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NORTH DAKOTA



Critical Challenges. Practical Solutions.



Energy & Environmental Research Center (EERC)

PLAINS CO₂ REDUCTION (PCOR) PARTNERSHIP

North Dakota Industrial Commission
Oil and Gas Research Council
July 21, 2023

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Assistant Director for Regulatory Compliance and Energy Policy



PCOR PARTNERSHIP

2003–PRESENT

The PCOR Partnership addresses regional capture, transport, use, and storage challenges facing commercial carbon capture and storage (CCS)/carbon capture, utilization, and storage (CCUS) deployment. The PCOR Partnership focuses on:

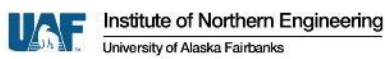
- Strengthening the technical foundation for geologic CO₂ storage and enhanced oil recovery (EOR).
- Advancing capture technology.
- Improving application of monitoring technologies.
- Promoting integration between capture, transportation, use, and storage industries.
- Facilitating regulatory frameworks.
- Providing scientific support to policy makers.
- Engaging the public through outreach and education



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PARTNERSHIP MEMBERS



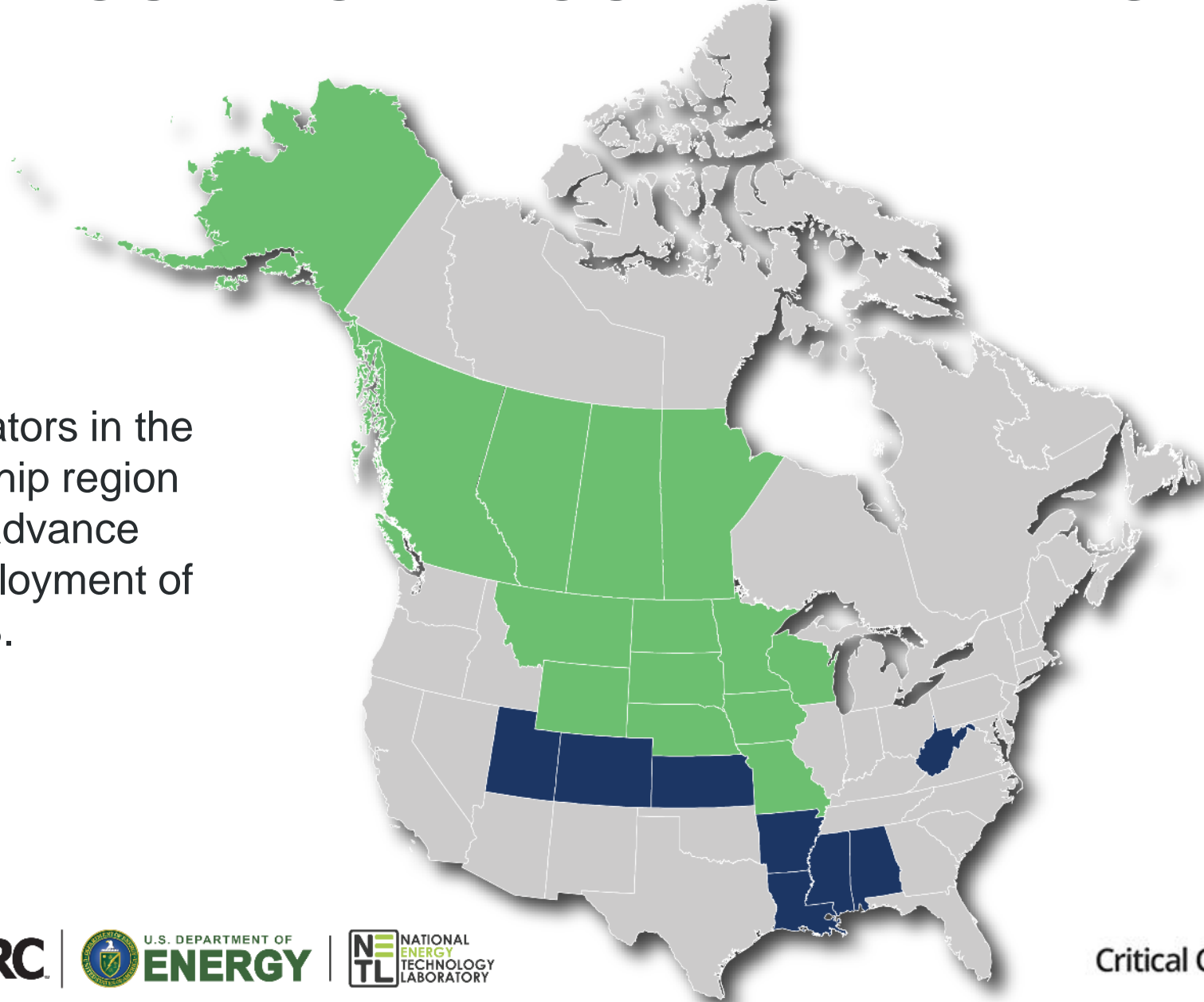
Active and Developing CCUS Projects in the PCOR Partnership Region

- Active Capture
- ▼ Active Injection
- Developing Capture
- ▽ Developing Injection
- CO₂ Pipeline
- - - Proposed CO₂ Pipeline



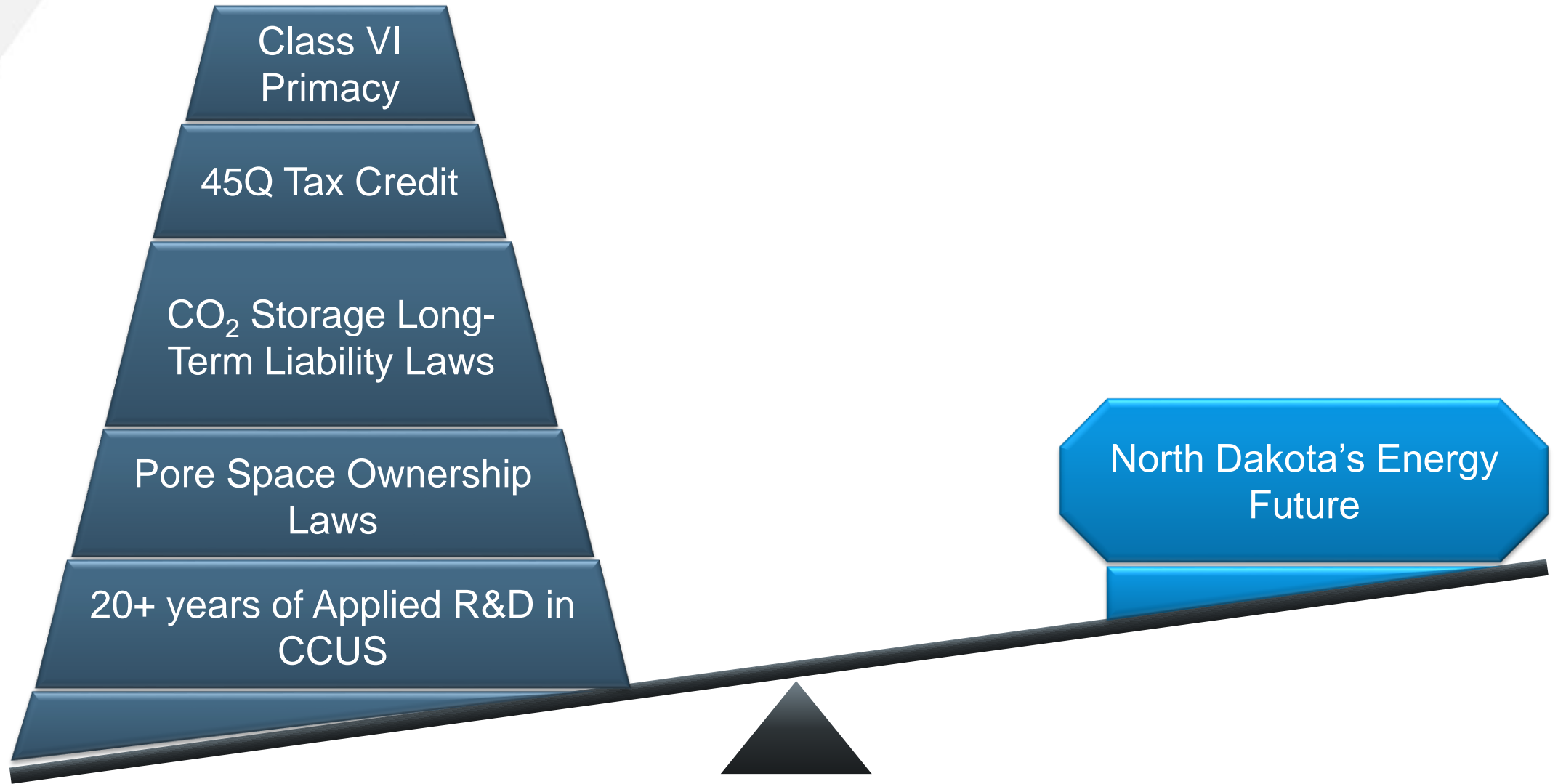
2023 REGULATORY ROUNDUP REPRESENTATION

Engaging regulators in the PCOR Partnership region and beyond to advance commercial deployment of CCS and CCUS.



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NORTH DAKOTA'S LEVERAGE



PCOR'S VALUE TO NORTH DAKOTA

- Regional and state leadership and expertise in CCS and CCUS.
- Help the state of North Dakota maintain a leadership role in the deployment of CCS and CCUS.
- Advance carbon management practices, including CO₂ utilization to ensure the greatest ultimate recovery of the state's oil and gas resources.

Geologic Storage Permits Approved in ND:

1. Red Trail Richardton Ethanol Broom Creek Storage Facility #1, Stark County
 - Permit to inject issued March 2023.
2. Minnkota Center Milton R. Young Station (MRYS) Broom Creek Storage Facility #1, Oliver County
3. Minnkota Center MRYS Deadwood Storage Facility #1, Oliver County
4. Dakota Gasification Company (DGC) Beulah Broom Creek Storage Facility #1, Mercer County
5. Blue Flint Underwood Broom Creek Storage Facility #1, McLean County
 - Permit to inject issued May 2023.

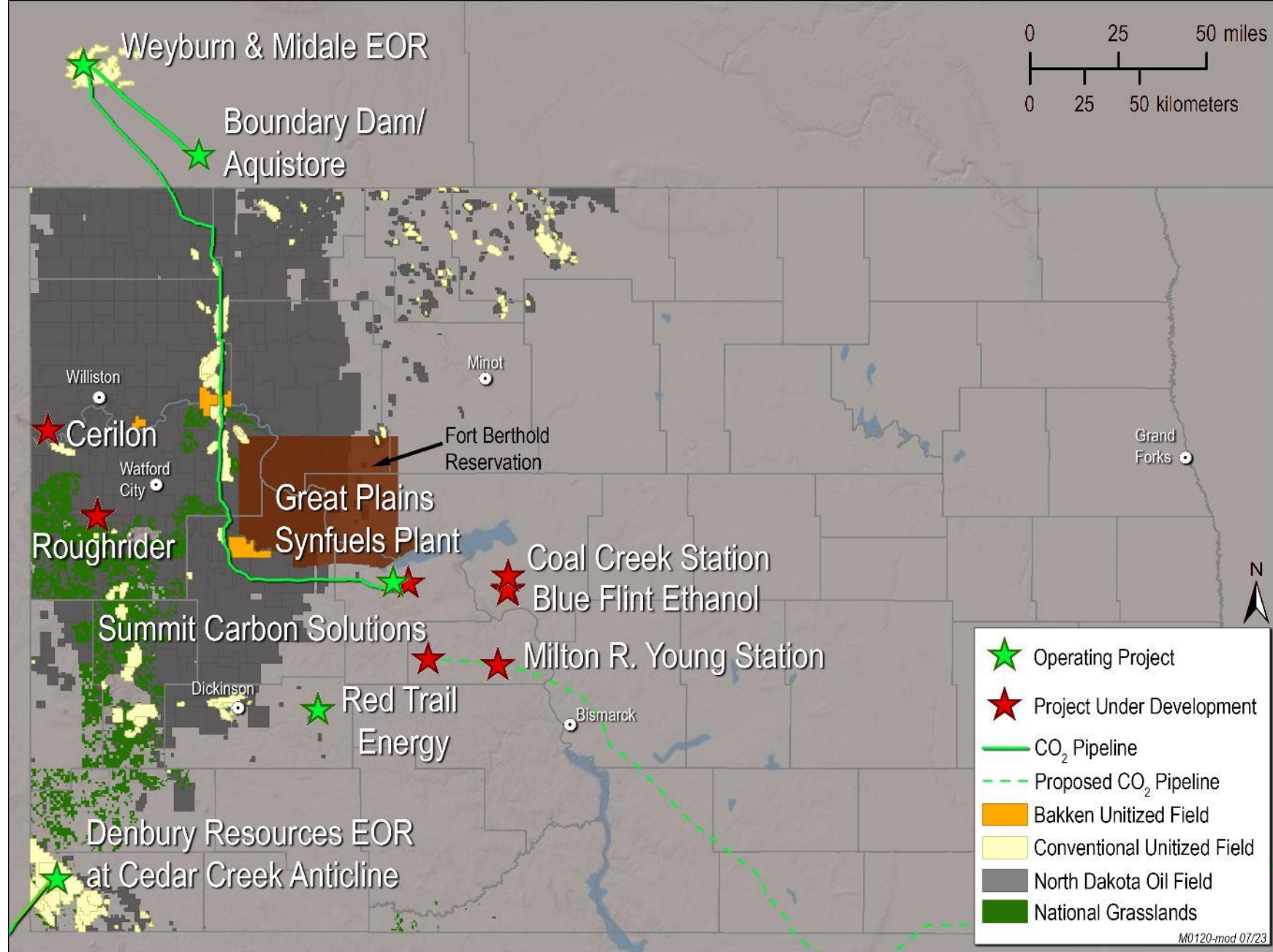
Pending Geologic Storage Permits in ND:

1. DCC West Project LLC (Broom Creek) (hearing 6/30/2023)



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NORTH DAKOTA CCS/CCUS ACTIVITY



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M0120-mod 07/23

FUNDED PCOR BUDGET

- The North Dakota Industrial Commission (NDIC) committed to supporting PCOR’s 5-year effort by matching U.S. Department of Energy (DOE) funding with cash cost share:
 - Up to \$2M through the Lignite Research Program (LRP).
 - Up to \$2M through the Oil and Gas Research Program (OGRP).
- The EERC applied for \$5M in additional funding from DOE in 2022. DOE recompeted the appropriated funds through a new Funding Opportunity Announcement (DE-FOA-0002799). Likewise, 2023 appropriated funds will be recompeted per DOE’s Notice of Intent (DE-FOA-0003013).
- The EERC requests the remaining cost-share commitment from OGRP for \$500,000.

	2019	2020	2021	Total
DOE	\$5,000,000	\$5,000,000	\$5,000,000	\$15,000,000
NDIC – OGRP	\$500,000	\$500,000	\$500,000	\$1,500,000
NDIC – LRP	\$500,000	\$500,000	\$500,000	\$1,500,000



PCOR BUDGET

Funding Source	Commitment to DOE Program as of May 2023	May 2023* Request	Total Program
DOE	\$15,000,000		\$15,000,000
NDIC OGRP	\$1,500,000	\$500,000	\$2,000,000
NDIC LRP	\$1,500,000	\$500,000	\$2,000,000
University of Wyoming	\$377,424		\$377,424
University of Alaska Fairbanks	\$375,450		\$375,450
Industry	\$0	\$1,139,990	\$1,139,990
Total	\$18,752,874	\$2,139,990	\$20,892,864

* If DOE does not provide additional funding, the May 2023 request will be considered complementary funding to advance the goals and objectives of the PCOR Partnership Program and will not be reported to DOE as cost share.



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SUMMARY

- There is a continued need for the PCOR Partnership to lead the region in CCUS.
- PCOR can help the state of North Dakota maintain a leadership role in carbon management, including the deployment of CO₂ utilization technologies to maximize the ultimate recovery of the state's oil and gas resources.
- The PCOR Partnership continues to grow with new industry, state, and regulatory members each month.



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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 trees with yellowing leaves. In the background, there are several large, multi-story brick buildings and a parking lot filled with cars.

THANK YOU

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ACKNOWLEDGMENT

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PCOR PRODUCTS

Deliverables

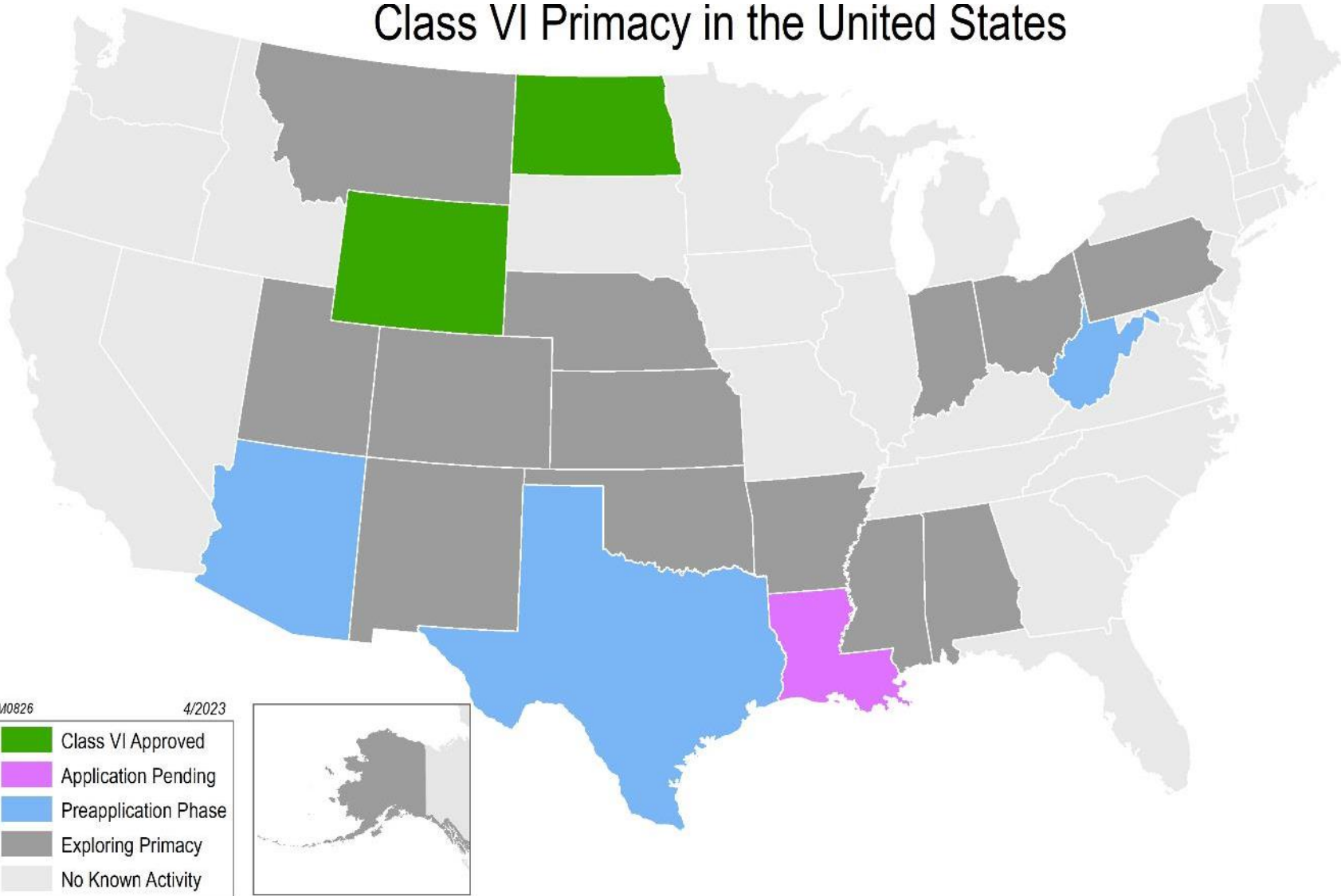
- Risk-Based Area of Review
- Storage Optimization
- PCOR Atlas
- Stacked Storage Opportunity Assessment
- Subsurface and Legacy Well Integrity
- Regional Business Model Assessment
- Monitoring, Verification, and Accounting (MVA) Strategies
- Evaluation of Risk Management
- Regional Permitting Guidance
- CCUS Project Development
- Infrastructure, Scale-Up, and Technoeconomic Assessments
- National Risk Assessment Partnership (NRAP) Testing and Validation

White Papers

- Plume Stability
- Well Testing for CO₂ Storage Sites
- Technical and Legal Considerations for Pore Space
- Capillary Entry Pressure
- LGR, Rel Perm, Cap Press (SMART)
- Step Rate Test
- Evaluation of Geophysical Technologies for CCS



Class VI Primacy in the United States



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2021 AND 2022 HIGHLIGHTS

- Over 250 members; 75 new since 2019
- PCOR Partnership annual meetings held in Jackson, Wyoming (106 participants) and Anchorage, Alaska (129 participants)
- 2021 and 2022 Regulatory Roundup held in Deadwood, South Dakota (record attendance)
- TAB meetings held in Jackson, Wyoming (2021), Houston, Texas (2022), Anchorage, Alaska (2022), Washington D.C. (2023)
- Field effort initiated at the Red Trail Energy (RTE) CCS site
- Collaboration with UAF and UW
- New PCOR Partnership public and partner websites
- Several products (deliverables and white papers) published
- Numerous white papers in development



PCOR PARTNERSHIP PRODUCTS

- Storage Optimization – 4/30/21
- Stacked Storage Opportunity Assessment (D3a submitted 8/31/21; D3b submitted 3/31/22)
- Regional Business Model Assessment – 12/31/21
- Subsurface and Legacy Well Integrity – 12/31/21
- MVA Strategies – 6/30/22
- Evaluation of Risk Management – 9/30/22
- Regional Permitting Guidance (D8a and D8b submitted 9/30/22)
- Infrastructure, Scale-Up, and Techno-Economic Assessments – 3/31/23
- NRAP Testing and Validation (Part 1 submitted 12/17/21; Part 2 submitted 3/31/23)
- Risk-Based Area of Review – 1/31/21
- PCOR Partnership Atlas 6th Edition – 6/30/21
- **Basement Faulting and Stress State, Induced Seismicity – 9/30/23**
- **Regional Socioeconomic Assessments – 9/30/23**
- **Updated Regional Business Model Assessments – 12/31/23**
- **PCOR Partnership Atlas 7th Edition – 3/31/24**
- **PCOR Partnership Initiative Road Map – 5/31/24**
- **Enabling Sustainable Monitoring for CCUS – 6/30/24**



PCOR PARTNERSHIP PRODUCTS

- Pore Space: Technical and Legal Considerations for CO₂ Storage in North Dakota
- Incorporating Capillary Entry Pressure Measurements into Evaluations of Storage Permanence for Permitting Class VI Injection Wells
- Impacts of Local Grid Refinement, Capillary Pressure, and Relative Permeability on Early Injection Well Behavior During Simulation of Large-Domain Dedicated Carbon Dioxide Storage
- Texas Response to Winter Storm Uri (Jackson Walker LLP)
- Applications and Value of Well Testing for Carbon Dioxide Storage Sites
- Class VI Injection Well Step Rate Test Procedural Recommendations
- Characterization and Monitoring Technologies for Geologic Carbon Storage
- Pipeline Cost and CO₂ Transport Considerations Based on Three Hypothetical Pipelines in the PCOR Partnership Initiative Region (with Resolute Engineering)
- Pressure Interference Evaluation to Support Storage Resource Planning the Plains CO₂ Reduction (PCOR) Partnership Region
- Risk-Based Area of Review (AOR) Estimation in Overpressured Reservoirs to Support Injection Well Storage Facility Permit Requirements for CO₂ Storage Projects
- Fort Berthold Indian Reservation Screening Assessment for Geologic Storage of Carbon Dioxide
- Evaluation of Geophysical Technologies for Application to CCS (updated)
- Matching Capture Technologies with Point Sources in the PCOR Partnership Region
- Carbon Capture and Storage Monitoring with Distributed Fiber Optic Sensing (with Silixa)
- A Quantitative Approach for Demonstrating Plume Stabilization

PCOR PARTNERSHIP PRODUCTS

WHITE PAPERS UNDER DEVELOPMENT

- Isotope Analysis/Soil Gas Monitoring
- Carbon Capture Transportation and Use for CO₂ Streams Containing Impurities
- The Role of CCUS in Growing a Hydrogen Economy
- Approaches to Geomechanical Evaluations
- Storage Potentials of EOR Reservoirs
- Selection and Use of Corrosion-Resistant Alloys in CCS and CCUS Projects (guidelines and white paper; with Stress Engineering)
- Repurposing Carbon Steel Pipelines for CCS and CCUS Projects (guidelines and white paper; with Stress Engineering)



PARTNER ENGAGEMENT



WELCOME NEW PARTNERS!

Thanks to all PCOR partners for your continued support, and a warm welcome to our newest PCOR partners:

- [Bank of North Dakota](#)
- [Emerson Automation Solutions](#)
- [Hitachi Industrial Equipment & Solutions America, LLC](#)
- [Hunting Energy Services](#)
- [Marubeni-Itochu Tubulars America Inc.](#)
- [OLI Systems, Inc.](#)
- [Stress Engineering Services, Inc.](#)
- [Sumitomo Corporation of Americas](#)
- [Wyoming Oil & Gas Conservation Commission](#)

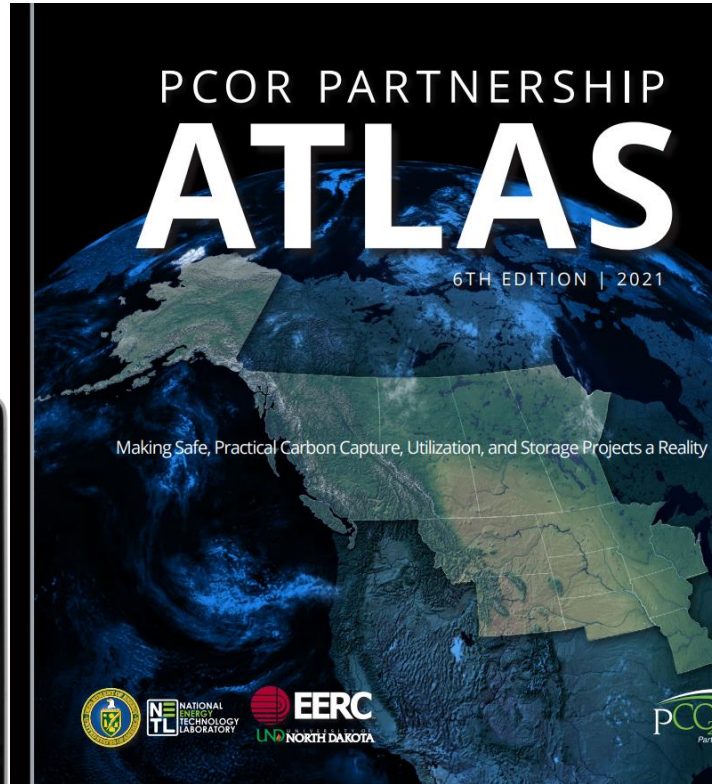
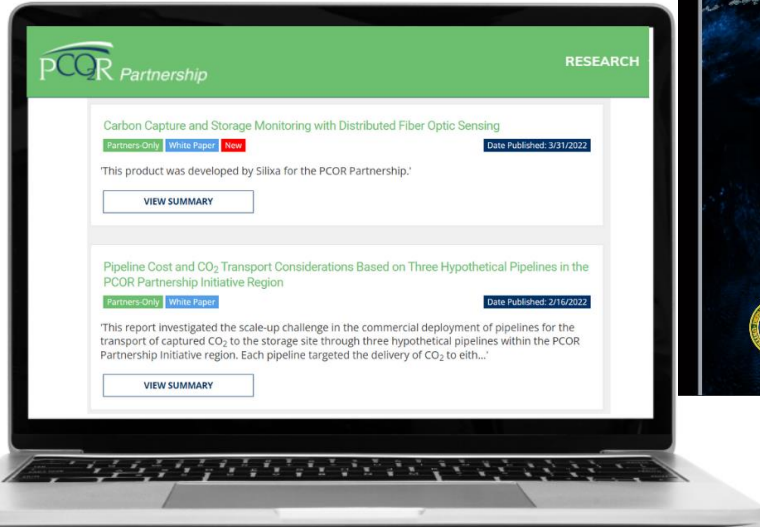


The EERC attended and presented at the Annual Research Institute of Innovative Technology for the Earth (RITE) CCUS Workshop in Japan on January 24, 2023.
(Photo: Charlie Gorecki presenting at RITE)



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PCOR PARTNERSHIP PRODUCTS



Available online to all partners at undeerc.org/PCORPartners

ENERGY & ENVIRONMENTAL RESEARCH CENTER AT THE UNIVERSITY OF NORTH DAKOTA

Fact Sheet

Practical, Environmentally Sound CO₂ Sequestration

Section 45Q of the U.S. Internal Revenue Code was

ENERGY & ENVIRONMENTAL RESEARCH CENTER AT THE UNIVERSITY OF NORTH DAKOTA

Fact Sheet

Practical, Environmentally Sound CO₂ Sequestration

Demonstrating CO₂ Storage in the PCOR Partnership Region

The Plains CO₂ Reduction (PCOR) Partnership is in its 20th year of collaboration with public and private partners to demonstrate the permanent, safe, and practical underground storage of carbon dioxide (CO₂) from industrial facilities—carbon capture, utilization, and storage or CCUS.

- In Phase I of the program (fall 2003 to fall 2005), work focused on characterizing the stationary CO₂ emission sources as well as the geological storage layers suitable for CO₂ storage in the PCOR Partnership region.
- In Phase II (fall 2005 to fall 2009), the PCOR Partnership completed four small-scale field validation tests.
- The multifaceted Phase III program, active through December 2018, was built around commercial-scale demonstrations and unprecedented collaboration at the local, regional, and cross-border levels.
- The Regional Initiative (2019–2024) is focused on identifying and addressing regional storage and transportation challenges facing the commercial deployment of CCUS.

What Is the Tax Credit?

45Q tax credits are available based on where the CO₂ is sourced and how it is stored:

- \$85/tonne for dedicated storage from carbon capture on power or industrial facilities.
- \$60/tonne for associated storage from carbon capture on power or industrial facilities.
- \$180/tonne for dedicated storage from direct air capture.
- \$130/tonne for associated storage from direct air capture.

When Is the Tax Credit Available?

Projects that have entered the construction phase by January 1, 2033, are eligible for 45Q tax credits. The credit is available to qualified facilities for 12 years once equipment is placed in service.

How Do Taxpayers Receive the Credit?

In order to qualify for the tax credit, project operators of dedicated storage projects must report CO₂ volumes under the U.S. Environmental Protection Agency (EPA) Greenhouse Gas Reporting Program (GHGRP) Subpart RR. Subpart RR requires an EPA-approved monitoring, reporting, and verification (MRV) plan and outlines methods for calculating stored CO₂. (<https://www.epa.gov/ghgrp/html-40/chapter-11/subchapter-c/part-98/subpart-rr>)

Who Receives the Tax Credit?

The annual carbon oxide sequestration credit provided by 45Q is generally granted to the taxpayer that owns the capture equipment and physically or contractually ensures secure geologic storage, which is formally defined in Subpart RR.

National Energy Technology Laboratory (NETL), and Lignite Research Program, along with other CCUS technology. The PCOR Partnership is in the upper Great Plains and northwestern U.S. Department of Energy & Environmental Research Center (EERC).

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org
members are welcome.

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REGIONAL SOURCES AND SEDIMENTARY BASINS

