August 5, 2024

CCS Deployment Pathway – Plenary Panel

Dan Hancu, Division Director, Point Source Capture, FECM

Gokul Vishwanathan, Demonstrations Program Manager, OCED

Martin Perez, Associate Director for Carbon Management, OCED

U.S. DEPARTMENT OF ENERGY

Fossil Energy and Carbon Management

August 2024

FECM Point Source Carbon Capture:

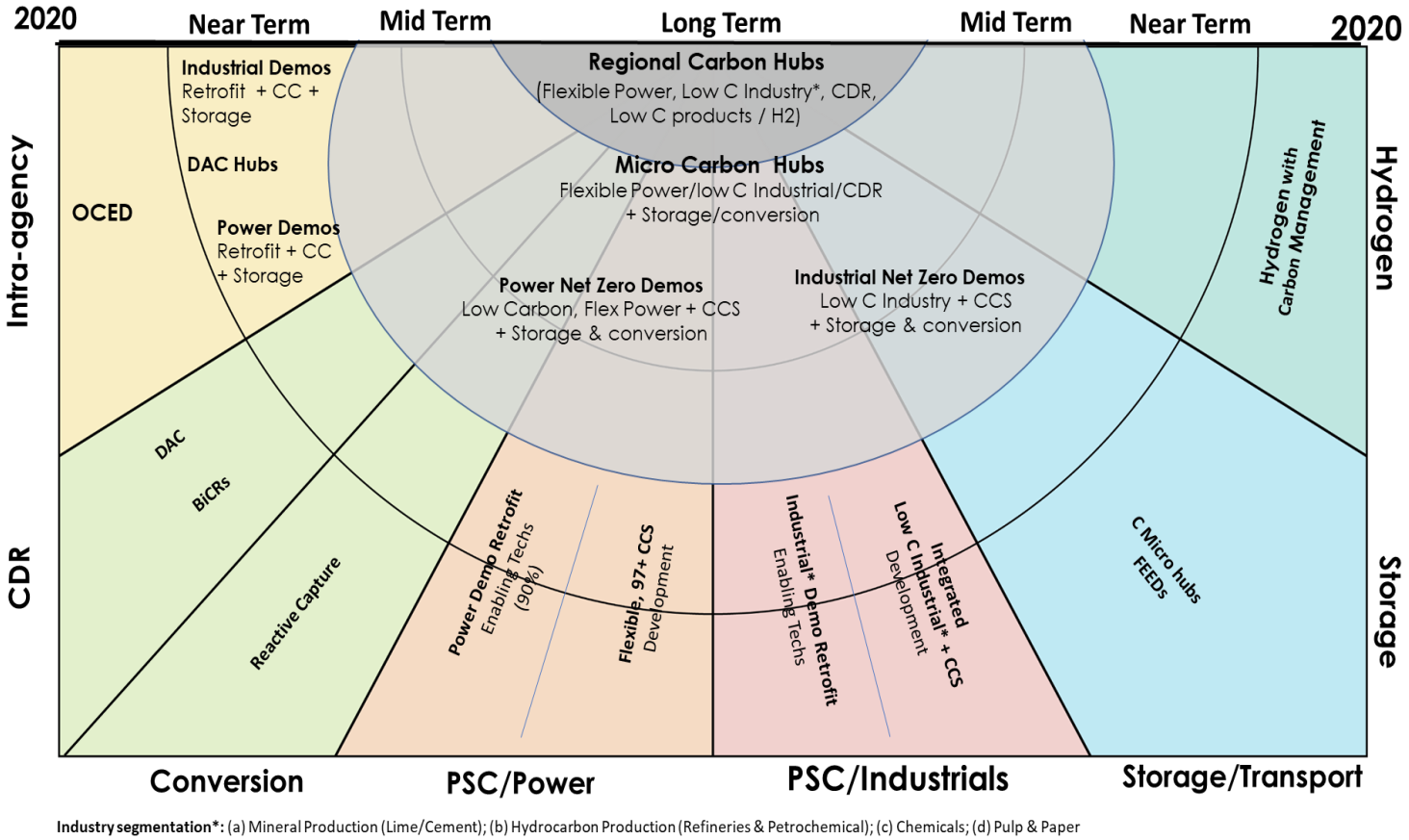
FY 24 Annual Meeting Update

U.S. DEPARTMENT OF ENERGY

Fossil Energy and Carbon Management

FECM Point Source Carbon Capture Team

Carbon Management: Strategic Vision



Industry segmentation*: (a) Mineral Production (Lime/Cement); (b) Hydrocarbon Production (Refineries & Petrochemical); (c) Chemicals; (d) Pulp & Paper

Near-term: First-of-a-kind demonstrations of PSC technologies in integrated, retrofit, single-source-to-single-sink carbon capture and storage demonstration projects.

Medium-term: Clusters emerge in which multiple point-source or carbon dioxide removal sources feed a single high-capacity reservoir while net-zero flexible power and integrated industrial decarbonization approaches are being demonstrated.

Longer-term: The clusters will be linked to form a network of regional hubs fed by multiple net-zero power and industrial sources

DOE Point Source Carbon Capture Portfolio

	Components	Small Pilots	Large Pilots	Demo
	 Testing novel materials & processes with simulated exhaust	 Bench- and Pilot-scale technology testing with real flue gas	 Engineering scale for integrated capture system	 Unit-wide Carbon transport & storage
			No storage	
ARPA-E	✓ FLECCS	✓ FLECCS		
FECM	✓ ✓	✓ ✓	✓ MTR, UIC, TCM	
IEDO	✓	✓		
OCED				✓ ✓ 25 MW 75 KTA **BIL Funded** ✓ ✓ unit 300+ KTA

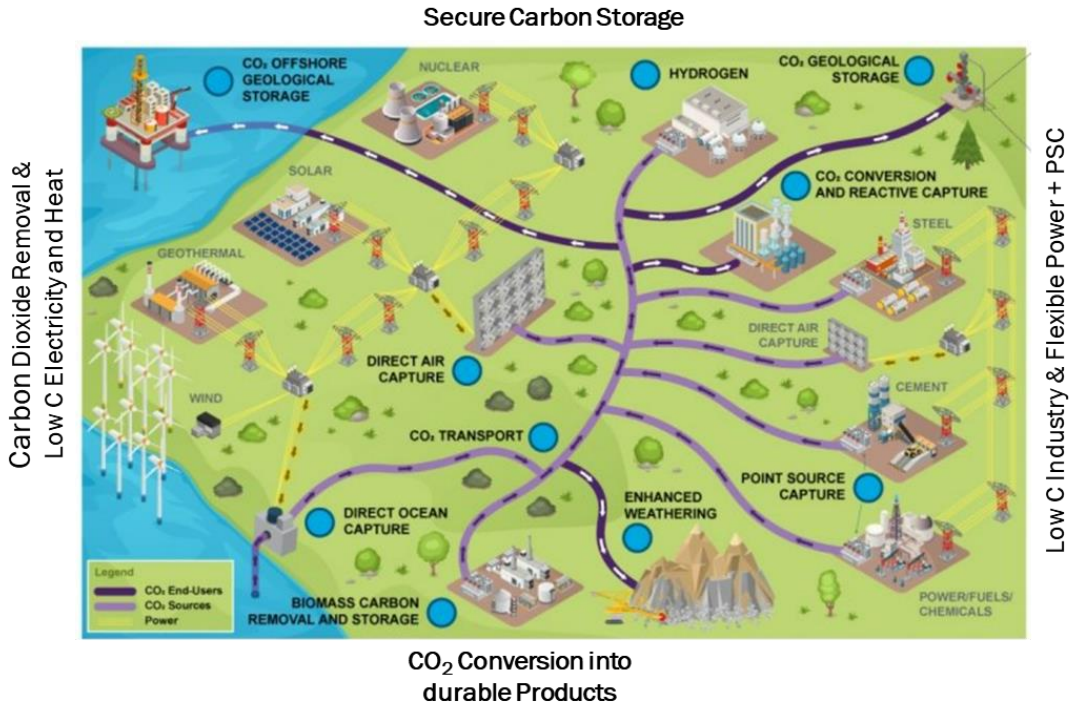
✓ Industrial
✓ Power

ARPA-E: Advanced Research Program Agency – Energy
OCED: Office of Clean Energy Demonstration

FECM: Fossil Energy and Carbon Management;
IEDO: Industrial Efficiency & Decarbonization Office

PSC Strategic Vision

Support demonstration of first-of-a-kind carbon capture on power and industrial sectors coupled to dedicated and reliable carbon storage, that will lead to commercially viable carbon hub opportunities for widescale deployment and facilitate a carbon-free economy by 2050, emphasizing robust analysis of life cycle impacts, and understanding air/water quality impacts.



Focus Area 1: Enabling Power CCS Demonstration

- Enabling technologies

Focus Area 2: Net Zero, Flex Power

- Technology development to support flexible CCS with high capture efficiency
- FEEDs to seed the formation of Carbon Hubs.

Focus Area 3: Support Industrial Retrofit Demos

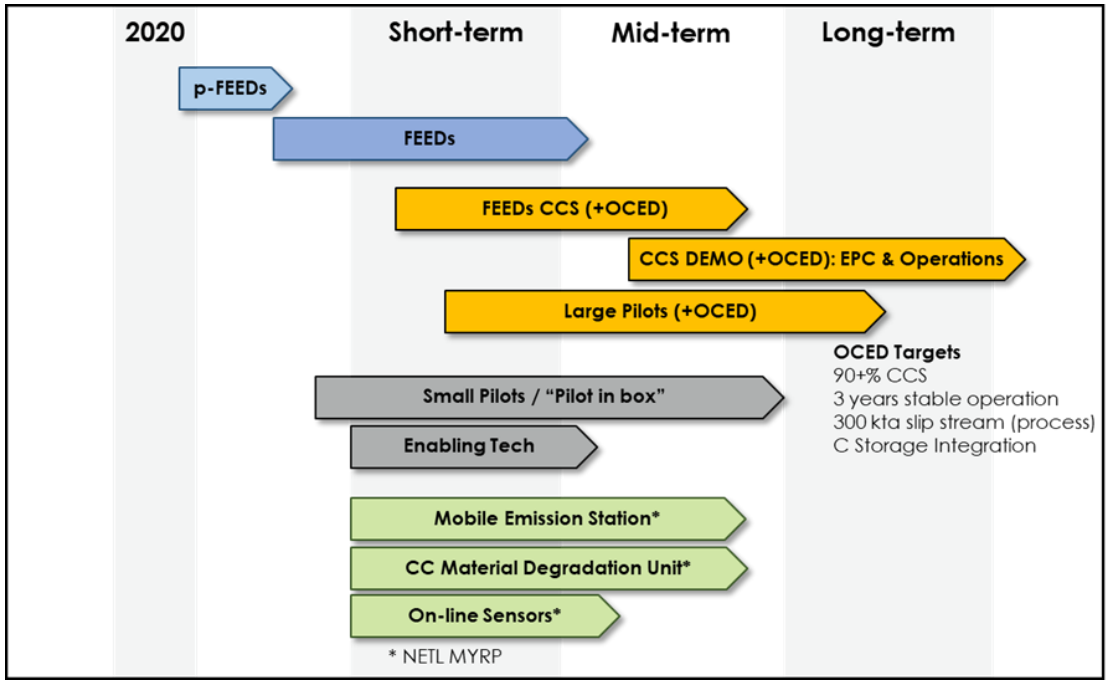
- Enabling technologies

Focus Area 4: Integrated decarbonized industrial + CCS

- Technology development for integrated decarbonized industrial processes coupled with transformational CCS
- FEEDs to seed the formation of Carbon Hubs.

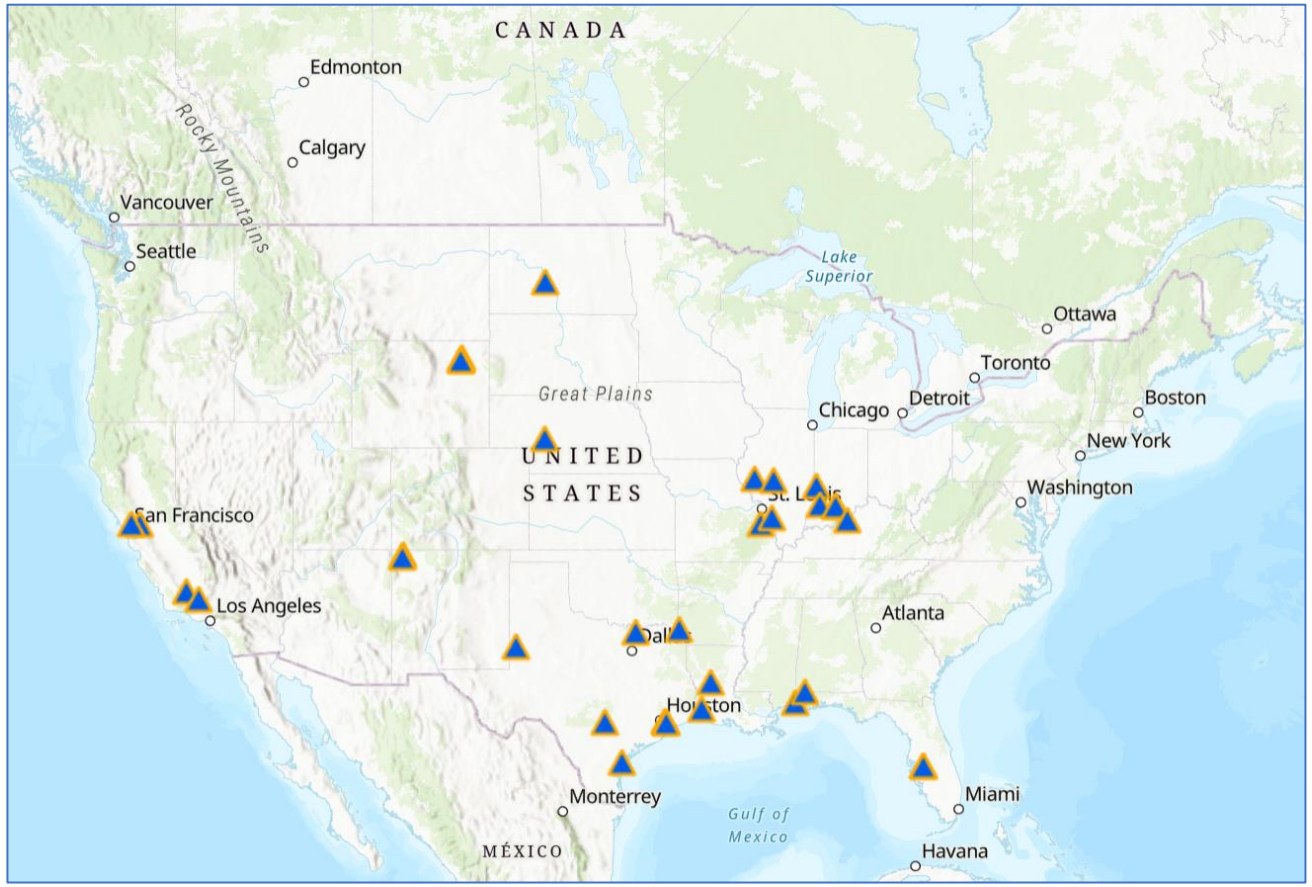
Enabling Power/Industrial CCS Demonstrations

Develop technologies to support successful demonstration of retrofit CCS projects at electricity generation and industrial facilities with the emphasis of measuring, monitoring and controlling CCS-related environmental impacts to assure just and sustainable deployment.



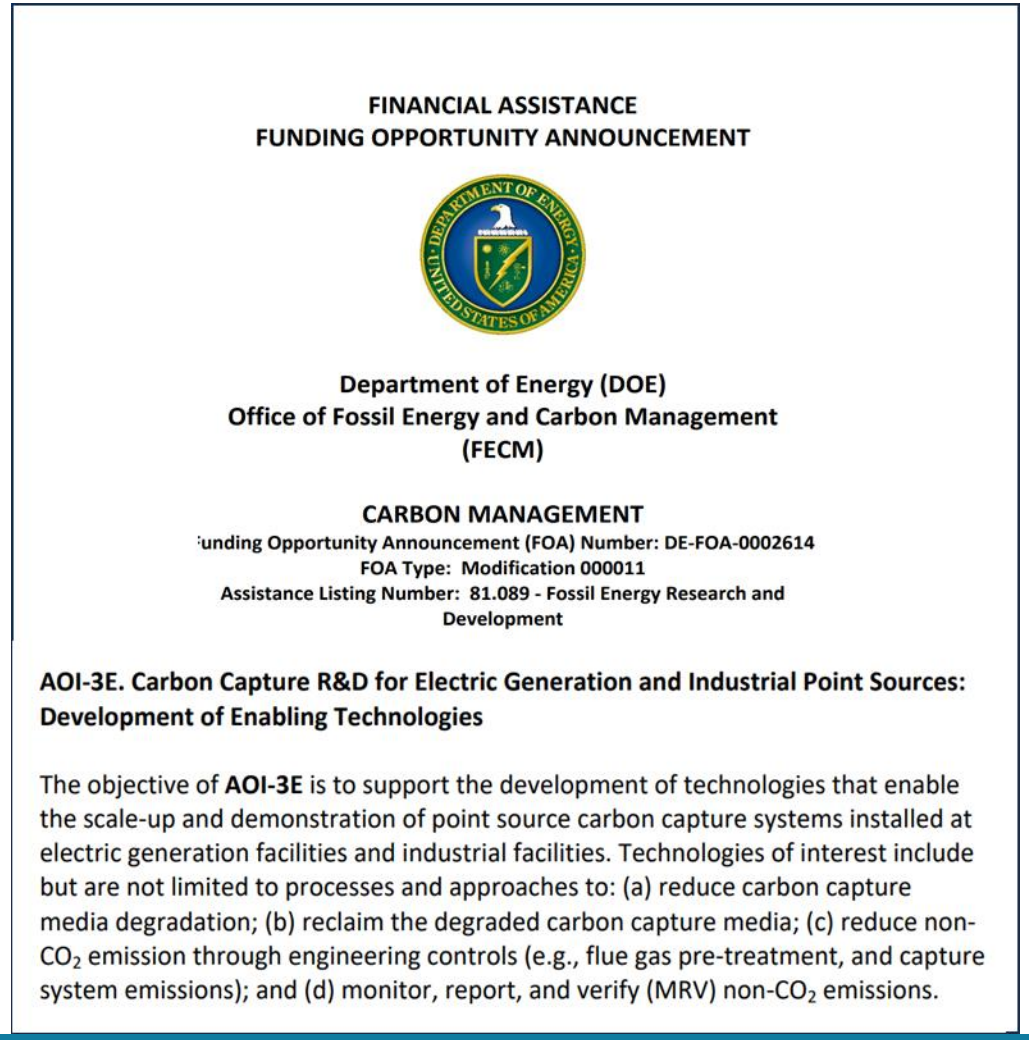
1. Engineering control methods/equipment (e.g., pre-treatment, post-treatment acid wash, upstream filters, aerosol controls, corrosion inhibitors)
2. Evaluate and predict capture media degradation/secondary emissions
3. Reuse/recycle processes for capture material
4. Pollutant air dispersion models
5. Online sensors to measure gas- and liquid-phase degradation products
6. Carbon Capture pFEEDs & FEEDs
7. Mobile Pilots ("Pilots in box")

Enabling Power/Industrial CCS Demonstrations: FEEDs



- ✓ 35+ pFEEDs and FEEDs; 14 OSTI reports
- ✓ Provide FOAK cost of capture taking into account specific locality factors (e.g., water availability, retrofit capability, capacity factor)
- ✓ Co-benefits and EH&S analysis

Enabling Tech for Power/Industrial CCS Demonstrations



FINANCIAL ASSISTANCE
FUNDING OPPORTUNITY ANNOUNCEMENT

Department of Energy (DOE)
Office of Fossil Energy and Carbon Management
(FECM)

CARBON MANAGEMENT
Funding Opportunity Announcement (FOA) Number: DE-FOA-0002614
FOA Type: Modification 000011
Assistance Listing Number: 81.089 - Fossil Energy Research and Development

AOI-3E. Carbon Capture R&D for Electric Generation and Industrial Point Sources: Development of Enabling Technologies

The objective of **AOI-3E** is to support the development of technologies that enable the scale-up and demonstration of point source carbon capture systems installed at electric generation facilities and industrial facilities. Technologies of interest include but are not limited to processes and approaches to: (a) reduce carbon capture media degradation; (b) reclaim the degraded carbon capture media; (c) reduce non-CO_2 emission through engineering controls (e.g., flue gas pre-treatment, and capture system emissions); and (d) monitor, report, and verify (MRV) non-CO_2 emissions.

FedConnect: Opportunity Summary

Enabling Power/Industrial CCS Demonstrations.. NOI for Mobile Testing Units / pFEEDs

FOA 2614 Round 6: Notice of Intent

U.S. DEPARTMENT OF ENERGY

NATIONAL ENERGY TECHNOLOGY LABORATORY
Albany, OR • Morgantown, WV • Pittsburgh, PA

NATIONAL ENERGY TECHNOLOGY LABORATORY

Notice of Intent No.: DE-FOA-0003397

DISCLAIMER: The "Notice of Intent to Issue" is for informational purposes only; the Department of Energy is not seeking comments on the information in this notice and applications are not being accepted at this time. Any information contained in this notice is subject to change.

This is a Notice of Intent to Issue
Funding Opportunity Announcement No. DE-FOA-0002614
Title: Carbon Management (Round 6)

AOI-3F. Engineering-Scale Testing of Transformational Carbon Capture Technologies for Natural Gas Combined Cycle (NGCC) Power Plants

AOI-3G. Engineering-Scale Testing of Transformational Carbon Capture Technologies in Portable Systems at Industrial Plants

AOI-3H-a. Preliminary Front-End Engineering Design Studies (Pre-FEED) for Carbon Capture Systems at Existing (Retrofit) Domestic NGCC Power Plants

AOI-3H-b. Preliminary Front-End Engineering Design Studies (Pre-FEED) for Carbon Capture Systems at Hydrogen Production Facilities Using Coal, Mixed Coal/Biomass, or Natural Gas Feedstock

FECM – OCED Carbon Capture Connectivity

Integrated CCS FEEDs

	Sector	Fuel	Host Site	FECM	OCED
Heildelberg Materials	Cement Production		Mitchell Cement Plant in Mitchell, Indiana, 2 MTA CO2	Capture pre-FEED Storage FEED	Integrated CCS FEED IDP DEMO
Tampa Electric Company	Electricity Generation	NG	Polk Power Station in Mulberry, Florida, 3 MTA CO2	Enterprise (ION) Pilot/10 MW TCM Capture pre-FEED Storage FEED	Integrated CCS FEED
University of Illinois at Urbana-Champaign	Electricity Generation	Coal	Dallman 4, PC coal power plant at City Water, Light and Power in Springfield, Illinois	10 MW Pilot Storage FEED	Integrated CCS FEED
MTR	Electricity Generation	Coal	Dry Fork Station (DFS), Gillette, Wyoming	10 MW Pilot Storage FEED	Integrated CCS FEED

FECM – OCED Carbon Capture Connectivity

CCS Demo

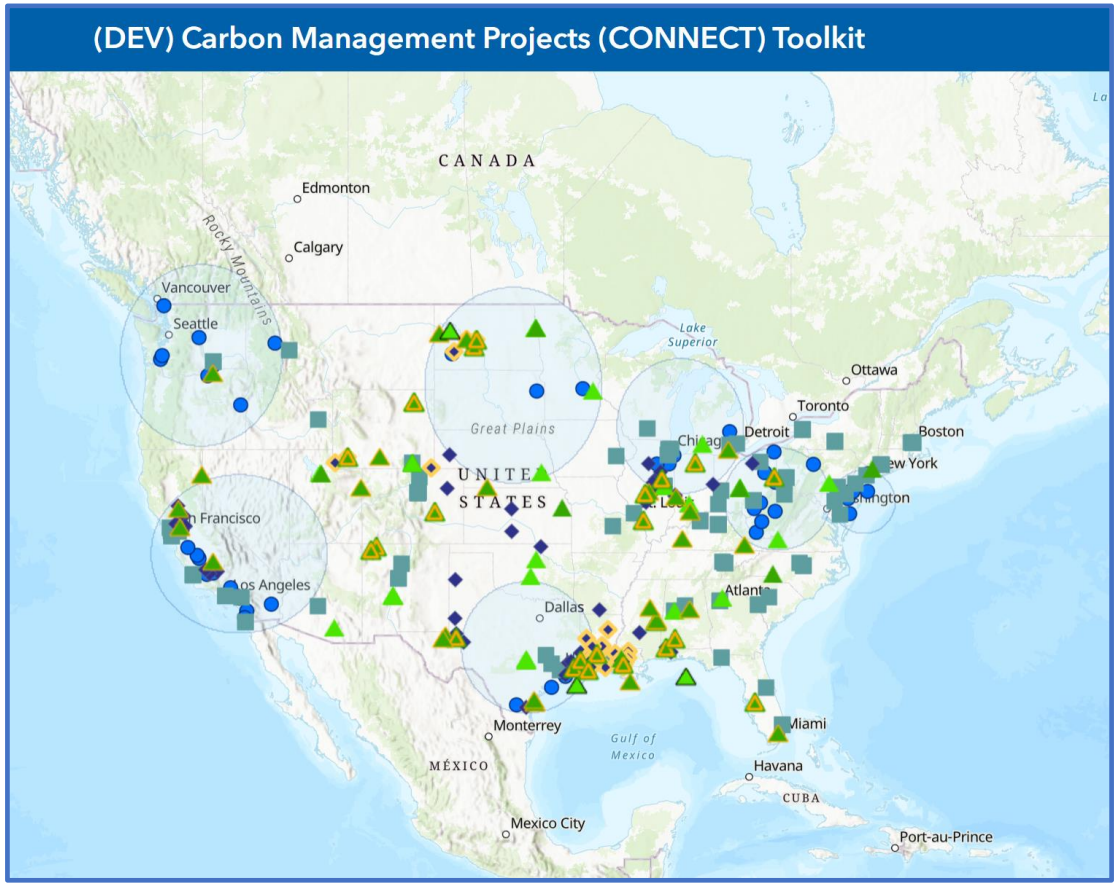
	Sector	Fuel	Host Site	FECM	OCED
Sutter CCUS LLC / Calpine	Electricity Generation	NG	Sutter Energy Center, Yuba City, CA	Enterprise (ION) 10 MW TCM (ION)	CCS Demo

Carbon Capture Large Pilots

	Sector	Fuel	Host Site	FECM	OCED
PPL Corporation	Electricity Generation	NG	Cane Run Generating Station, PPL Corporation, Louisville, Kentucky	Uky Small Pilots Capture FEED	67 KTA CC Pilot
TDA Research	Electricity Generation	Coal	Basin Electric's Dry Fork Power Station	1 MW TCM Pilot	158 kta CC Pilot
RTI International	Pulp and Paper	Biomass & Fossil	Vicksburg Containerboard Mill, Vicksburg, Mississippi	10 MW TCM Pilot	120 kta CC Pilot

Carbon Capture Demonstration Projects Program | Department of Energy

Connecting the Dots: Carbon Management Projects (CONNECT) Toolkit



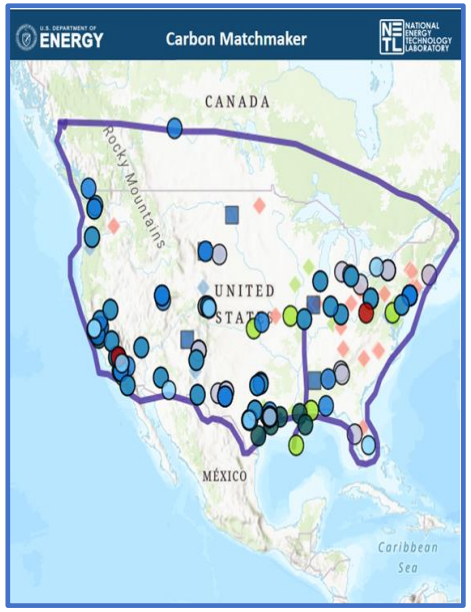
- Provide the public with a single-point access to **integrated and regularly curated information** on federally funded carbon management research, development, and demonstration (RD&D) projects in the United States
- Enable users to drill down into project details, and **generate national/regional/county-level maps**
- Serve as a hub of public information on these projects and related federal initiatives, Class VI permits/applications, existing infrastructure, point-source emissions (EPA's FLIGHT), natural resources, communities, and protected lands

(DEV) CONNECT Toolkit (doe.gov)

Carbon capture program: *Outreach*

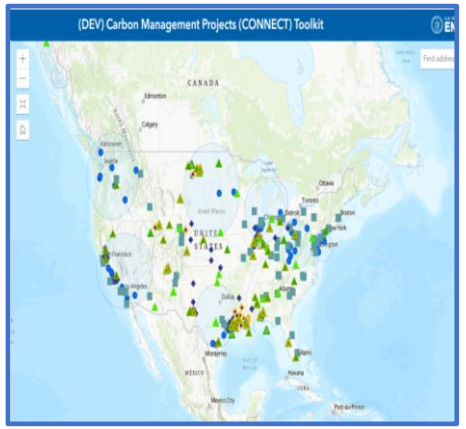
Carbon Capture Newsletter

Carbon Capture Program R&D Compendium



Carbon Matchmaker

Commercial Liftoff Report



Carbon Management Projects (CONNECT) Toolkit

[Pathways to Commercial Liftoff: Carbon Management (energy.gov)]

https://www.netl.doe.gov/carbon-management/carbon-capture

https://www.energy.gov/fecm/carbon-matchmaker

OCED
Office of Clean Energy Demonstrations

THE OFFICE OF
CLEAN ENERGY DEMONSTRATIONS

Carbon Capture Large-Scale Pilot Projects Overview

August 5th, 2024
Gokul Vishwanathan, Demonstrations Program Manager
Office of Clean Energy Demonstrations
U.S. Department of Energy

Disclaimer

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- **DOE can only communicate public and non-privileged information during this meeting or event.**
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Agenda

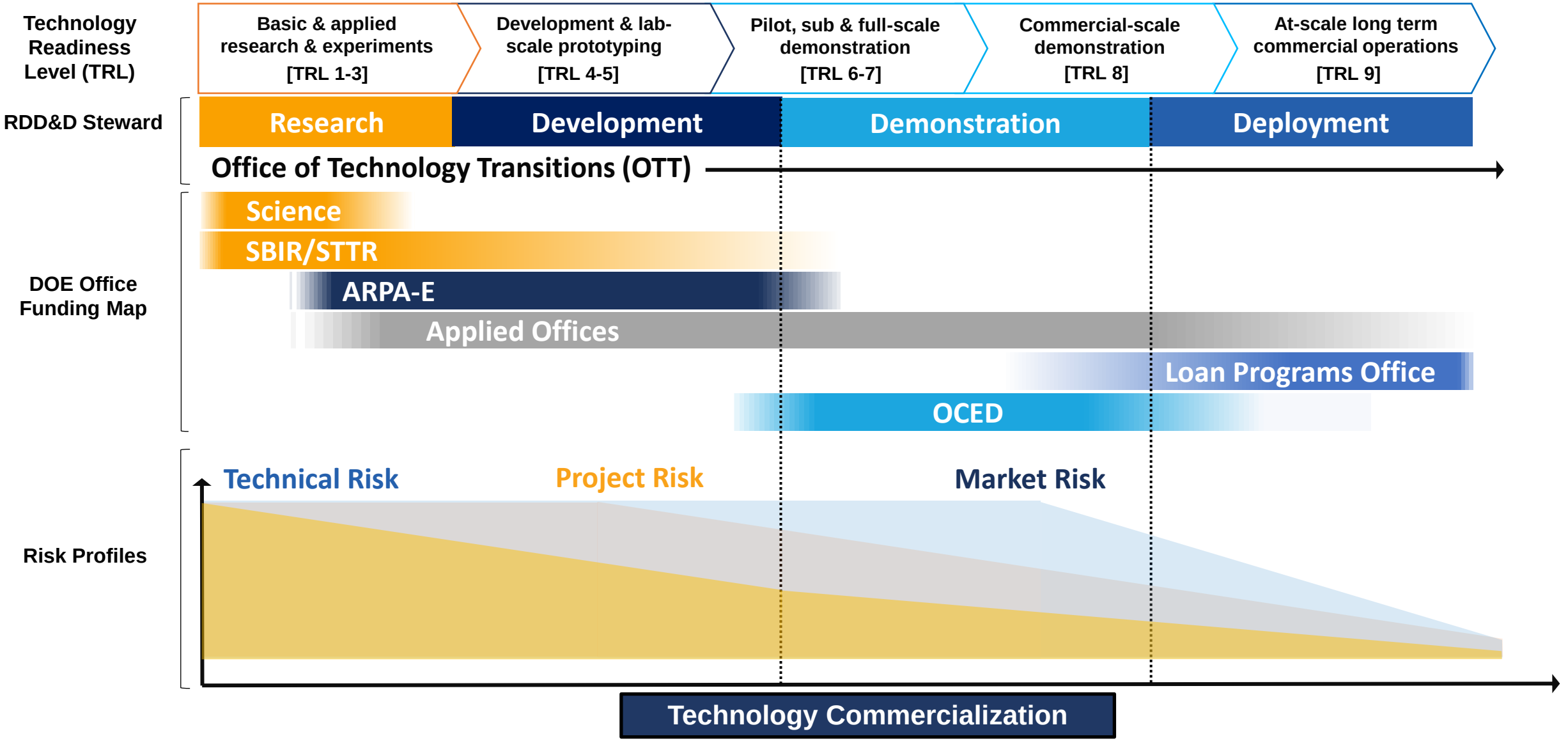
- OCED Overview
- OCED Carbon Management Portfolio
- Carbon Capture Large-Scale Pilot Projects Program

OCED Overview

OCED Mission

Deliver clean energy technology **demonstration projects at scale** in partnership with the **private sector** to **accelerate deployment**, **market adoption**, and the **equitable transition** to a decarbonized energy system.”

Role Across Research, Development, Demonstration & Deployment (RDD&D) Continuum



OCED Mandate

SCALE EQUITABLE, CLEAN ENERGY

Help enable 100% clean electricity by 2035 & net -zero emissions by 2050 through an equitable energy transition

UNLOCK NEW INVESTMENT

Unlock and scale trillion-dollar clean energy follow on investment from the private sector and other sources of capital

DE-RISK TECHNOLOGY

Maintain risk-based, balanced, and defensible portfolio of investments

PROVIDE PROJECT OVERSIGHT

Serve as primary DOE office to deliver full scale clean energy demonstration projects and project management oversight excellence

ENGAGE & COLLABORATE

Leverage private sector and broader energy ecosystem to inform OCED and DOE technology commercialization efforts

OCED Scope

Advanced Reactor Demonstrations ($2.5 billion)

Carbon Management ($7 billion)

Clean Energy Demonstrations on Mine Land ($500 million)

Distributed Energy Systems Demonstrations ($50 million)

Energy Improvements in Rural or Remote Areas ($1 billion)

Industrial Demonstrations ($6.3 billion)

Long-Duration Energy Storage Demonstrations ($505 million)

Regional Clean Hydrogen Hubs ($8 billion)

Liftoff Enabling Programs ($133 million)

OCED Scope

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Industrial Demonstrations ($6.3 billion)

Long-Duration Energy Storage Demonstrations ($505 million)

Regional Clean Hydrogen Hubs ($8 billion)

Liftoff Enabling Programs ($133 million)

OCED Carbon Management Portfolio

Carbon Management

Three programs

Carbon Capture Demonstration Projects: Develop six carbon capture facilities to improve costs, emissions reductions, and environmental effects from coal and natural gas

Carbon Capture Large-Scale Pilot Projects: Establish and test innovative carbon capture pilot projects large enough to support new processes and technology improvements at scale

Regional Direct Air Capture Hubs: Develop four regional direct air capture hubs to capture and sequester, utilize, or sequester and utilize at least 1,000,000 metric tons of CO_2 annually from a single unit or multiple interconnected units

OCED's CO_2 Capture Projects Span Across Sectors

x 5 Natural Gas Combined-Cycle Power Plants

x 5 Coal-Fired Power Plants

x 2 Direct Air Capture Projects

x 3 Cement Plants

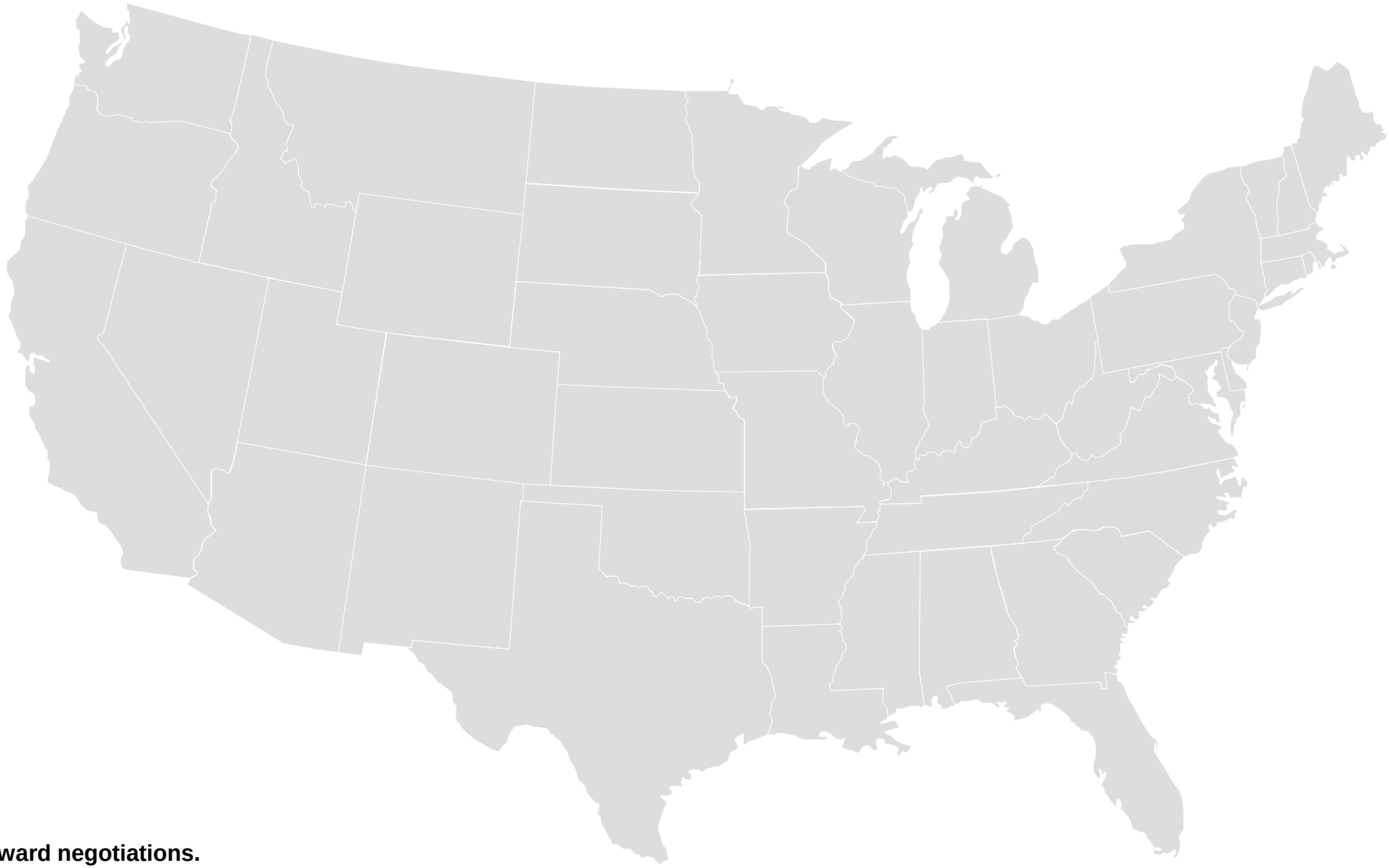
x 4 Chemicals & Refining Plants

x 1 Pulp & Paper Facility

*Several projects are pending award negotiations.

OCED Has Selected 20+ Projects Capturing CO_2

Selectees Include…



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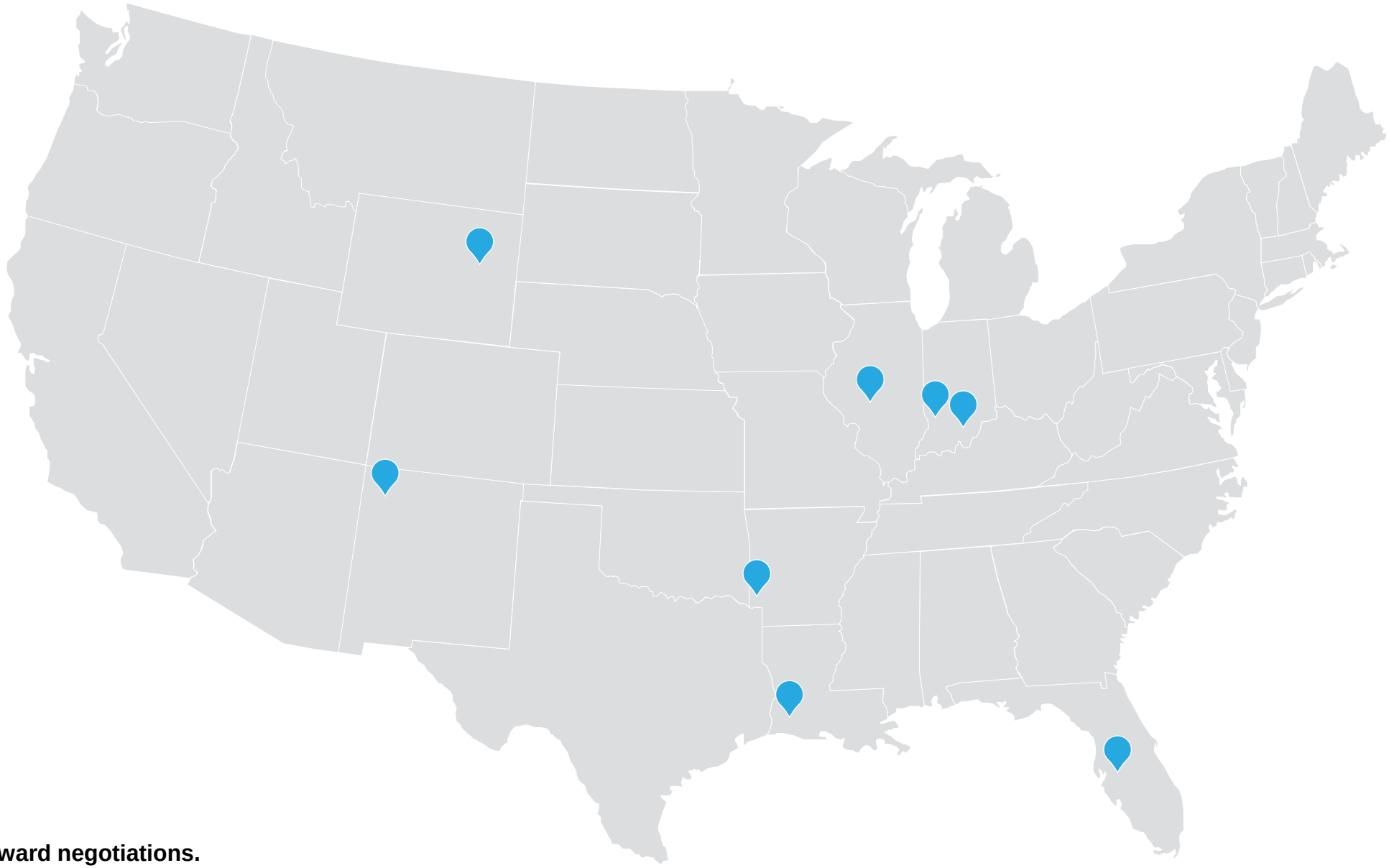
OCED Has Selected 20+ Projects Capturing CO_2

Selectees Include…

8 **Carbon Capture Front-End Engineering and Design Studies**



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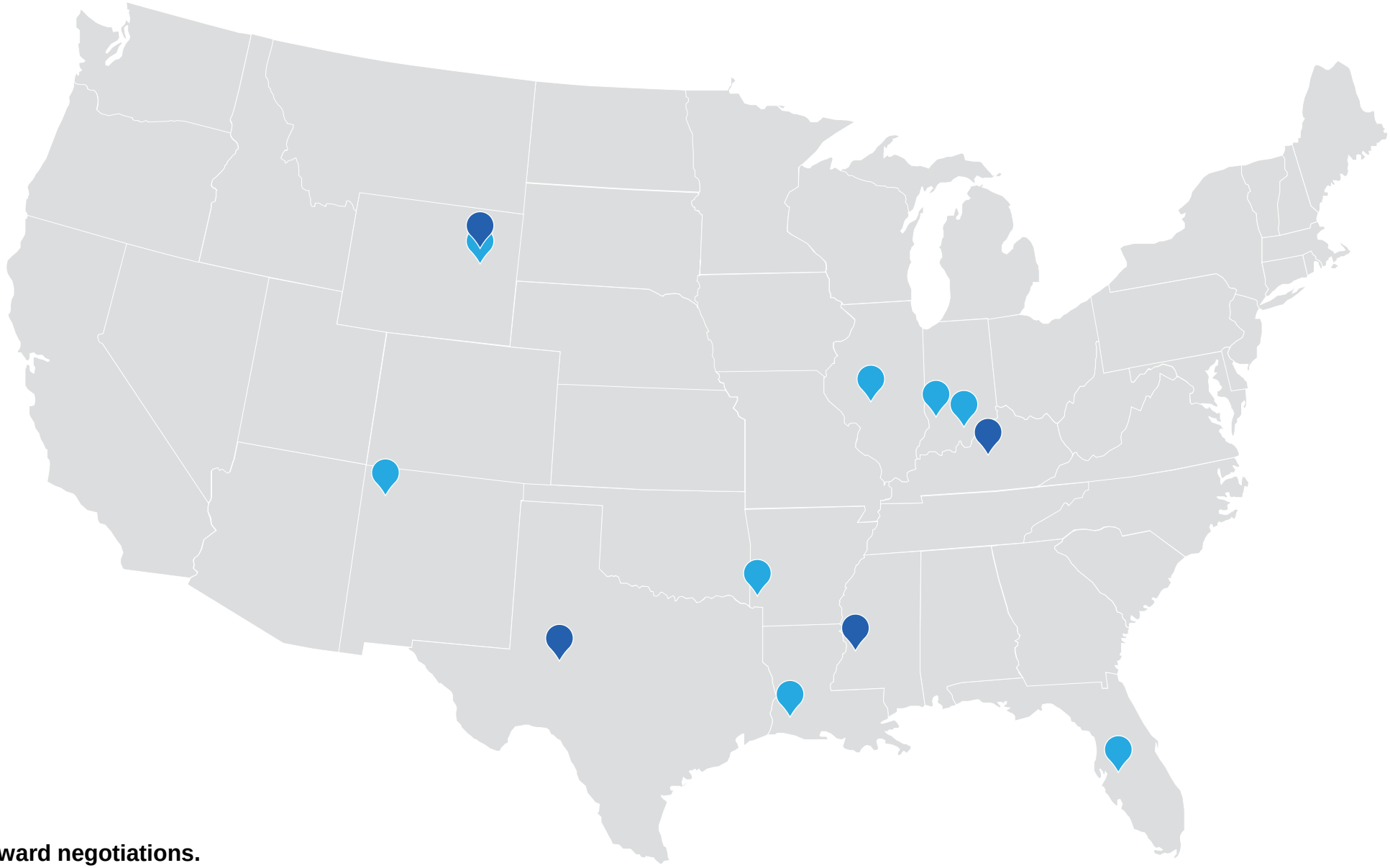
OCED Has Selected 20+ Projects Capturing CO_2

Selectees Include…

8 **Carbon Capture Front-End Engineering and Design Studies**

4 **Carbon Capture Large-Scale Pilot Projects**



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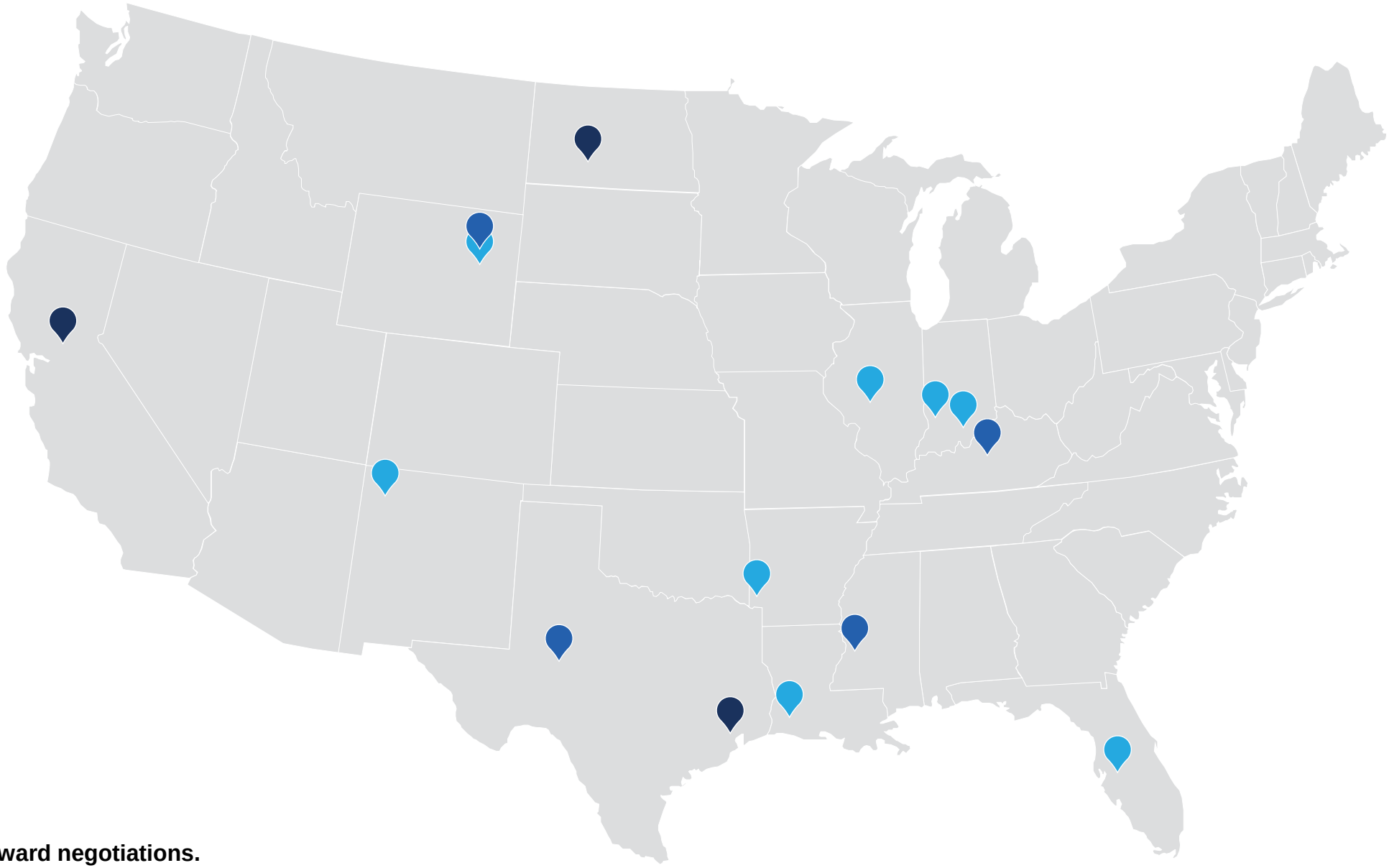
OCED Has Selected 20+ Projects Capturing CO_2

Selectees Include…

- **8** Carbon Capture Front-End Engineering and Design Studies
- **4** Carbon Capture Large-Scale Pilot Projects
- **3** Carbon Capture Demonstration Projects



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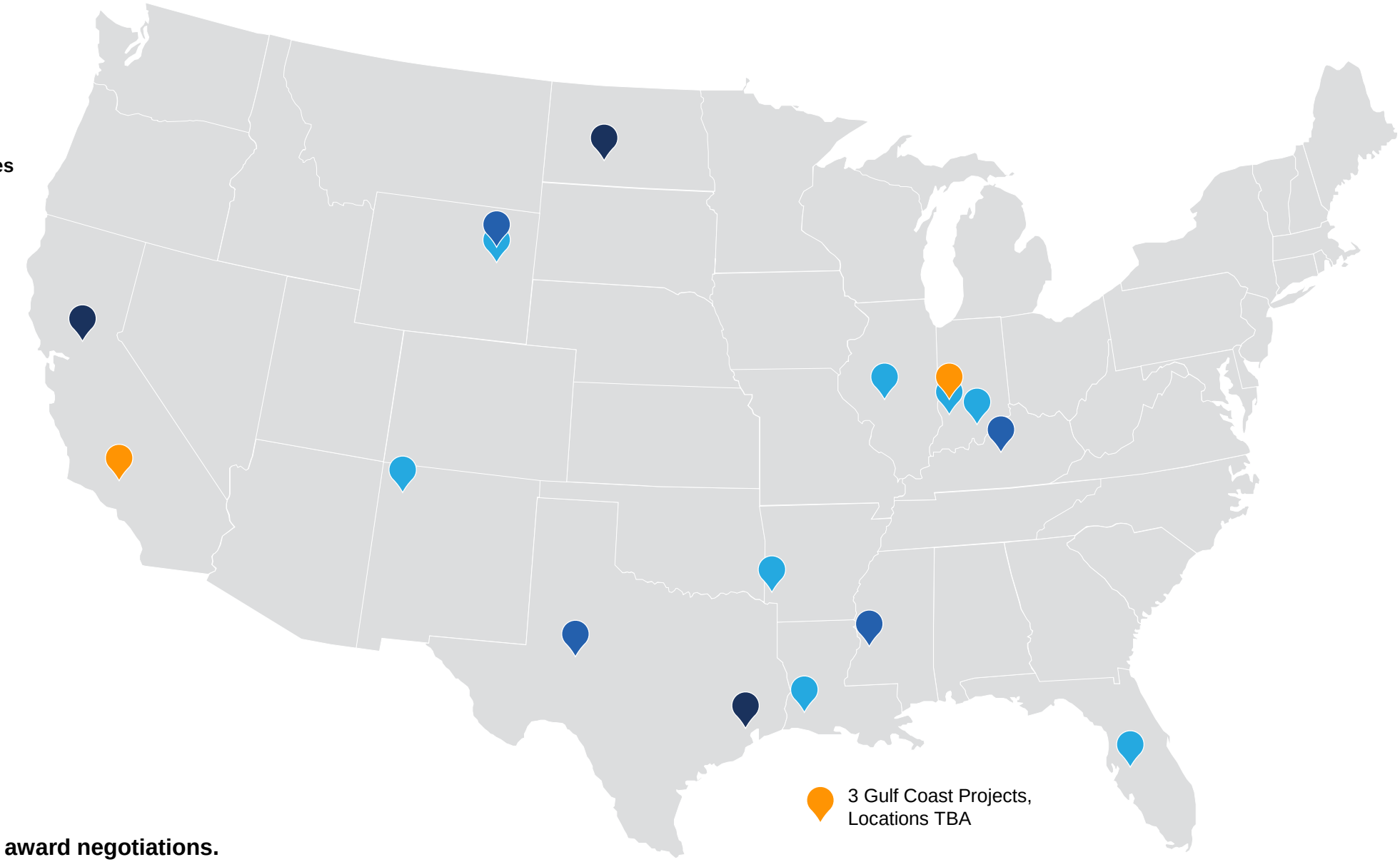
OCED Has Selected 20+ Projects Capturing CO_2

Selectees Include…

- **8** Carbon Capture Front-End Engineering and Design Studies
- **4** Carbon Capture Large-Scale Pilot Projects
- **3** Carbon Capture Demonstration Projects
- **5** Industrial Demonstration Projects



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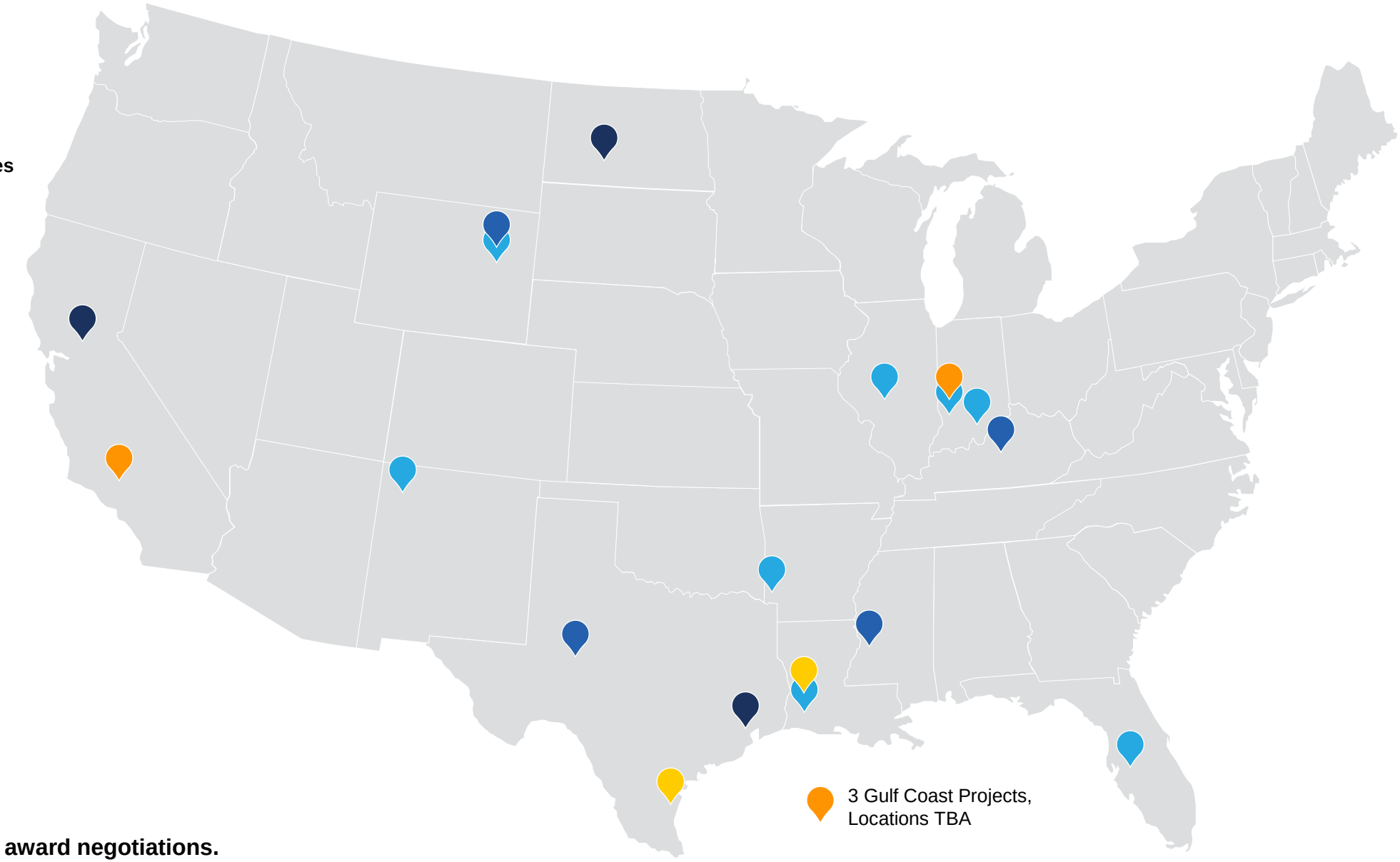
OCED Has Selected 20+ Projects Capturing CO_2

Selectees Include…

- **8** Carbon Capture Front-End Engineering and Design Studies
- **4** Carbon Capture Large-Scale Pilot Projects
- **3** Carbon Capture Demonstration Projects
- **5** Industrial Demonstration Projects
- **2** Direct Air Capture Hubs

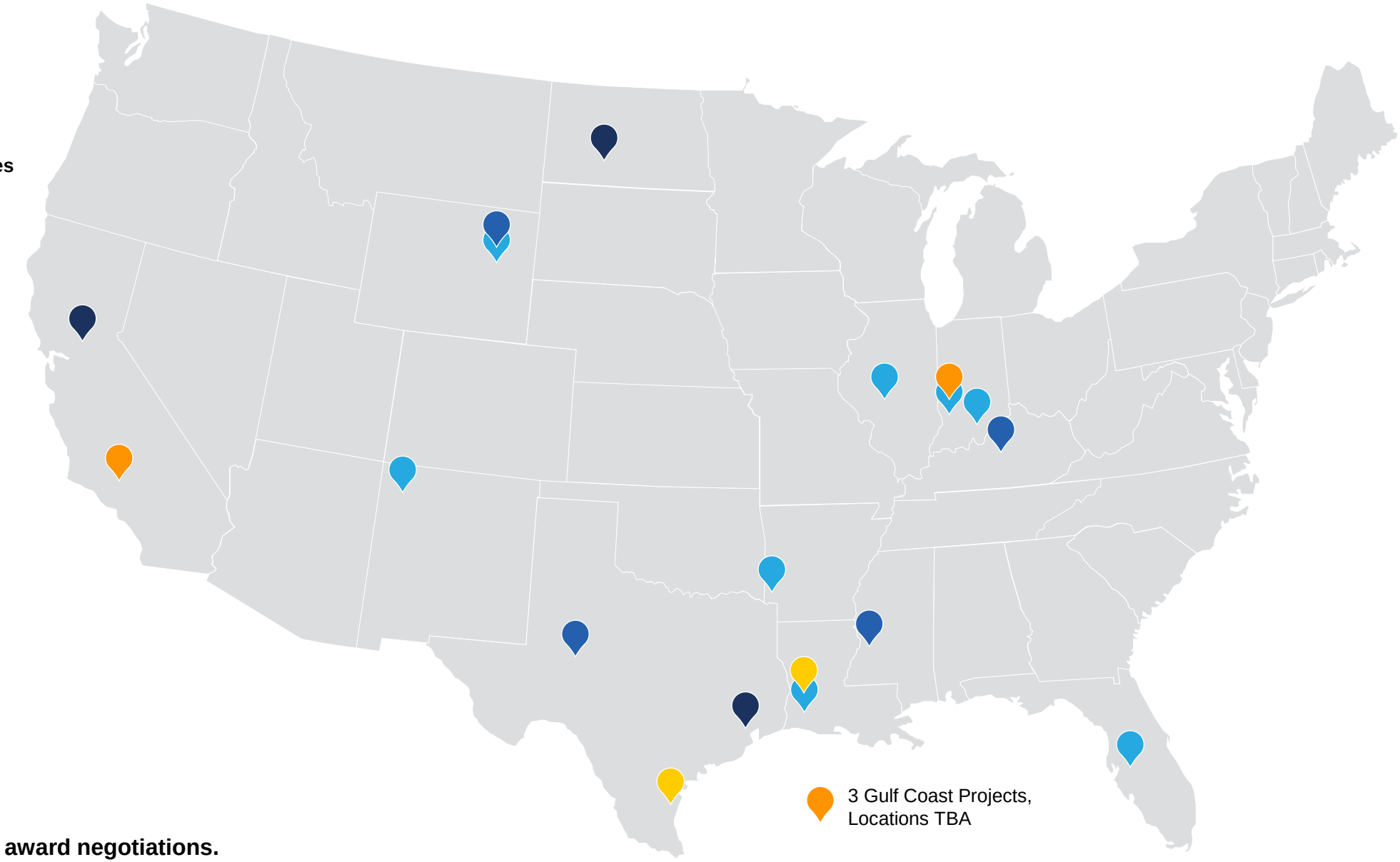


***Several projects are pending award negotiations.**

OCED Has Selected 20+ Projects Capturing CO_2

Selectees Include…

- **8** Carbon Capture Front-End Engineering and Design Studies
- **4** Carbon Capture Large-Scale Pilot Projects
- **3** Carbon Capture Demonstration Projects
- **5** Industrial Demonstration Projects
- **2** Direct Air Capture Hubs
- **6** Hydrogen Hubs *(not shown on map)*



***Several projects are pending award negotiations.**

Breadth of CO_2 Capture, Storage, and Utilization Plans

OCED's CO_2 capture projects represent a variety of CO_2 capture technologies, including:

- Solvents (11 projects)
- Sorbents (3 projects)
- Cryogenic (1 project)
- Membrane (1 project)
- Limestone (1 project)

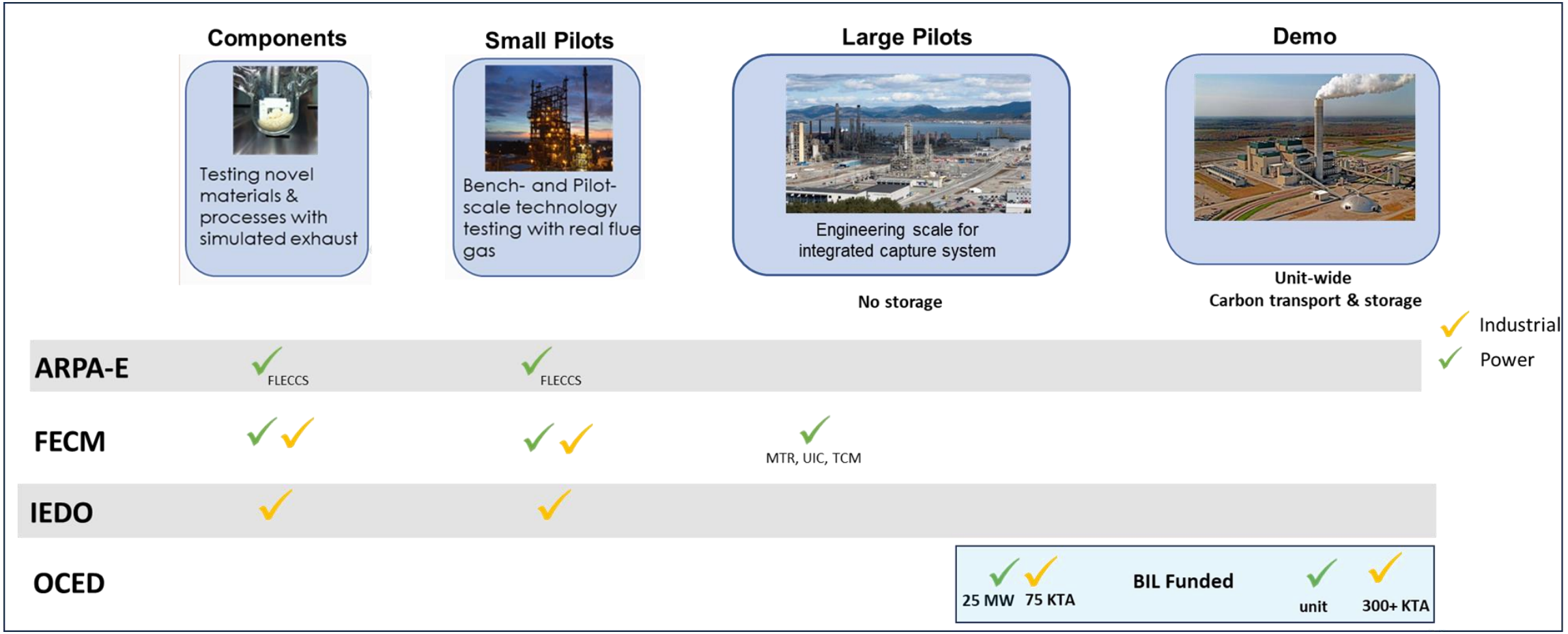
Many projects plan to store the CO_2 permanently and safely in geologic formations (17+ projects)

Others plan to utilize the CO_2 to make valuable products, such as (4+ projects):

- E-methanol
- Ethylene
- Electrolyte Solutions for EV Batteries
- Beverage-grade CO_2

***Several projects are pending award negotiations.**

Carbon Capture Technology Progression



ARPA-E: Advanced Research Program Agency – Energy
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Carbon Capture Large-Scale Pilot Projects Program

Carbon Capture Large-Scale Pilot Projects Program

Establish and test innovative carbon capture pilot projects large enough to support new processes and technology improvements at scale.

Current Status

- February 2023: Announced $820M funding opportunity for Carbon Capture Large-Scale Pilot Projects
- **February 2024: Selected four projects for award negotiations in Kentucky, Mississippi, Texas, and Wyoming. All projects in negotiations.**
- **DOE is considering another FOA for more Carbon Capture Large-Scale Pilot Projects**

OCED's CO_2 Capture Pilot Projects Span Across Sectors

x 1 Natural Gas Combined-Cycle Power Plant (KY)

x 1 Coal-Fired Power Plant (WY)

x 1 Refining Plant (TX)

x 1 Pulp & Paper Facility (MS)

All projects are pending award negotiations.

Carbon Capture Large-Scale Pilot Projects Under Award Negotiation

Carbon Capture Pilot at Vicksburg Containerboard Mill

Selectee
RTI International

Location
Redwood, Mississippi

Federal Cost Share
Up to $88 million*

*Pending negotiations

Image credit: RTI International

CO_2 Capture Technology

- RTI's non-aqueous solvent (NAS) technology
- Capture 120,000 metric tons of CO_2 annually

CO_2 Storage/Utilization Plan

- Geologic storage

Proposed Activities

- FEED study and large-scale pilot
- Establish a Community Engagement Network
- Engagement with several labor unions on workforce agreements
- Expected to create approximately 90 construction jobs

Carbon Capture Pilot at Big Spring Refinery

Selectee
Delek US Holdings

Location
Big Spring, Texas

Federal Cost Share
Up to $95 million*

*Pending negotiations

Image credit: Svante Technologies Inc.

CO_2 Capture Technology

- Second-generation sorbent based post-combustion capture process developed by Svante Technologies Inc.
- Capture 145,000 metric tons of CO_2 annually from FCCU

CO_2 Storage/Utilization Plan

- Permanent storage or utilization, to be finalized.

Proposed Activities

- FEED study and large-scale pilot
- Create a Community Advisory Committee to prioritize public feedback, concerns and suggestions
- Establish a Carbon Capture Schoolhouse to train organized labor and expand skilled workforce
- Expected to create up to 200 construction jobs

Carbon Capture Pilot at Cane Run Generating Station

Selectee
PPL Corporation (Kentucky Utilities Company)

Location
Louisville, Kentucky

Federal Cost Share
Up to $72 million*

*Pending negotiations

Image credit: PPL Corporation

CO_2 Capture Technology

- Solvent-agnostic process; advanced heat-integrated CO_2 capture technology developed by University of Kentucky
- Capture 67,000 metric tons of CO_2 annually

CO_2 Storage/Utilization Plan

- Partner with a CO2 off-taker who will upgrade it for use as beverage-grade CO_2

Proposed Activities

- FEED study and large-scale pilot
- Establish a Community Advisory Board that could include labor unions, local stakeholders, first responders, community residents and community-based organizations. Provide preliminary workforce and training assessments
- Expected to create approximately 40-100 construction jobs

Carbon Capture Pilot at Dry Fork Power Station

Selectee
TDA Research

Location
Gillette, Wyoming

Federal Cost Share
Up to $49 million*

*Pending negotiations

Image credit: TDA Research

CO_2 Capture Technology

- Sorbent based post-combustion capture process developed by TDA
- Capture 158,000 metric tons of CO_2 annually

CO_2 Storage/Utilization Plan

- Evaluate transport and storage options

Proposed Activities

- FEED study and large-scale pilot
- Committed to hiring four underrepresented interns during each project phase, prioritizing tribal members and students from Minority Serving Institutions
- Expected to create approximately 40-60 construction jobs and 20-25 operations jobs

Stay Connected

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- **OCED Website & Newsletter**
  energy.gov/oced
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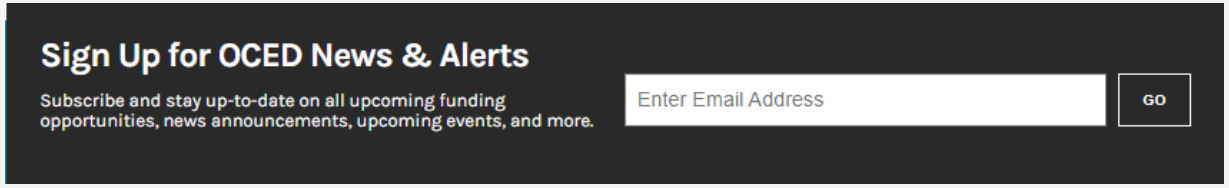

- **OCED Exchange (RFIs, NOIs, and FOAs)**
  oced-exchange.energy.gov
- **Follow us on LinkedIn**
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Thank you!

OCED

Office of Clean Energy Demonstrations

For more information, please visit: energy.gov/OCED

Office of Clean Energy Demonstrations

THE OFFICE OF

CLEAN ENERGY DEMONSTRATIONS

Carbon Capture Demonstration Projects Program Overview

August 5th, 2024

Martin Perez, Associate Director for Carbon Management

Office of Clean Energy Demonstrations

U.S. Department of Energy

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Carbon Capture Demonstration Projects Program

Develop six carbon capture facilities to significantly improve costs, emissions reductions, and environmental effects of coal and natural gas use.

Current Status

- February 2023: Announced $1.7B funding opportunity for Carbon Capture Demonstration Projects
- **December 2023: Selected three projects for award negotiation in Texas, North Dakota, and California**
- DOE anticipates future FOAs for Carbon Capture Demonstration Projects

Carbon Capture Front-End Engineering and Design (FEED) Studies

- September 2022: Announced $189M funding for FEED studies
- May 2023: Selected FEED studies for award negotiation
- **Winter 2023/2024: Awarded six FEED studies**
- *Other FEED study selectees are still in negotiations*

Carbon Capture Demonstration Projects Program - Funding Opportunities

FOA 1: FRONT-END ENGINEERING DESIGN STUDIES FOR INTEGRATED CARBON CAPTURE, TRANSPORT, AND STORAGE SYSTEMS

- Issued September 2022
- Topic Areas – Coal, Natural Gas, and Industrial Facilities
- Selected:
  - ✓ 4 Coal Facilities
  - ✓ 3 Natural Gas Facilities
  - ✓ 2 Industrial Facilities

FOA 2: CARBON CAPTURE DEMONSTRATION PROJECTS - CAPTURE, TRANSPORT, AND STORAGE

- Issued February 2023 - Targeting 6 Awards
- Topic Areas – Coal, Natural Gas, and Industrial Facilities
- Selected:
  - ✓ 1 Coal Facility
  - ✓ 2 Natural Gas Facilities
  - ✓ 0 Industrial Facilities

FOA 3: TBD

- Anticipate demonstration projects supporting coal and Industrial Facilities

Carbon Capture Demonstration Projects Program

What are we striving to accomplish:

1. Industry liftoff for carbon capture projects using traditional fuels
    - Broad mix of CC technologies
    - Across many different applications

2. Demonstrate
    - Technical performance
    - Cost viability
    - Market acceptance
    - Environmental performance

3. Community participation
    - Encourage meaningful engagement and participation of underserved communities and underrepresented groups, workforce organizations, labor unions, and consultation with Tribal Nations
    - Address community, labor, and workforce desires and/or concerns, including assessing opportunities to improve jobs and job quality outcomes and identifying workforce needs and gaps

Carbon Capture Front-End Engineering and Design (FEED) Studies

FEED Study Approach

Technical Baseline Assessment

- Performance baseline
- Prior scale efforts for CC and storage
- Cost, schedule, risk management and technical
- Strategies for managing project risks and uncertainties
- Finalize project scope and approach

FEED Study

- Integrated FEED carbon capture, pipeline, and storage
- Produce an AACE class 3 cost estimate for the integrated FEED
- Environmental information volume meeting NEPA requirements
- CBP, reflective of community and labor engagement, investing in the American workforce, Justice40, and DEIA

AWARDED
CARBON CAPTURE
FEED STUDY PROJECT

Foreman Cement Plant Integrated CO_2 Capture

Recipient
Southern States Energy Board

Location
Foreman, Arkansas

Federal Cost Share
$7.58 million

Image credit: Southern States Energy Board

CO_2 Capture Technology

- Air Liquide's Cryocap™ cryogenic-based technology
- Future project could capture 1.4 million metric tons of CO_2 annually from the site

FEED Study Description

- Study will examine CO_2 storage opportunities by working with a commercial off-taker and drilling a stratigraphic test well to support an EPA UIC Class VI permit application

FEED Study Activities

- Develop engineering designs, a preliminary engineering design package, final FEED report, preliminary pipeline route, final pipeline FEED study, robust CBP, and Environmental Health & Safety Assessment Report

AWARDED
CARBON CAPTURE
FEED STUDY PROJECT

Polk Power Station Integrated CO_2 Capture

Recipient
Tampa Electric Company (TEC)

Location
Mulberry, Florida

Federal Cost Share
$4.72 million

Image credit: Tampa Electric Company

CO_2 Capture Technology

- ION Clean Energy, Inc.'s post-combustion technology
- Future project could capture 3 million metric tons of CO_2 annually from the site

FEED Study Description

- Study will determine the cost of retrofitting ION Clean Energy, Inc.'s post-combustion carbon capture technology with pipeline transport and secure geologic storage for the Polk Power Station natural gas combined cycle plant

FEED Study Activities

- Develop a CO_2 pipeline transportation FEED study and carbon capture supplemental FEED study, secure carbon storage permitting, create storage-field development plan, continue community benefits work, and initiate NEPA process

AWARDED
CARBON CAPTURE
FEED STUDY PROJECT

Mitchell Cement Plant Integrated CO_2 Capture

Image credit: Heidelberg Materials

Recipient
Heidelberg Materials

Location
Lawrence County, Indiana

Federal Cost Share
$4.99 million

CO_2 Capture Technology

- Amine-based carbon capture technology
- Future project could capture 2 million metric tons of CO_2 annually from the site

FEED Study Description

- Study will evaluate the cost and performance of retrofitting a cement plant with amine-based carbon capture technology, identify site-specific considerations for a full-scale integration, and examine CO_2 storage opportunities

FEED Study Activities

- Develop engineering designs, a preliminary engineering design package, final FEED report, preliminary pipeline route, final pipeline FEED study, robust CBP, and Environmental Health & Safety Assessment Report

AWARDED
CARBON CAPTURE
FEED STUDY PROJECT

Lake Charles Power Station Integrated CO_2 Capture

Recipient
Entergy Services, LLC

Location
Westlake, Louisiana

Federal Cost Share
$8.63 million

Image credit: Entergy Services, LLC

CO_2 Capture Technology

- Mitsubishi Heavy Industries' state-of-the-art KS-21™ solvent
- Future project could capture 2.5 million metric tons of CO_2 annually from the site

FEED Study Description

- Study will investigate the cost of retrofitting a post-combustion carbon capture technology using Mitsubishi Heavy Industries' state-of-the-art KS-21™ at the natural gas combined cycle power plant at Lake Charles Power Station

FEED Study Activities

- Develop FEED analysis for an integrated carbon capture, transport, and storage project, a CO_2 pipeline transportation FEED study, continue community benefits work, and initiate NEPA process

AWARDED
CARBON CAPTURE
FEED STUDY PROJECT

Edwardsport Flex Fuel Integrated Capture for Indiana's ENergy Transition (EFFICIENT)

Image credit: Duke Energy Indiana, LLC

Recipient
Duke Energy Indiana, LLC (Duke Energy)

Location
Edwardsport, Indiana

Federal Cost Share
$8.19 million

CO_2 Capture Technology

- Honeywell Advanced Solvent Carbon Capture process
- Future project could capture 3.6 million metric tons of CO_2 annually from the site

FEED Study Description

- Study will evaluate the feasibility of capturing and storing CO_2 from the flue gases of the two heat recovery steam generators at the Edwardsport Integrated Gasification Combined Cycle power generation plant

FEED Study Activities

- Develop engineering designs, a preliminary engineering design package, final FEED report, preliminary pipeline route, final pipeline FEED study, robust CBP, and Environmental Health & Safety Assessment Report

AWARDED
CARBON CAPTURE
FEED STUDY PROJECT

Integrated Carbon Capture and Storage Project at Dry Fork Station

Recipient
Membrane Technology and Research Carbon Capture

Location
Gillette, Wyoming

Federal Cost Share
$4.65 million

Image credit: Membrane Technology and Research Carbon Capture

CO_2 Capture Technology

- MTR Carbon Capture's second-generation Polaris™ membrane
- Future project could capture 3 million metric tons of CO_2 annually from the site

FEED Study Description

- Study will analyze the requirements needed for the capture technology installed at the site to capture, compress, and store CO_2, with a minimum carbon capture rate of 90%. The study will also assess the potential integration with CO_2 pipeline and geologic storage using CarbonSAFE data

FEED Study Activities

- Develop FEED study for the integrated carbon capture and storage project at Basin Electric Power Cooperative

UNDER NEGOTIATION
CARBON CAPTURE
FEED STUDY PROJECT

Four Corners Power Plant Integrated Carbon Capture and Storage

Recipient
Navajo Transitional Energy Company, LLC (NTEC)

Location
Navajo Nation

Federal Cost Share*
$8.13 million

*Pending negotiations

Image credit: Navajo Transitional Energy Company, LLC

CO_2 Capture Technology

- Mitsubishi Heavy Industries Americas, IncKS-21™ solvent for carbon capture
- Future project could capture 10 million metric tons of CO_2 annually from the site

FEED Study Description

- Study will develop an integrated carbon capture, transport, and storage project at the Four Corners Power Plant, capable of capturing a minimum of 95% of the CO2 emissions from the facility (10,000,000+ tonnes/year)

FEED Study Activities

- Develop a CO_2 capture FEED study, CO_2 transportation FEED study, storage field development plan, an initial CBP, and initiate the NEPA process

UNDER NEGOTIATION
CARBON CAPTURE
FEED STUDY PROJECT

Integrated Capture, Transport, & Geological Storage of CO_2 Emissions from City Water, Light & Power

Recipient
University of Illinois at Urbana-Champaign

Location
Springfield, Illinois

Federal Cost Share*
Up to $4.75 million

*Pending negotiations

Image credit: City Water, Light and Power

CO_2 Capture Technology

- Linde-BASF solvent-based capture system
- Future project could capture 2 million metric tons of CO_2 annually from the site

FEED Study Description

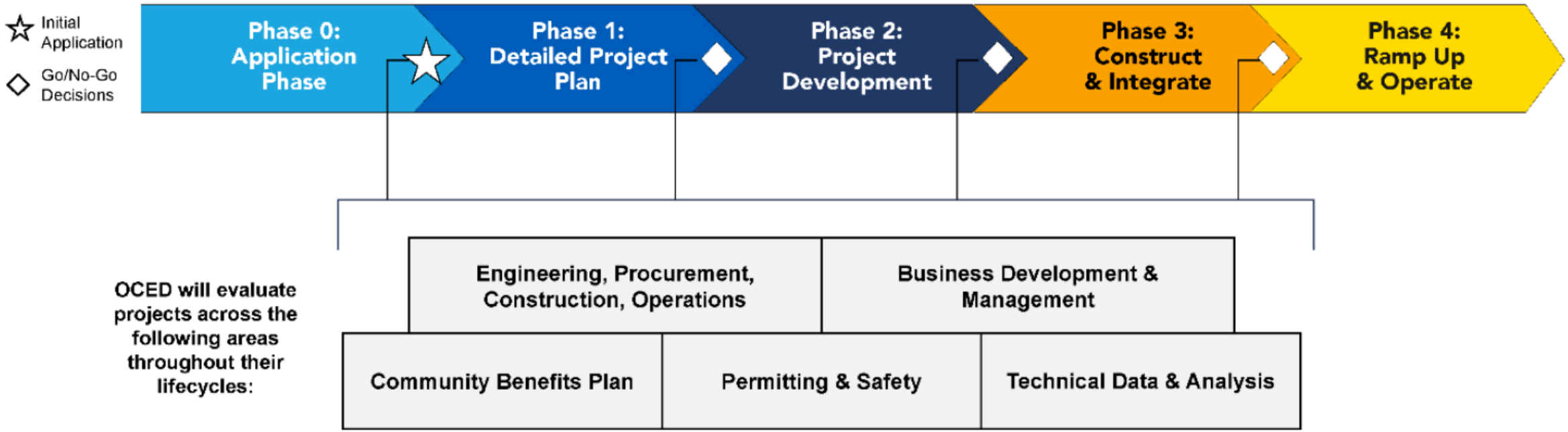
- Study will build and operate an end-to-end carbon dioxide capture, transport, and storage solution for the Dallman #4 unit at City Water, Light and Power (CWLP)

FEED Study Activities

- Develop engineering designs, a preliminary engineering design package, final FEED report, preliminary pipeline route, final pipeline FEED study, robust CBP, and Environmental Health & Safety Assessment Report

Carbon Capture Demonstration Projects

Project Management



Independent project review teams will conduct regular project evaluations in accordance with the office's center of excellence for demonstration project management oversight.

AWARDED
CARBON CAPTURE DEMONSTRATION PROJECT

Baytown CCS Project

Selectee
Calpine Texas CCUS Holdings, an indirect subsidiary of Calpine

Location
Baytown, Texas

Federal Cost Share
Up to $270 million*

*Pending negotiations

Image credit: Calpine Corporation

CO_2 Capture Technology
- Shell's CANSOLV solvent technology
- Capture 2 million metric tons of CO_2 annually

CO_2 Storage/Utilization Plan
- Geologic storage in saline sites on the Gulf Coast

Proposed Activities
- Greywater cooling to minimize freshwater use
- Plans to develop a Community Benefits Agreement (CBA)
- Partnering with Minority-Serving Institutions to support 10 paid, pathway to employment internships
- Estimate creating approximately 22-26 permanent jobs and 1.5 million hours of construction jobs

UNDER NEGOTIATION
CARBON CAPTURE DEMONSTRATION PROJECT

Sutter Decarbonization Project

Selectee
Sutter CCUS, LLC,
a Calpine subsidiary

Location
Near Yuba City, California

Federal Cost Share
Up to $270 million*

*Pending negotiations

Image credit: Calpine Corporation

CO_2 Capture Technology

- ION Clean Energy solvent technology
- Capture up to 1.75 million metric tons of CO_2 annually

CO_2 Storage/Utilization Plan

- Saline geologic formations 10 miles from the plant in CA

Proposed Activities

- Air cooling to minimize water consumption
- Negotiating a Project Labor Agreement (PLA)
- Plans to support 10 paid, pathway to employment internships through Minority Serving Institutions
- Estimate creating approximately 15-20 permanent jobs and 1.5 million hours of highly skilled craft labor

UNDER NEGOTIATION
CARBON CAPTURE DEMONSTRATION PROJECT

Project Tundra

Selectee
Dakota Carbon Center East Project LLC

Location
Center, North Dakota

Federal Cost Share
Up to $350 million*

*Pending negotiations

Image credit: Dakota Carbon Center East Project LLC

CO_2 Capture Technology

- Mitsubishi Heavy Industries' KS-21 solvent technology
- Capture 4 million metric tons of CO_2 annually

CO_2 Storage/Utilization Plan

- Saline geologic formations near the power plant in ND

Proposed Activities

- Plan to negotiate a Community Benefits Agreement (CBA) and Project Labor Agreement (PLA)
- Existing Collective Bargaining Agreement with International Brotherhood of Electrical Workers
- Estimate creating approximately 25 permanent jobs and a minimum of 400 construction jobs

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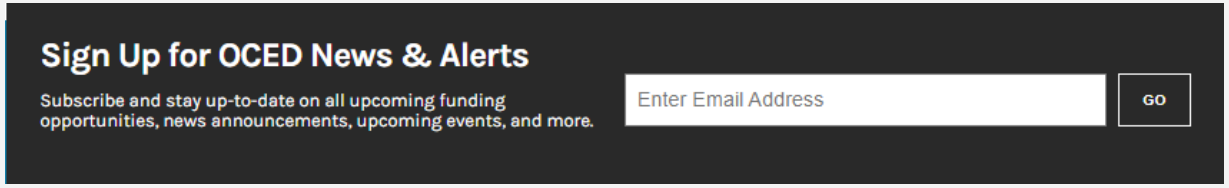

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