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Energy & Environmental Research Center (EERC)

Plains CO₂ Reduction Partnership Initiative FE0031838

U.S. Department of Energy National Energy Technology Laboratory 2021 Carbon Management and Oil and Gas Research Project Review Meeting August 4, 2021

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PRESENTATION OUTLINE

- Technical Status and Accomplishments
- Lessons Learned
- Synergy Opportunities
- Project Summary



PLAINS CO₂ REDUCTION (PCOR) PARTNERSHIP

2019-2024 - Commercial Deployment

Partnered with University of Wyoming and University of Alaska Fairbanks to accomplish goal.

Goal:

Identify and address regional capture, transport, and storage challenges facing commercial deployment of carbon capture, utilization and storage (CCUS).

2003–2019 2019–2024 Institute of Northern Engineering University of Alaska Fairbanks



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TECHNICAL STATUS AND ACCOMPLISHMENTS





PCOR PARTNERSHIP INITIATIVE TASK OVERVIEW

Technical Challenges

Geologic Characterization Storage Performance and Optimization MVA Strategies Risk Management

Data Collection, Sharing, and Analysis

NRAP Validation Machine Learning Risk-Based Area of Review (AOR)

Regional Infrastructure

Techno-Economic Analysis Infrastructure Scale-Up Challenges Socioeconomic Impacts Public and Industry Outreach

Nontechnical Challenges

Policy and Regulatory Challenges Business Models Pathways to Commercial Deployment





CARBON DIOXIDE STORAGE OPTIMIZATION



- Potential for optimization remains in many saline aquifer CO₂ storage subdisciplines.
- CO₂ storage optimization was investigated using numerical simulations of CO₂ injection (eight separate cases) in a hypothetical scenario targeting the Cambrian– Ordovician Deadwood and Black Island Formations (informally referred to as the Basal Cambrian System).



RISK-BASED AREA OF REVIEW

- Risk-based area of review estimation in overpressured reservoirs to support injection well storage facility permit requirements for CO₂ storage projects
- Published in *Greenhouse Gases:* Science and Technology





PCOR PARTNERSHIP ATLAS



- Provides an up-to-date look at PCOR Partnership activities.
- Additional regional characterization.
- Updates on the growing number of commercial projects in the region.
- Additional background information to support CCUS.
- Gives the reader a better understanding of how CCUS plays a role in addressing concerns about climate change while allowing future energy needs to be met.



POLICY AND REGULATORY DEVELOPMENTS

- Pore space
- Long-term liability
- 45Q tax credit
- State tax credit
- · Low carbon fuel standard

Regulatory Roundup Meeting August 17–18, 2021





POLICY AND REGULATORY: UNDERGROUND INJECTION CONTROL CLASS VI PRIMACY

Class II

Brines and other

fluids associated with

oil and gas

production, including

 $CO_2 EOR.$

of minerals.

This class is banned

by EPA.

Class I

Hazardous and

nonhazardous fluids

(industrial and

municipal wastes).



USDW and are

typically shallow.

dioxide for long storage.

CONTINUING EFFORTS

- Aquistore modeling and simulation
- NRAP testing and validation
- Stacked storage opportunity assessment and geomechanical modeling
- Subsurface and legacy well integrity
- Regional business case assessment
- MVA strategies
- Website upgrade





REGIONAL SOURCES AND SEDIMENTARY BASINS



:0	D2 Source Types	Anı	nual CO₂ Output,					
ric.	Ag Processing	tonnes						
ş	Cement Plant	0	100,000-250,000					
-	Electrical Utility	0	250,000-750,000					
2	Ethanol Plant	0	750,000-2,500,000					
	Fertilizer	\bigcirc	2,500,000-7,500,000					
	Industrial	\bigcirc	7,500,000-15,000,000					
	Petroleum and Natural Gas	\sim						
	Refineries/Chemical		Sedimentary Basin					



LESSONS LEARNED

- Update to "Evaluation of Geophysical Technologies for Application to CCS"
- Coring program, wireline logging, and seismic survey considerations
- Understanding geologic modeling and computation simulations





SYNERGY OPPORTUNITIES

- Developing CCUS opportunities in the region
- Catalyst for CCUS projects in the region
- Focused on infrastructure development strategies
- Ethanol industry in the region accelerating CCUS
- CarbonSAFE Phase III
- Brine extraction and storage test (BEST)



Critical Challenges. Practical Solutions.

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ACCELERATING CCUS DEPLOYMENT IN THE PCOR PARTNERSHIP INITIATIVE REGION

- Demonstrating that the CCUS chain of carbon capture, transportation, and storage has achieved the technology readiness level required for commercial-scale deployment.
- Providing templates for developing the construction and operating permits for commercial geologic storage projects.
- Determining the actual capital and operating costs of deploying and operating commercial CCUS projects that comply with applicable (federal and/or state) Class VI regulations.
- Demonstrating that favorable economics can be achieved for several commercial CCUS projects in the region given the available CCUS technology.





PCOR PARTNERSHIP INITIATIVE SUMMARY

Challenges being addressed

- Pore space leasing
- Capillary entry pressure
- Maximum injection pressure
- Pressure interference
- Approaches to geomechanical and geochemical evaluations
- Impact of CCUS to electric grid stability

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PROJECT OVERVIEW – GOALS AND OBJECTIVES

- The goal of the PCOR Partnership Initiative is to identify and address regional capture, transport, and storage challenges facing commercial deployment of CCUS in an expanded region, compared to past initiatives. To achieve this goal, the PCOR Partnership Initiative will meet the following objectives:
 - Address key technical challenges by advancing critical knowledge and capabilities.
 - Facilitate data collection, sharing, analysis, and collaboration.
 - Evaluate regional infrastructure challenges and needs.
 - Promote regional technology transfer.



PCOR PARTNERSHIP INITIATIVE

The PCOR Partnership Initiative is addressing regional capture, transport, use, and storage challenges facing commercial CCUS deployment. The Initiative is focusing on:

- Strengthening the technical foundation for geologic CO₂ storage and enhanced oil recovery.
- 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.



PCOR PARTNERSHIP: ORGANIZATION CHART





PCOR PARTNERSHIP: PROJECT GANTT CHART

				Budget Period 1								Budget Period 2										
			Year 1			Year 2				Year 3		Year 4			Year 5							
	-		2019	1.00	20	020			20	021		0.10	20	22	0.10		20	023	0.17	0.10	2024	
Task	Start Date	End Date	Q1 Oct Nov Dec	Q2 Jan Feb Mar	Q3 Apr May Jun	Q4 Jul Aug Sep	Q5 Oct Nov Dec	Q6 Jan Feb Mai	Q7 Apr May Jun	UR Jul Aug Sep	Q9 Oct Nov Dec	Q10 Jan Feb Mar	Q11 Apr May Jun	Q12 Jul Aug Sep	Q13 Oct Nov Dec	Q14 Jan Feb Mar	Q15 Apr May Jur	Q16 1 Jul Aug Sep	Q17 Oct Nov Dec	Q18 Jan Feb Mar	Q19 Apr May Jun	Q20 Jul Aug Ser
Task 1.0 – Project Management and Planning	10/1/19	9/30/24		V D1					МЗ												M11	
Task 2.0 – Technical Challenges	1/23/20	6/30/24	xx xx xx	x					İ					Í				ļ		M 10		
2.1 - Characterization	1/23/20	6/30/24	xx xx xx	x						7 0	03.A	D3.B	7					7	7 D11			
2.2 - Technology Validation - Collaboration	1/23/20	6/30/24	xx xx xx	x					V D2		7	7 D5										
2.3 – MVA Strategies	1/23/20	6/30/24	XX XX XX	x									_	7 D6								
2.4 – Risk Management	1/23/20	6/30/24		x										7	7 D7							
Task 3.0 – Data Collection, Sharing, and Analysis	10/25/19	6/30/24							(
3.1 – Data Sharing	10/25/19	6/30/24							•	M5		<hr/>	M7									• M12
3.2 – NRAP Validation	4/1/20	3/31/24						🔻 D14								7	🗸 D10					
3.3 - Machine Learning	4/1/20	6/30/24																				
Task 4.0 – Regional Infrastructure	1/23/20	6/30/24	xx xx xx	x				ļ	ļ			🔶 Мб										
4.1 - Assessment and Techno-Economic Analysis	1/23/20	6/30/24		x	r⁻ � M2										7	7 D9						
4.2 - Infrastructure Scale-Up Challenges	1/23/20	6/30/24	xx xx xx	x																		
4.3 – Socioeconomic Impacts	5/1/20	3/31/24			->													7	7 D12			
4.4 - Public and Industry Outreach	1/23/20	6/30/24		x						🗸 D15						7	🗸 D15					
Task 5.0 – Technology Transfer	1/23/20	6/30/24	XX XX XX	x					ļ						♦ N	18						
5.1 - Nontechnical Challenges	1/23/20	6/30/24	xx xx xx	X M1				(M4					7	7 D8	•	м9					
5.2 – Global CCUS Leadership	1/23/20	6/30/24	xx xx xx	x																		
5.3 – Business Models	5/1/20	6/30/24			L+						7	7 D4							7	7 D13		

Summary Task	
Activity Bar	
Milestone (M) 🔶	
Deliverable (D) 🔻	
Critical Path	
Definitization 1/23/2020	
No Activity Prior to Definitization	xx xx
No Activity Prior to Definitization	XX XX

Milestones (M) 🔶	Deliverables (D) 🔻	
/1 – Regulatory Roundup Scheduled (3/31/20)	D1 – Project Management Plan (2/21/20)	
I2 – Initial Techno-Economic Framework Established (4/30/20)	D2 – Topical Report – Storage Optimization (4/30/21)	
/I3 – Annual Meeting Scheduled (3/31/21)	D3.A – Topical Report – Stacked Storage Opportunity Assessment (8/31/21)	
14 – Regulatory Roundup Scheduled (3/31/21)	D3.B – Topical Report – Stacked Storage Scenario Geomechanical Modeling (3/31/22)	
15 – Data Shared with National Lab for NRAP Assessment (6/30/21)	D4 – Topical Report – Regional Business Model Assessment (12/31/21)	
I6 – GHGT-16 Abstract Submitted (1/31/22)	D5 – Topical Report – Subsurface and Legacy Well Integrity (12/31/21)	
17 – BP1 EDX Submitted (3/31/22)	D6 – Topical Report – MVA Strategies (6/30/22)	
/8 – Draft Journal Article Completed (11/30/22)	D7 – Topical Report – Evaluation of Risk Management (9/30/22)	
/9 – Regulatory Roundup Scheduled (3/31/23)	D8 – Topical Report – Regional Permitting Guidance (9/30/22)	
110 – GHGT-17 Abstract Submitted (1/31/24)	D9 – Topical Report – Infrastructure, Scale-Up, and Techno-Economic Assessments (12/31/22)	
/11 – Annual Meeting Scheduled (3/31/24)	D10 – Topical Report – NRAP Testing and Validation (3/31/23)	
112 – BP2 EDX Submitted (6/30/24)	D11 – Topical Report – Basement Faulting and Stress State, Induced Seismicity (9/30/23)	
	D12 – Topical Report – Regional Socioeconomic Assessments (9/30/23)	
	D13 – Topical Report – Updated Regional Business Model Assessment (12/31/23)	
	D14 – Topical Report – Risk-Based Area of Review (1/31/21)	
	D15 – PCOR Partnership Atlas (6/30/21 and 3/31/23)	7 23 2



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