



EERC



U N I V E R S I T Y O F
NORTH DAKOTA

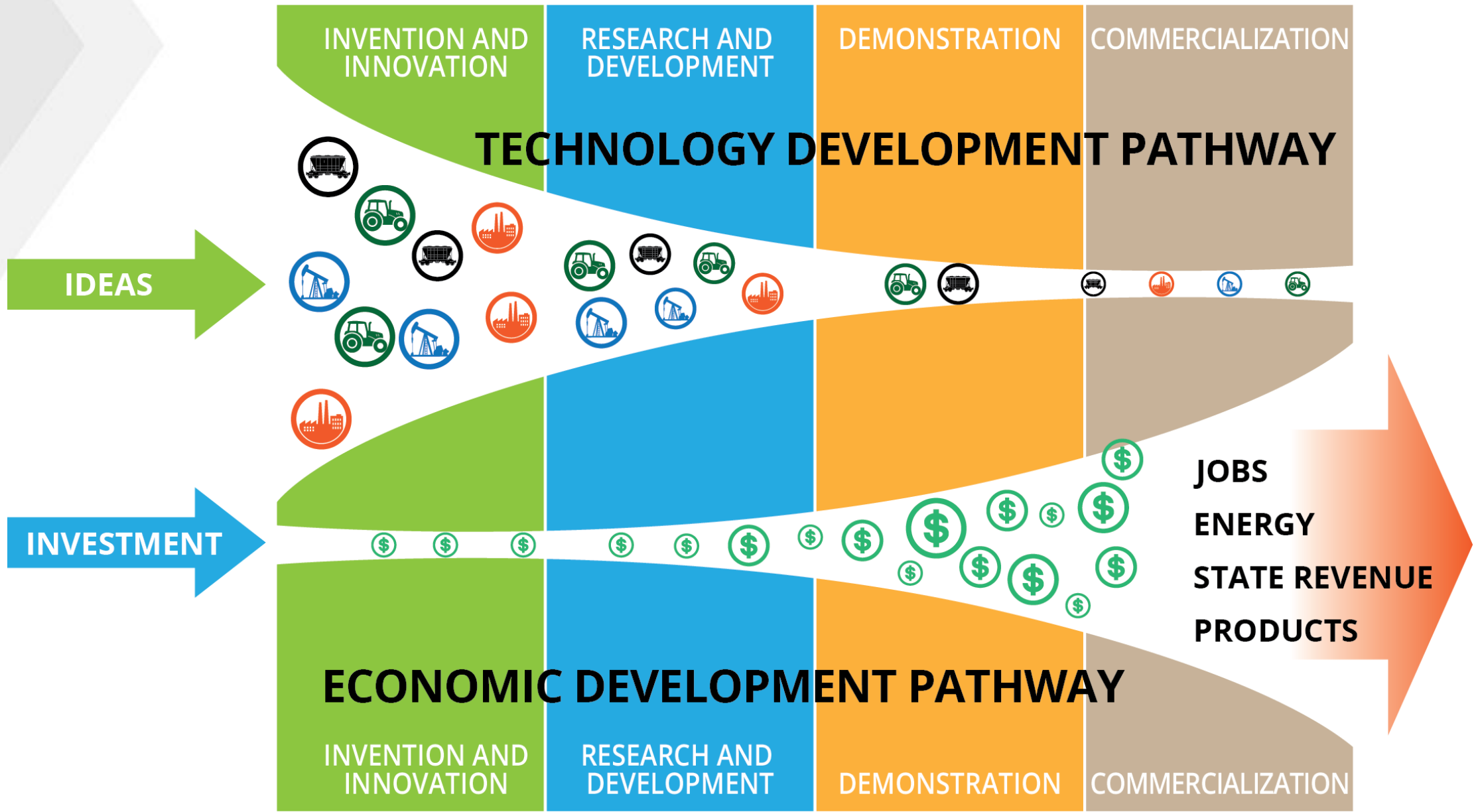


Critical Challenges. Practical Solutions.

State Energy Research Center – 5+ Years of Progress

Presented to the ND Legislature -
Senate Appropriations – Education
and Environment Division

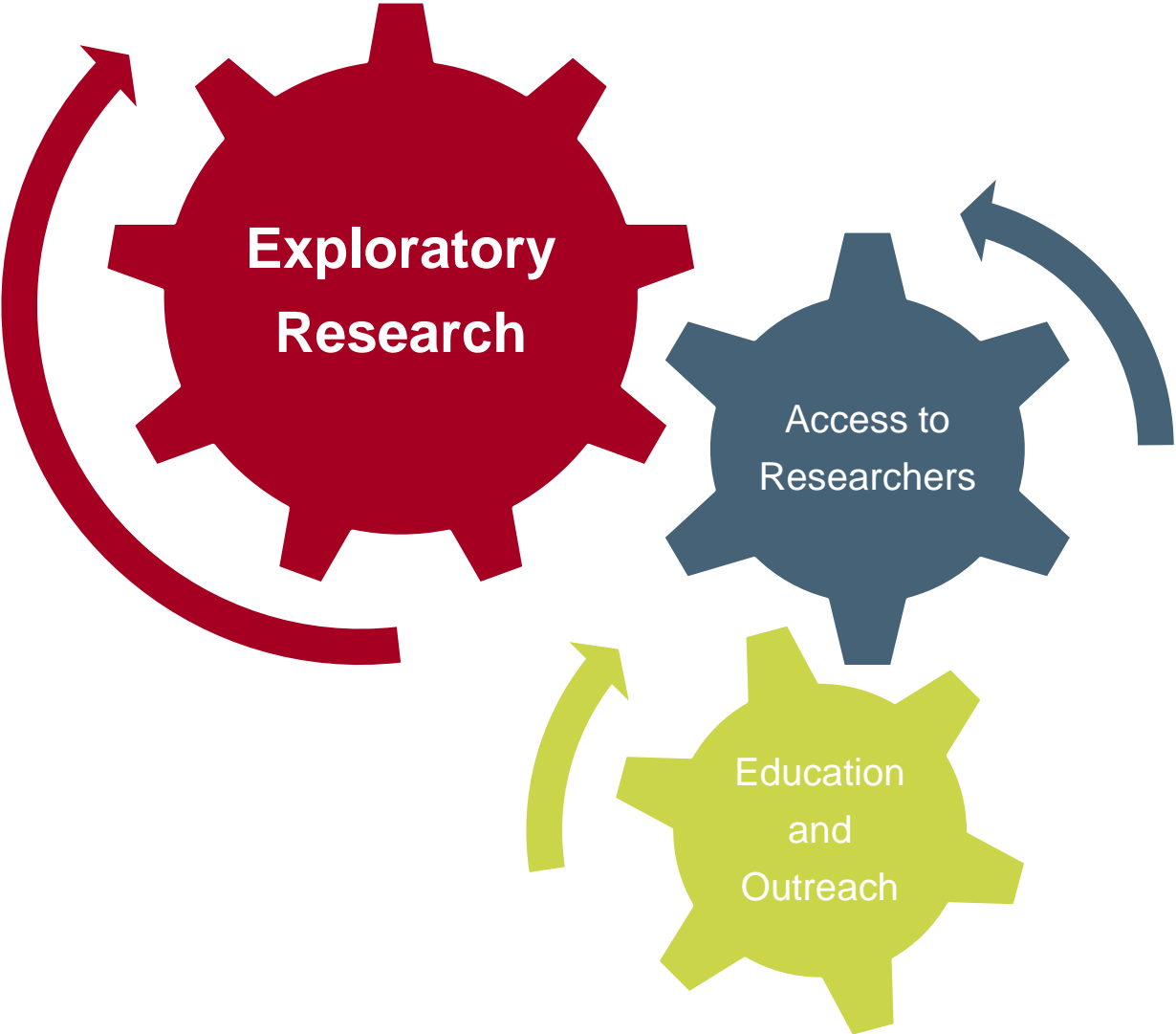
Tom Erickson, EERC SERC Director
January 27, 2025



“ This funding would support North Dakota through 1) exploratory research, 2) ready access to EERC experts to address critical state needs in a timely manner, and 3) education and outreach throughout the state to advance North Dakota’s critical role.”

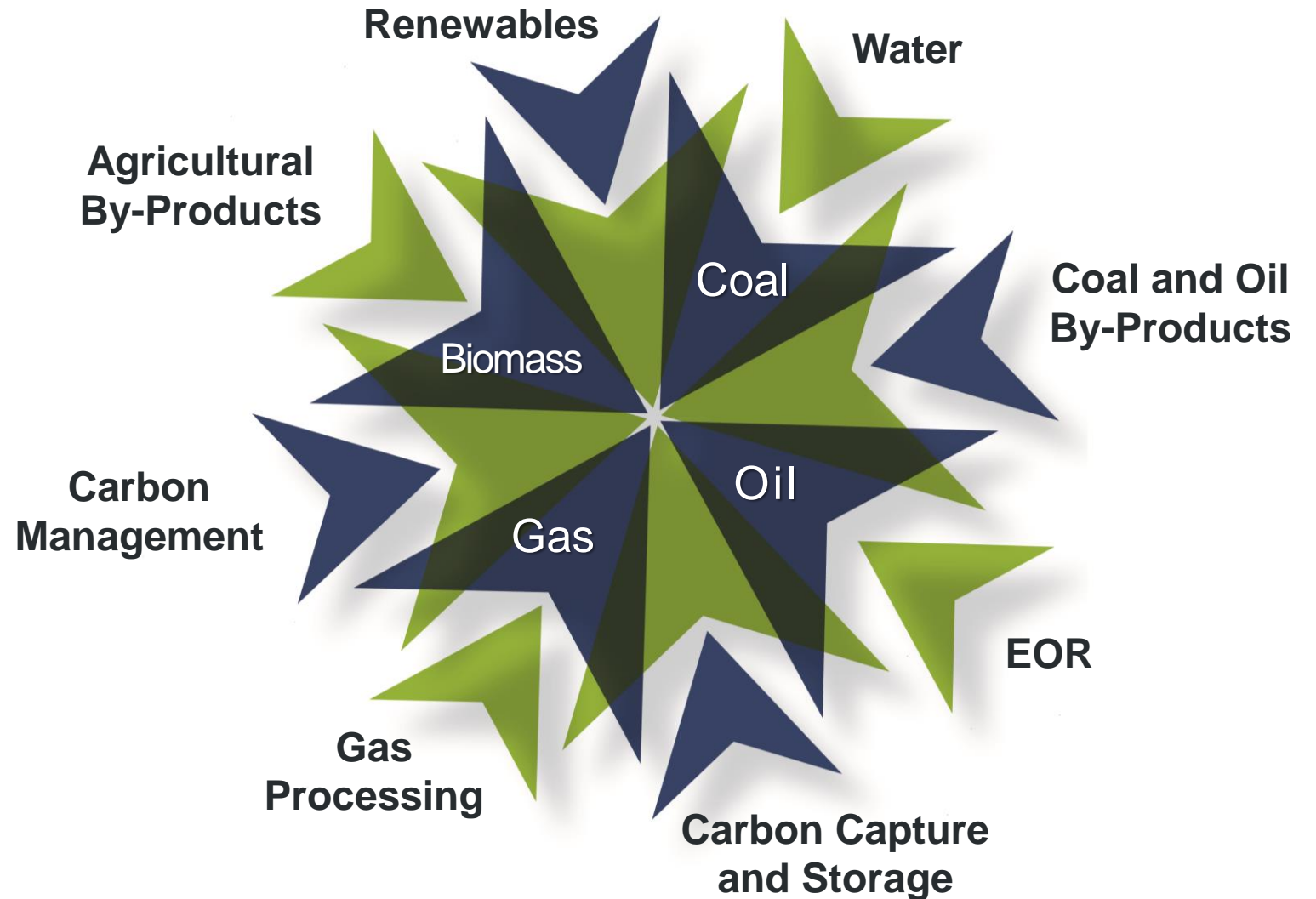
“ Although the return on investment of this funding may be difficult to quantify, as evidenced by past performance, the benefits of these efforts will be orders of magnitude greater than the investment.”

EXPLORATORY RESEARCH



INVENTION AND INNOVATION

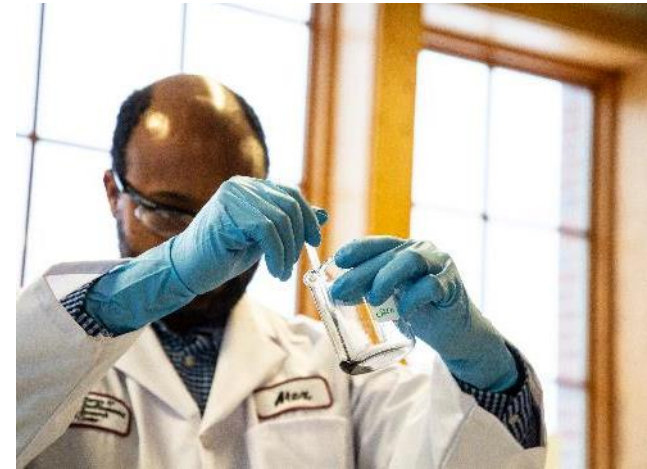
**Funded 60+
projects/strategic
initiatives across all
North Dakota energy
platforms!**



RESEARCH AND DEVELOPMENT

SERC exploratory projects lead to larger research and development (R&D) projects, largely funded by the federal government.

- \$71 million on proposed follow-on R&D
- \$33 million in awarded R&D to date
- \$24 million in pending awards
- Launched two strategic initiatives:
 - Enhance Energy Resiliency for North Dakota's Military Installations
 - Critical and Novel Materials for North Dakota's Energy Growth



DEMONSTRATION

Several SERC-supported technologies have begun demonstration/application testing already.

- One technology in field demonstrations
- One technology nearing field demonstration
- Several technologies being tested for application-specific uses
- Several technologies seeking funding opportunities to advance to demonstration/specific-use evaluations



COMMERCIALIZATION

SERC technologies are being protected and already commercialized to serve North Dakota.

- 11 U.S. patent applications submitted to date (21 additional continuation, CIP, divisional or foreign applications)
- Six U.S. patents received to date (five additional continuation or CIP patents received)
- One commercial license finalized
- One commercial license near completion
- Other conversations occurring about licensing opportunities



Polar Bear™

INVENTION AND INNOVATION

- SERC award to advance the compressor technology.

RESEARCH AND DEVELOPMENT

- Initial \$1,000,000 federal award.
- Significant “in-kind” support from Steffes.
- Additional \$2,000,000 federal award.

DEMONSTRATION

- Two manufacturers working on new compressor models.
- First demonstration is in the field.
- Additional demonstration units ready for deployment.
- Larger commercial pilot project in development.

COMMERCIALIZATION

- Multiple patents already received.
- Commercial license with Steffes near completion.



GRAPHENE FROM ND LIGNITE

INVENTION AND INNOVATION

- SERC award to evaluate concept.
- SERC award to explore applications in low-viscosity oil.

RESEARCH AND DEVELOPMENT

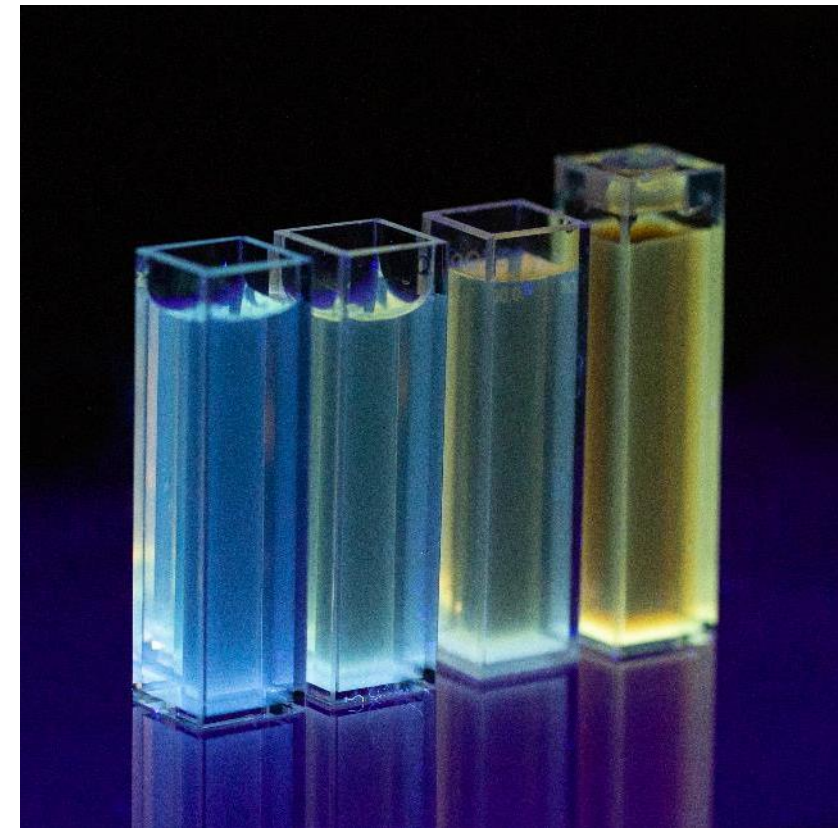
- \$930,000 federal award to further research.

DEMONSTRATION

- \$1.5 million to investigate for lithium batteries.

COMMERCIALIZATION

- Two patents received, with an additional CIP application in process.



**READY
ACCESS TO
EERC
EXPERTS**

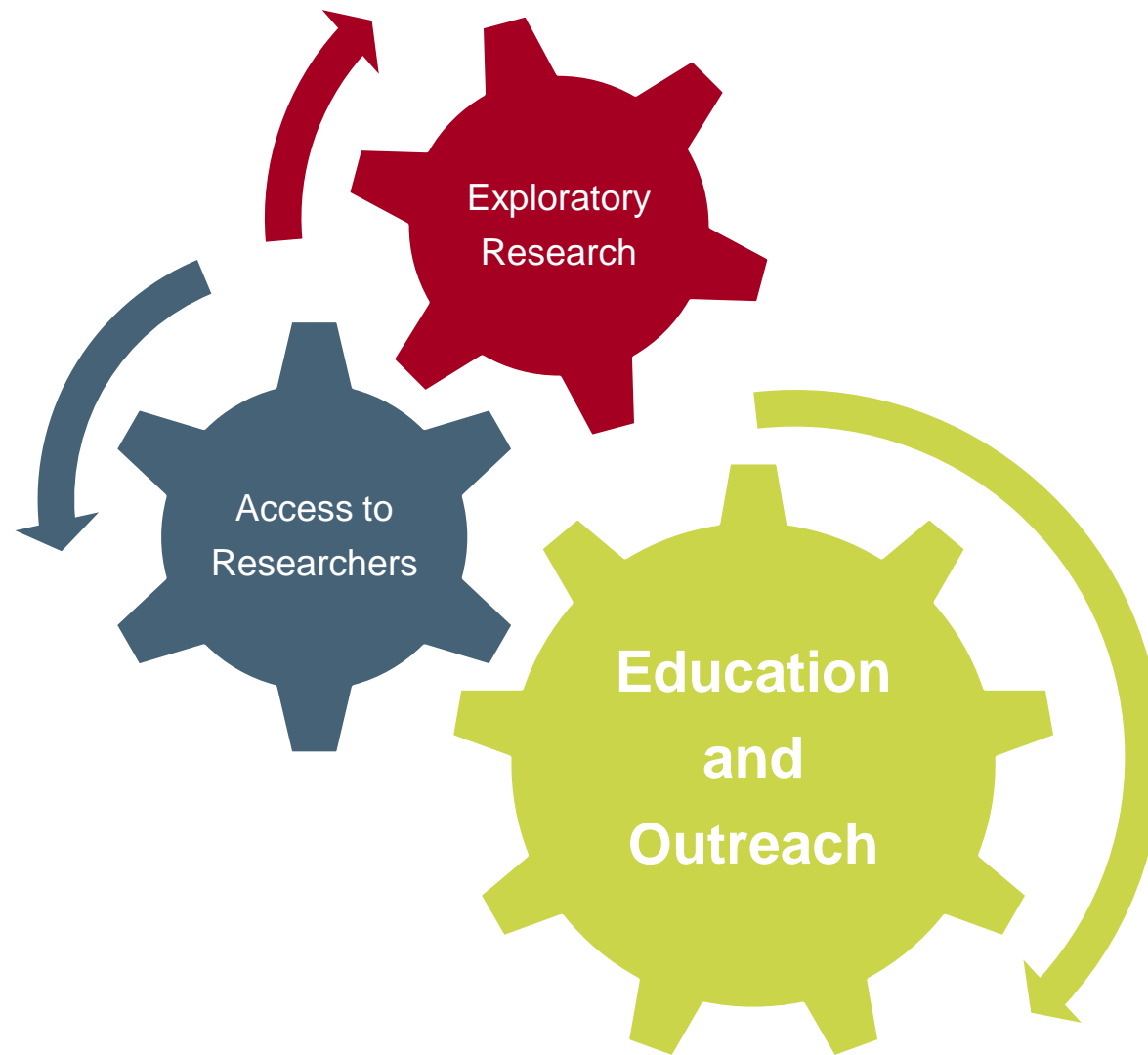


SUMMARY OF ACTIVITIES

North Dakota Industrial Commission (NDIC)-chosen projects are focused on serving a critical and timely need for North Dakota.

- Updated the grid resiliency plan for the ND Transmission Authority.
- Supported a legislatively directed study (HB1429) by conducting an EOR tax analysis in conjunction with the ND Tax Commission.
- Launched a study on the effect of large loads (such as data centers) on the ND transmission grid and how to better design for their inclusion.

EDUCATION AND OUTREACH



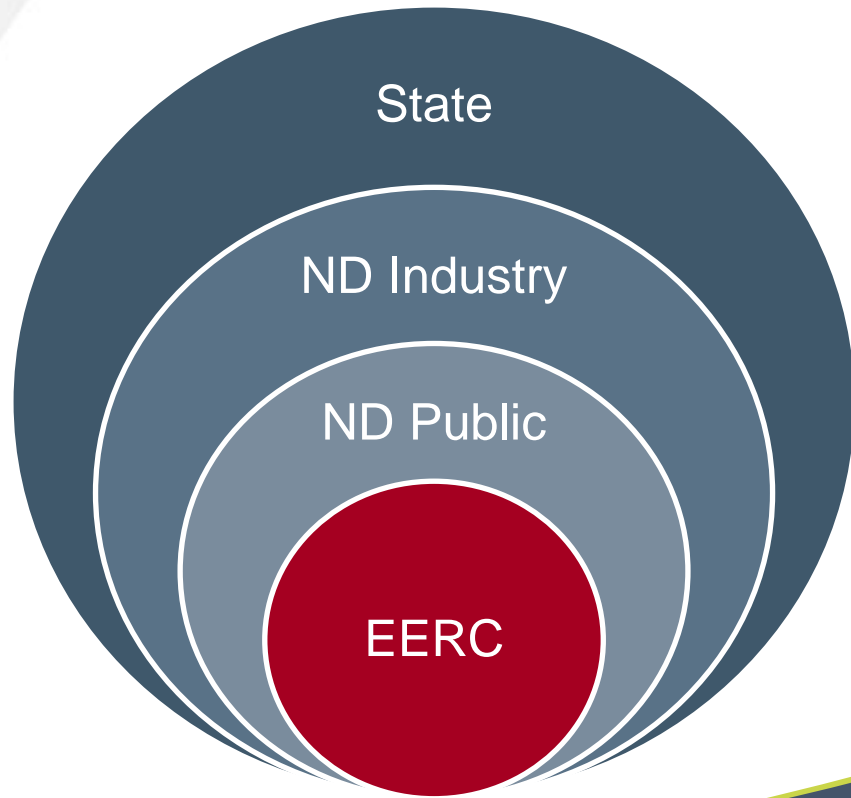
ENERGY HAWKS

The Energy Hawks Program provides an opportunity for college students to learn about North Dakota's wide range of energy technologies to enhance their ability to serve North Dakota as employees, leaders, taxpayers, and voters in the future.

- 86 university students from throughout North Dakota.
- Students come from a wide academic background.
- Energy Hawks learn about “all things North Dakota energy.”
- Program includes a weeklong tour in western North Dakota visiting with state and industry leaders and touring facilities.
- Students are then tasked with identifying new opportunities.



QUALIFYING AND QUANTIFYING THE IMPACT



2019

2020

2021

2022

2023

2024

and BEYOND!



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A wide-angle photograph of a university campus at sunset. The sun is low on the horizon, casting a warm glow over the scene. In the foreground, there are large trees with some yellowing leaves. In the background, several multi-story brick buildings and a parking lot with many cars are visible under a clear sky.

THANK YOU

Critical Challenges. Practical Solutions.



EERC



UNIVERSITY OF
NORTH DAKOTA



Critical Challenges. Practical Solutions.

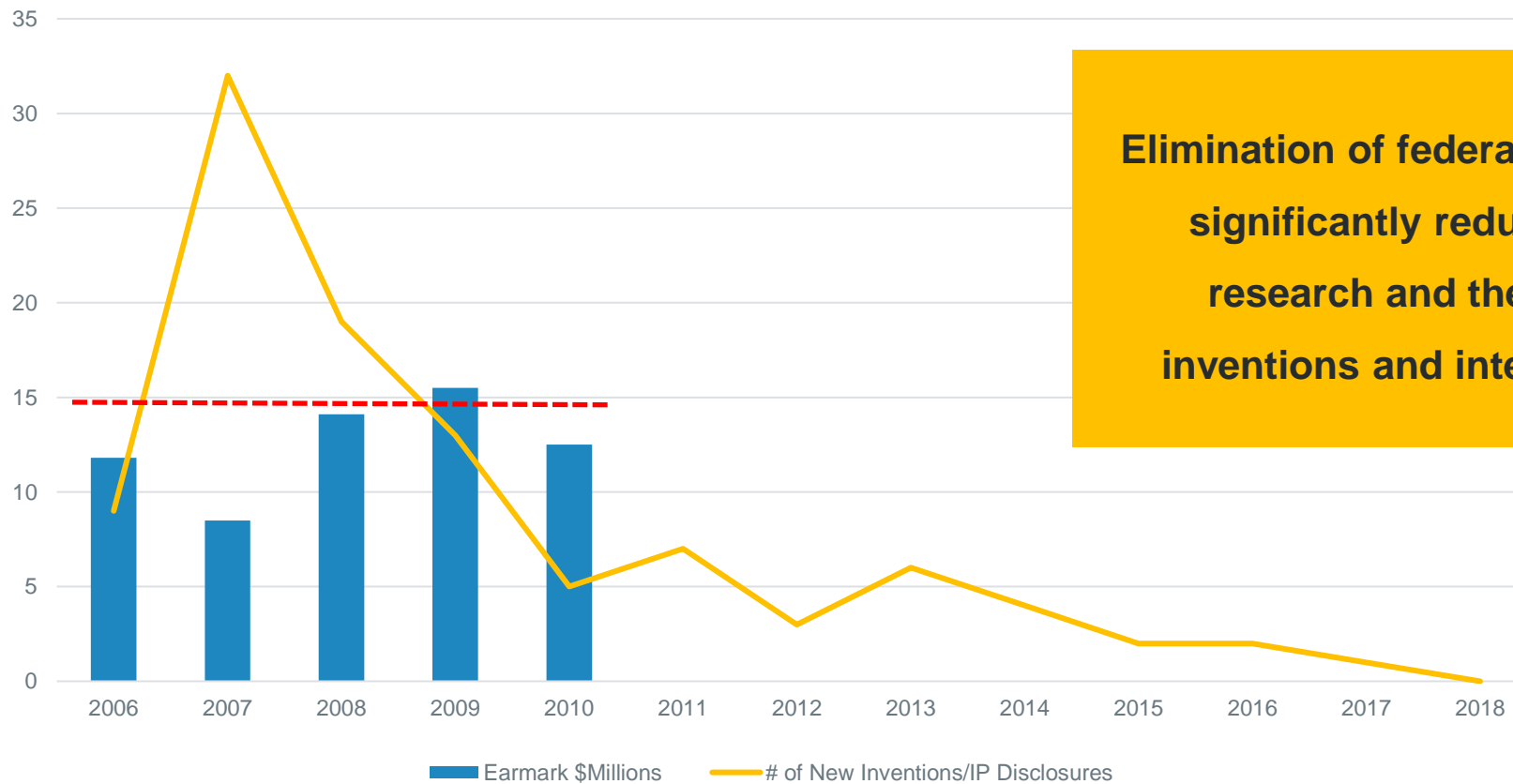


Energy & Environmental Research Center (EERC)

Back-Up Material

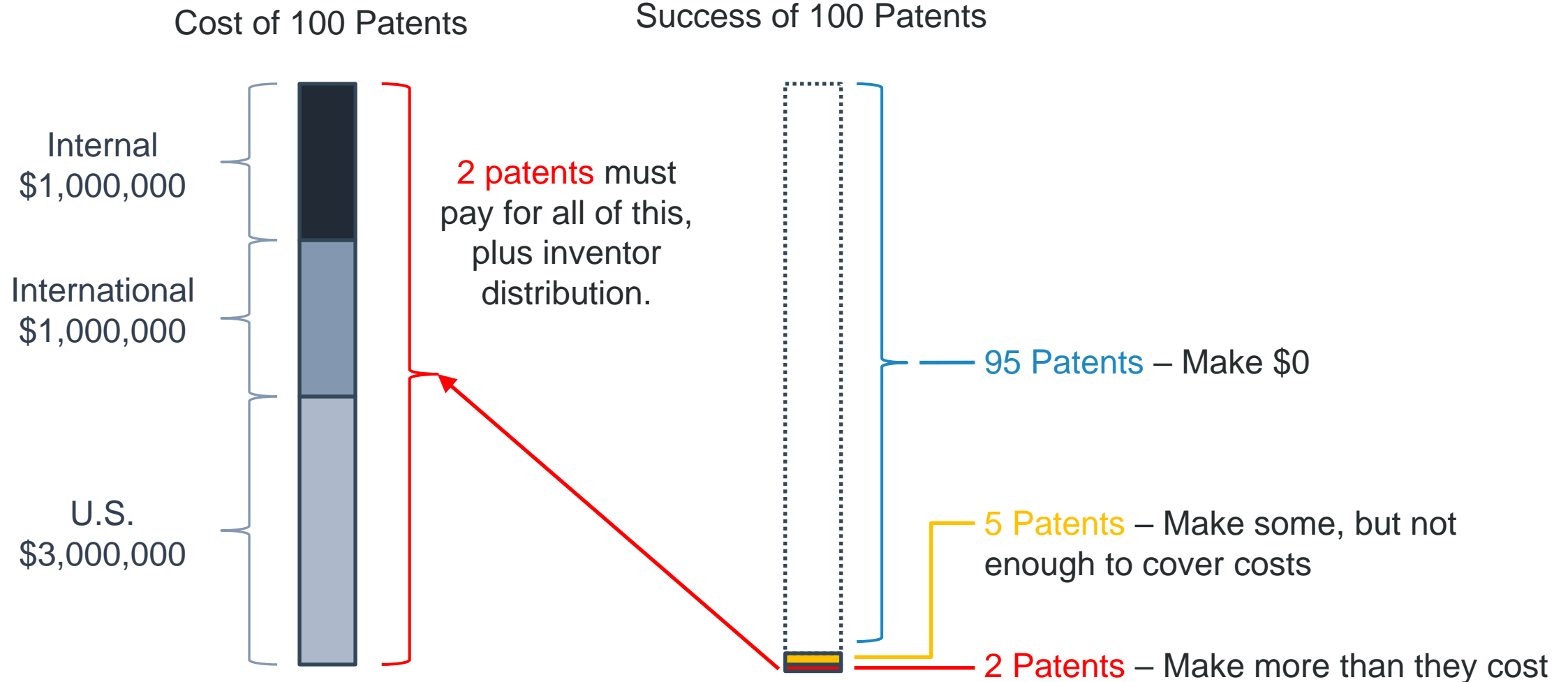
SIGNIFICANT REDUCTION IN NEW EERC INNOVATION AND INVENTION

Reduced Exploratory Research Funding Results in Fewer Inventions



Elimination of federally directed funding significantly reduced exploratory research and the resulting new inventions and intellectual property.

FINANCIAL CHALLENGE OF PATENTING



IP MATURITY

IP, when transferred to the EERC Foundation, is typically not fine-tuned for commercial applications; it requires significant further development and demonstration.

Example: Mercury Control

- 2003 – First IP submitted
- 2005 – Core IP created
- 2006–2008 – First license (failed!)
- 2009 – Second license
- approx. 2014 – Royalties finally exceed expenses

*10 Years
of Risk*

**Further development
means additional
research funding!**



NORTH DAKOTA GRID RESILIENCY PLAN

Project Goal

- Develop a grid resiliency plan to assess natural, technological, and manmade threats to the North Dakota electric grid, evaluate their impacts and consequences, and recommend various mitigation strategies.

Risks Identified

- Ice/snowstorms, changing resource mix and resource inadequacy, aging infrastructure, energy policy, supply chain interruptions, and cyberattacks.

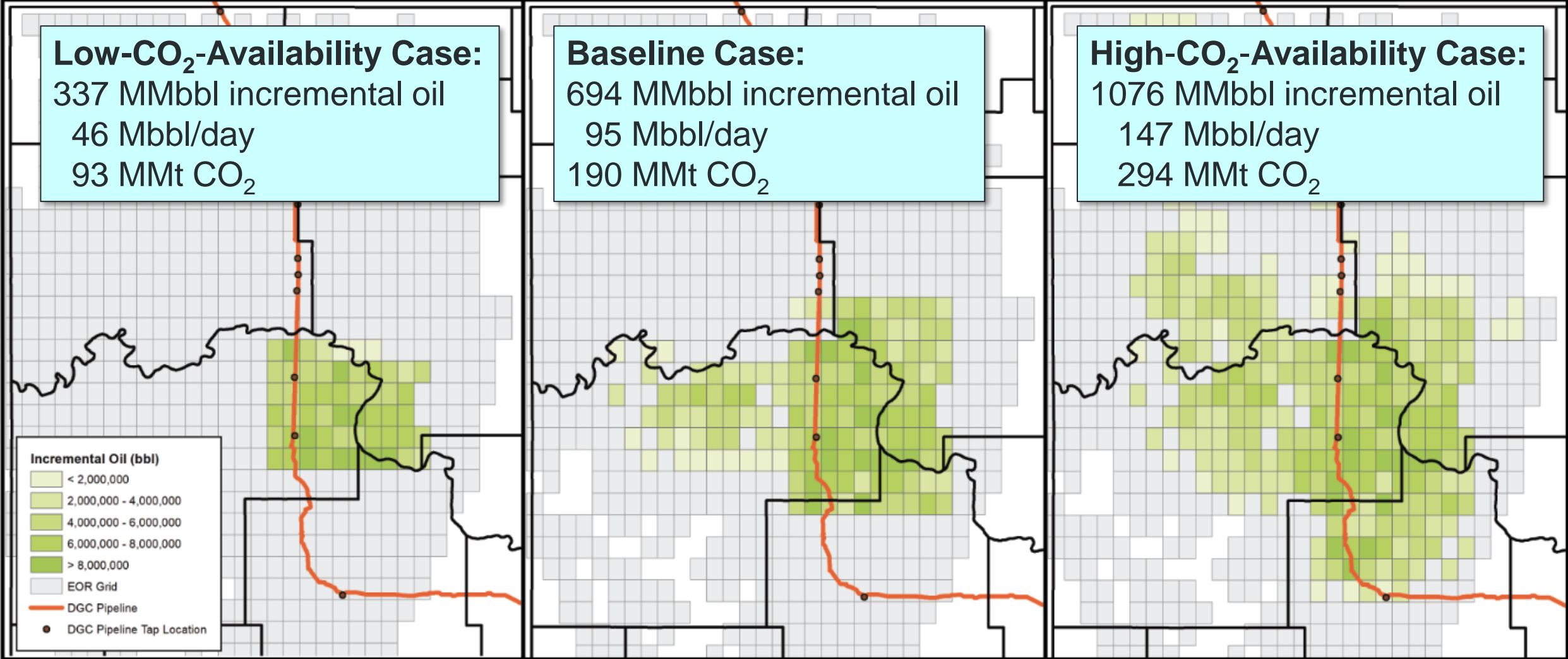
Recommendations

- Strengthen resource adequacy
- Enhance infrastructure resilience
- Centralize supply chain management
- Implement cybersecurity measures
- Prioritize maintenance of aging infrastructure
- Establish continuous resilience assessment



Critical Challenges. Practical Solutions.

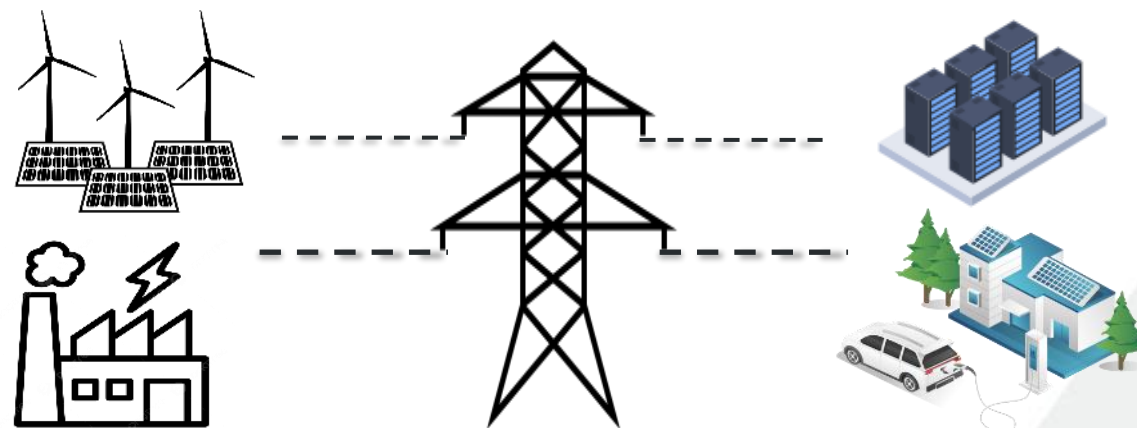
BAKKEN 20-YEAR CO₂ EOR PERFORMANCE



FUTURE-PROOFING NORTH DAKOTA'S ELECTRICAL INFRASTRUCTURE

PROJECT OVERVIEW

- Investigate critical issues impacting the North Dakota electrical grid
 - Changing resource mix
 - New policies and regulations affecting electricity generation
 - Increasing renewables
 - Delays in transmission infrastructure build-out
 - Load growth on resource adequacy and electricity reliability
- Develop North Dakota grid model and analyze resource adequacy and transmission capacity
- Facilitate the development of tailored solutions to address operational, policy, regulatory, and economic challenges of the electricity grid of the future
- Engage stakeholders for input and future directions



Critical Challenges. Practical Solutions.

VALUE FROM NORTH DAKOTA BRINES/CO₂ CAPTURE

INVENTION AND INNOVATION

- SERC award to investigate the topic of North Dakota brines.
- SERC award to further develop concept for North Dakota brines.

RESEARCH AND DEVELOPMENT

CO₂ Ocean Capture (direct air capture [DAC]):

- *\$500,000 DOE ARPA-E award*
- *\$250,000 DOE award (Phase I)*
- *\$900,000 BIRD Foundation award*

DEMONSTRATION

- *Moving toward first demonstration in Israel.*

COMMERCIALIZATION

- *Three patents received to date – application and disclosures active.*
- *Commercial license with Carbon Blue.*

