EERC OVERVIEW

Presented to the North Dakota Senate Energy & Natural Resources Committee
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EERC VISION

TO LEAD THE WORLD IN DEVELOPING SOLUTIONS TO ENERGY AND ENVIRONMENTAL CHALLENGES.
EERC QUICK FACTS FY22

- Approved contracts: 179
- Fiscal year funding: $76 million
- 77% of contracts were with private industry
- Economic impact in the Grand Forks region: $108.3 million
DIVERSE EXPERTISE
AND CAPABILITIES TO IMPACT THE WORLD
OUR FACILITIES
254,000 SQ FT OF FACILITIES
A STATE OF AG AND ENERGY
In 2019, North Dakota energy consumption was 0.67 quads (39th).

Energy consumption per capita that same year was 0.0009 quads (3rd).

Industrial energy consumption that same year was 0.36 quads.

But…North Dakota is 6th in overall U.S. energy production.

And a leader in agricultural products.

It takes energy to feed and power the world.
RESEARCH

TECHNOLOGY DEVELOPMENT PATHWAY

ECONOMIC DEVELOPMENT PATHWAY

INVESTMENT

IDEAS

EXPLORATORY RESEARCH

RESEARCH AND DEVELOPMENT

DEMONSTRATION

COMMERCIALIZATION

JOBS
ENERGY
STATE REVENUE
PRODUCTS

Image credit: EERC
CO₂ CAN BE MANAGED
North Dakota has more than 100 billion tons of CO₂ storage potential, with the most promising areas near electrical generation.
NORTH DAKOTA CCUS ACTIVITY

Approved permits:
• Red Trail Energy
• Minnkota (Milton R. Young Station)

Pending permits:
• Great Plains Synfuels Plant
• Blue Flint Ethanol
Red Trail Energy

- RTE announced June 16, 2022 as the official start date of CCS operations.
- RTE is capturing 100% of CO₂ from the fermentation process and is injecting approximately 500 metric tons of CO₂ per day into the Broom Creek Formation.
PROJECT TUNDRA
COAL CREEK STATION
ENHANCED OIL RECOVERY (EOR)
EOR in North Dakota Legacy (conventional) Fields – Size of the Prize

Identified
201
Conventional Oil Fields
Requiring
358,000,000 Tons of CO₂
To Produce Up to
1,041,000,000 Barrels of Incremental Oil

Denbury Resources EOR at Cedar Hills field initiated in 2022.
CEDAR CREEK ANTICLINE CO₂ EOR PILOT

Interval Control Valves (ICVs)
**BAKKEN EOR SIZE OF THE PRIZE**

**OOIP Estimates**
- 300 Bbbl (Flannery and Kraus, 2006)
- 900 Bbbl (Continental Resources, 2011)

**Technically Recoverable Reserve Estimates**
- 24 Bbbl (Continental Resource, 2011)
- 7.4 Bbbl (USGS, 2013)
- 4.3 Bbbl (USGS, 2021)

**Bakken and Three Forks Production to Date**
- ~4 Bbbl (NDIC, 2022)
BAKKEN OIL IN PLACE
BAKKEN OIL RECOVERY
BAKKEN OIL RECOVERY BY 2033
EOR in Bakken and Three Forks – Size of the Prize

EOR in the Bakken Using

1.1 – 3.2 billion Tonnes of CO₂

Could Produce Up to

3.2 – 7 billion Barrels of Incremental Oil

References: Kuuskraa and others, 2020, USEA/DOE-002415-20-01. Sorensen and others, 2015, URTeC: 2169871.
2017 – Bear Creek  
Operator = XTO  
Location = Dunn County  
Small-scale CO₂ injection test demonstrated ability of CO₂ to mobilize stranded oil in the Bakken.

2018–2019 – Stomping Horse  
Operator = Liberty Resources  
Location = Williams County  
Multi-well rich gas EOR pilot demonstrated ability to build reservoir pressure and keep the injected gas in the drill spacing unit.

2021–2022 – East Nesson  
Operator = Liberty Resources  
Location = Mountrail County  
EOR pilot test using injection of rich gas pulsed with water and surfactant yielded >4000 barrels of incremental oil over 9 months.
Leak Detection Innovation

- In-line inspection “small diameter”
- Artificial intelligence monitoring
- Advanced acoustics
- Subsurface polymer absorption monitoring
- Intelligent sensors for early detection anywhere
- Advanced aerial sensor technology
- New generation monitoring from space
Brine Extraction and Storage Test, Johnsons Corner, ND

• Demonstrated active reservoir management
• Developed a brine treatment testbed
• Demonstrated geologic homogenization, conditioning, and reuse of produced water
• Reduces rate and magnitude of pressurization of formation as a result of SWD
• Potential to integrate CO₂ storage through carbonated brine injection
Achieve Near-Zero Flaring

- Increase the environmental competitiveness of North Dakota oil
- Continue to attract investment and jobs
- Generate additional revenue

Polar Bear$^\text{SM}$
- Robust
- Adaptive
- Environmentally Sensitive
HYDROGEN ENERGY ROAD MAP UPDATE
Senate Bill 2014 of the 2020 North Dakota Legislature

Interim Report Topics

– Basis for Hydrogen
– Producing Low-Carbon Hydrogen
– Working with Hydrogen
– Opportunities for North Dakota
– Hydrogen Policy
OPPORTUNITIES FOR NORTH DAKOTA

Hydrogen produced from:
- Natural gas reforming with carbon sequestration
- Water electrolysis using low-carbon electricity

NDH₂

Low-Carbon Ammonia

Petroleum and Crop Oil Refining

Natural Gas Pipeline Blending
CHARACTERIZATION OF SALT FORMATIONS

Salt cavern storage could support petrochemical and energy industries.
CHARACTERIZATION OF NORTH DAKOTA’S SALT FORMATIONS

• A primary goal of the project was to drill a characterization well to investigate North Dakota’s subsurface salt beds.

• Core and logs were collected from target salt formations.

• Preliminary results indicate that N.D. salts have thicknesses and compositions similar to other areas in North America where caverns have been developed in bedded salts.

Salt caverns can be used to store hydrogen and natural gas liquids (i.e., propane, ethane), thereby helping to grow N.D.’s energy and petrochemical industries.
Preliminary results are promising and indicate that N.D. salt members may be thick enough and have the right composition to develop subsurface caverns.

NEXT STEPS

• Core analysis interpretation

• Geologic modeling

• Geomechanical simulation to determine cavern geometry and stability

• Engineering assessment of infrastructure and facility needs
The EERC is developing new and innovative ways to extract REEs and CMs from:

- Deep, Unminable Coal Seams by In Situ Extraction
- Existing Lignite Coal Mines
- Coal Ash
- ND Shales – Pierre, Niobrara, Upper and Lower Bakken
Elements with Greatest Potential to Contribute to the Williston Basin Market
GRAPHITE AND GRAPHENE FROM N.D. LIGNITE

Graphene Quantum Dots

N.D. Lignite-Derived Graphite

Graphene Sheet

Critical Challenges. Practical Solutions.
LOW-WEIGHT, HIGH-STRENGTH COAL-BASED BUILDING MATERIALS FOR INFRASTRUCTURE PRODUCTS

**ROOFING MATERIALS**
Coal-core composites provide light weight, low cost, and high-volume roofing materials.

**DECKING AND SIDING**
Coal plastic composite (CPC) decking boards reduce manufacturing costs compared to commercial wood plastic composite (WPC) decking boards and meet all applicable ASTM and International Building Code (IBC) performance specifications.

**ARCHITECTURAL BLOCK AND BRICK**
Coal-derived materials added to block and brick formations enable improved structural and thermal insulation properties.
EDUCATE THE WORLD!
State Energy Research Center

Clean Sustainable Energy Authority

Lignite, Oil and Gas, Renewable Research Programs, and Legislatively Directed Projects
IDEAL OPPORTUNITIES IN NORTH DAKOTA
THANK YOU
THE FUTURE: A CARBON-CONSTRAINED WORLD

Offshore Energy

Two oil & gas firms to develop CCS project that connects Germany & Norway

CARBON CAPTURE USAGE & STORAGE

August 30, 2022, by Nermina Kulovic

Low-carbon hydrogen key to net-zero transition

Global refiners prepare for low-carbon future

Global refiners in 2022 maintained investments in projects aimed at preparing their conventional oil refining operations for a low-carbon future in line with the global energy transition.

Dec. 5, 2022

Oil & Gas Journal, 1/4/2023