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Point Source Carbon Capture for Industrial Decarbonization

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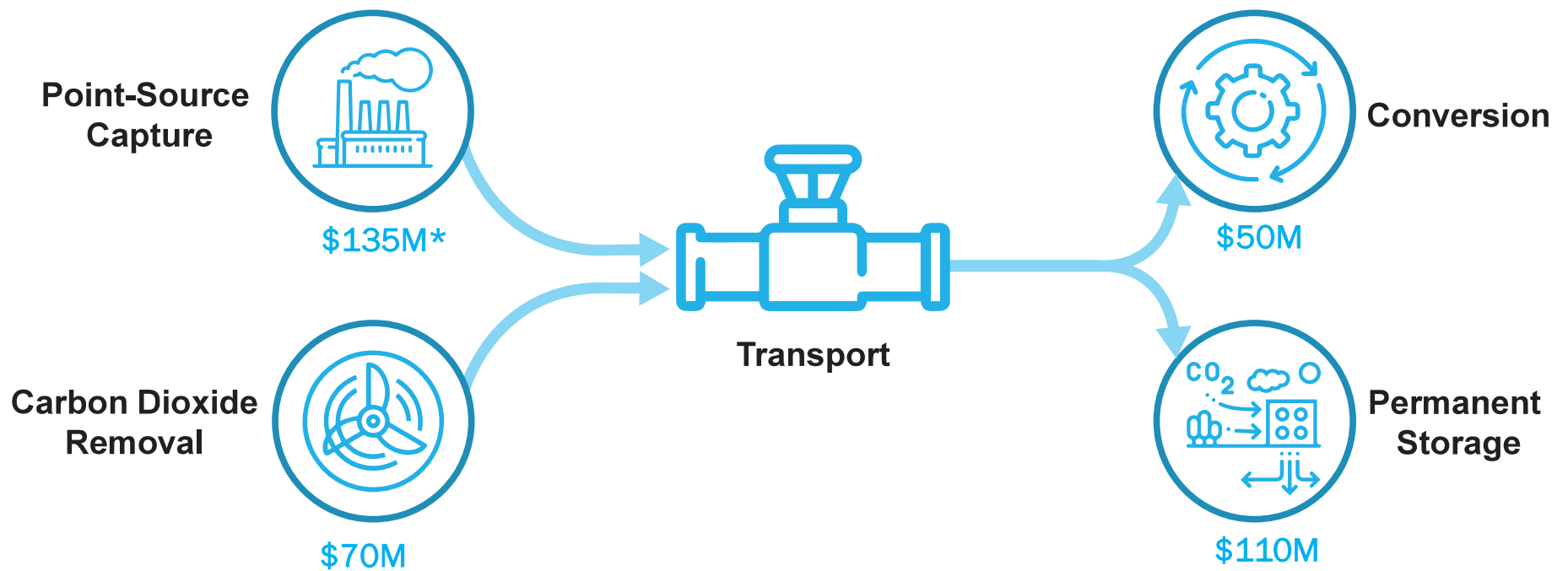
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U.S. DEPARTMENT OF
ENERGY

Fossil Energy and
Carbon Management

“Carbon management” refers to:



* FY 23 Enacted Budget

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



CO₂ 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

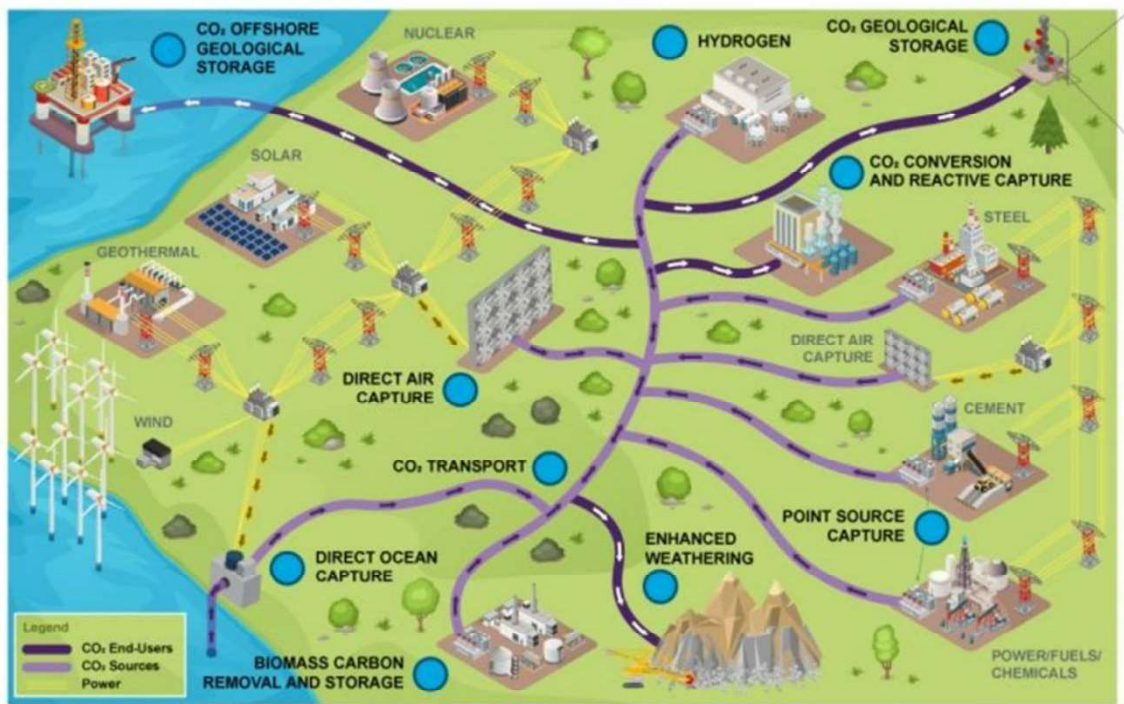


Strategic Engagement

Integrated carbon management

*Dedicated and Reliable
Carbon Storage*

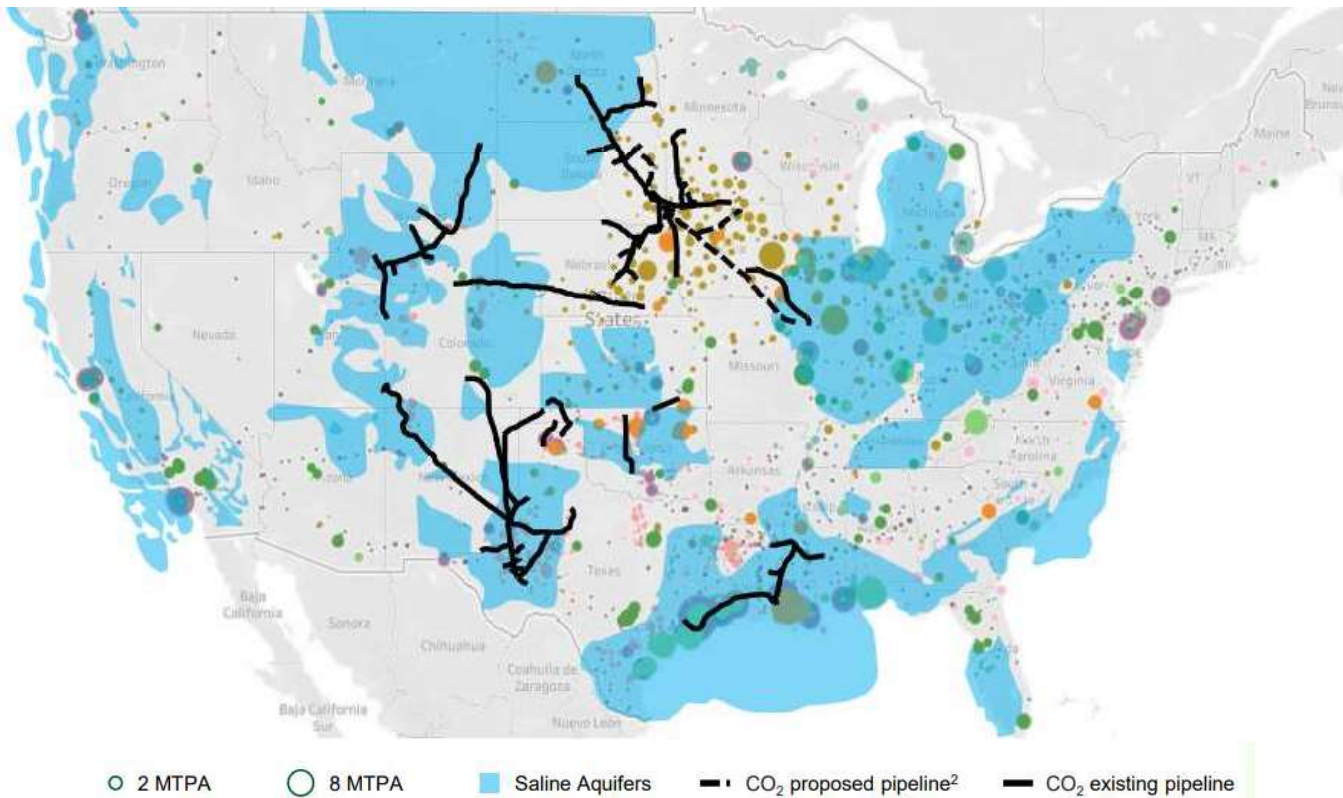
*Low-Carbon
Energy*



*Point-Source
Carbon Capture*

Carbon Dioxide Removal

Carbon management is one solution to address industrial emissions



Point source CO₂ emissions by sector¹, MTPA

■ Potentially addressable through CCUS
 □ Unlikely to be addressed through CCUS

Refineries	56	178
Pulp and paper	117	130
Chemicals	27	107
Ethanol	46	77
Iron and steel	7	72
Cement	50	67
NG Processing	17	60
Hydrogen	40	44
Ammonia	32	35
LNG equipment	0	34

~2,500 facilities 10 sectors

[Pathways to Commercial Liftoff: Carbon Management \(energy.gov\)](https://www.energy.gov/pathways-to-commercial-liftoff-carbon-management)

Carbon capture evolution at DOE

1st and 2nd Generation Technologies

2025: \$40/tonne CO₂



2008 -

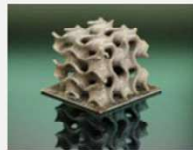
- ✓ Lower CAPEX/OPEX
- ✓ Reduced regeneration energy
- ✓ Increased working capacity

Transformational Technologies

2030: \$30/tonne CO₂



Hollow Fibers



3D Print



Biphase Solvent

2015 -

- ✓ Water Lean Solvents
- ✓ Adv. Membranes
- ✓ Hybrid Systems
- ✓ Process Intensification

Scale-up



TCM

2018 -

- ✓ Engineering Scale testing
- ✓ FEED studies

Negative Emissions Technologies & Industrial



Carbon Engineering, DAC



Ethanol Plant

2020 -

- ✓ DAC & BiCRS
- ✓ Industrial
- ✓ NG

CCS FEEDs for cement plants

Pre-FEEDs



LafargeHolcim Cement Plant
Florence, CO

1.5 MTA CO₂

Svante's VeloxoTherm™
adsorption-based process



Balcones Cement Plant,
New Braunfels, TX

1 MTA CO₂

MTR's Polaris membrane



FEEDs



Holcim Ste. Genevieve Cement Plant
Bloomsdale, Missouri

2.9 MTA CO₂

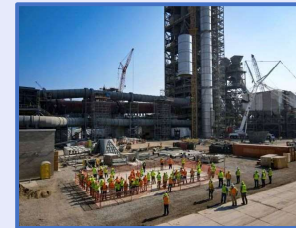
Air Liquide' Cryocap FG



Balcones Cement Plant,
New Braunfels, TX *

1.6 MTA CO₂

RTI's Non-Aqueous Solvent



Mitchell Cement Plant
Mitchell, IN

2 MTA CO₂

MHI's KS-21



Ash Grove Foreman
Foreman, AR

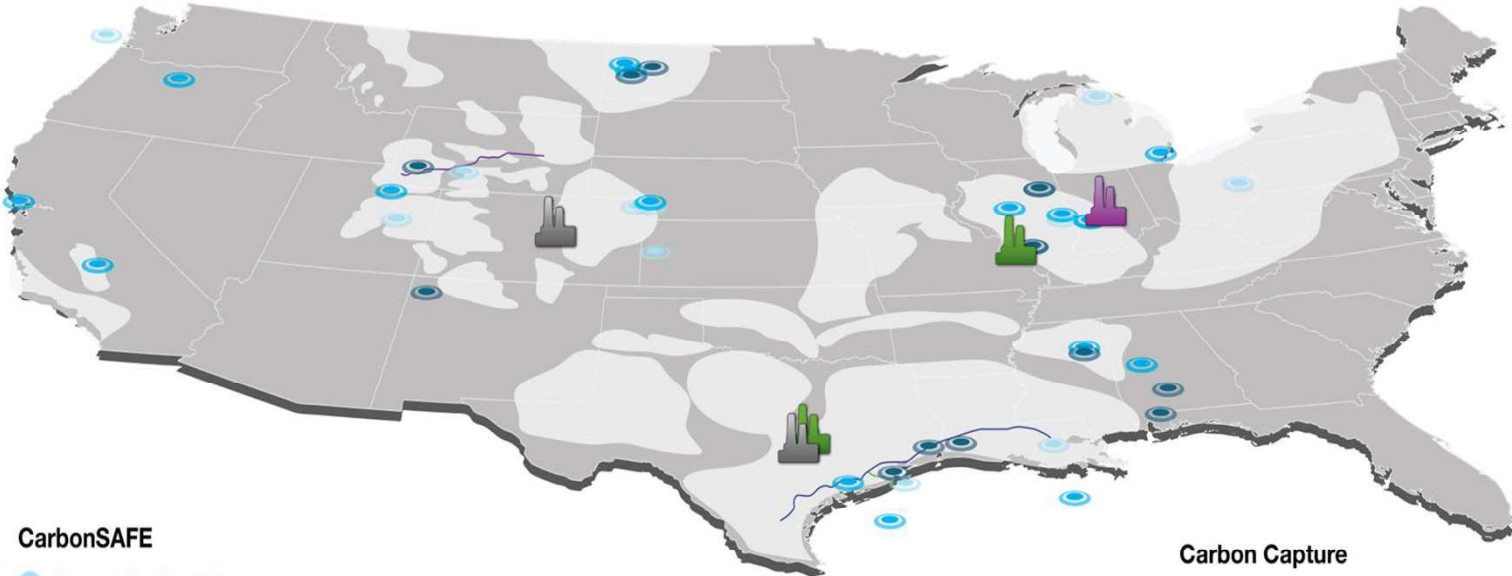
Air Liquide' Cryocap FG



* Selected projects for integrated Carbon Management under FOA 2738, under negotiations



CCS FEEDS for cement plants



- CarbonSAFE**
- Phase 1: Pre-Feasibility
 - Phase 2: Feasibility
 - Phase 3: Site Characterization and CO₂ Capture Assessment

- Carbon Capture**
- Active
 - Completed
 - Not Awarded Yet



Bipartisan Infrastructure Law & IRA funding: Carbon management



Carbon Transport and Storage

\$2.5B for expanding storage capacity

\$100M for CO₂ transportation engineering studies

\$2.5B CO₂ transportation loan support via CIFIA program

Carbon Capture & Industrial Decarb

\$2.5B Commercial CCS demo
\$1B Large CCS pilots

\$6.3B: Industrial Decarbonization

Carbon Dioxide Removal

\$3.5B for DAC Hubs
\$115M for DAC Prizes

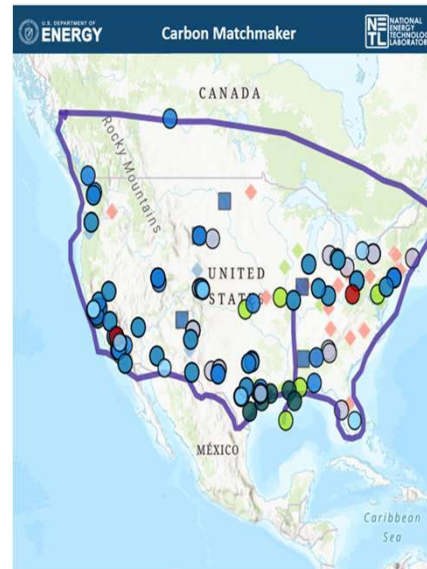
Carbon capture program: *Outreach*



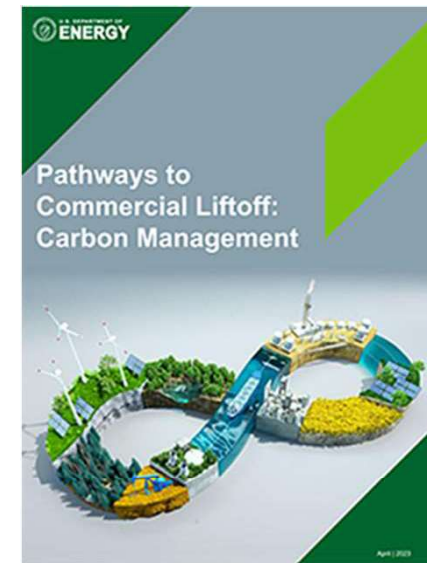
Carbon Capture Newsletter



Carbon Capture Program R&D Compendium



Carbon Matchmaker



Commercial Liftoff Report

[Pathways to Commercial Liftoff: Carbon Management \(energy.gov\)](https://www.energy.gov)

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

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