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# Carbon Management

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U.S. DEPARTMENT OF  
**ENERGY**

Fossil Energy and  
Carbon Management



# FECM's Office of Carbon Management

*Focused on minimizing the environmental and climate impacts of fossil fuels and industrial processes, while working to achieve net-zero GHG across our economy*



## The Office of Carbon Management Technologies

Leads and invests in research, development, demonstration, and deployment across five divisions...



Hydrogen  
with Carbon  
Management



Carbon  
Transport  
and Storage



CO<sub>2</sub>  
Removal and  
Conversion



Integrated  
Carbon  
Management



Point-Source  
Carbon  
Capture



## The Office of Strategic Planning, Analysis, and Engagement

Leads in strategic activities and international, domestic, and intergovernmental coordination across two divisions...



Systems, Economic,  
and Environmental  
Analysis



Strategic  
Engagement



# DOE is confident carbon management is technically feasible

**Carbon Capture  
Retrofit on  
Ethanol  
Production**

**Archer Daniels**

**2010**



**Carbon Capture  
Retrofit on  
Hydrogen  
Production**

**Air Products**

**2013**



**Carbon Capture  
Retrofit on  
Coal-Fired  
Power Plant**

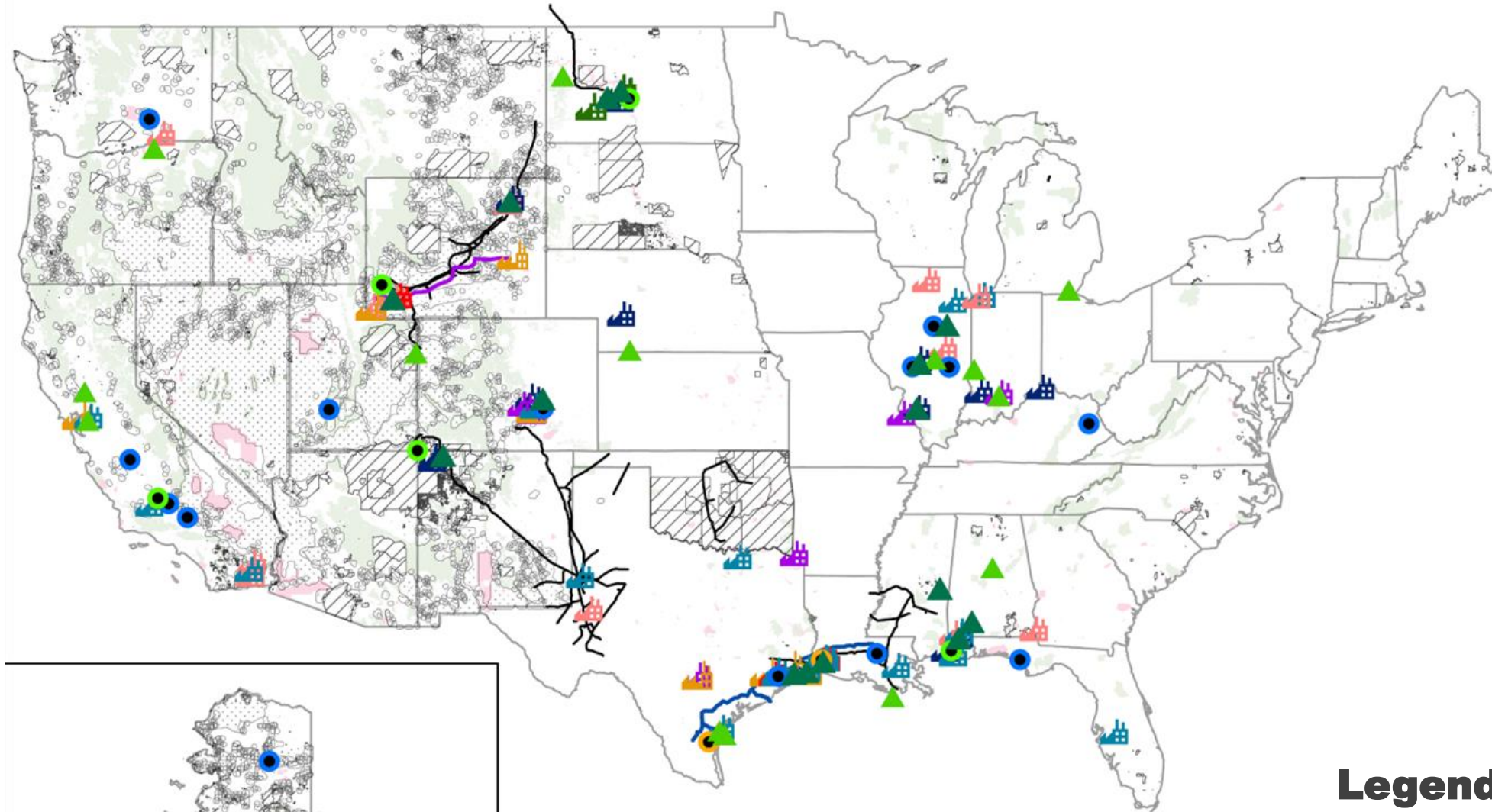
**Petra Nova**

**2016**





# Carbon Management –



## Legend

### CarbonSAFE

- Phase II
- Phase III

### DAC Hub

- TA1
- TA2

### TA3

### PreFEED/FEED Study

- Cement
- Chemicals
- Power-Coal
- DAC

### Ethanol

- Power-Natural Gas
- Hydrogen

### FEED Pipeline Selected

- Carbon Solutions – WyoTCH

### HEP – Gulf Coast Decarb System

- Existing CO2 Pipeline
- Tribal Lands
- Bureau of Land Management
- Department of Defense
- Forest (USFS)

Map Credit: National Energy Technology Laboratory, Research & Innovation Center  
September 12, 2023  
Data Sources: U.S. Census Bureau, EPA, Niche's Verity Velocity Suite, NREL, NETL



# Funding for Carbon Management Approaches



## H<sub>2</sub> with Carbon Management

Conversion of carbon-based feedstocks to H<sub>2</sub> coupled with carbon management



## Carbon Dioxide Removal

Removal of atmospheric CO<sub>2</sub> and durable store



## Carbon Conversion

Conversion of CO<sub>2</sub> to value-added products



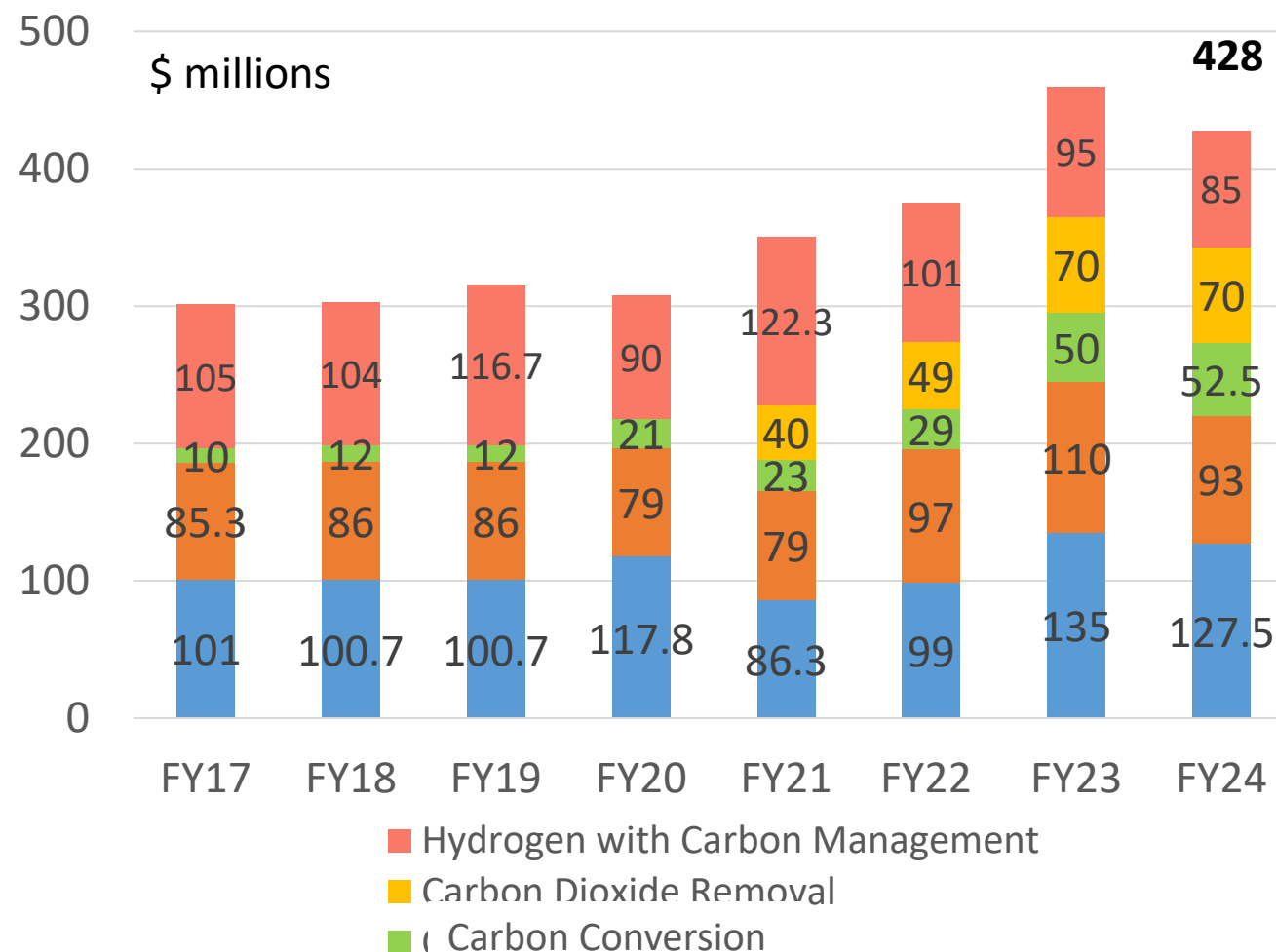
## Carbon Storage

Safe, cost-effective, and permanent geologic storage of CO<sub>2</sub>



## Carbon Capture

Capturing CO<sub>2</sub> from new and existing industrial and power plants



# Point Source Carbon Capture

*Advancing technologies for the capture of CO<sub>2</sub> from point sources, such as natural gas power and industrial facilities, with minimum cost and energy penalty.*

## Major program areas:

- Capture from power generation sources
- Capture from industrial sources
- Emissions control
- R&D solvents, sorbents, membranes, novel concepts

FY24 Congressional Budget:  
**\$127.5M**

### Components



Testing novel materials & processes with simulated exhaust

### Small Pilots



Bench- and Pilot-scale technology testing with real flue gas

### Large Pilots



Engineering scale for integrated capture system

No storage

### Demo



Unit-wide  
Carbon transport & storage



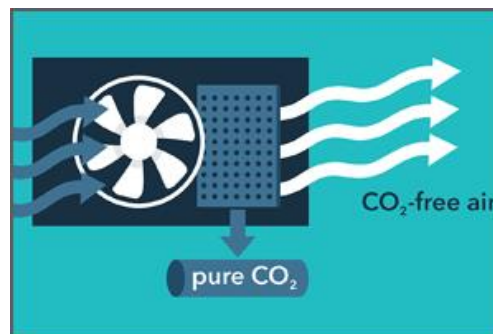
# Carbon Dioxide Removal (CDR)

*Advance diverse CDR approaches in service of facilitating gigaton-scale removal by 2050, emphasizing robust analysis of life cycle impacts of various CDR approaches and a deep commitment to environmental justice, including rigorously evaluating CDR, defining conditions for success and leveraging leadership and expertise.*

## Major program areas:

- Direct air capture
- Biomass Carbon Removal and Storage (BiCRS)
- Ocean CDR
- Enhanced Mineralization

FY24 Congressional Budget: \$70M



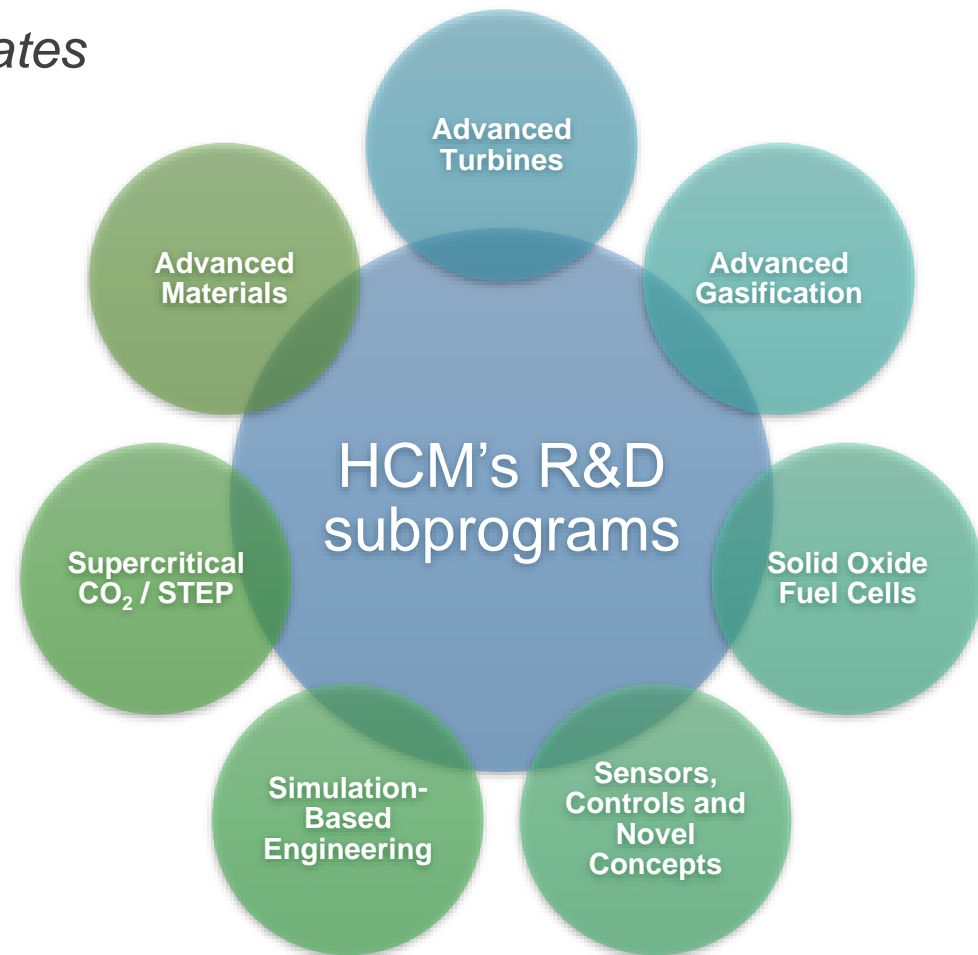
# Hydrogen with Carbon Management

*Hydrogen with Carbon Management (HCM) division integrates carbon neutral or net-negative greenhouse gas (GHG) emissions technologies with carbon capture and storage (CCS) capabilities and improved fuel conversion efficiency.*

## Major program areas:

- Improving efficiency
- Increasing plant availability
- Achieving ultra-low emissions
- R&D overall system efficiency, reducing capital and operating cost, enabling affordable carbon capture

FY23 Congressional Budget: **\$85M**





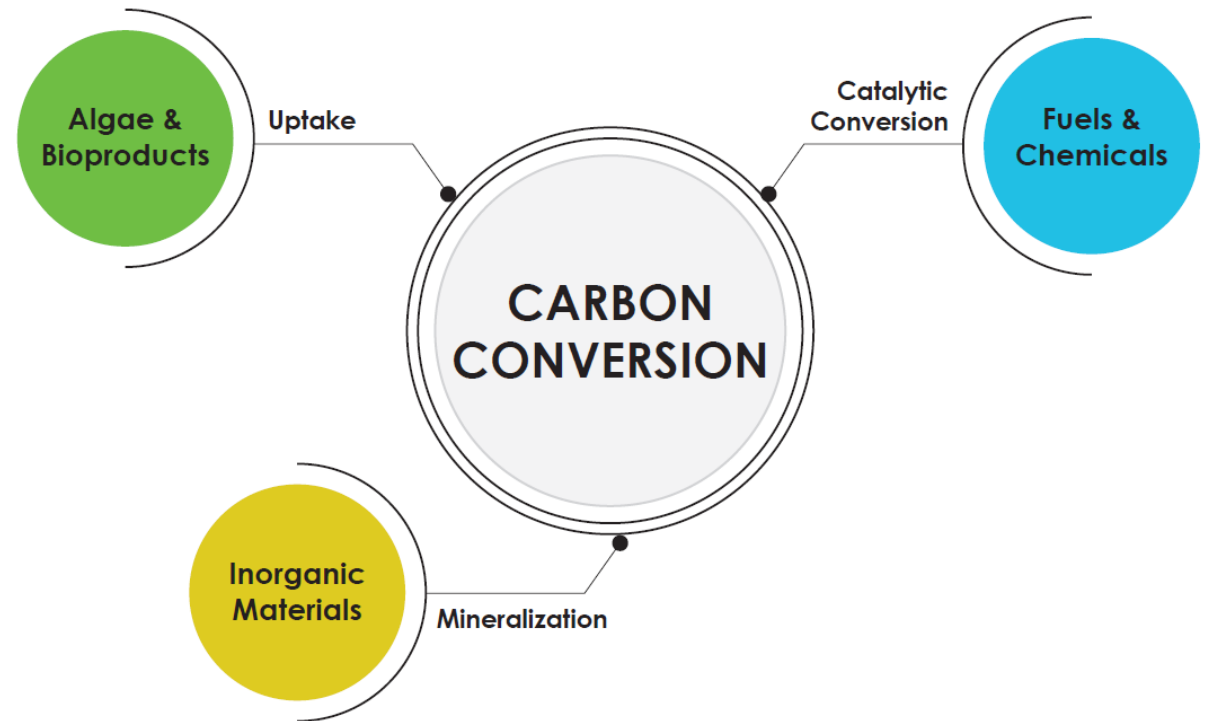
# CO<sub>2</sub> Conversion

*Research, develop and demonstrate a broad suite of technologies that convert CO<sub>2</sub> into environmentally responsible, equitable and economically valuable products and enable low-carbon supply chains to meet the goal of a decarbonized economy by 2050.*

## Three major program areas:

- Biological Uptake
- Catalytic Conversion
- Mineralization

FY23 Congressional Budget:  
**\$52.5M**



# CO<sub>2</sub> Transport Program

## **Pre-Front-End Engineering Design Studies:**

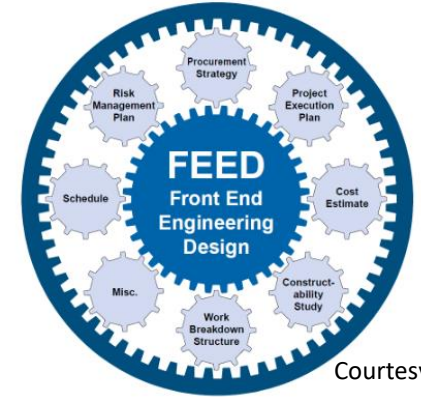
- Supports conceptual design & development of commercial-scale, intermodal CO<sub>2</sub> transport HUBs
- HUB designs may include multiple integrated transportation modes, including but not limited to pipeline, rail, maritime, truck and facilitate offtake of CO<sub>2</sub> streams at various conditions and compositions.

## **Front End Engineering Design Studies:**

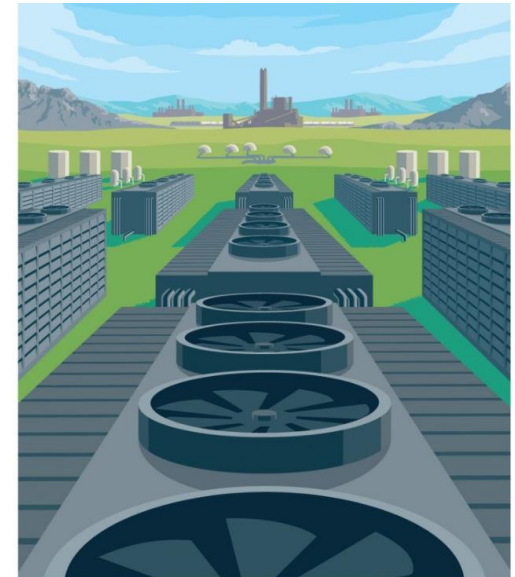
- BIL provides \$100 million for carbon transport infrastructure FEED studies
- Accelerate the planning and development CO<sub>2</sub> transportation infrastructure by a variety of modes, such as through rail, trucks, ships, and pipelines

## **CO<sub>2</sub> Infrastructure Finance and Innovation Act (CIFIA):**

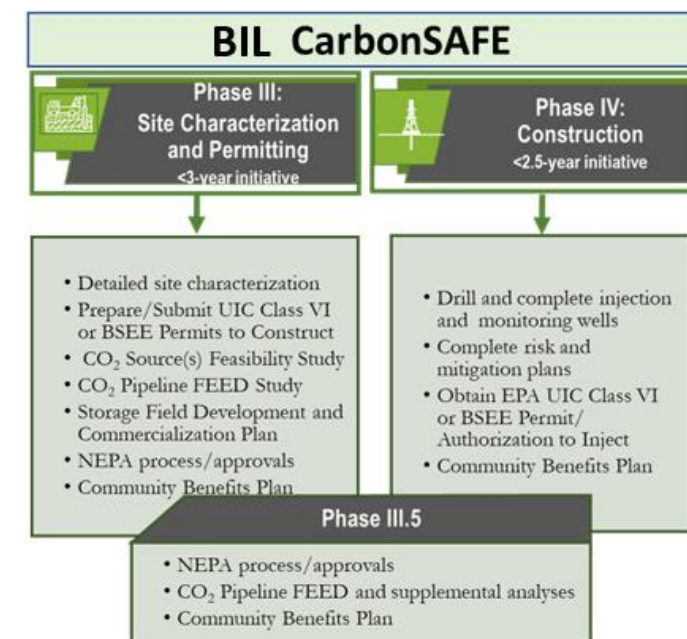
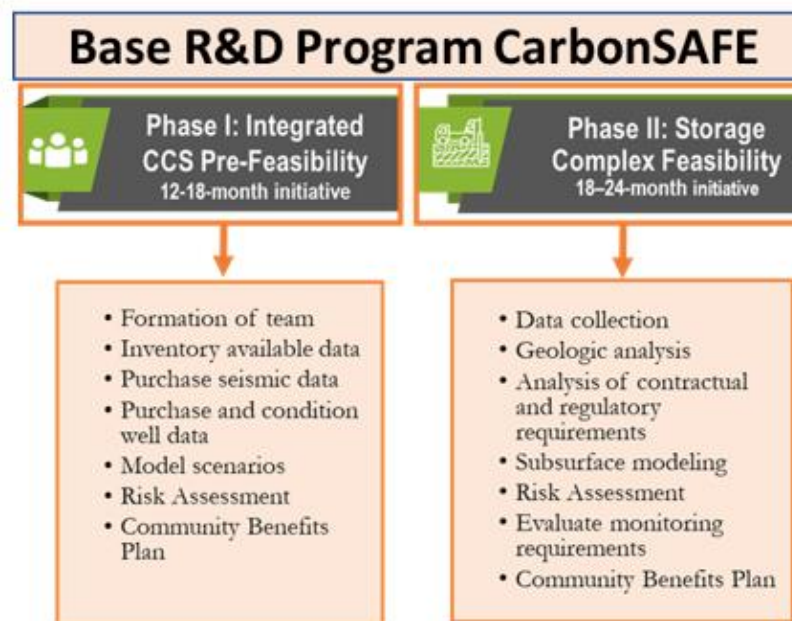
- DOE Loan Program Office financing large scale transport construction
- CIFIA supports CCUS and DAC technology deployment by financing projects that build shared CO<sub>2</sub> transport infrastructure
- BIL provides \$2.1 billion for CO<sub>2</sub> transport infrastructure projects including:
  - Secured loans and loan guarantees (“CIFIA Loans”)
  - Grants for building excess capacity on new and existing CO<sub>2</sub> infrastructure
- Managed via a partnership between DOE’s Fossil Energy and Carbon Management Office, DOE's Loan Programs Office, and the National Energy and Technology Lab



Courtesy: Valency



# Carbon Storage Program



**2003**

- DOE-led regional partnerships to validate CO<sub>2</sub> geologic storage.
- Completed injection test projects, with no negative impacts to human health or the environment.

**2016**

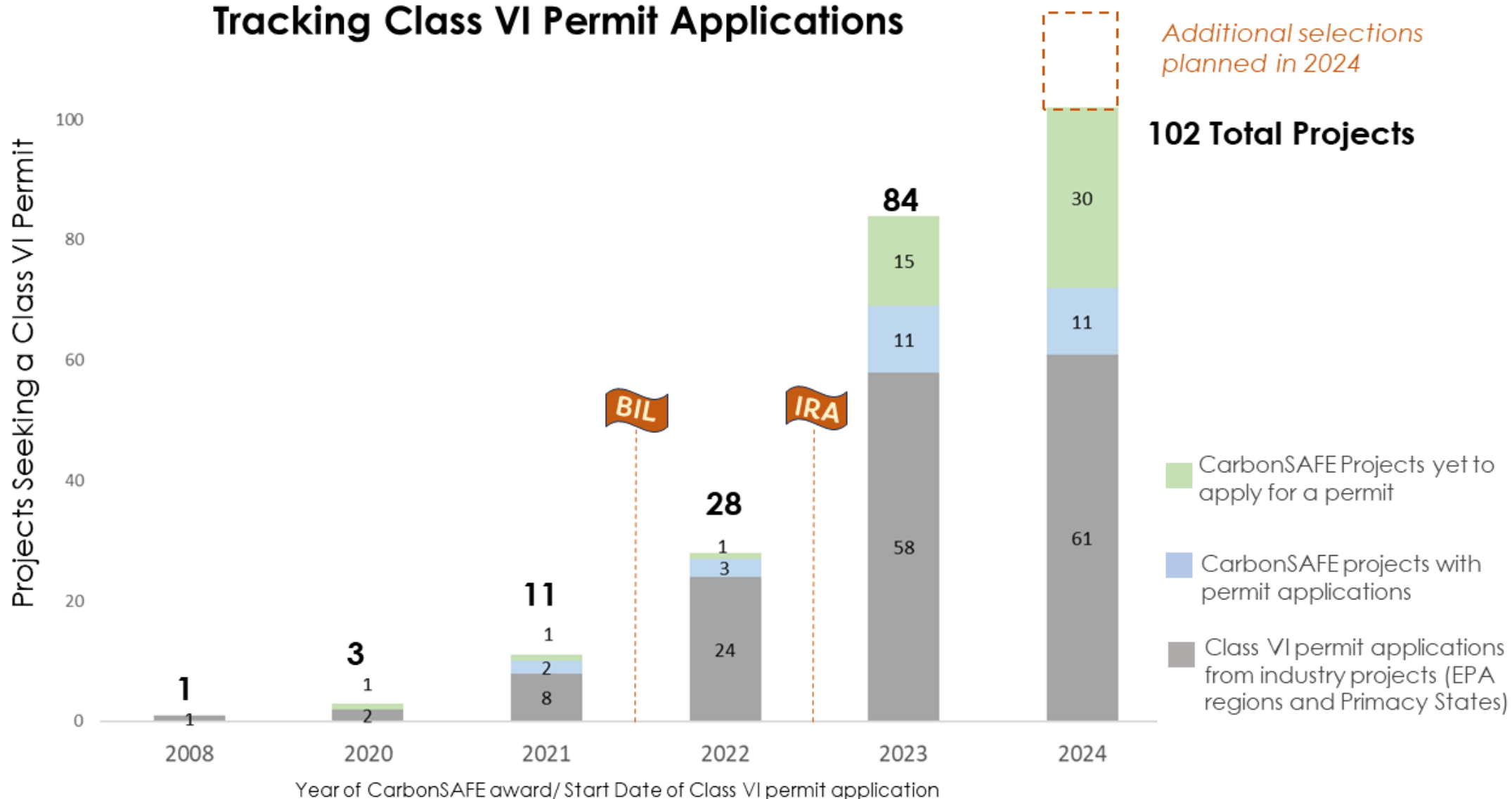
- Successful tests led to the CarbonSAFE program.
- Focused on ensuring CO<sub>2</sub> storage sites will be ready for integrated CCS system deployment in the 2025-2030 timeframe.

**2023**

- BIL builds on last 20+ years of CO<sub>2</sub> research.
- Enables commercial deployment of CO<sub>2</sub> storage.

# Carbon Storage Project Growth

## Tracking Class VI Permit Applications







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A collage of five images related to energy and science: a tall industrial tower, two scientists in a lab, two field researchers, a large array of solar panels, and a row of laboratory beakers.

# Thank You!

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## Questions?

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