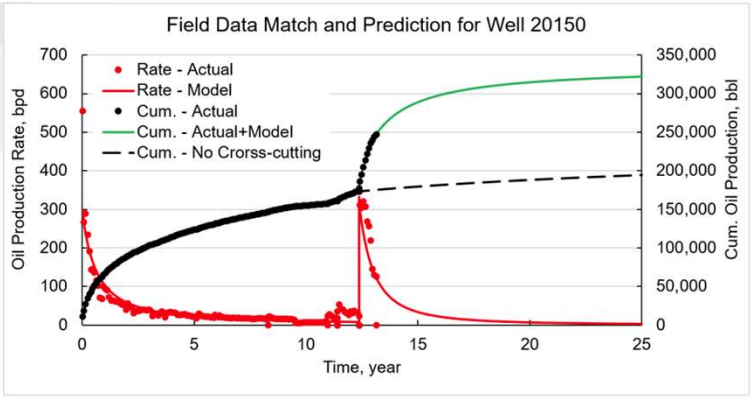


- EOG drilled initial laydown wells in 2011-2012
- Middle Bakken thickness approximately 25 ft
- Grayson Mill drilled two batches of 3-mile standup wells in 2024-2025
- New wells delivering commercial production rates
- Legacy wells realized 45-70 MBO uplift within one year
- Analog rock is less than half the thickness of both source and reservoir rocks but similar initial formation pressure as Martens unit

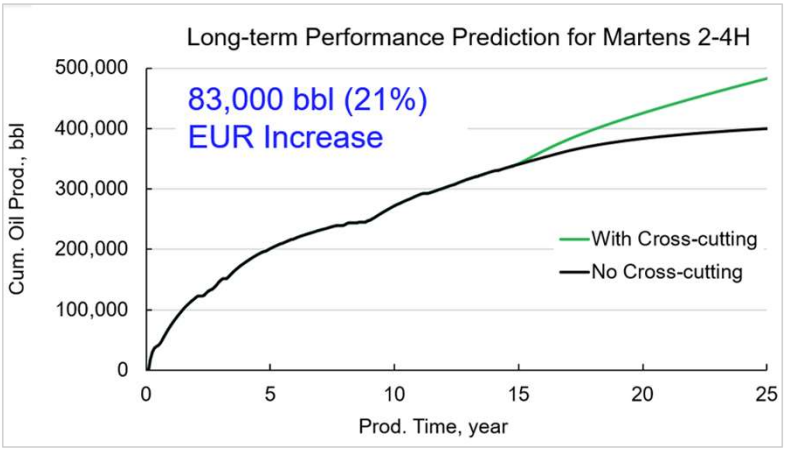


Model Shows EUR Uplift of 20- 65%

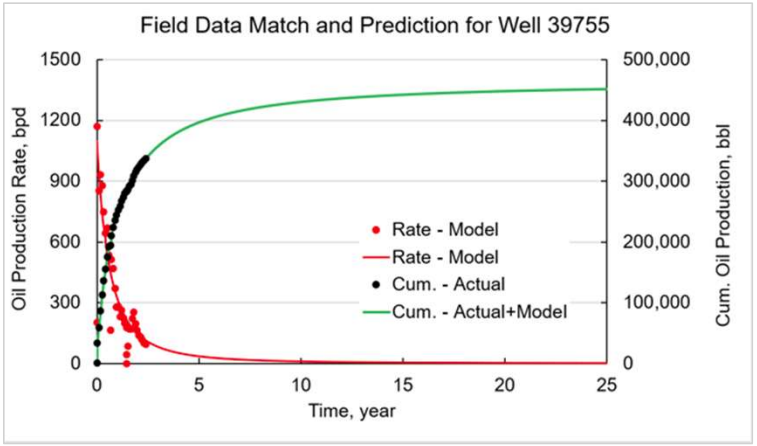
Analog Well Showing Enhanced Production After Waffle Frac.



EERC Partnership Model Showing 21% Increase



Analog New Well Showing Economic Production



- EERC modeling demonstrates **significant uplift** in existing-well recovery while maintaining economic new-well development
- Comparable field **analogs have outperformed** modeled expectations.
- **Superior reservoir quality and advanced completion technology** provide a credible pathway to results exceeding both modeled forecasts and analog performance.

Conclusions – Why Waffle?

Significant Remaining Resource

- The unit appears materially under-recovered, with significant remaining resource and multiple technically viable redevelopment opportunities

Scalable Bakken Solution

- SOGC believes this project proves a scalable pathway for extending the productive life of thousands of mature wells in the Bakken

Practical Recovery Enhancement

- SOGC's goal is to prove increased oil recovery in older technology units, units with stripper wells nearing end of life, with a well and frac design that is achievable for small and mid-size operators

Industry Knowledge Sharing

- SOGC plans to present the results of this study through BPOP and at the Williston Basin Petroleum Conference in 2028

Appendix

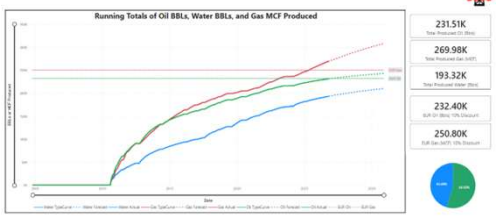
Existing Middle Bakken Well Information

Well Distribution

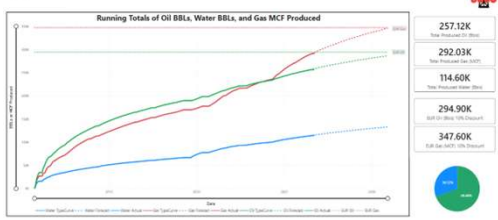
- 12 total wells
- 8 Middle Bakken
- 3 Three Forks
- 1 P&A Middle Bakken

Stripper	Lease Name	Remaining Oil MB	Cum Oil	Ult. Oil, MB
*	ANDERSON 1-6H	0.848	231.51	232.358
*	MARTENS 1-5H	37.741	257.12	294.861
	MARTENS 2-4H	81.342	341.63	422.972
	MARTENS 2-5H	8.266	344.63	352.896
*	MARTENS 2-6H	0.728	222.99	223.718
*	MARTENS 4-6H	15.52	141.66	157.18
*	MARTENS 5-5XH	61.127	274.87	335.997
*	MARTENS 5-6XH	38.883	228.31	267.193
	Total	244.455	2042.72	2287.175

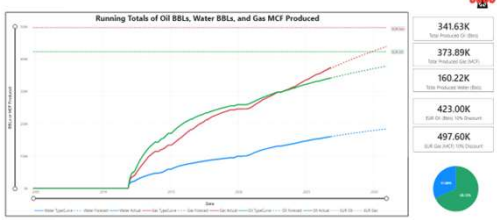
ANDERSON 1-6H



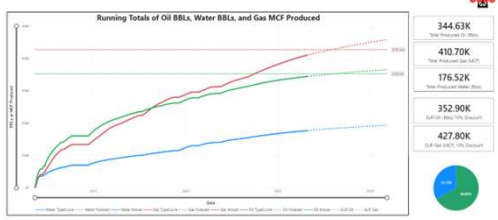
MARTENS 1-5H



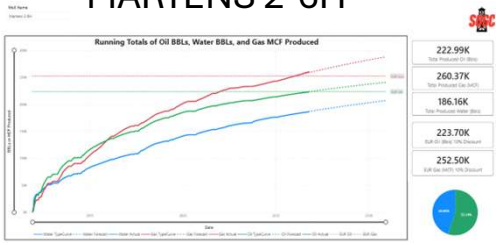
MARTENS 2-4H



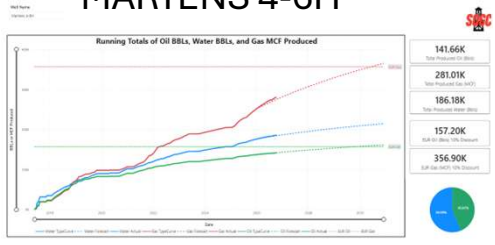
MARTENS 2-5H



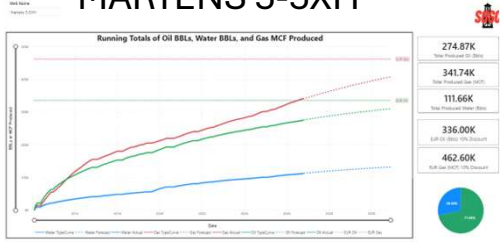
MARTENS 2-6H



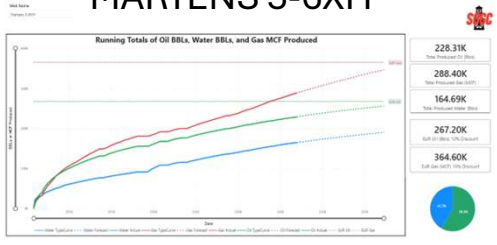
MARTENS 4-6H



MARTENS 5-5XH

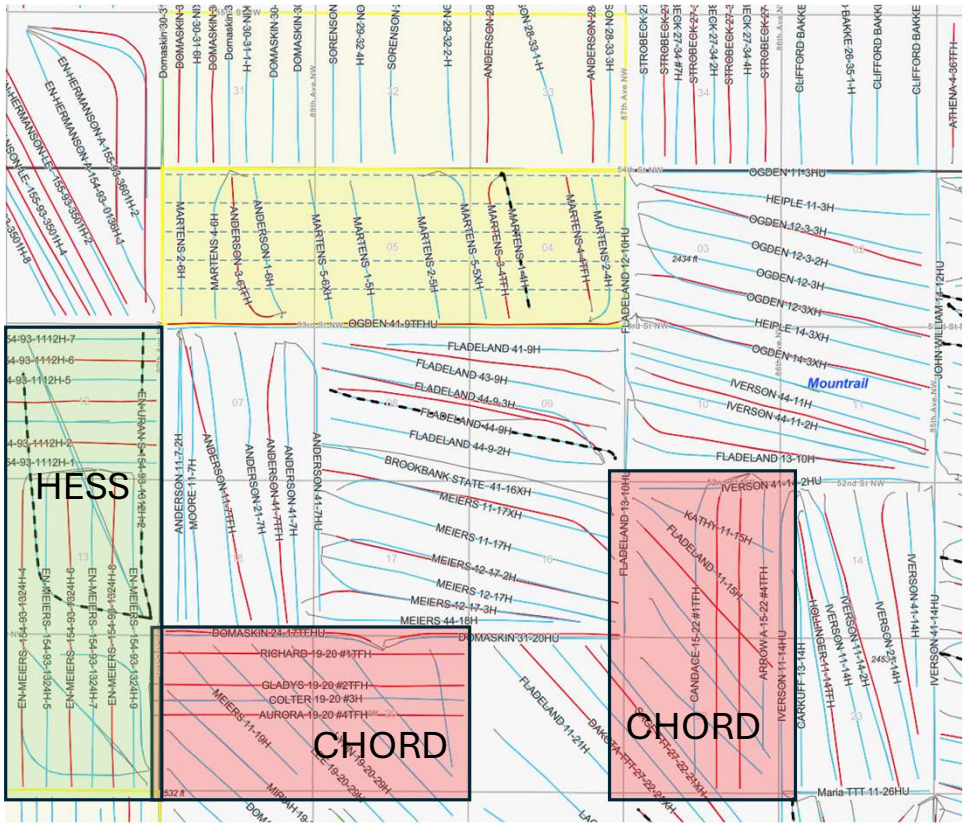


MARTENS 5-6XH



Alternate Design Analog Wells

- Limited Bakken cross-cutting well analogs
- Hess/Chevron: New MB wells replacing P&A'd MB wells
- Whiting/Chord: New TF wells cross-cutting beneath existing MB laterals
- Grayson Mill/Devon: New MB wells cross-cutting legacy MB laterals (next slide)
- Existing analogs support technical feasibility of cross-cutting development



Oil and Gas Research Program
Grant Round 63 Abstract Summaries

G-63-L Extending Well Life and Increasing Oil Production Via Casing Gas Recovery by University of North Dakota Energy & Environmental Research Center

Project Description: Building on the successful Clean Natural Gas Capture and Emissions Reduction Program, which funded deployment of 30 single-stage gas capture units across the Bakken, this project advances next-generation oilless compression technology to unlock improved oil recovery (IOR) through aggressive casing gas pressure drawdown. Conventional field compressors frequently choke, degrade, or fail when processing wet, liquid-rich casinghead gas. To overcome this critical technical barrier, this project will field-validate a newly engineered, two-stage oilless compressor featuring double the throughput capacity and double the discharge pressure capability of the original design, uniquely capable of handling severe liquid fallout without operational interruption.

By drawing down annular casing gas pressure, the system directly lowers bottomhole flowing pressure, increasing reservoir drawdown and accelerating liquid crude influx into the lateral. To demonstrate broad field applicability and statewide scalability, the project will pilot oilless units across three distinct Bakken production regimes: (~150–100 bpd), (~80–40 bpd), and (~20 bpd). This multitier field validation will quantify the IOR uplift and extend the economic lifespan of mature Bakken wells prior to plug and abandonment—delivering a high-return solution that maximizes North Dakota's hydrocarbon recovery, extends resource life, and increases state royalty revenues.

Objective: To Improve oil production before wells reach their economic limit by exploring the use of a new prototype oilless compressor designed to recover wet casing gas. Reducing pressure in the production casing lowers the flowing bottomhole pressure, increasing inflow from the reservoir. The technique increases the total oil recovery for the well and generates additional revenue.

Expected Results: Oilless compression technology provides cost advantages over conventional compression due to the capability to handle wet wellhead gas and its reliability, simplification, and reduced maintenance. A new two-stage compressor has been prototyped to meet the flow and pressure requirements for casing gas recovery. Casing gas recovery improves oil recovery; however, application has been limited due to the high costs of conventional compression. Three field trials will be conducted to answer the following:

1. What improved oil recovery (IOR) can be achieved by reducing casing pressure in Bakken wells at various production rates (i.e., well life at ~150–100 bpd, ~80–40 bpd, and ~20 bpd)?

2. Will a newly designed oilless compressor perform adequately in the field (uptime, flow rate, pressure capacity, pressure control)?

3. Is there an optimum casing drawdown pressure with respect to oil production performance?

The technology has application to at least 5000 out of over 17,000 Bakken wells. The potential for added tax revenue to North Dakota is $10,000–$100,000 per well.

Duration: 12 months

Budget: The total cost is $877,000. The grant request from OGRP is $438,500. Cost share commitments are provided by Advanced Flow Solutions ($144,500) and Steffes ($294,000). The in-kind cost share includes the engineering, development, and field-testing during the project term.

Table 4. Budget Breakdown

Project-Associated Expense	NDIC Share (cash)	Commercial Share (in-kind)	Total Project
Labor	$78,486	$0	$78,486
Travel	$2011	$0	$2011
Subcontractor – Steffes	$300,000	$0	$300,000
Printing and Duplicating	$12	$0	$12
Laboratory Fees and Services			
Document Production Service	$2769	$0	$2769
Total Direct Costs	$383,278	$0	$383,278
Facilities and Administration	$55,222	$0	$55,222
Total Cash Requested	**$438,500**	**$0**	**$438,500**
In-Kind Cost Share			
AFS	$0	$144,500	$144,500
Steffes	$0	$294,000	$294,000
Total In-Kind Cost Share	**$0**	**$438,500**	**$438,500**
Total Project Costs	**$438,500**	**$438,500**	**$877,000**

Participants: UND EERC, Advanced Flow Solutions Inc., Steffes, LLC, and selected operators.

DIRECTOR'S COMMENTS
G-63-L
Extending Well Life and Increasing Oil Production via Casing Gas Recovery
Submitted by: University of North Dakota
Energy & Environmental Research Center (UND EERC)

Principal Investigator: Darren D. Schmidt
Request for: $438,500
Total Project Costs: $877,000
Duration: 12 Months

Description of the Project:

The project will field-test next-generation two-stage oilless compression technology designed to increase oil recovery from Bakken wells by reducing gas pressure and lowering bottomhole flowing pressure. Testing across three production levels will evaluate oil production improvements, reliability, and scalability, with the goal of extending the economic life of mature wells and increasing recovery from existing Bakken resources.

Objective: To advance technologies that reduce the frequency and duration of pipeline releases.

Statement	Weighting Factor	G-63-L1
1. Objective	9	36
2. Achievability	7	21
3. Methodology	8	16
4. Contribution	8	24
5. Awareness/Background	5	15
6. Project Management	3	6
7. Equipment/Facilities	2	6
8. Value/Industry-Budget	4	12
9. Financial Match – Budget	4	12
Average Weighted Score		148
	Total: 50	250 possible points
Overall Recommendation:		
Fund		
Funding May Be Considered		X
Do Not Fund		

Technical Reviewers' Comments

Financial commitment from other sources – A minimum of 50% of the total project must come from other sources to meet the program guidelines. Support less than 50% from Industrial Commission sources should be evaluated as favorable to the application.

Reviewer G-63-L

Director's Recommendation: Consider funding in the amount of $438,500.

Energy & Environmental Research Center (EERC)

Extending Bakken Well Life & Increasing Oil Production Through Casing Gas Recovery

Funding Request:	$438,500
Project Value:	$877,000 50% cost share
Partners:	Steffes LLC, Advanced Flow Solutions, Chord Energy

November 9, 2026

Darren Schmidt, P.E.

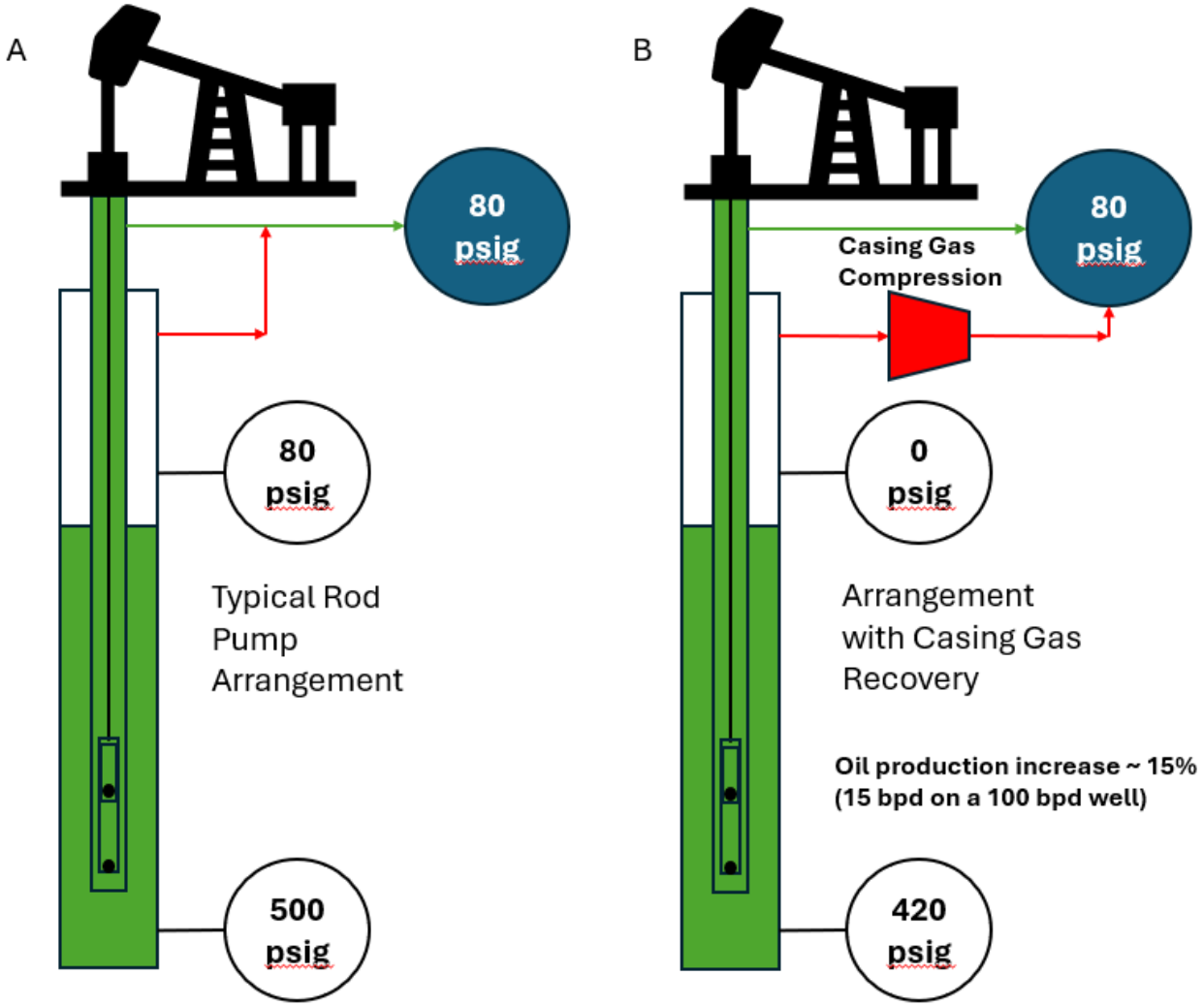
© 2025 University of North Dakota Energy & Environmental Research Center.

North Dakota has more than 17,000 active Bakken wells and over 5,500 wells immediately suitable for casing gas recovery technology.

This project can increase oil recovery from existing wells, extend well life, delay abandonment, and generate substantial new tax revenue for North Dakota.

- 5,500+ candidate wells statewide
- $100M to $500M potential future state tax benefit
- Technology ready for field validation
- Results achievable within the current biennium

Lower Casing Pressure = More Oil Production



$$P_{wf} = P_c + P_h$$

P_c = *Casing pressure*
P_h = *Hydrostatic pressure*

Hydrostatic = 420 psig

$$q = J \times (P_r - P_{wf})$$

- q: Oil production rate (stb/day)
- J: Productivity Index (bpd/psi)
- P_r: Static Reservoir Pressure (psi)
- P_{wf}: Flowing Bottomhole Pressure (psi)

If:
J = 0.125,
Pr = 1300 psi

Oil Production Diagram A = 100 bpd
Oil Production Diagram B
with Casing Gas Recovery = 110 bpd

Production increase contribution from increased inflow to the well = **10% or 10 bpd**

Recovering casing gas also improves the downhole pump volumetric efficiency which can account for **30% of the increased oil production.**

New Compression Technology

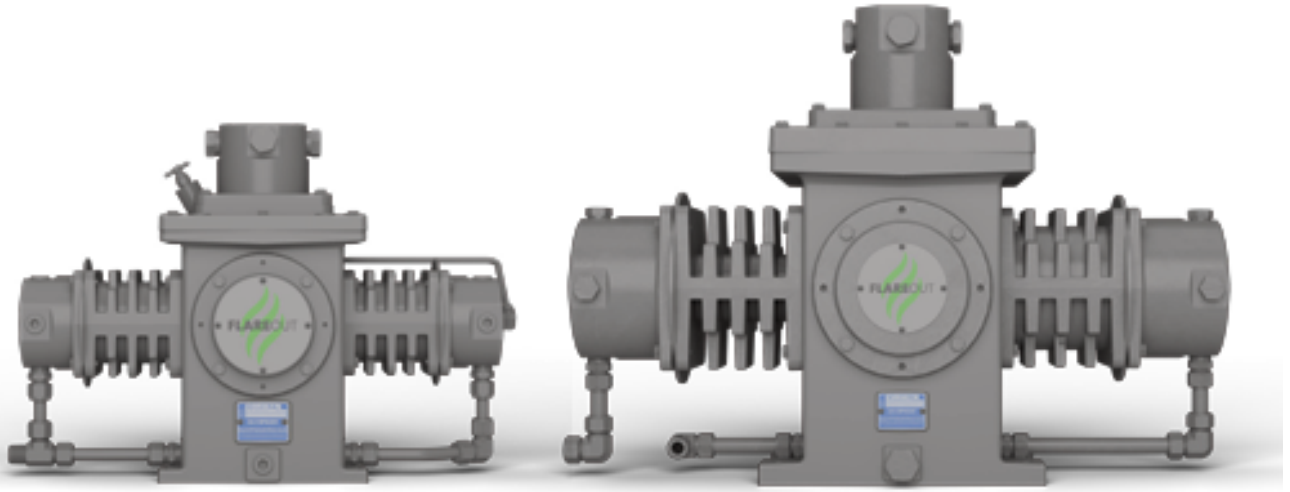
Features

- **Requires no oil changes or other routine maintenance for one year**
- Unphased by ingesting small amounts of entrained hydrocarbon liquid
- Large turndown ratio to handle a variety of flow rates, or a fluctuating flow rate
- Double mechanical seal for leak-free operation
- Multiple instrumentation taps
- Multiple patented features
- One-year limited warranty

Patented vaporizer prevents damage from entrained liquids

Applications

- Tank battery gas
- Treater gas
- Packing leakage
- Instrument vent gas
- Wellhead gas
- Casing pressure



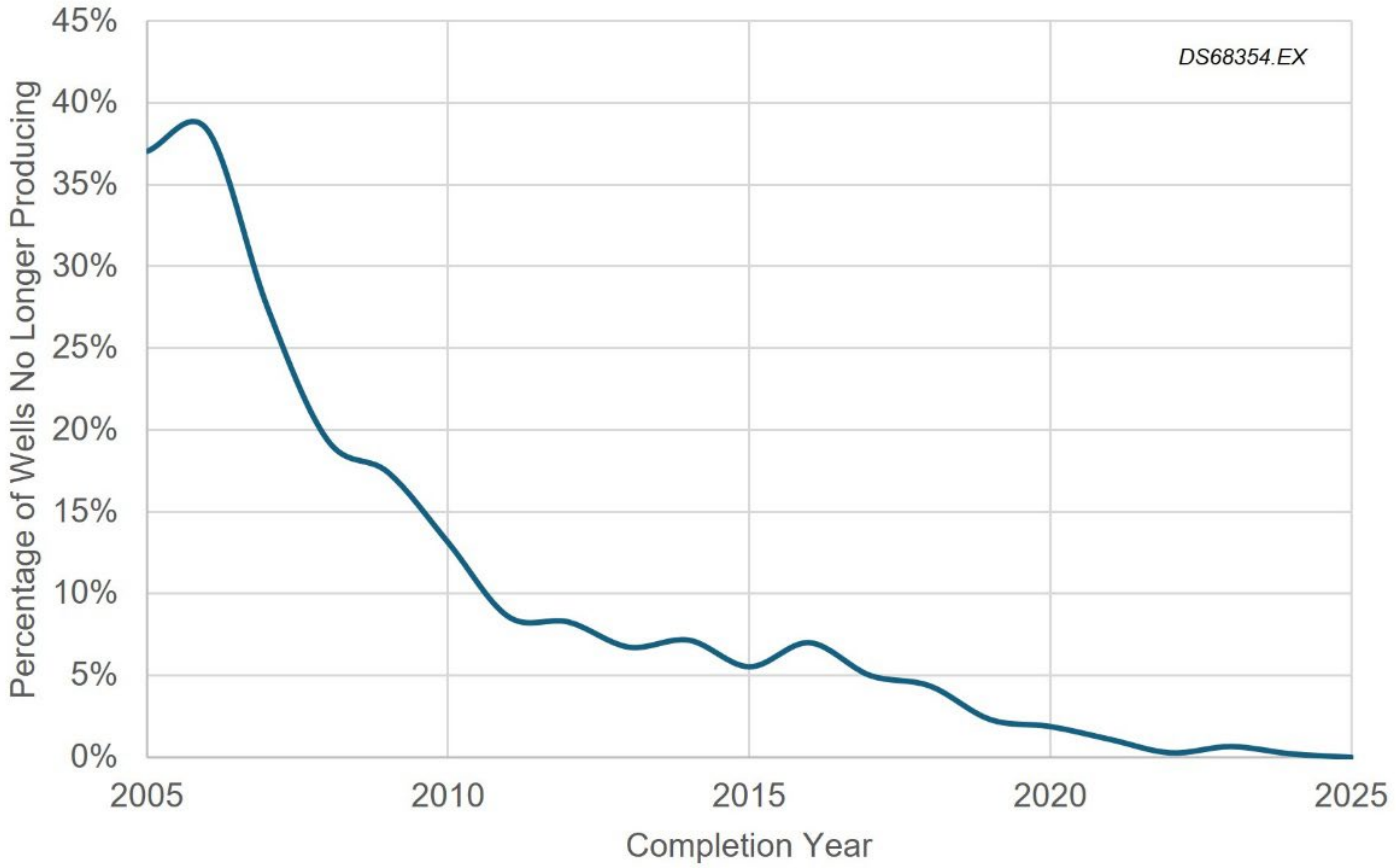
FLAREOUT® Model S7

FLAREOUT® Model T15

Available in (3) Models



North Dakota is near the beginning of a well inventory that is transitioning to nonproductive status.



Incremental Oil Recovery Creates Immediate Value

Expected Incremental Recovery Per Well

Production Rate	Incremental Oil	Added Revenue	Added State Tax
150 bpd	15,675 bbl	$784K	$78K
120 bpd	13,008 bbl	$650K	$65K
100 bpd	10,065 bbl	$503K	$50K
80 bpd	7,270 bbl	$363K	$36K

Even mature wells producing only 40 to 60 bpd can generate meaningful incremental oil and tax revenue through casing gas drawdown.

Small Investment ⟶ Large Taxpayer Return

Target Market

Production Range	Wells
40-60 bpd	2,017
60-120 bpd	2,005
>120 bpd	1,537
Total Candidates	5,559

Estimated North Dakota Tax Impact

Category	Tax Revenue
>40 bpd wells	$35.7M
60-120 bpd wells	$101.4M
>120 bpd wells	$120.5M
Total	$257.6M

Funding Leverage

State Request: $438,500

Potential Tax Return: $257.6 Million

Why Fund?

Immediate Opportunity for North Dakota

Strategic Alignment

✅ Supports Governor Armstrong's call to unlock additional oil recovery

✅ Aligns directly with new legislative funding for enhanced oil recovery technologies

✅ Keeps mature Bakken wells economic longer

✅ Delays costly plugging and abandonment

✅ Preserves future EOR opportunities

✅ Delivers production response within days, not years

Darren Schmidt, P.E.
Distinguished Petroleum Engineer
eercinfo@undeerc.org
701.777.5000

Energy & Environmental Research Center
University of North Dakota
15 North 23rd Street, Stop 9018
Grand Forks, ND 58202-9018

www.undeerc.org
701.777.5000



THANK YOU

Critical Challenges. Practical Solutions.

SPECIFICATIONS	FLAREOUT-S7	FLAREOUT-S15	FLAREOUT-T15
POWER RATING	7.5 HP	15 HP	15HP
CAPACITY (FLOW RATE)	50 MCFD @30 psig inlet 150 psig outlet	100 MCFD @0 psig inlet	50 MCFD @0 psig inlet
MAWP	200 PSIG	120 PSIG	300 PSIG
MAX SUCTION PRESSURE	60 PSIG	60 PSIG	40 PSIG
MAX DISCHARGE PRESSURE	150 PSIG	100 PSIG	250 PSIG
MAX OPERATING TEMP	350 °F		
DRIVE TYPE	DIRECT		
DIMENSIONS	22"W x 14"L x 16"H	32"W x 23"L x 23"H	
UNIT WEIGHT	102 lbs	400 lbs	

Oil and Gas Research Program
Grant Round 63 Abstract Summaries

G-63-M Multi-Well Demonstration of Natural Gas Liquids (NGL) Huff-and-Puff Enhanced Oil Recovery in the Bakken by Energy Transformed, Inc.

Project Description: To Energy Transformed (ET4m) is partnering with Chevron Corporation to conduct an enhanced oil recovery (EOR) pilot project on a drilling spacing unit (DSU) in the Bakken Formation. This project will be the first long-term cyclic injection of natural gas liquids (NGLs) in North Dakota. The project builds on previous work conducted in the Eagle Ford Formation in Texas by BlackBrush Oil and Gas (DeLapp et. al., 2025) . NGLs are widely understood in EOR processes to be first-contact-miscible (FCM) (Green and Willhite, 1998) . Miscible fluids form a single phase with the reservoir oil enhancing the oil's mobility properties; swelling the oil, reducing oil viscosity, and reducing oil density. In very tight reservoirs such as the Bakken, these effects drive the affected oil out of the very low permeability rock / shale and into the wellbore to be produced to surface. NGLs, because of their properties, are immediately miscible with oil at reservoir pressure and temperature upon first contact, hence there is no need to inject large volumes of fluid to increase reservoir pressure to induce miscibility. Additionally, the density of NGLs assists with a rapid reservoir pressure response minimizing injection volumes. Economic application requires efficient recovery and reuse of the NGLs upon reproduction. ET4m specializes in the recovery and reuse technology to enable EOR with NGLs. The project will provide the field experience from full-scale cyclic injection in multiple wells necessary to evaluate the effectiveness of oil recovery and the ability to reproduce and reuse NGLs over a 24 month project period.

Oil recovery factors from unconventional shale reservoirs tend to be 10% or less from primary depletion in most cases. Advances in drilling and hydraulic fracturing are making incremental improvements on this however a huge resource remains in reservoirs that have already been drilled up. Developing economically viable enhanced oil recovery (EOR) technologies capable of increasing recovery from existing wells represents one of the largest opportunities to extend the productive life of North Dakota's oil industry while maximizing utilization of existing infrastructure.

Objective: To evaluate, design, execute, monitor, and optimize a multi-well field demonstration of Natural Gas Liquids (NGL) Huff-and-Puff enhanced oil recovery within the Bakken Formation.

To demonstrate the efficacy of the injection of intermediate hydrocarbon components, predominantly propane, butanes, and natural gas liquid mixtures in a huff and puff manner to mobilize incremental oil from mature shale wells. Small scale, single well pilot projects supplemented with detailed reservoir simulation provide strong evidence that NGL Huff and Puff has the potential to deliver a step change in recovery factor, potentially doubling the recovery achieved with primary depletion alone.

To demonstrate the effectiveness of a novel surface facility concept that separates NGLs from the oil for reuse at the wellsite and stabilizes the oil for custody transfer. The technology addresses economic challenges with large-scale application of NGL Huff and Puff, economic recovery of the NGLs, and stabilization of the incremental oil recovered with NGLs.

Expected Results: Within the first 6 cycles, the wells being treated are expected to increase oil production rates significantly, potentially returning to their initial rate when they were first brought into production. Through the nominal 24-month term of the project, the wells are expected to have gone through approximately 10 cycles and delivered incremental reserves on the order of 30% to 50% of their cumulative primary production up to the start of the project. Continued application of the NGL Huff and Puff process is expected to double ultimate recovery from the project wells after 3 to 5 years of cycling.

Duration: 24 months

Budget: The total cost is $24,600,000. The grant request from OGRP is $4,850,000. Cost share is provided by ET4M, Chevron, and C3 Oil Field Services.

Bakken CMS Demonstration Cost Summary

Expense	NDIC Share	ET4m	Chevron	C3 OFS	Total
Project Design		$ 200,000	$ 100,000		$ 300,000
Workovers/Well Conditioning/Well Tie-ins	$ 500,000		$ 2,500,000		$ 3,000,000
NGL Recycle System Incl. Winterization	$ 1,500,000	$ 10,500,000			$ 12,000,000
Mob./Installation/Commission		$ 300,000	$ 300,000		$ 600,000
First Phase Y-Grade Injection Y-Grade			$ 2,500,000		$ 2,500,000
Second Phase Y-Grade Injection Y-Grade			$ 2,500,000		$ 2,500,000
Second Phase Opt. including conformance control	$ 400,000			$ 200,000	$ 600,000
Sampling and Lab Analysis	$ 200,000	$ 200,000	$ 200,000		$ 600,000
Gathering facility upgrade	$ 250,000		$ 250,000		$ 500,000
Labor					
Subcontract EERC	$ 1,500,000				$ 1,500,000
Subcontract Texas Tech	$ 500,000				$ 500,000
Total	$ 4,850,000	$ 11,200,000	$ 8,350,000	$ 200,000	$ 24,600,000
NDIC Request	$ 4,850,000				
Total Cost Share	$ 19,750,000				

Participants: Energy Transformed, Inc., Chevron Corporation, UND EERC, Texas Tech University, C3 Oil Field Services.

DIRECTOR'S COMMENTS
G-63-M
Energy Transformed, Inc.
Multi-Well Demonstration of Natural Gas Liquids (NGL) Huff-and-Puff Enhanced Oil Recovery in the Bakken Petroleum System
Principal Investigator: David Szabo
Request for: $4,850,000
Total Project Costs: $24,600,000
Duration: 24 Months

Description of the Project:
To Energy Transformed (ET4m) is partnering with Chevron Corporation to conduct an enhanced oil recovery (EOR) pilot project on a drilling spacing unit (DSU) in the Bakken Formation. This project will be the first long-term cyclic injection of natural gas liquids (NGLs) in North Dakota. The project builds on previous work conducted in the Eagle Ford Formation in Texas by BlackBrush Oil and Gas (DeLapp et. al., 2025) . NGLs are widely understood in EOR processes to be first-contact-miscible (FCM) (Green and Willhite, 1998). Miscible fluids form a single phase with the reservoir oil enhancing the oil's mobility properties; swelling the oil, reducing oil viscosity, and reducing oil density. In very tight reservoirs such as the Bakken, these eUects drive the aUected oil out of the very low permeability rock / shale and into the wellbore to be produced to surface. NGLs, because of their properties, are immediately miscible with oil at reservoir pressure and temperature upon first contact, hence there is no need to inject large volumes of fluid to increase reservoir pressure to induce miscibility. Additionally, the density of NGLs assists with a rapid reservoir pressure response minimizing injection volumes. Economic application requires eUicient recovery and reuse of the NGLs upon reproduction. ET4m specializes in the recovery and reuse technology to enable EOR with NGLs. The project will provide the field experience from full-scale cyclic injection in multiple wells necessary to evaluate the eUectiveness of oil recovery and the ability to reproduce and reuse NGLs over a 24 month project period.
Oil recovery factors from unconventional shale reservoirs tend to be 10% or less from primary depletion in most cases. Advances in drilling and hydraulic fracturing are making incremental improvements on this however a huge resource remains in reservoirs that have already been drilled up. Developing economically viable enhanced oil recovery (EOR) technologies capable of increasing recovery from existing wells represents one of the largest opportunities to extend the productive life of North Dakota's oil industry while maximizing utilization of existing infrastructure.

Objective:
To evaluate, design, execute, monitor, and optimize a multi-well field demonstration of Natural Gas Liquids (NGL) Huff-and-Puff enhanced oil recovery within the Bakken Formation. To demonstrate the efficacy of the injection of intermediate hydrocarbon components, predominantly propane, butanes, and natural gas liquid mixtures in a huff and puff manner to mobilize incremental oil from mature shale wells. Small scale, single well pilot projects supplemented with detailed reservoir simulation provide strong evidence that NGL Huff and Puff has the potential to deliver a step change in recovery factor, potentially doubling the recovery achieved with primary depletion alone.
To demonstrate the effectiveness of a novel surface facility concept that separates NGLs from the oil for reuse at the wellsite and stabilizes the oil for custody transfer. The technology addresses economic challenges with large scale application of NGL Huff and Puff, economic recovery of the NGLs and stabilization of the incremental oil recovered with NGLs.

Statement	Weighting Factor	G-63-M1	G-63-M2
1. Objective	9	36	36
2. Achievability	7	28	28
3. Methodology	8	32	32
4. Contribution	8	40	40
5. Awareness/Background	5	15	20
6. Project Management	3	6	12
7. Equipment/Facilities	2	8	8
8. Value/Industry-Budget	4	20	20
9. Financial Match – Budget	4	20	16
Average Weighted Score		205	212
	Total: 50		
Overall Recommendation:			
Fund		X	X
Funding May Be Considered			
Do Not Fund			

Technical Reviewers' Comments

Reviewer G-63-M1

This project should be funded. It has potential to generate science and technology data that would place North Dakota and the Bakken at the forefront of unconventional oil and gas industry technical expertise, around the world, ironically back where it was at the beginning, as the world's first unconventional oil producing province.

The use of the currently sub-market valued resource of NGL from Bakken production to potentially double the current estimated Bakken reservoir EUR is hard to even imagine, but it sure would be a wonderful thing, even if half that increase occurred. That is a win-win along multiple economic avenues for North Dakota, with increased oil and gas production, extended resources life, additional tax proceeds, etc. **Recommendation: Fund**

Reviewer G-63-M2

If this project succeeds results will be applicable to a large portion of the Bakken oil field. The background of the investigator team is exceptional. The plan includes well defined milestones. The significant involvement of EERC makes achievement of project objectives much more likely. Data from a successful project could have a significant positive impact on the ultimate recovery from the Bakken reservoir. **Recommendation: to fund with cost share changes.**

Director's Recommendation: Fund for $3,000,000

Grant Proposal

Multi-Well Demonstration of Natural Gas Liquids (NGL) Huff-and-Puff Enhanced Oil Recovery in the Bakken Petroleum System

C3 OFS

Outline

The need for Improved Recovery

What is the NGL Huff and Puff concept and what is Unique about it

Project scope and location

Project cost estimate / grant request

Project Execution Plan and Key milestones

Benefits to North Dakota

The Team

Backup

What is “Miscibility” and “Swelling” (EERC Video)

The Need for Improved Recovery

Chevron has committed to improved recovery in Shale and Tight (S&T) assets

- EOR at scale is a strategic initiative focused on getting more from every well
  - Chemical EOR – methods broadly applicable with R&D focused on chemical development
  - Gas EOR methods – science around solvents very well understood but reservoir characterization is a critical aspect impacting gas EOR effectiveness and requires field pilots to understand
- Why Y-Grade now
  - Lower upfront capital
  - Using existing infrastructure and wells allowing enabling infrastructure to catch up
  - Learnings will apply to other EOR methods
  - Availability
- Scale-up will require an "all of the above" approach across the basin
  - Y-Grade
  - Produced gas
  - CO2
  - Chemicals

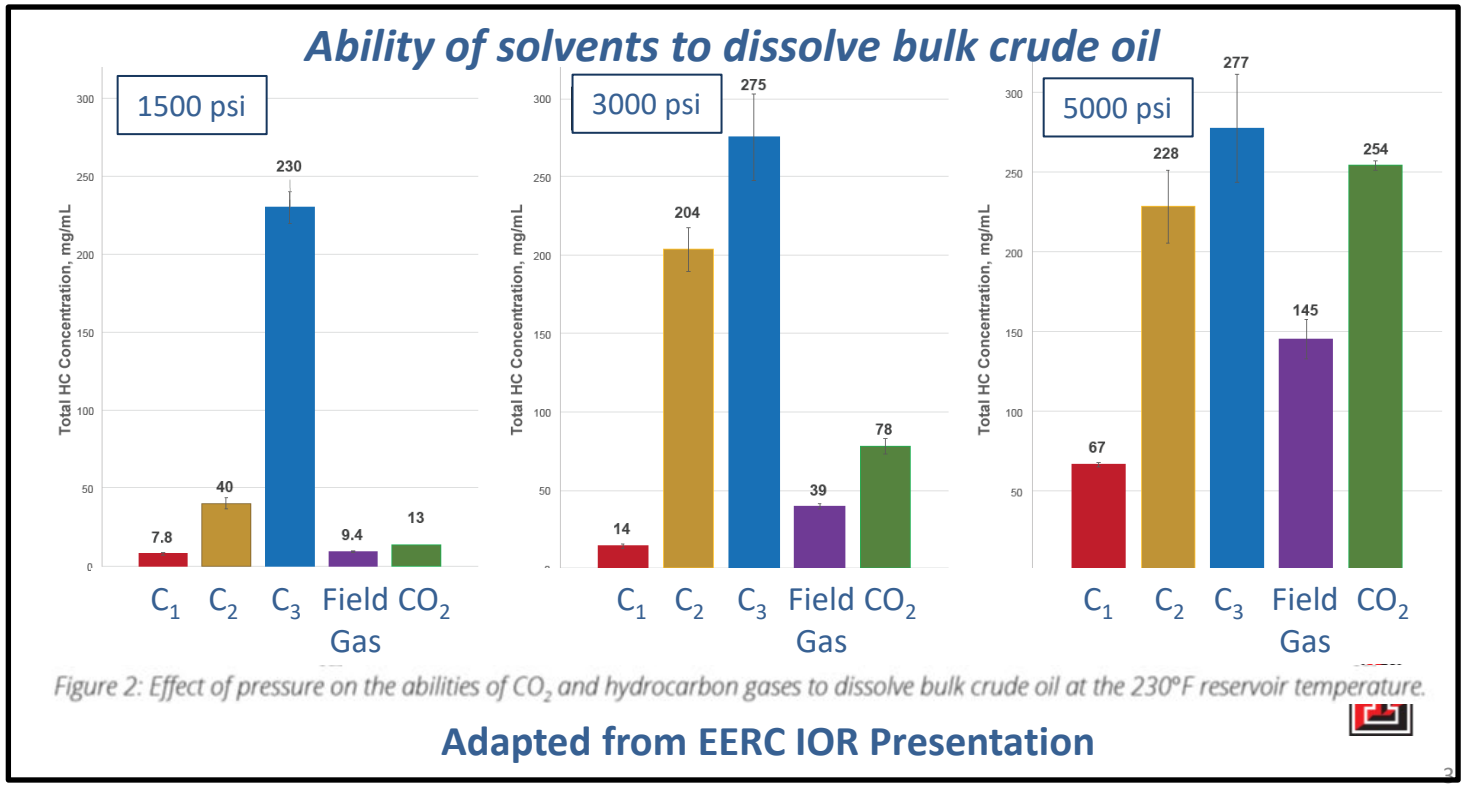


Figure 2: Effect of pressure on the abilities of CO_2 and hydrocarbon gases to dissolve bulk crude oil at the 230°F reservoir temperature.

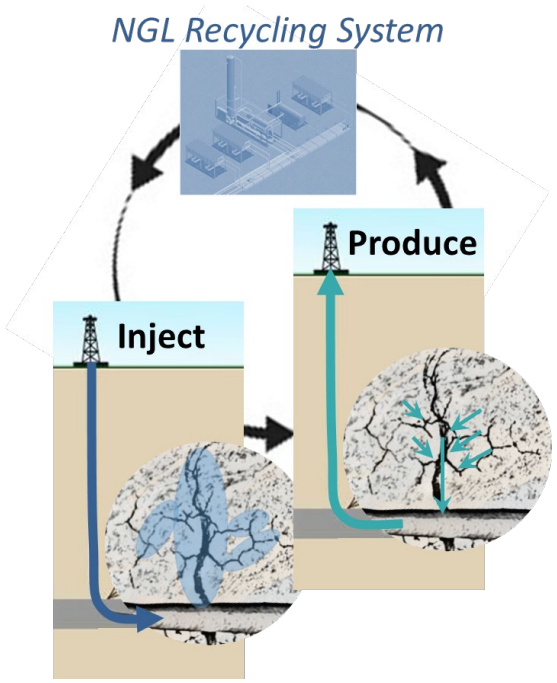
Adapted from EERC IOR Presentation

C3 OFS

Energy Transformed Cyclic Miscible Stimulation (CMS)

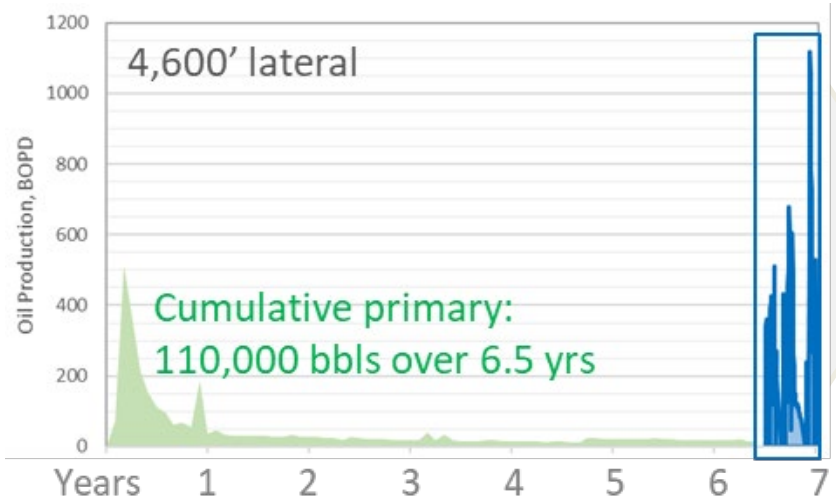
The Concept I-10 P-30

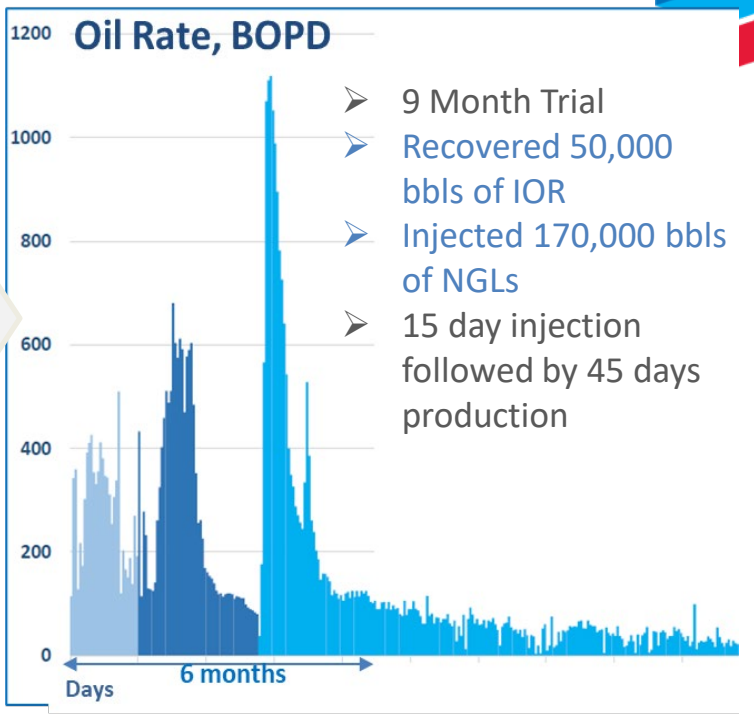
50 HnP cycles over 5 years



The Field Trial delivered 50,000 bbls in 3 cycles over 9 months

Single Well with 3 Cycles



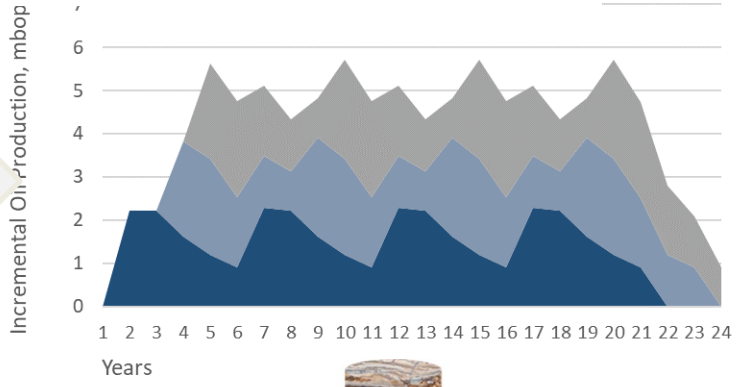


Highlights

- Because MMP is low, the process is effective over the lifecycle of the well
- A single NGL Recycle System (NRS) treats a group of 8 – 10 wells over 3 – 5 years …….then moves to a new set of wells.
- Each NRS can treat up to 50 wells over its equipment life
- Installing 3 NRSs delivers 5,000 bpd IOR for 20 years (EF example)

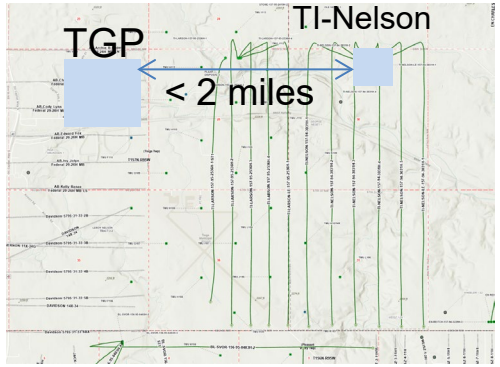
Employing 3 NRS's

Typical EF EUR = 300,000



Mountrail County site near Tioga top candidate

- Site selection evaluated for
  - DSU & well arrangement
  - Depletion level
  - Fluid window – lower GOR
  - Y-grade supply distance and access
  - UIC permitting concerns
- TI-Nelson selected for pre-screening with DMR regarding EOR project and UIC permit



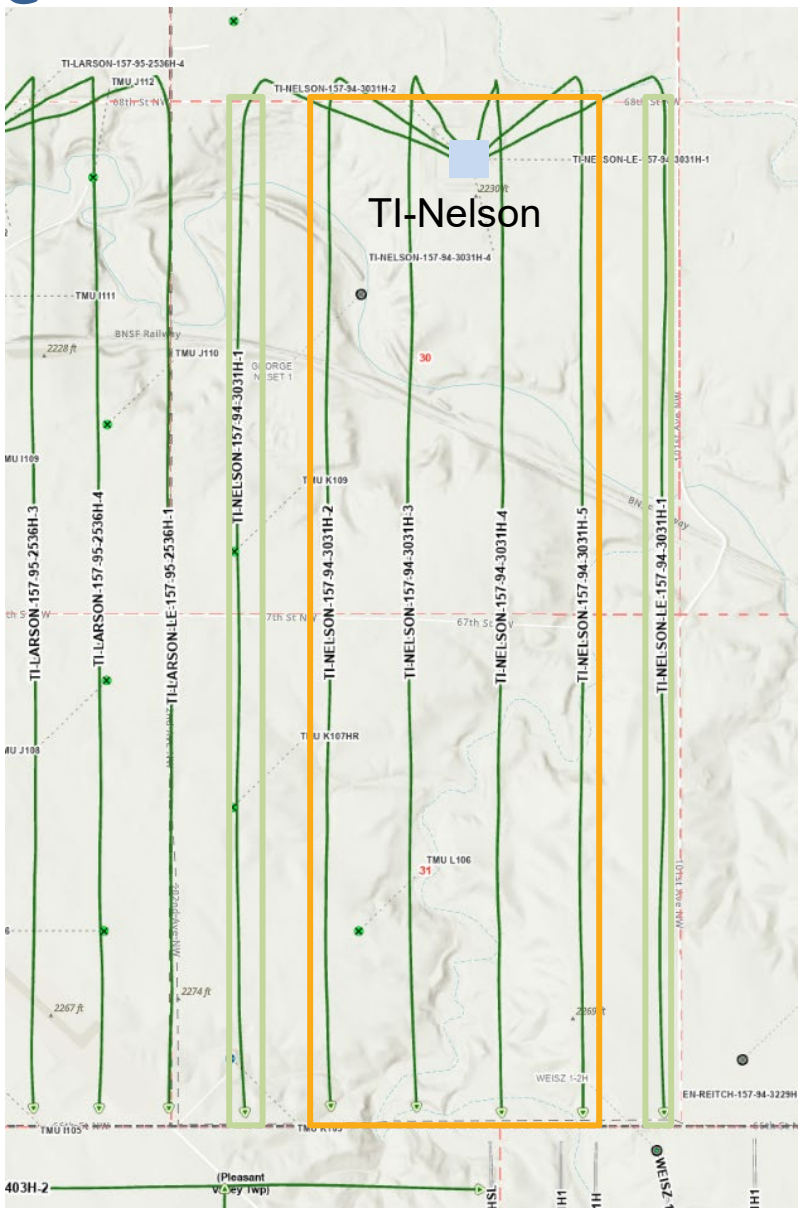
Well Name	API	Well category
TI-NELSON-157-94-3031H-1	330610463900	Capture well
TI-NELSON-157-94-3031H-2	330610460000	Huff ‘n puff injector
TI-NELSON-157-94-3031H-3	330610460100	Huff ‘n puff injector
TI-NELSON-157-94-3031H-4	330610460200	Huff ‘n puff injector
TI-NELSON-157-94-3031H-5	330610464000	Huff ‘n puff injector
TI-NELSON-LE-157-94-3031H-1	330610464100	Capture well

Proposed huff ‘n puff wells

Proposed capture only well

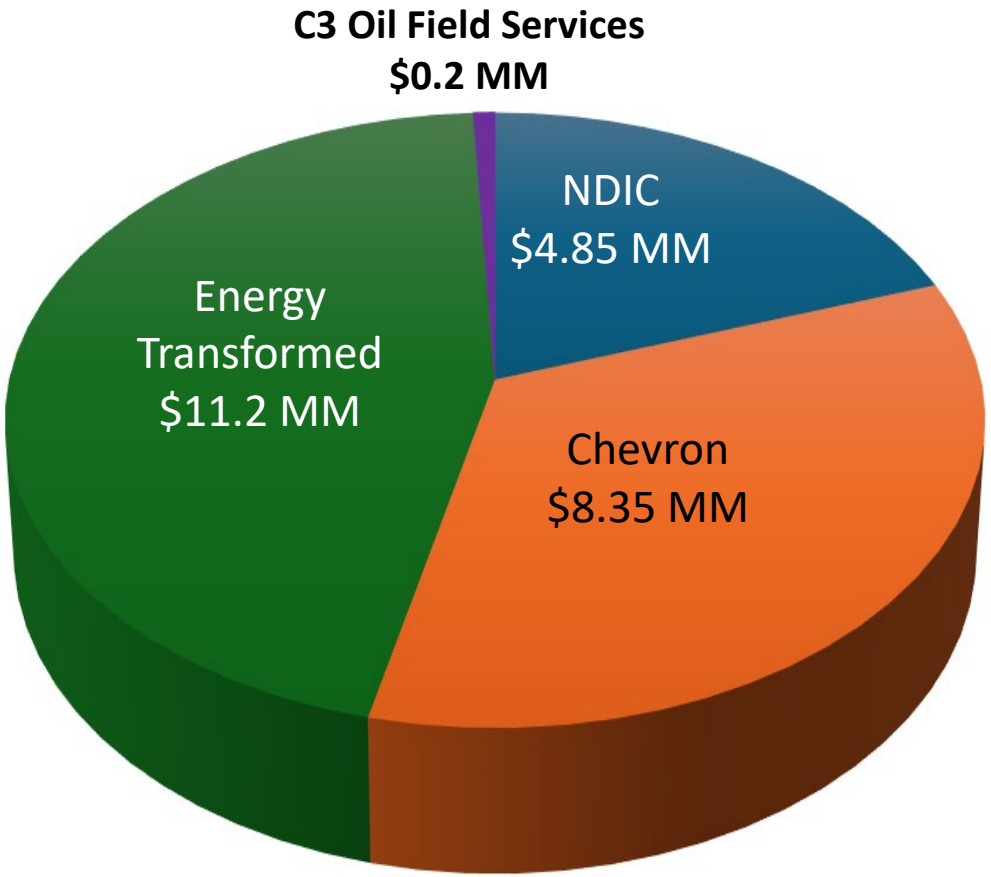
Chevron MB

3rd Party well

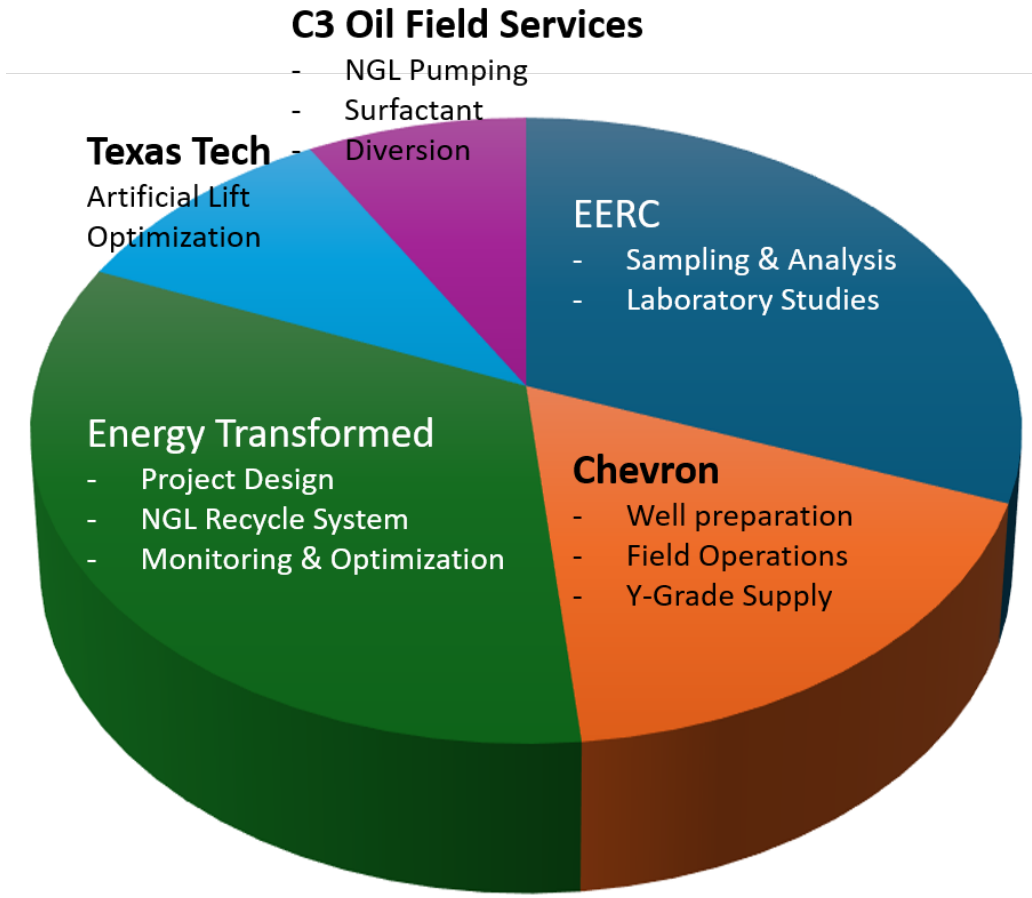


Project cost estimate and grant request

Project Funding Sources: $24.6 MM



How the $4.85 MM NDIC Funds will be spent



C3 OFS

Project Execution Plan and Key Milestones

Bakken NGL Huff and Puff Project Timeline												
	2026	2027				2028				2029		
Activity												
Candidate Selection												
Project Planning												
Detailed Engineering												
Fabrication												
Installation												
Phase 1 Establish Base Performance												
Phase 2 Evaluate Optimizations												
Reports									X			X

Benefits to North Dakota

Targeting a 50% or greater increase in Bakken recovery factor (ie: from 10% to 15%+) with….

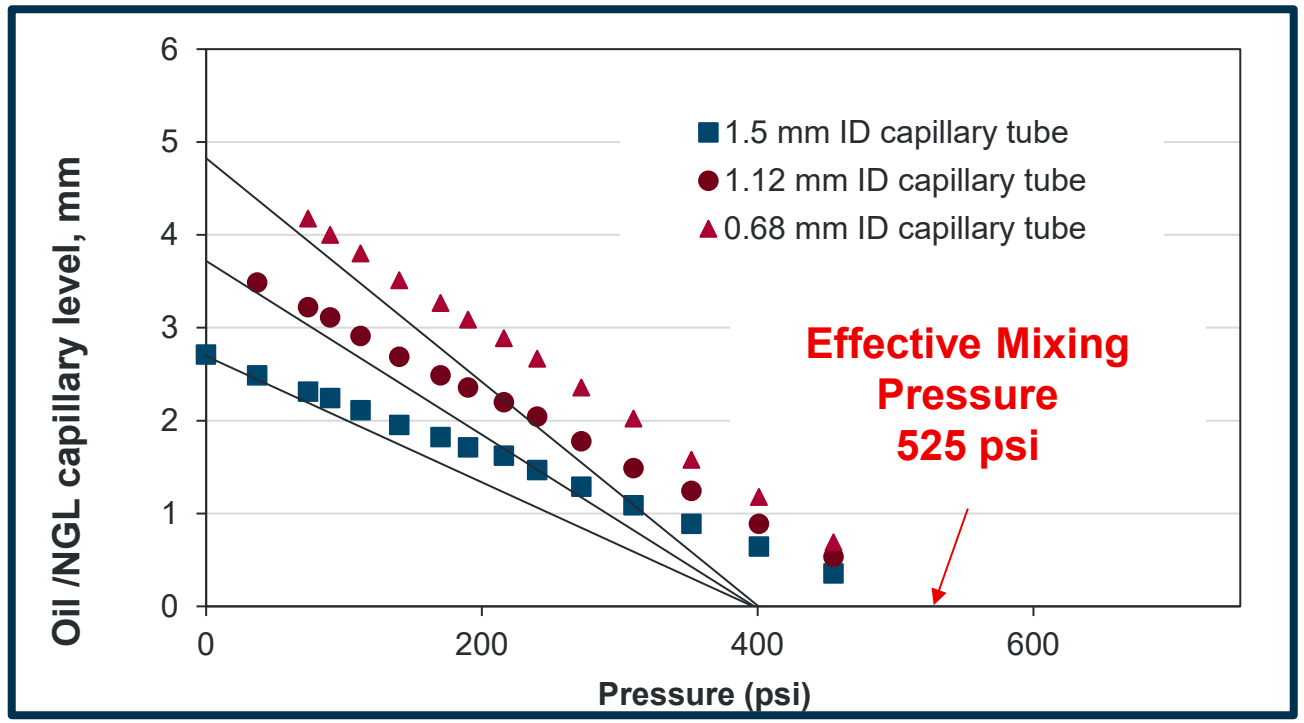
- Utilization of existing wells and infrastructure
- Minimal incremental surface disturbance
- Value Add for Unfractionated North Dakota NGLs (Y-Grade)

How does / can CMS Scale?

- Example:
  - 10,000 bpd NGL can sustain 10 x 8 well projects
  - One 8 well project can deliver 1500 – 2000 bpd incremental oil
  - Therefore 10 projects involving 80 wells and using 10,000 bpd NGL can deliver 15,000 – 20,000 bpd of incremental production sustained for several years.
  - Can we scale to 100 projects using 100,000 bpd and treating 800 wells in 5 years adding 150,000 – 200,000 bpd?
- North Dakota produces approximately 450,000 bpd of NGL
- There are about 35,000 wells drilled into the Bakken in North Dakota…..not all are suitable targets but perhaps 50% are…

NGL Interactions With Bakken Oil

- NGL–oil interaction experiments demonstrate rapid oil swelling, highlighting a dominant fluid-level EOR mechanism.
- NGL exhibits a remarkably low pressure requirement for effective mixing with Bakken crude oil (525 psi).



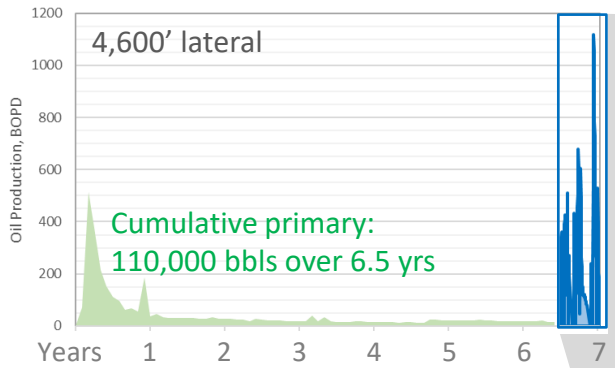
Vanishing IFT technique

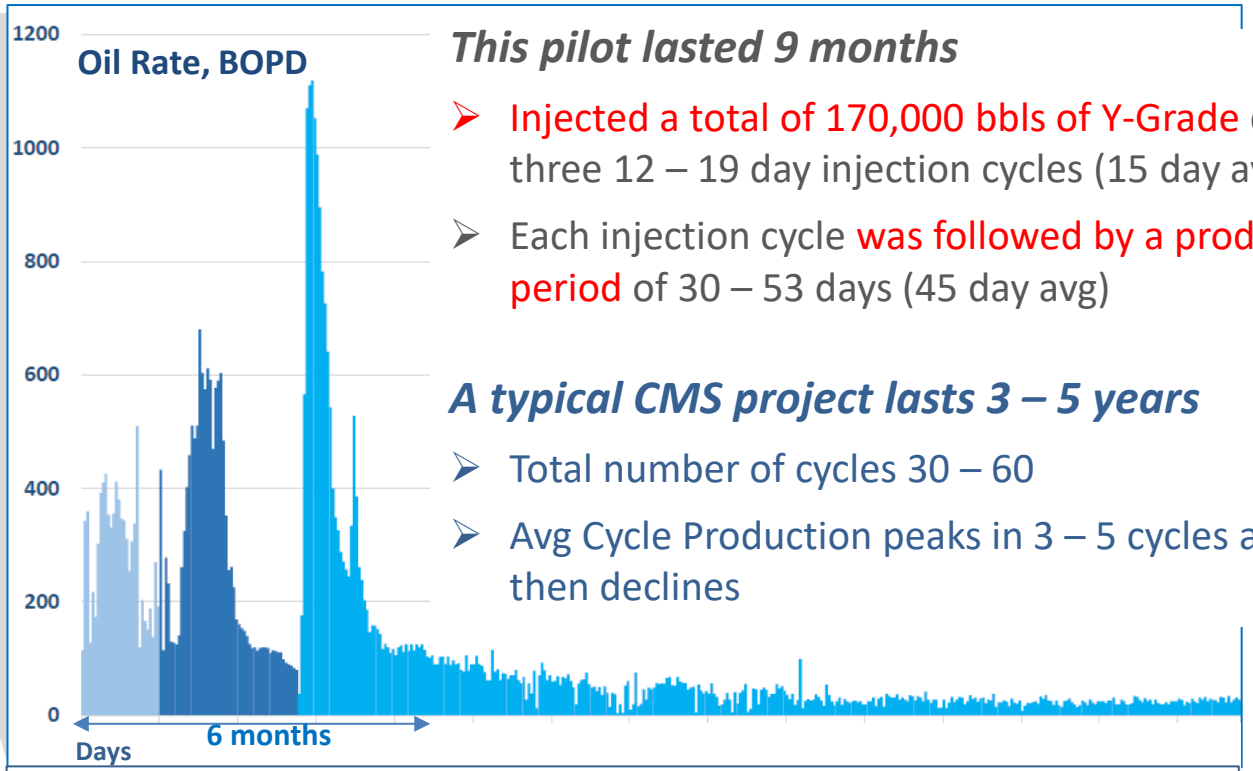
Backup

CMS Works

Eagle Ford Single Well Multi Cycle Demonstration in 2023

Added 50,000+ bbls of **incremental oil** after 3 cycles of injection





This pilot lasted 9 months

- Injected a total of 170,000 bbls of Y-Grade during three 12 – 19 day injection cycles (15 day avg)
- Each injection cycle was followed by a production period of 30 – 53 days (45 day avg)

A typical CMS project lasts 3 – 5 years

- Total number of cycles 30 – 60
- Avg Cycle Production peaks in 3 – 5 cycles and then declines

After 170,000 bbls of solvent injected, reservoir processes appear to have reached steady state with returned solvent exceeding 70%.

Key Observations:

- Oil rate exceeds IP30 after 3 cycles
- No attempt to recycle in this pilot. Produced fluids were extremely volatile and difficult to stabilize
- 3 +/- bbls solvent injected yields one bbl incremental oil. With recycle, 1 bbl solvent delivers 1 bbl incremental oil

Why CMS Works

Min Miscibility Pressure is LOW for NGLs

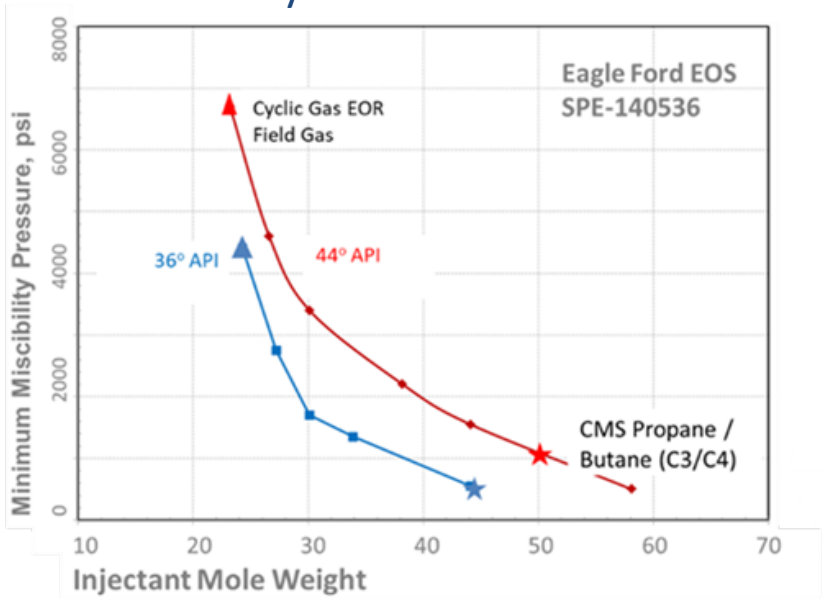
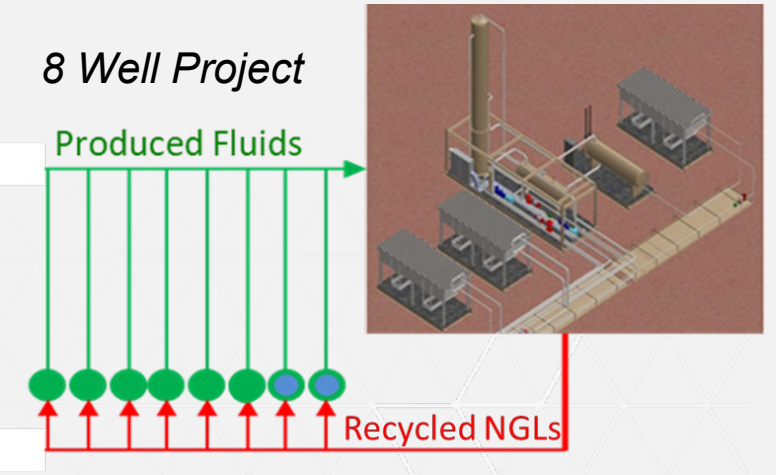


Figure 2 – Minimum Miscibility Pressure vs Injectant Mole Weight

Miscibility, driven by **Molecular Diffusion**, is key to incremental recovery

How it Works

- Inject into 2 wells at a time (6,000 bpd continuously)
- 10 days of injection followed by 30 days of production
- Each well has 9 Cycles / year / well = 270,000 bbls NGLs injected
- 2 – 3 bbls of injected NGLs delivers 1 bbl of incremental oil



70% - 90% of injected NGL (C3/C4) is produced back on the production cycle, captured in the NGL Recycle System (NRS), and reinjected

Oil and Gas Research Program
Grant Round 63 Abstract Summaries

G-63-N Maximizing Primary Recovery from Mission Canyon Horizontal Wells Through Selective Inflow Control Technology by Browning Oil Company, Inc.

Project Description: This field-scale research and technology demonstration to evaluate selective inflow control as a method to improve primary oil recovery from open-hole horizontal wells completed in conventional Mission Canyon reservoirs in North Dakota. The initial pilot will be conducted in BOCI-operated MHMU #6, API 33-007-00088, in the Medora Heath–Madison Unit. During drilling, the well encountered a fractured interval near the heel after the wellbore entered a deeper portion of the Mission Canyon/Fryburg target. Subsequent production has underperformed expectations, and BOCI believes this interval may be contributing a disproportionate share of produced water while limiting production from the remainder of the lateral.

BOCI proposes to install a production liner equipped with mechanically actuated, reclosable sleeves separated by external isolation packers. This system will allow individual sections of the existing open-hole lateral to be selectively opened, closed, isolated, and tested. Following installation, the ESP will be rerun and the well will be tested under multiple sleeve configurations. Oil, water, total-fluid rate, water cut, pressure, fluid level, ESP performance, tracer response, and sleeve position will be monitored to determine how individual portions of the lateral contribute to production.

Objective: To determine whether selective isolation of a high-water-contributing interval can reduce water production, redistribute pressure drawdown and inflow toward other portions of the lateral, and increase oil contribution from reservoir contact that is currently underutilized. Testing will also determine whether changes in production are repeatable as individual intervals are opened and closed.

This project is broader than remediation of a single well. BOCI operates several conventional North Dakota fields, including MHMU, FHMU, SFTU, and TRMU, where primary recovery remains an important development mechanism and additional horizontal drilling opportunities may remain. In these fields, localized fractures, high-permeability intervals, or unfavorable wellbore placement can cause a small portion of an open-hole lateral to dominate fluid production. The resulting water volumes can consume artificial-lift and surface-handling capacity, reduce oil productivity, increase operating cost, and discourage additional drilling. The proposed project is distinct from prior NDIC-supported

work focused on mature Mission Canyon wells and water-coning mitigation. BOCI's objective is to evaluate selective inflow control as a tool to preserve and improve primary recovery in fields where continued development and new drilling may still be economic.

Expected Results: To determine whether selective isolation of individual sections of an open-hole Mission Canyon lateral can materially change the well's inflow profile and improve oil recovery. This project will also provide a baseline for improved oil production to determine feasibility for more advanced systems.

- Identify whether one or more discrete intervals are responsible for disproportionate water entry;
- Determine whether those intervals can be effectively isolated;
- Quantify the resulting change in oil and water production;
- Evaluate whether inflow can be redirected toward other portions of the lateral;
- Determine whether individual lateral sections can be managed dynamically as reservoir conditions change;
- Establish screening criteria for applying the technology to other conventional horizontal wells.

Duration: 20 months

Budget: The total cost is $1,344,000. The grant request from OGRP is $672,000. Cost share is provided by Browning Oil Company.

Participants: Browning Oil Company, UND EERC, NCS Multistage

DIRECTOR'S COMMENTS
G-63-N
Browning Oil Company, Inc.
Maximizing Primary Recovery from Mission Canyon Horizontal Wells Through Selective Inflow Control Technology
Principal Investigator: Kelly Blackwood
Request for: $672,000
Total Project Costs: $1,344,000
Duration: 20 Months

Description of the Project:
This field-scale research and technology demonstration to evaluate selective inflow control as a method to improve primary oil recovery from open-hole horizontal wells completed in conventional Mission Canyon reservoirs in North Dakota. The initial pilot will be conducted in BOCI-operated MHMU #6, API 33-007-00088, in the Medora Heath–Madison Unit. During drilling, the well encountered a fractured interval near the heel after the wellbore entered a deeper portion of the Mission Canyon/Fryburg target. Subsequent production has underperformed expectations, and BOCI believes this interval may be contributing a disproportionate share of produced water while limiting production from the remainder of the lateral. BOCI proposes to install a production liner equipped with mechanically actuated, reclosable sleeves separated by external isolation packers. This system will allow individual sections of the existing open-hole lateral to be selectively opened, closed, isolated, and tested. Following installation, the ESP will be rerun and the well will be tested under multiple sleeve configurations. Oil, water, total-fluid rate, water cut, pressure, fluid level, ESP performance, tracer response, and sleeve position will be monitored to determine how individual portions of the lateral contribute to production.

Objective:
To determine whether selective isolation of a high-water-contributing interval can reduce water production, redistribute pressure drawdown and inflow toward other portions of the lateral, and increase oil contribution from reservoir contact that is currently underutilized. Testing will also determine whether changes in production are repeatable as individual intervals are opened and closed. This project is broader than remediation of a single well. BOCI operates several conventional North Dakota fields, including MHMU, FHMU, SFTU, and TRMU, where primary recovery remains an important development mechanism and additional horizontal drilling opportunities may remain. In these fields, localized fractures, high-permeability intervals, or unfavorable wellbore placement can cause a small portion of an open-hole lateral to dominate fluid production. The resulting water volumes can consume artificial-lift and surface-handling capacity, reduce oil productivity, increase operating cost, and discourage additional drilling. The proposed project is distinct from prior NDIC-supported work focused on mature Mission Canyon wells and water-coning mitigation. BOCI's objective is to evaluate selective inflow control as a tool to preserve and improve primary recovery in fields where continued development and new drilling may still be economic.

Statement	Weighting Factor	G-63-N1	G-N2
1. Objective	9	27	27
2. Achievability	7	28	28
3. Methodology	8	32	24
4. Contribution	8	32	16
5. Awareness/Background	5	20	15
6. Project Management	3	12	6
7. Equipment/Facilities	2	8	4
8. Value/Industry-Budget	4	16	12
9. Financial Match – Budget	4	12	4
Average Weighted Score		187	136
	Total: 50		250 possible points
Overall Recommendation:			
Fund		X	
Funding May Be Considered			X
Do Not Fund			

Technical Reviewers' Comments

Reviewer G-63-N1
A large portion of North Dakota conventional reservoir production is from water drive and waterflooded Mission Canyon pools. Successful application of technology that can control fluid inflow could very significantly increase ultimate oil and gas recovery from those pools. This technology could prove even more important when EOR with natural gas, surfactants, or CO2 is utilized.
Recommendation: Fund

Reviewer G-63-N2
While the science and technology contribution from the project is likely to be small, it does provide research data on a new application, implementation, and operation of sophisticated oil and gas industry technology that can be used in other fields, formation, and basins. In that regard, even a failure to meet objectives and goals of increased oil cut, and other metrics, would still use research data for future applications of this proposed technology.
Recommendation: Funding May Be Considered

Director's Recommendation: Fund in the amount of $672,000

NDIC OIL & GAS RESEARCH PROGRAM · ROUND 63 · GRANT NO. OGRP G-63-N

Maximizing Primary Recovery from Mission Canyon Horizontal Wells Through Selective Inflow Control Technology

COMPANY	DATE	OGRP REQUEST	TOTAL PROPOSED PROJECT
Browning Oil Company, Inc.	**November 2026**	**$672K**	**$1,344K**

Pilot: MHMU #6, Medora Heath–Madison Unit, Billings County, North Dakota

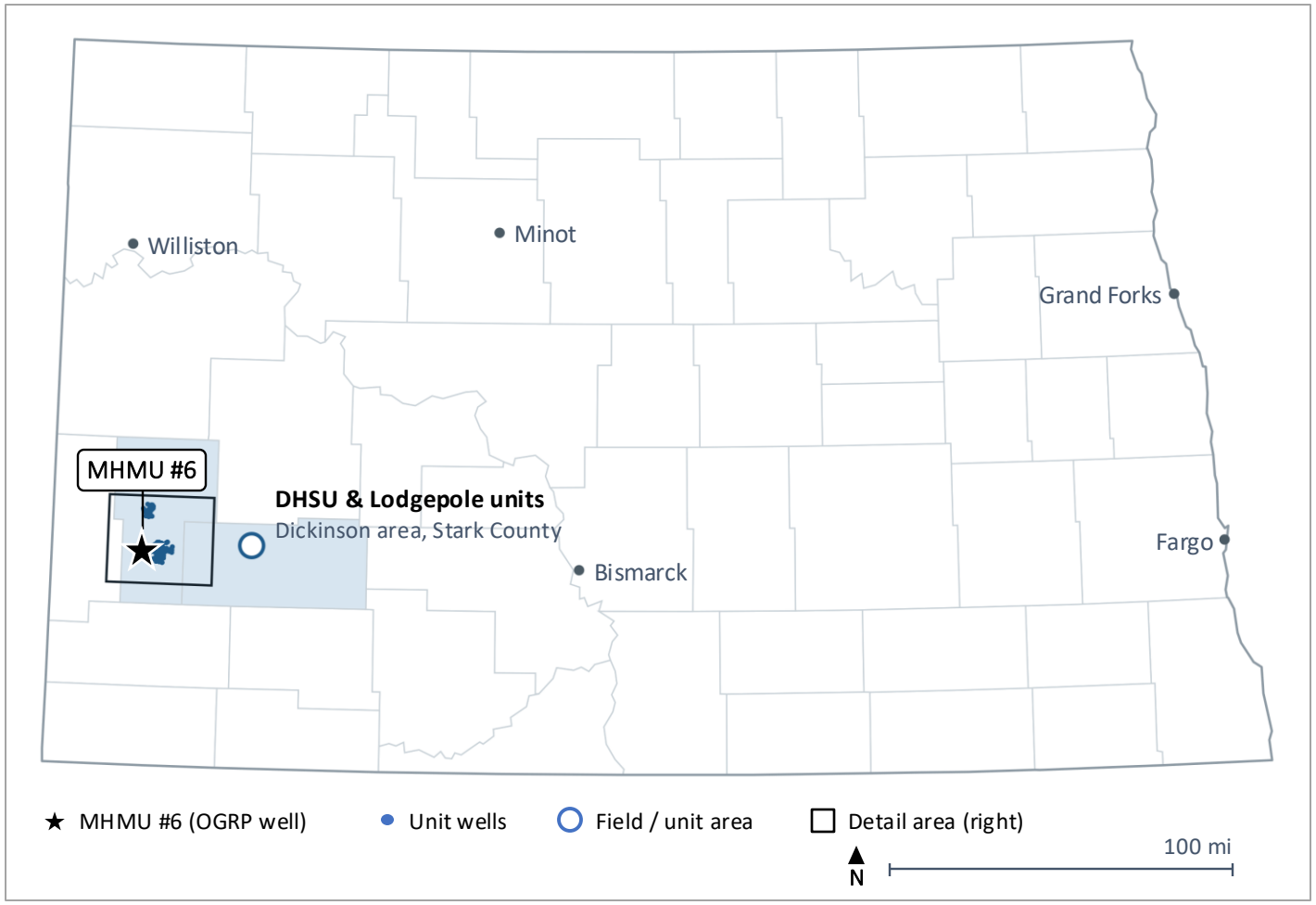
PROJECT PARTNERS

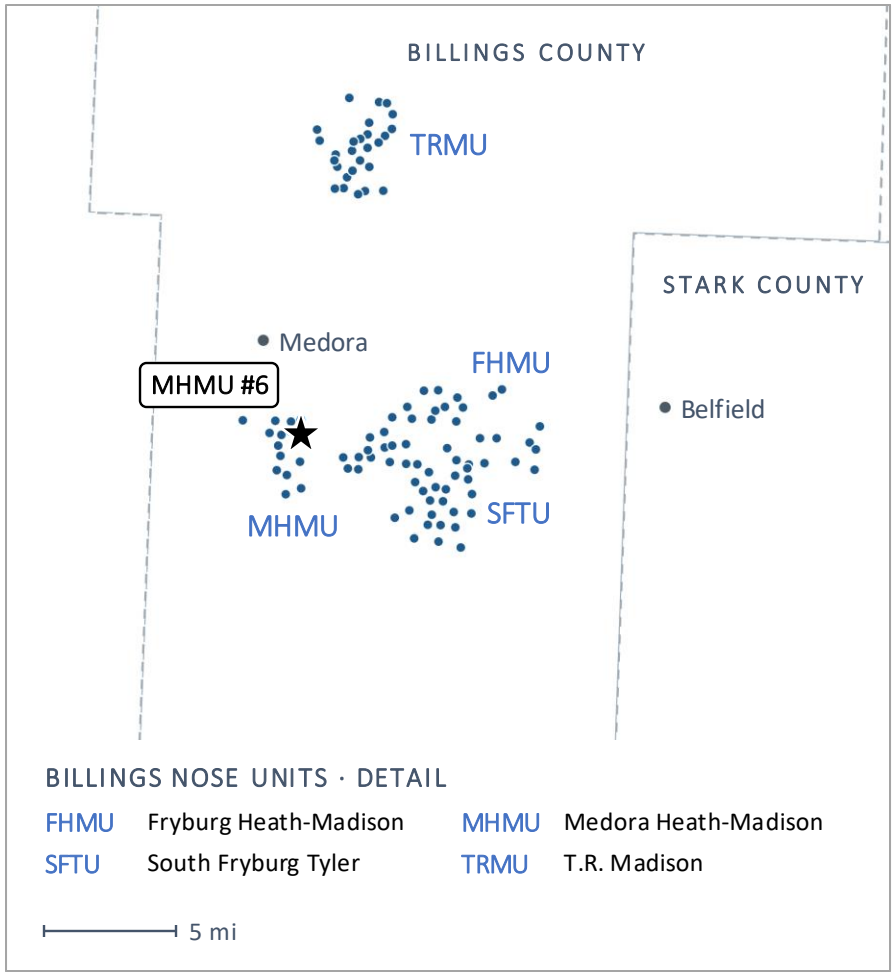
MHMU #6 and Browning's North Dakota assets

Browning Oil Company, Inc.

OGRP PROJECT SITE · NORTH DAKOTA

Medora Heath-Madison Unit #6 · NW¼ SE¼ Sec. 12, T139N, R102W · Billings County · Medora field · NDIC File No. 3938 · API 33-007-00088





Browning Oil Company, Inc.

Install, test and evaluate a re-closable sleeve completion in MHMU #6

Six steps on an existing well; no new well or pad. $1,344K project, $672K from OGRP

1 Baseline

Integrate survey, drilling, mud log, production, water analysis and the Aug 2025 pressure test to define the pre-install condition

2 Design

With NCS & EERC, design sleeve placement between external packers along the ~3,500 ft open-hole Mission Canyon lateral

3 Install

Pull the ESP, run the liner and packer/sleeves, open & close certain sleeves & pump oil/water tracers, run new ESP.

4 Test

Return well to production through existing BOCI facilities.

5 Monitor

Daily oil, water and fluid rates, ESP data, fluid levels, pressures, tracers and water chemistry

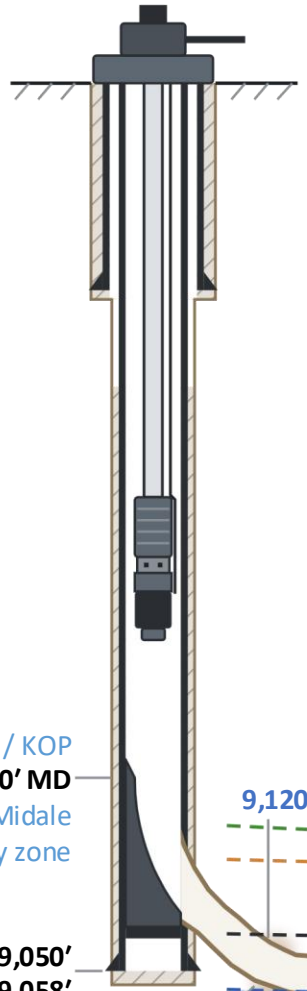
6 Evaluate

Compare configurations; deliver candidate-selection, design and operating guidance with EERC. Make recommendations for additional sleeve tests, stimulations, etc.

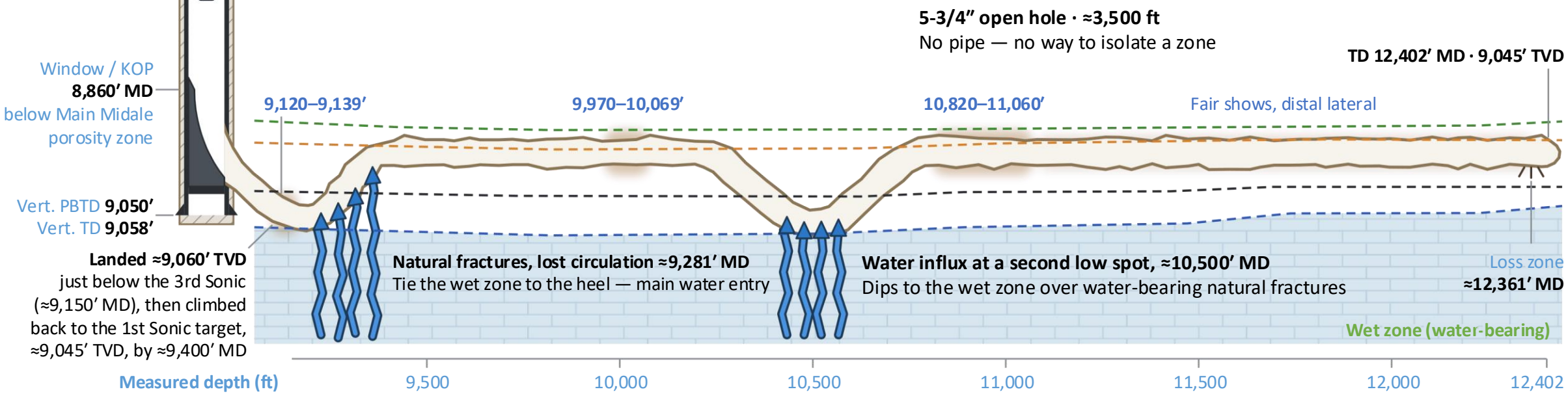
Outcome: a proven, or clearly bounded, method for managing water in Mission Canyon horizontal wells

MHMU #6

Browning Oil Company, Inc.

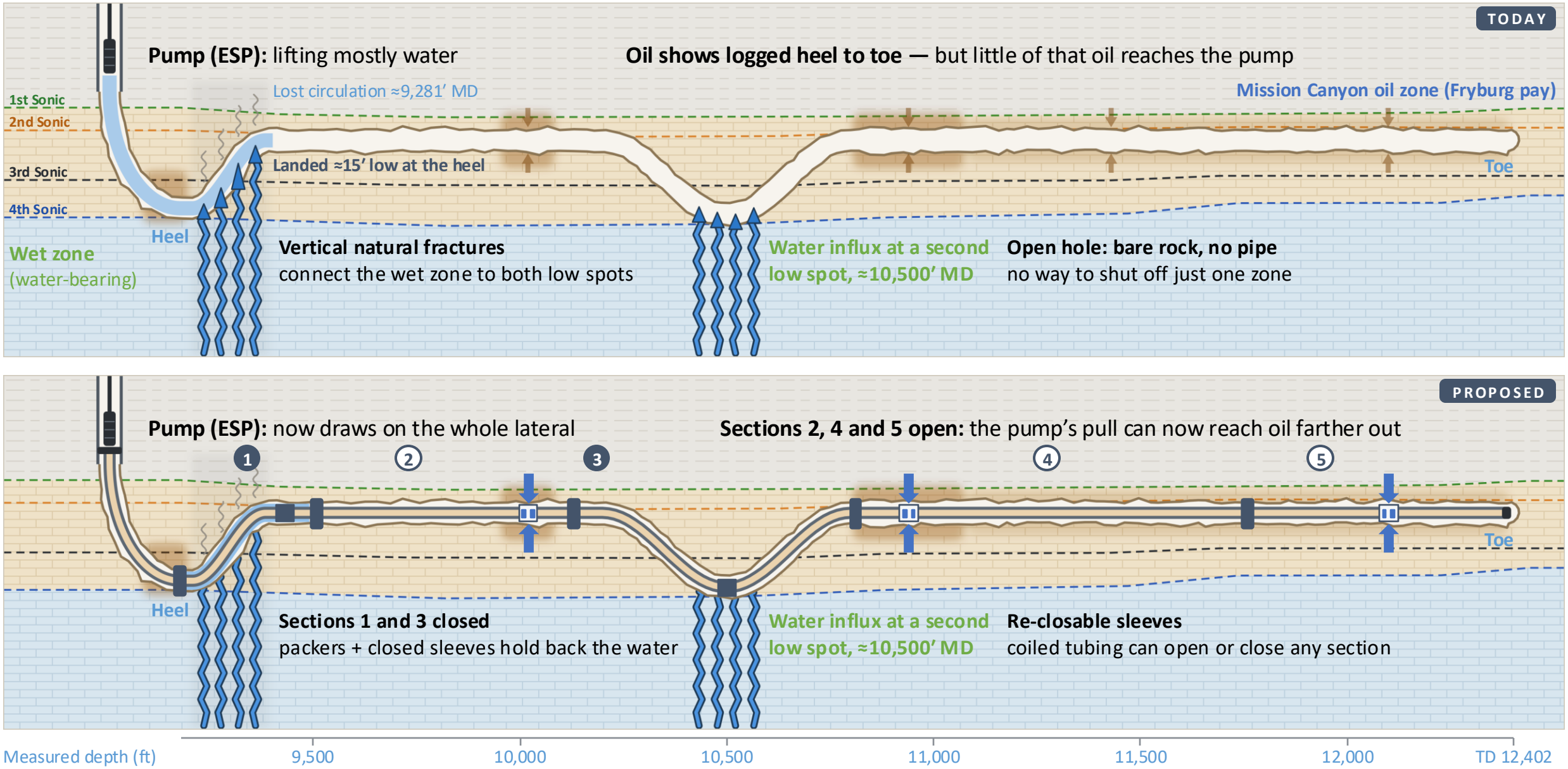


- Madison open-hole lateral sidetrack previous owner drilled
- Drilling, steering and operational issues caused heel of well to be landed too low
- Open hole completion did not allow lateral to be properly tested
- Subsequent locations, laterals and resource remain in place to develop



Shut off the wet zone, open up the rest of the lateral

Proposed re-closable sleeve completion · MHMU #6, open-hole Mission Canyon lateral · Billings County, ND



A $1.344MM field test, with BOCI paying half

$672K requested from NDIC, matched 1:1 by $672K of BOCI cash

Budget category	What it pays for	NDIC	BOCI	Total
Well service rig and well preparation	Pull and rerun equipment, clean out the well, pressure control	$175K	$175K	**$350K**
Coiled tubing and sleeve intervention	Coiled tubing, shifting tools and crews to open and close sleeves	$150K	$150K	**$300K**
Artificial lift / ESP services and equipment	ESP, well testing, pressure surveys, tracers, sampling	$275K	$275K	**$550K**
EERC technical analysis and research	Data and lab analysis, interpretation of results, reporting	$50K	$50K	**$100K**
Travel and field support	Project travel for design, installation, testing and reviews	$10K	$10K	**$20K**
Indirect / administrative	Administrative and facilities costs	$12K	$12K	**$24K**
Total project		**$672K**	**$672K**	**$1,344K**

Research costs only: routine lease operating costs of MHMU #6 stay with BOCI and are not in this budget

Priced by vendors

$511K of sleeves, packers, shifting tools, tubulars, ESP and tracers quoted by NCS, Steelhead and Halliburton

Tracked separately

BOCI accounts for project spending apart from normal lease costs, so nothing routine reaches the grant

Cost check before the rig moves

Costs, equipment and contractors are confirmed at a readiness review before field mobilization

Three organizations, each with a defined role

Operator, completion technology provider and independent research partner

Browning Oil Company, Inc.

Applicant and operator

RESPONSIBILITIES

- Project management, engineering, geology and field supervision
- Provides MHMU #6, site, infrastructure and historical data
- Matches the grant 1:1 ($672K)

QUALIFICATIONS

Operates MHMU, FHMU, SFTU and TRMU. Will Saint (project management, production engineering), Greg McFarland (geology), Kelly Blackwood (technical and reservoir advisor)

NCS Multistage

Completion technology provider

RESPONSIBILITIES

- Designs and supplies liner, packers, sleeves, shifting tools and tracers
- Supports installation and sleeve operation
- Coiled-tubing sleeve intervention tools

QUALIFICATIONS

Open-hole isolation, mechanically actuated sleeves and tracer technology. Brandon Gowisnock (technology evaluation)

EERC, University of North Dakota

Independent research partner

RESPONSIBILITIES

- Data integration and baseline characterization
- Reservoir and production evaluation of each sleeve configuration
- Interpretation of results and technical reporting

QUALIFICATIONS

Independent technical capability in data integration, reservoir and production evaluation, and research deliverables

A focused field test with statewide payoff

What we propose, and why it matters to North Dakota

WHAT WE PROPOSE

- Install a re-closable sliding sleeve completion in MHMU #6, an open-hole Mission Canyon lateral in Billings County, ND
- Demonstrate that sleeves can mechanically control water production and improve oil cut
- $1,344K field test: $672K from OGRP, matched 1:1 by BOCI

VALUE IF SUCCESSFUL

- Extends the productive life of similar mature conventional wells in North Dakota
- Cuts water production and the lease operating expense that comes with it
- Results are shared so other operators can adopt the method at analogous sites
- Even a negative result defines where the technology should not be applied

The ask: $672K from OGRP to prove the method in one well and open it to the state's mature Madison wells

Oil and Gas Research Program
Grant Round 63 Abstract Summaries

G-63-P Verification and Demonstration of Extiel's Absolute Pyrolysis Technology (APT): Local Production of Sequestration-Ready CO2 for Bakken Enhanced Oil Recovery and Low Carbon-Intensity Hydrogen for Ammonia and Urea from North Dakota Natural Gas and Lignite by Extiel Technologies, LLC

Project Description: Extiel Technologies developed a patented process that converts any carbonaceous material into clean synthesis gas, then into pure hydrogen and clean CO2 ready for EOR sequestration and qualified for 45Q credits of $85 per metric ton. Hydrogen is monetized as ammonia, urea, carbon-free power, SAF, or renewable diesel; these co-products defray the cost of delivering EORCO2 to North Dakota producers, unlocking a projected 8 billion barrels of secondary recovery over 50 years. North Dakota Energy Ventures, LLC (NDeV) has partnered with Extiel on ND oil and gas projects.

The project will demonstrate that APT produces high-quality syngas from abundant North Dakota feedstocks and that this syngas, with minimal post-treatment, yields sequestration-ready CO2 for EOR together with hydrogen for ammonia and urea.

Objective: To establish a third-party-verified heat and material balance on the APT-15k; to quantify the pre- and posttreatment needed to reach pipeline-specification CO2 and ammonia-grade hydrogen; to validate linear scaling of process parameters with electrical input across the APT-150k through APT-50M slate; to establish operating cost, uptime, labor intensity, and fabrication and installation cost sufficient to underwrite Phase II; and to confirm 45Q accounting for APT CO2 delivered to EOR.

Expected Results: Operation of the APT system will establish a real-world heat and material balance against Extiel's calculated product slate.

APT with EOR also reduces criteria pollutants, which are largely eliminated by pre-combustion processing of the synthesis gas.

The ash from coal may carry greater commercial value, having been exposed to the reducing environment of the APT reactor rather than the oxidizing environment of a boiler furnace — reduced metals being more valuable than their oxides.

Duration: 18 months

Budget: The total cost is $6,000,000. The grant request from OGRP is $3,000,000. Cost share is provided through a combination of cash raised by Extiel and in-kind contribution of engineering, research, and patent expense.

Exhibit 15. NDIC Budget Summary

Project Associated Expense	NDIC Grant	NDIC Loan	Applicant's Share (Cash)	Other Project Sponsor's Share	Total
Grant	$3,000,000	—	—	—	$3,000,000
Extiel Capital Raise	—	—	$1,500,000	—	$1,500,000
Extiel In-Kind	—	—	$1,500,000	—	$1,500,000
Total	**$3,000,000**	**—**	**$3,000,000**	**—**	**$6,000,000**

The application of funds by cost category over the 18-month period is set out below.

Participants: Extiel, E-Force Services, PLC Engineering Services, UND EERC.

DIRECTOR'S COMMENTS
G-63-P
Extiel Technologies, LLC
Verification and Demonstration of Extiel's Absolute Pyrolysis Technology (APT): Local Production of Sequestration-Ready CO2 for Bakken Enhanced Oil Recovery and Low Carbon-Intensity Hydrogen for Ammonia and Urea from North Dakota Natural Gas and Lignite
Principal Investigator: Michael O' Brien
Request for: $3,000,000
Total Project Costs: $6,000,000
Duration: 18 Months

Description of the Project:
Extiel Technologies developed a patented process that converts any carbonaceous material into clean synthesis gas, then into pure hydrogen and clean CO2 ready for EOR sequestration and qualified for 45Q credits of $85 per metric ton. Hydrogen is monetized as ammonia, urea, carbon-free power, SAF, or renewable diesel; these co- products defray the cost of delivering EORCO2 to North Dakota producers, unlocking a projected 8 billion barrels of secondary recovery over 50 years. North Dakota Energy Ventures, LLC (NDeV) has partnered with Extiel on ND oil and gas projects.
The project will demonstrate that APT produces high-quality syngas from abundant North Dakota feedstocks and that this syngas, with minimal post-treatment, yields sequestration-ready CO2 for EOR together with hydrogen for ammonia and urea.

Objective:
To establish a third-party-verified heat and material balance on the APT-15k; to quantify the pre- and posttreatment needed to reach pipeline-specification CO2 and ammonia-grade hydrogen; to validate linear scaling of process parameters with electrical input across the APT-150k through APT-50M slate; to establish operating cost, uptime, labor intensity, and fabrication and installation cost suUicient to underwrite Phase II; and to confirm 45Q accounting for APT CO2 delivered to EOR.

Statement	Weighting Factor	G-63-P1	G-63-P2	G-63-P3
1. Objective	9	36	36	36
2. Achievability	7	28	21	28
3. Methodology	8	32	32	32
4. Contribution	8	40	32	32
5. Awareness/Background	5	15	10	20
6. Project Management	3	9	9	12
7. Equipment/Facilities	2	8	4	8
8. Value/Industry-Budget	4	20	12	20
9. Financial Match – Budget	4	12	12	16

Average Weighted Score		200	136	204
	Total: 50			250 possible points
Overall Recommendation:				
Fund		X		X
Funding May Be Considered			X	
Do Not Fund				

Technical Reviewers' Comments

Reviewer G-63-P1
This is a very good project, that if successful, will be a huge multi-faceted boon for the state of North Dakota. It is an early laboratory-based step leading to additional field upscaling tests necessary to prove viability of the technology.
Recommendation: Fund

Reviewer G-63-P2
It looks like a great concept, $6 million to prove the concepts.

It appears that the project's main goal is to provide CO2 for Bakken EOR. Is there enough success and confidence with Bakken EOR to justify perusing the creation of a new CO2 source? What will be the price tag on the CO2/ton? Obviously we won't have an accurate price until this project is completed, but every other scenario is estimated in this proposal. It would be really good to have an anticipated cost and price of the product produced.
Recommendation: Funding May Be Considered

Reviewer G-63-P3
Recommend to fund $1,960,000.
If this project succeeds results will be applicable to a large portion of the Bakken
oil field. The background of the team is exceptional. The plan includes a well defined schedule.
The significant involvement of EERC makes achievement of project objectives very likely.
Data from a successful project could have a significant positive impact on the ultimate recovery from the Bakken reservoir.
Recommendation: Fund

Director's Recommendation: Fund for $1,500,000.

Verification and Demonstration of Absolute Pyrolysis Technology

Locally produced, sequestration-ready CO_2 for Bakken EOR — and the low carbon intensity hydrogen that pays for it

$6.0M
total program

$3.0M
NDIC request

18 mo
Phase I duration

EERC
Grand Forks host

Michael O'Brien · Executive Vice President, Director, Extiel Technologies, LLC · November 2026

North Dakota's CO_2 requirement has no supply path today

250,175 ~1.75 incremental bbl/MT of purchased CO_2

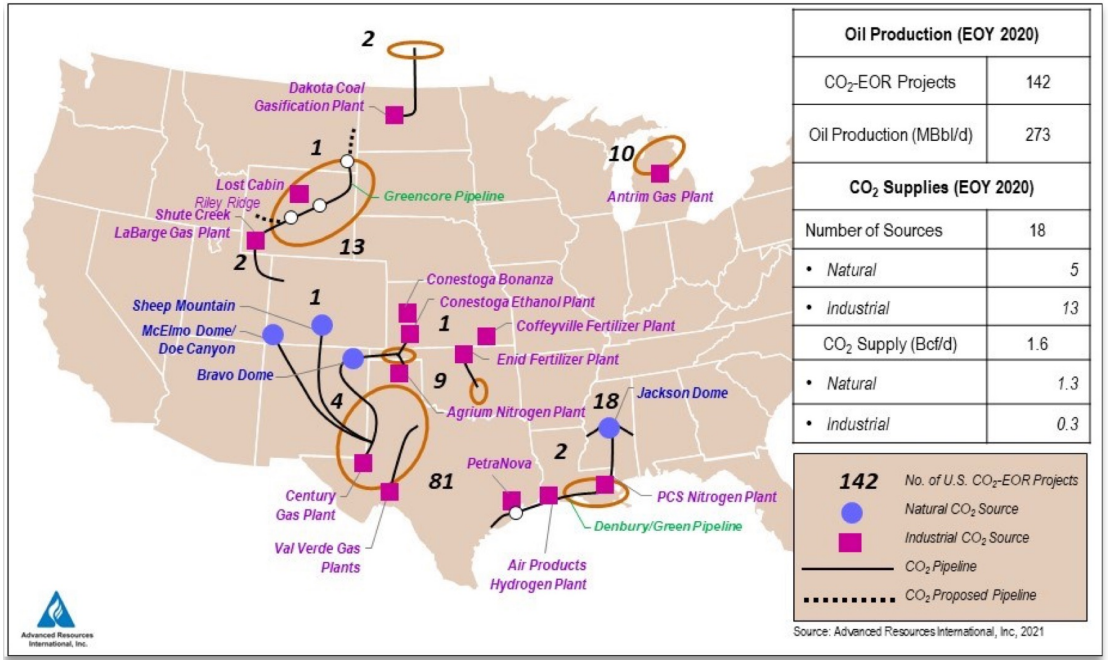
METRIC TONS PER DAY (MTPD) of CO_2 required to reach the state's 8-billion-barrel incremental recovery goal (50-year timeframe)

84,219 ~3.24 incremental bbl/MT of purchased CO_2

MTPD currently consumed by every CO_2-EOR project in North America combined

Roughly three times the CO_2 currently consumed for EOR across North America

Interstate pipelines are increasingly difficult to route and permit, developers will not build until capacity is subscribed, and "natural" CO_2 does not qualify for 45Q.



U.S. CO_2-EOR projects, sources and pipelines, end of 2020 — the supply base North Dakota would be competing for

Requirement confirmed publicly by Governor Armstrong and Chord CEO Danny Brown at the EERC Energizing North Dakota's Future conference:
100 million short tons/yr = 91 million MTPY.

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APT makes CO_2 and hydrogen from North Dakota feedstocks

1

Feedstock flexible

Natural gas, untreated associated gas, lignite, biomass, MSW — gaseous, liquid or solid, together or individually.

2

Pre-combustion capture

CO_2 separated before combustion from a single concentrated point source, not scrubbed from flue gas. No fuel burned, no flue stack, no flue gas emissions.

3

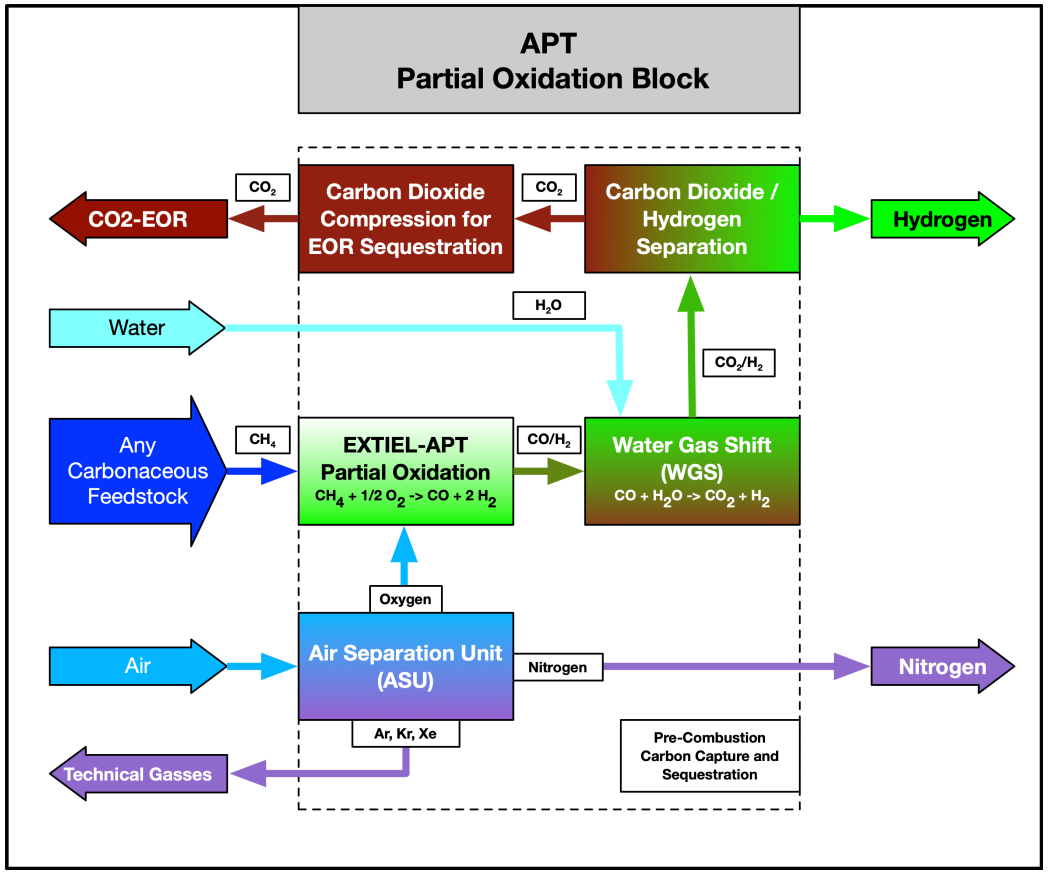
Three saleable streams + Tax Credits

Sequestration-ready CO_2 at pipeline specification, low carbon-intensity hydrogen, and Technical Gases (nitrogen, argon, krypton, xenon). $85/MT CO_2 sequestration tax credit - 45Q.

4

Self-powered

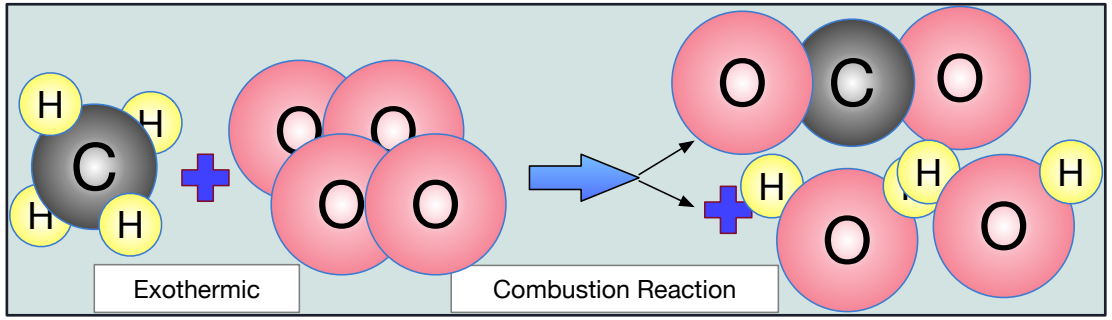
About 8% of produced hydrogen (natural gas feedstock), converted to power, runs the plant — no grid dependency.

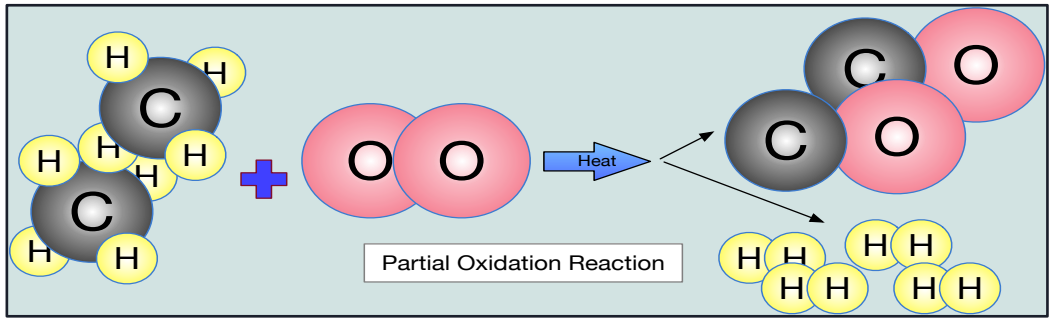


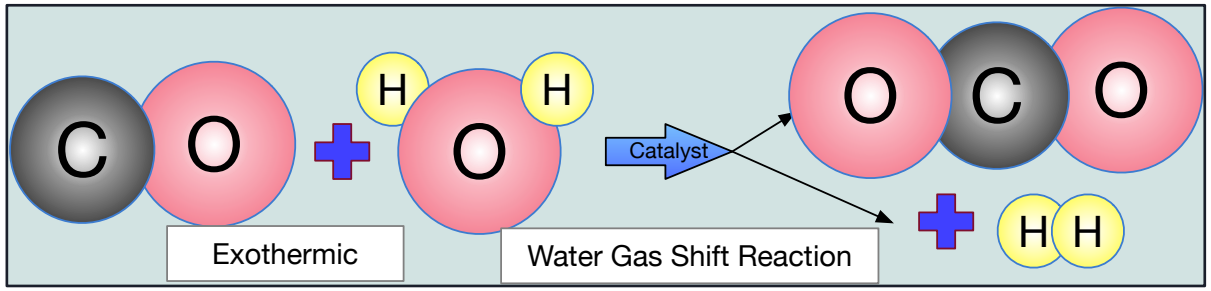
APT partial oxidation block — pre-combustion carbon capture and sequestration

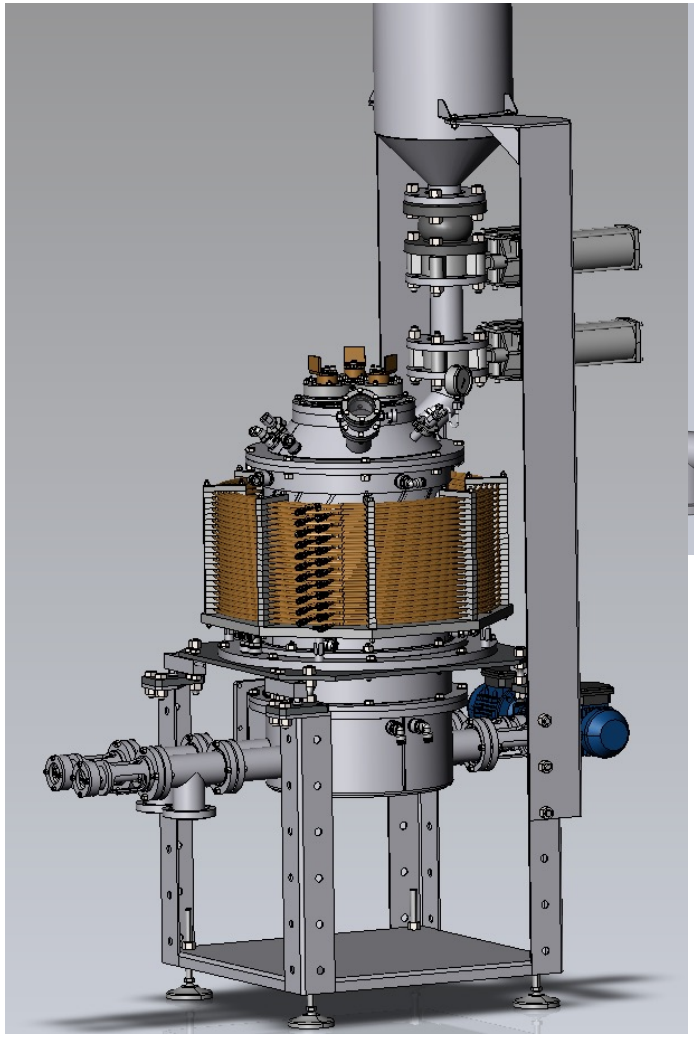
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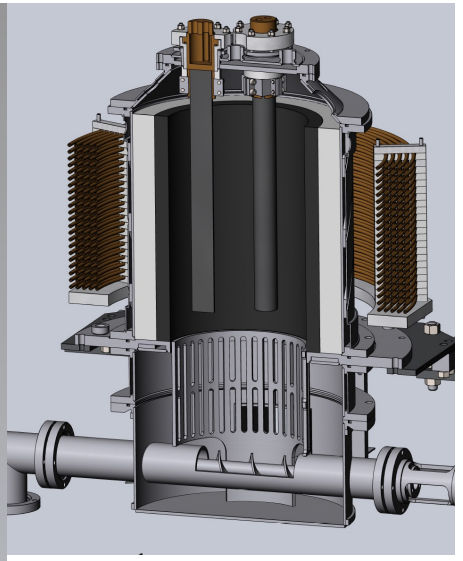
APT makes CO_2 and hydrogen from any carbonaceous matter









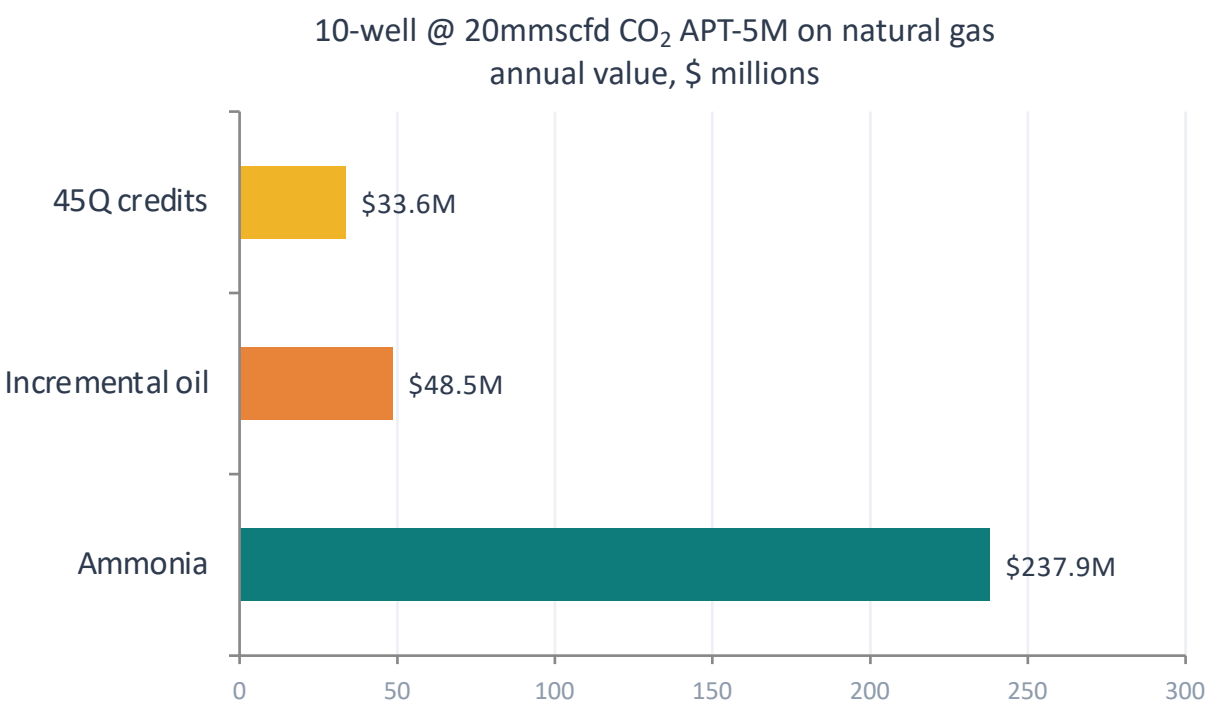


APT-15k reactor cutaway view

APT-15k reactor and skid assembly

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The hydrogen co-product makes the CO_2 affordable



83% of an APT-5M's incremental revenue on natural gas comes from ammonia sales

$286.5M total annual incremental revenue per APT-5M, plus $33.6M in 45Q credits

$2.86B annual revenue at APT-50M scale, with $336.3M in annual 45Q credits

Ammonia and urea revenue defrays the cost of delivering EOR-CO_2 to producers, minimizing the impact on lifting costs —Chord Energy makes this point directly in its letter of support.

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Two in-state feedstocks, one commercial platform

APT-5M commercial reference unit	Natural gas	Lignite
CO_2 delivered, MTPD	1,153.6	737.6
Net ammonia option, MTPY	267,345	78,972
Annual incremental revenue	$286.5M	$101.3M
Annual 45Q credits	$33.6M	$21.5M
APT-50M Units to meet 91 million MTPY state requirement	23 × APT-50M	36 × APT-50M

Complementary, not competing

Natural gas yields about 1.56× the CO_2 per unit of APT energy input and more than three times the hydrogen. Lignite is cheaper, available under long-term in-state supply, harder to export, and under acute market pressure as coal generation retires.

20 million

METRIC TONS of lignite consumed annually in ND for power (2024 figures)

23 TWh

2,600 MEGAWATTS average output (2024 figures)

22 million (25% of projected demand)

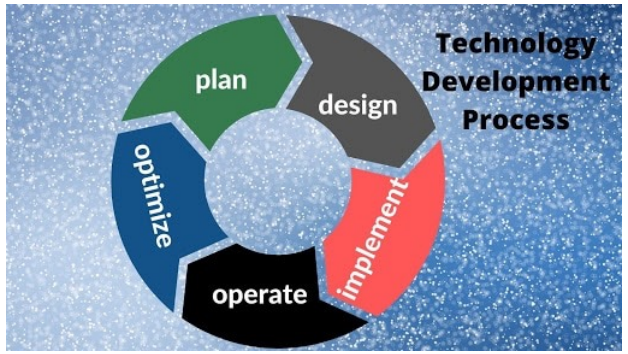
METRIC TONS of CO_2 a year from North Dakota's lignite power fleet — about 9 APT-50M units

32 TWh (net)

3,700 MEGAWATTS average output of carbon-neutral power if all **hydrogen burned in CCPP**

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What the Phase I demonstration actually delivers



1 **Third-party verified heat and material balance**

EERC-verified H&MB closing within tolerance on natural gas — the one deliverable Phase II financing waits on.

2 **Syngas quality benchmark**

Composition demonstrating materially lower oxidation and reduction by-products than a Lurgi-type gasifier on similar feedstock.

3 **Scalability data**

Operating data sufficient to confirm or correct the linear scaling assumption behind the APT-150k through APT-50M slate.

4 **Phase II cost basis**

Documented feedstock cost, uptime, labour intensity, fabrication and installation cost to underwrite the APT-500k field trial.

18 months

funding to final report

EERC

Grand Forks, existing permits

0 acres

no land, siting or permitting

6 gates

funds drawn against stage gates

Hosted inside EERC's existing permitted facility — no land acquisition, no site improvements, no OSBL utilities, no permitting delay.

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Each phase is financeable on the results of the one before it

	Proof of concept	Phase I APT-15k	Phase II APT-500k	Phase III APT-5M	Phase IV APT-50M
Timeline	Completed	**18 months**	12 months	36 months	36 months
EOR-CO_2 delivered	—	**3.46 MTPD**	115 MTPD	1,150 MTPD	11,500 MTPD
Installed cost	$12M invested	**$6M**	~$15M	~$300M	~$2.2B
Annual revenue	—	—	$10M	$230M	$2.9B
Annual 45Q credits	—	—	$3M	$30M	$300M

Council participation in Phase I is the gate that unlocks the private capital behind Phases II, III and IV

$12 million of private money has already gone into proving the concept. Phase I is the last rung that cannot be financed on prior results, because the verified balance does not yet exist. Every stage after it is underwritten by the data this grant produces — ending in units that each deliver 11,500 MTPD of CO_2 and $2.9 billion of annual revenue inside North Dakota.

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A smaller award changes the scope, not the deliverable

	Focused $3.0M total	Full $6.0M total
NDIC share at 50% match	$1.5M	$3.0M
Duration	15 months	18 months
Feedstocks tested	Gas + associated gas	Gas, APG, lignite, biomass
Third-party verified H&MB	**Yes**	**Yes**
Scalability data for Phase II	**Yes**	**Yes**
Extended reliability run	**Yes**	**Yes**
Lignite and biomass campaigns	—	**Yes**
Next stage Engineering	FEL-1 APT-500k	FEL-3 APT-500k

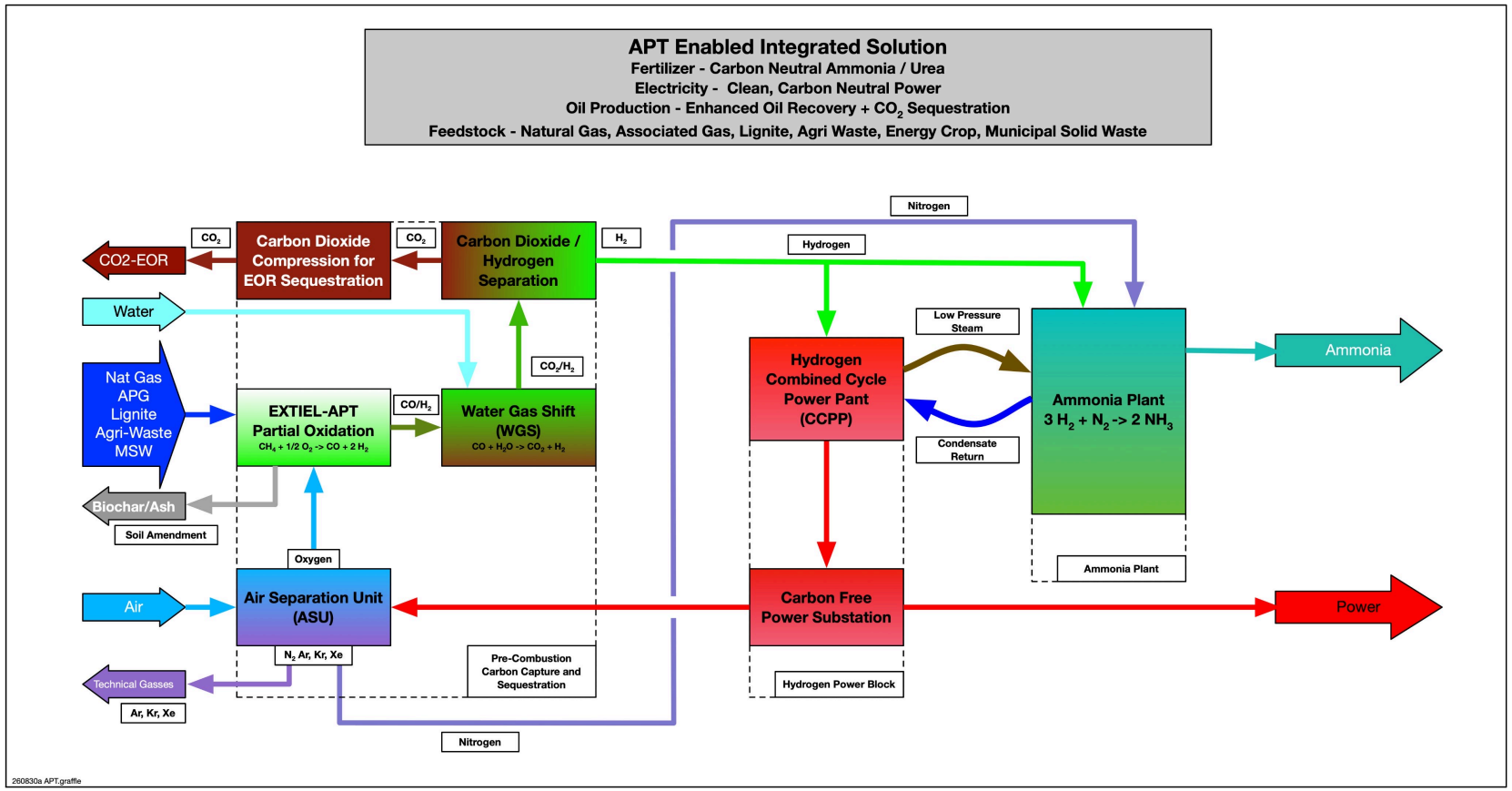
How we close the gap

1. Lean on EERC's installed base — their shift reactor, analysers, utilities and effluent handling, rather than duplicating them on our skid
2. Run natural gas first then “simulated” associated gas; lignite and biomass “as budget permits”
3. Shorten the operating campaign to what steady-state characterisation requires
4. Extiel absorbs a larger in-kind engineering and project-management share

At any award level: Extiel holds the match at 50% or better, the project stays stage-gated so the Council reviews progress before each tranche, and North Dakota gets a third-party-verified heat and material balance. A reduced award moves lignite and the extended run into Phase II — it does not put the verified number at risk.

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Hydrogen pathway 1 — carbon-neutral ammonia, urea, power



267,345

MTPY net ammonia from one APT-5M on natural gas

83%

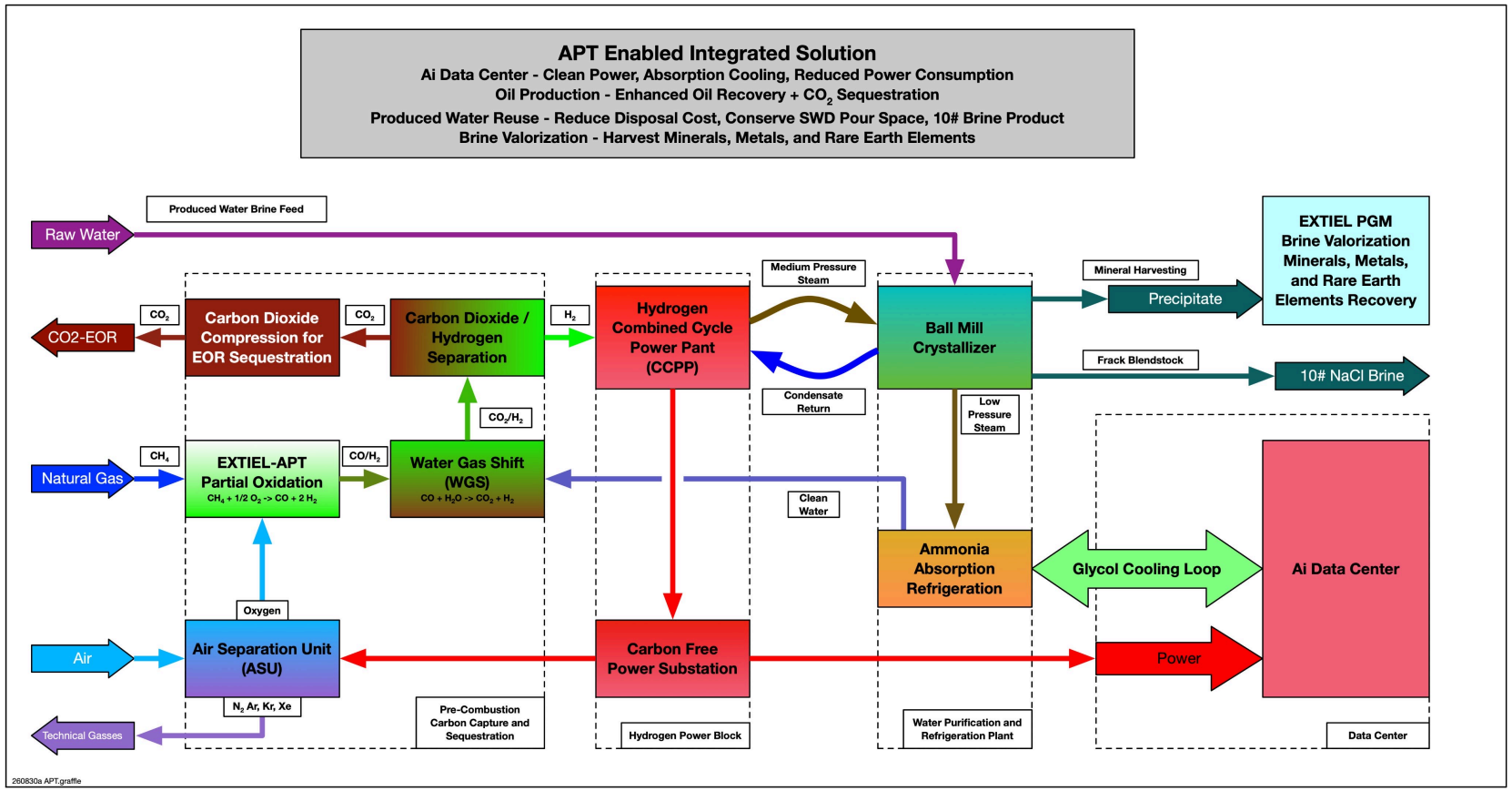
of that unit's incremental revenue

Nitrogen from the same air separation unit that feeds partial oxidation combines with APT hydrogen over a conventional Haber-Bosch loop. A small slipstream of CO_2 can be reacted with the ammonia to make urea instead, giving the operator a commercial choice between the two fertilizers and exportable power as markets move.

1 **The pathway that pays for the CO_2, and the one that lands in North Dakota agriculture.** CO_2 output and 45Q accounting are identical across all three pathways.

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Hydrogen pathway 2 — AI data center power, cooling and water



135 MW

carbon-free power from one APT-5M on natural gas

10# brine

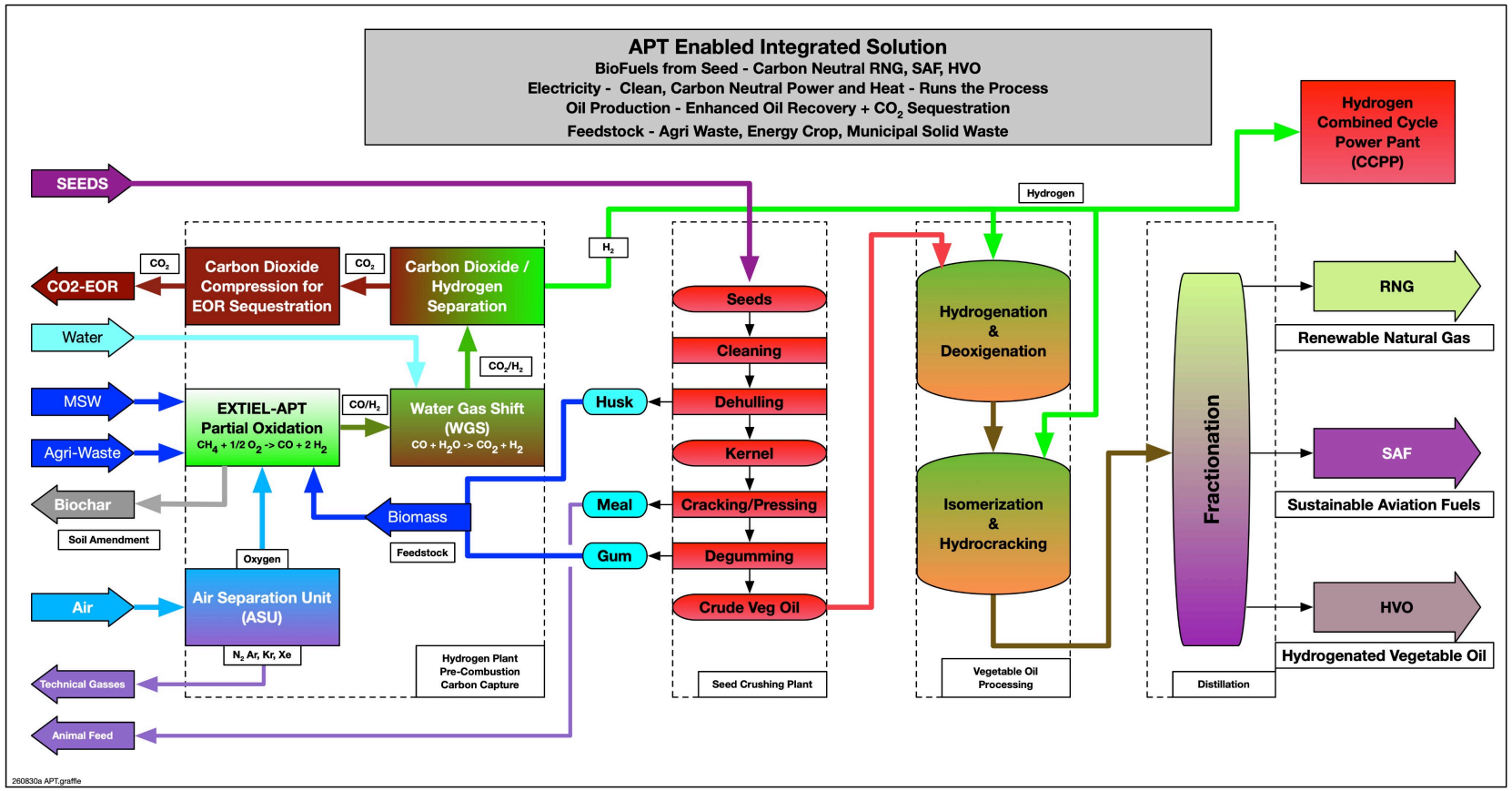
frack blend stock out of produced water

Hydrogen fires a gas turbine supplying the data center with carbon neutral power. Waste heat drives a ball mill crystallizer on produced water brine; the low-pressure steam overhead then runs ammonia absorption refrigeration, cooling the center through a glycol loop while displacing the electric chillers that normally eat a large share of site load.

2 **Produced water turns from a disposal liability into clean water, frack blend stock and a mineral precipitate — while conserving SWD pore space.** CO_2 output and 45Q accounting are identical across all three pathways.

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Hydrogen pathway 3 — renewable fuels from North Dakota oilseed



RNG / SAF / HVO

three fuel products off one fractionation train

Carbon-negative

recently-atmospheric carbon, sequestered through EOR

Seeds are crushed on site. Husk and gum by-products return to the APT reactor as biomass feedstock and the meal is sold as animal feed, while the crude vegetable oil is hydrogenated, deoxygenated, isomerized and hydrocracked using APT hydrogen, then fractionated into renewable natural gas, sustainable aviation fuel and hydrogenated vegetable oil.

3 **Both halves of the state's economy supply this plant: North Dakota grows the oilseed, APT supplies the hydrogen.** CO_2 output and 45Q accounting are identical across all three pathways.

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What North Dakota gets for it

1 CO_2 security

In-state, on-purpose CO_2 that does not wait on an interstate pipeline or compete for a shrinking natural supply.

2 A second life for lignite

Pre-combustion capture turns 22 million tonnes a year from the lignite fleet into EOR feedstock and 3,600 MW of clean power.

3 Fertilizer for ND agriculture and export

Ammonia and urea produced in-state from in-state feedstock, with export capacity on top.

4 45Q-qualified carbon

APT CO_2 is industrial, not natural — it earns the $85 per metric ton tax credit that piped natural CO_2 cannot.

5 Durable jobs

53 permanent operators per APT-5M and 89 per APT-50M, plus EERC engineering hours through the demonstration.

6 Debottlenecked gas

Associated gas consumed locally relieves gathering, processing and transmission constraints across the basin.

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The ask

Project scope is adjustable to the available funds.

1. **$3.0M** — requested against a $6.0M program — full scope, four feedstocks, 18 months
2. **~$1.5M** — a workable award — natural gas first, same verified deliverable, lignite deferred to Phase II
3. **50%+** — applicant match at every level, cash and in-kind, per OGRC 3.02

Already behind it

EERC

Prepared to host, design, install, operate and validate the system

Chord Energy

Prospective CO_2 consumer and gas supplier; timing fits their EOR plans

GAP Midstream

Pipeline infrastructure, associated gas supply agreements

$12M

Private capital already invested in the proof of concept

Michael O'Brien · Extiel Technologies, LLC · (1) 281.250.6552 · Houston, Dallas, Tuscaloosa

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Exhibits

Natural Gas

Unit Size	Nat Gas Feedstock	Carbon Dioxide* Production	Carbon Dioxide* Production	Carbon Dioxide* Production	Gross Hydrogen Production	Net Hydrogen** Production	Net Power Option **	Net Ammonia Option**	Net Urea Option**
	mscfd	MTPY	MTPD	mscfd	MTPY	MTPY	MW	MTPY	MTPY
APT-15k	644	11,870	34.61	657.48	1,656.30	1,524.02	4.1	8,020	13,974
APT-150k	6,444	118,704	346	6,575	16,563	15,240	40.6	80,203.4	139,738.1
APT-500k	2,148	39,568	115	2,192	5,521	5,080	13.5	26,734.5	46,579.4
APT-5M	21,482	395,681	1,153.59	21,916.08	55,210	50,800.51	135.3	267,345	465,794
APT-50M	214,817	3,956,808	11,536	219,161	552,100	508,005	1,353.2	2,673,446.0	4,657,938.1

Lignite Beulah ND ZAP Freedom Mine

Unit Size	Lignite Feedstock	Carbon Dioxide* Production	Carbon Dioxide* Production	Carbon Dioxide* Production	Gross Hydrogen Production	Net Hydrogen** Production	Net Power Option **	Net Ammonia Option**	Net Urea Option**
	MTPY	MTPY	MTPD	mscfd	MTPY	MTPY	MW	MTPY	MTPY
APT-15k	681	759	2.21	42.04	53.47	45.31	0.1	237	413
APT-150k	6,813	7,590	22	420	535	453	1.2	2,369.2	4,125.0
APT-500k	22,710	25,299	74	1,401	1,782	1,510	4.2	7,897.2	13,750.2
APT-5M	227,104	252,987	737.57	14,012.53	17,824	15,104.96	41.7	78,972	137,502
APT-50M	2,271,045	2,529,872	7,376	140,125	178,235	151,050	416.6	789,722.4	1,375,015.0

* CO2 output from Water Gas Shift reactor as part of Hydrogen production		mscfd	thousand standard cubic feet per day
** Net output after hydrogen consumed for self-generated power to run the process		MTPD	Metric Tons per Day
Power Hydrogen, Ammonia, and/orUrea can be prosuced in any combination		MTPY	Metric Tons per Year
260828a ND Grant Nat Gas to CO2+H2.xlsx			

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