



U.S. DEPARTMENT OF
ENERGY

Fossil Energy and
Carbon Management

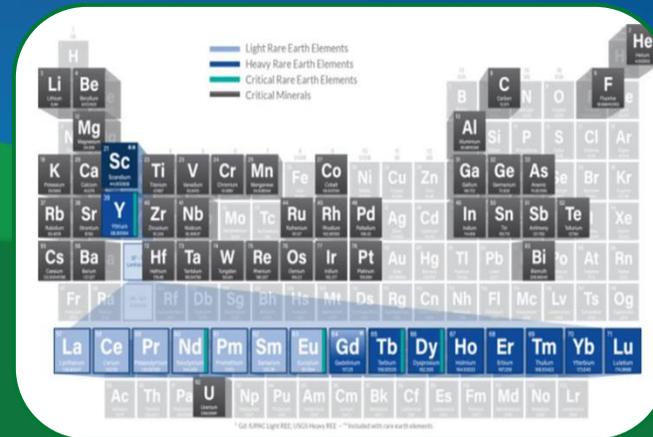
Carbon Capture Program at DOE

BIL Provisions Implementation Update & Progress toward decarbonization of Industrial and Power Sectors

Dan Hancu

Senior Program Manager, Point Source Carbon Capture
FOSSIL ENERGY AND CARBON MANAGEMENT

November 2nd, 2022



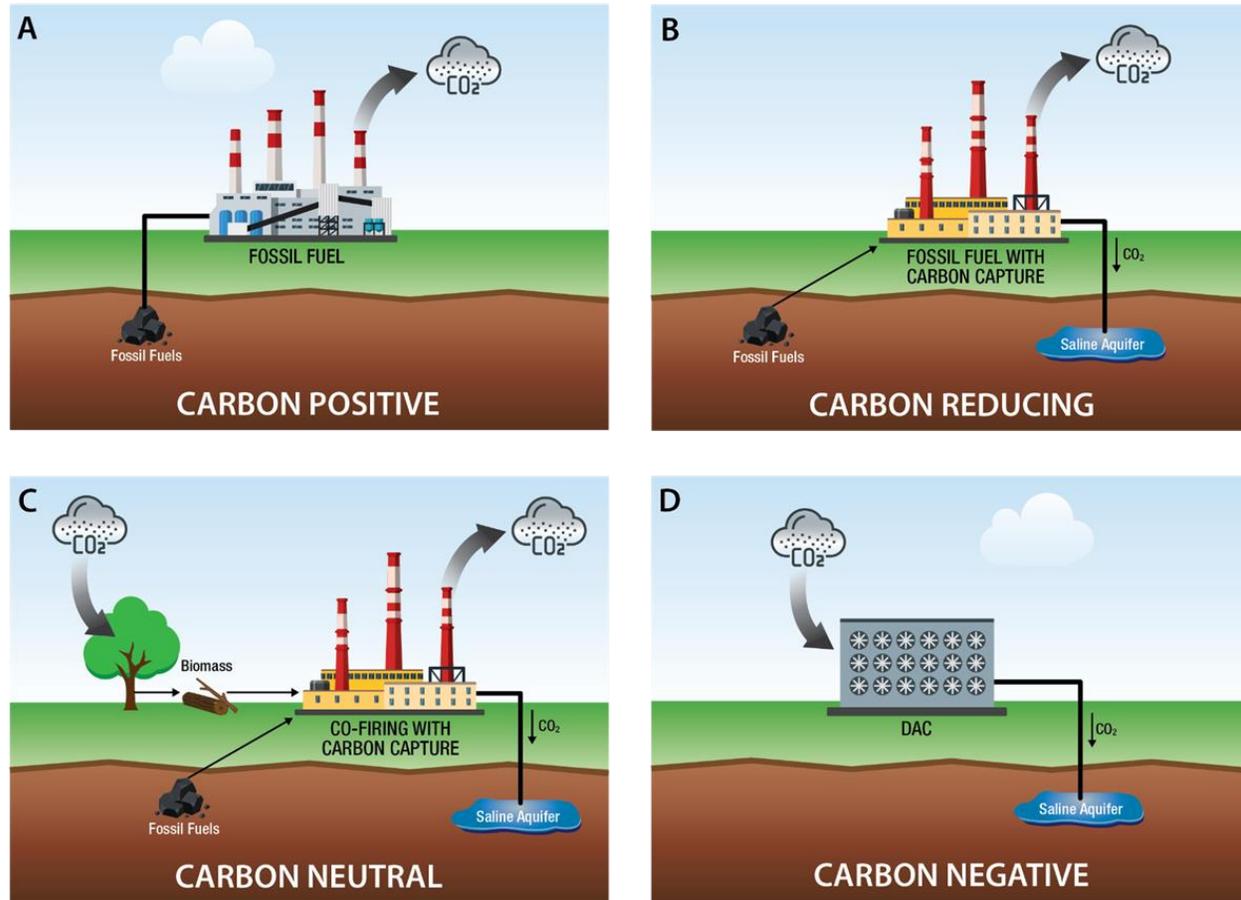
Agenda

- **What is CCUS?**
 - ❑ Carbon Dioxide Removal (CDR) vs. Point Source Carbon Capture (PSC)
 - ❑ Pre- and Post- Combustion
 - ❑ Carbon storage
- **DOE Realignment**
 - ❑ Fossil Energy and Carbon Management (FECM), Office for Clean Energy Demonstrations (OCED)
- **Infrastructure Bill**
 - ❑ Carbon managements provisions.. CCS Demos, DAC Hubs, Carbon Capture Large Pilots, CO₂ Transportation FEEDs, Carbon Storage
- **FECM Carbon Capture Program**
 - ❑ Program structure; technical approach; industrial, power, DAC

Administration's goals:

- ✓ *50% emissions reduction by 2030*
- ✓ *Carbon emissions-free power sector by 2035*
- ✓ *Net zero emissions economy by no later than 2050*

Carbon Dioxide Removal vs Carbon Reducing



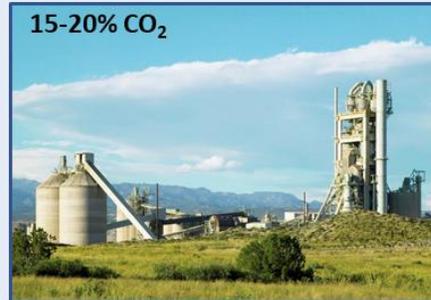
Carbon Negative vs. Carbon Reducing

CARBON REDUCING

Point-Source Capture (PSC) for Power Generation and Industrial Sectors



Power Plants



Cement Plants



Steel Plants



Hydrogen Plants

CARBON NEGATIVE

Carbon Dioxide Removal (CDR) from Air



Direct Air Capture (1)



Enhanced Weathering



Bioenergy Carbon Removal and Storage (BiCRS)

(1) Assume C storage as CO₂ off-take



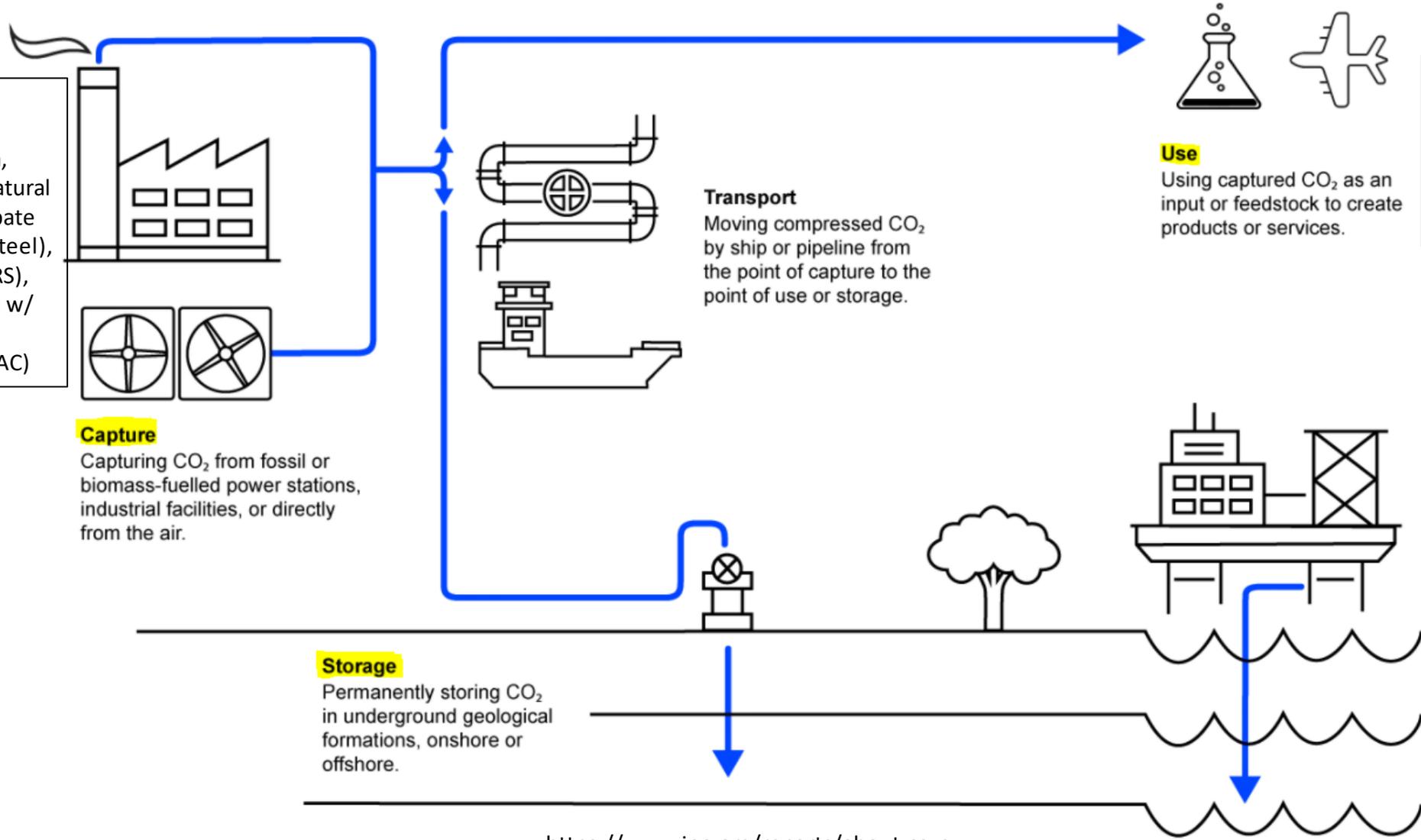
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Develop PSC / CDR technologies for a wide range of feed conditions

What is CCUS? Carbon Capture, Utilization, Storage

Applications:
 Ethanol, natural gas processing, ammonia, power generation (natural gas/coal), Hard-to-Abate industries (cement, steel), Biomass (BECCS/BiCRS), Hydrogen production w/ CCS, Direct Air Capture (DAC)



Capture
 Capturing CO₂ from fossil or biomass-fuelled power stations, industrial facilities, or directly from the air.

Transport
 Moving compressed CO₂ by ship or pipeline from the point of capture to the point of use or storage.

Use
 Using captured CO₂ as an input or feedstock to create products or services.

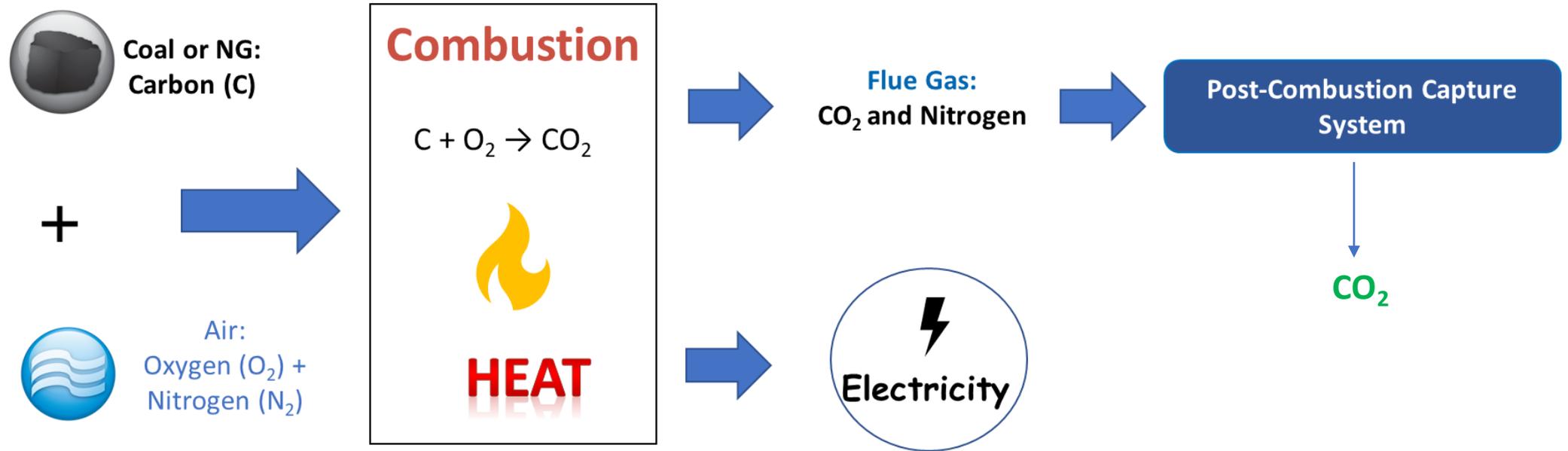
Storage
 Permanently storing CO₂ in underground geological formations, onshore or offshore.

Applications:
 Synthetic fuels and chemicals, CO₂-stored in cements or building materials, Enhanced Oil Recovery (EOR)

Geologic Carbon Sequestration
 (onshore/offshore)

<https://www.iea.org/reports/about-ccus>

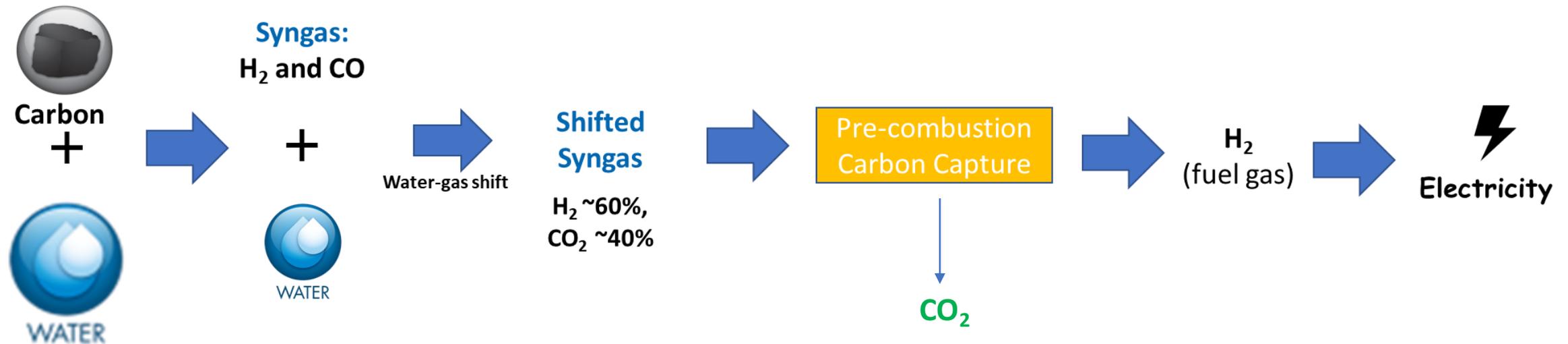
Point Source Carbon Capture.. **Post Combustion**



- Coal or natural gas (NG) is burned in air to make heat
- CO₂ is captured from flue gas **after** combustion

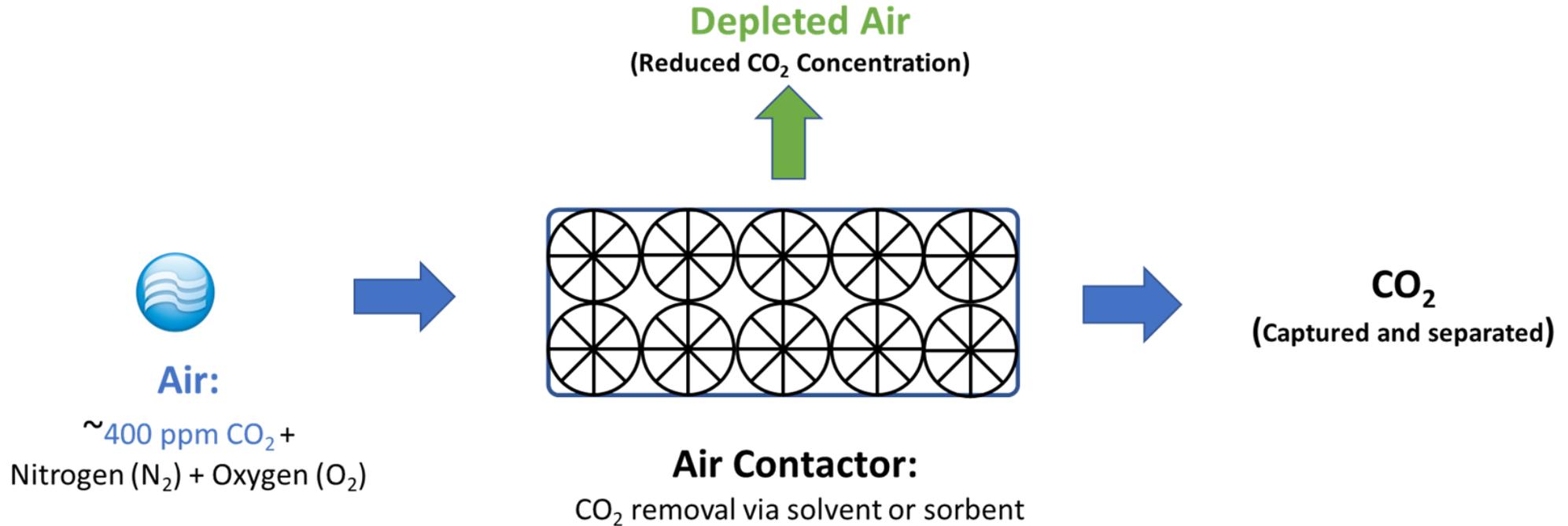


Point Source Carbon Capture.. Pre Combustion



- Carbon is reacted with water to make synthesis gas (syngas)
- CO₂ is captured from the shifted syngas **before** combustion

Carbon Dioxide Removal.. Direct Air Capture (DAC)



- Removes CO₂ from air
- Low CO₂ concentration increases energy requirement for separation

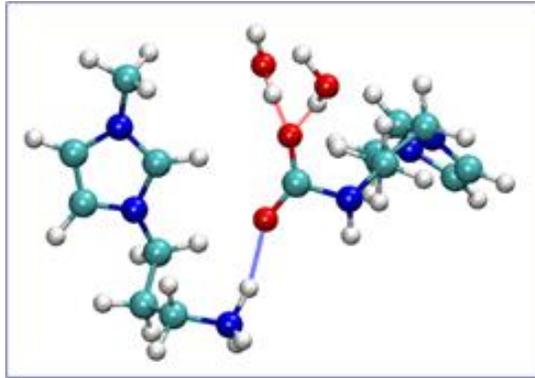


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Approaches to Carbon Capture

Solvents



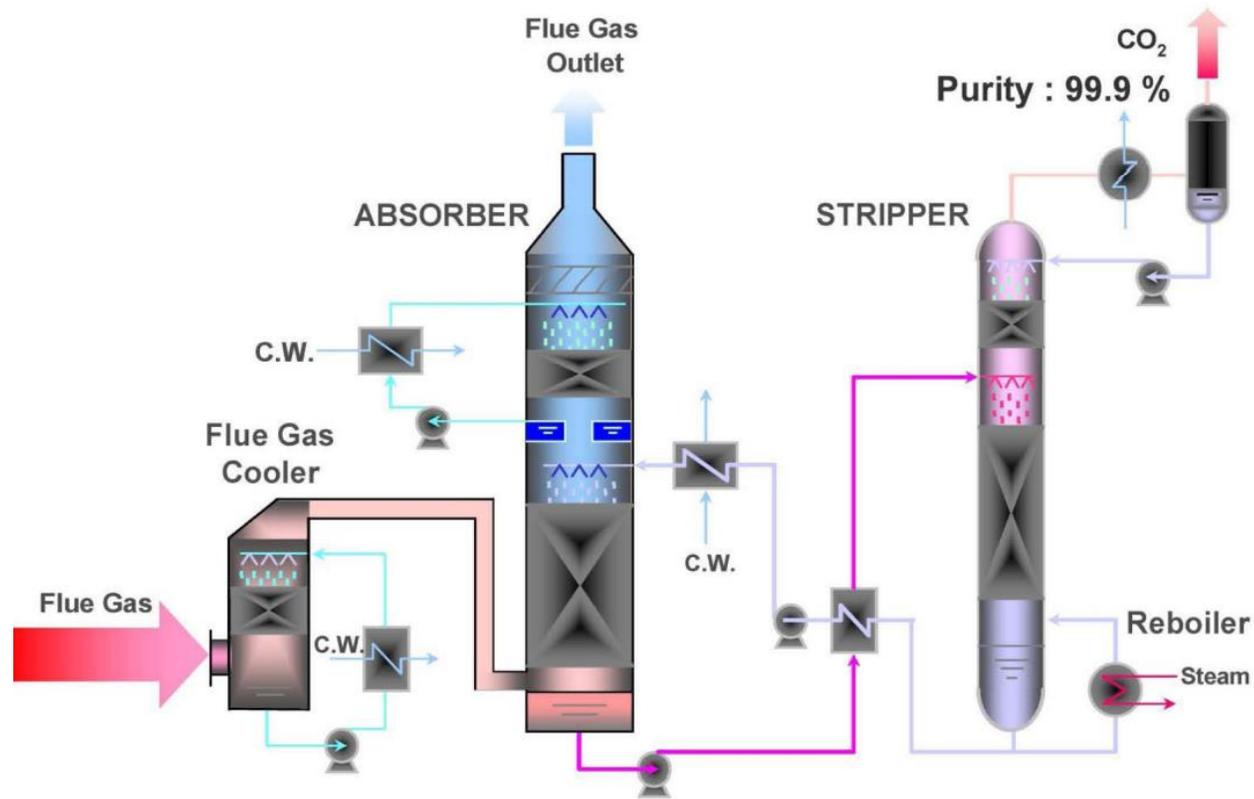
Sorbents



Membranes



Solvent-Based Carbon Capture



MHI: KM-CDR Process

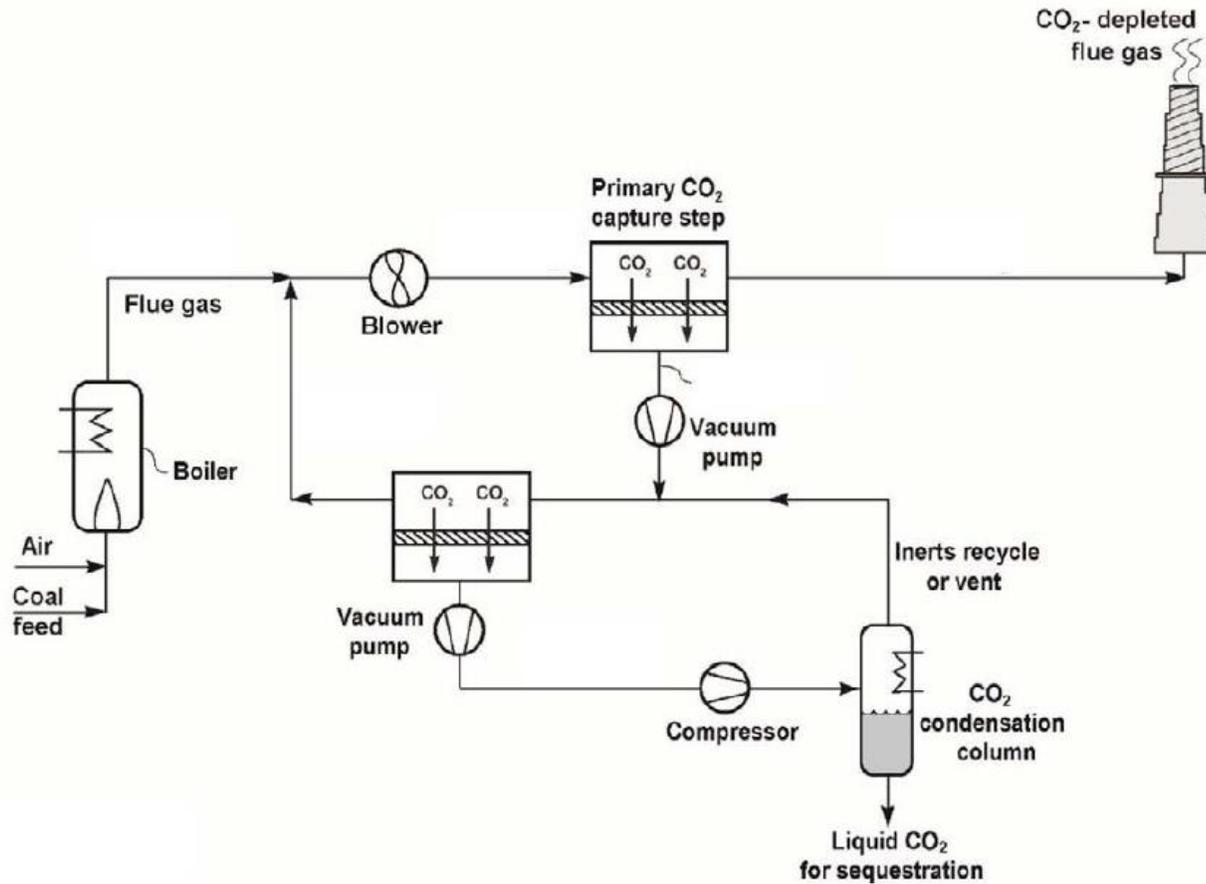
<https://www.netl.doe.gov/sites/default/files/netl-file/FE0003311.pdf>



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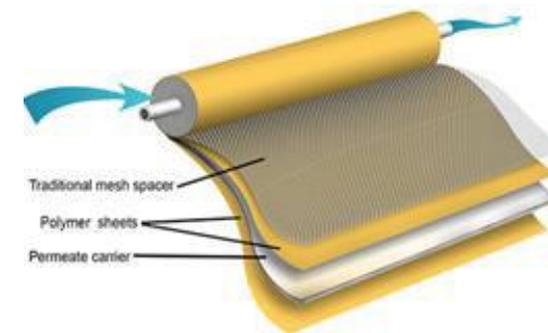
Membrane-Based Carbon Capture



MTR: Membrane Process



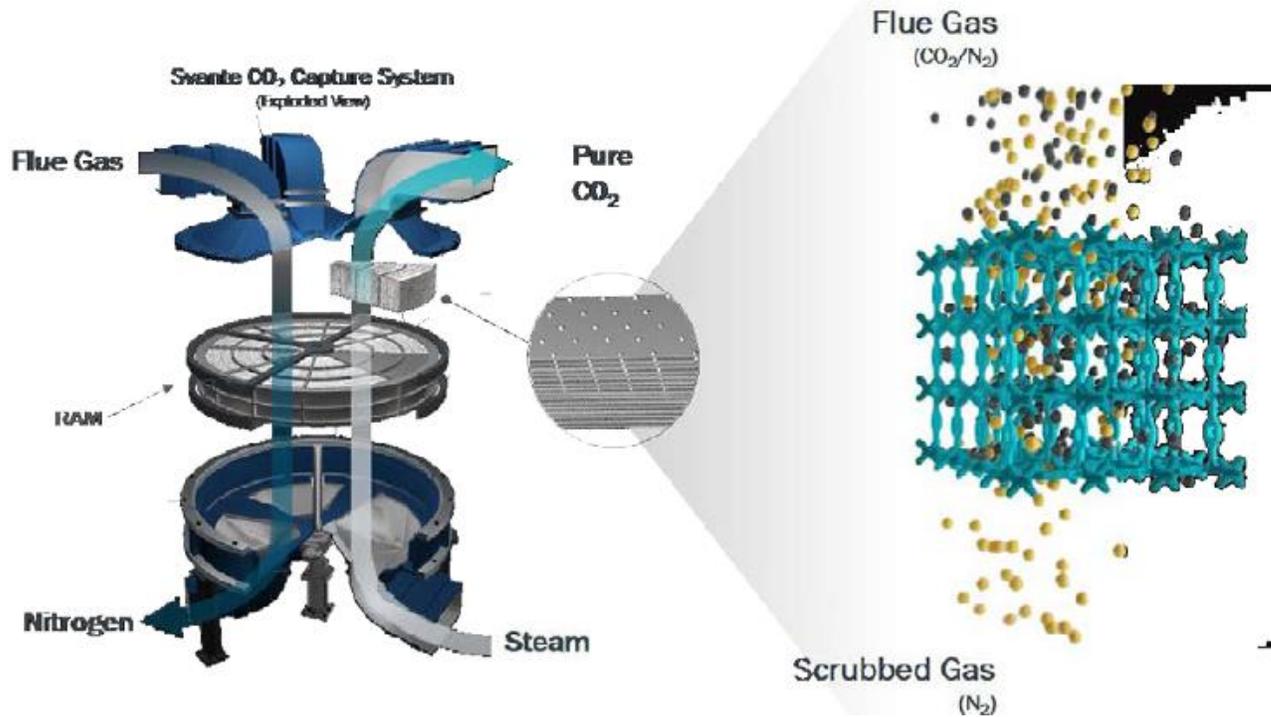
MTR Small Pilot
at National Carbon Capture Center



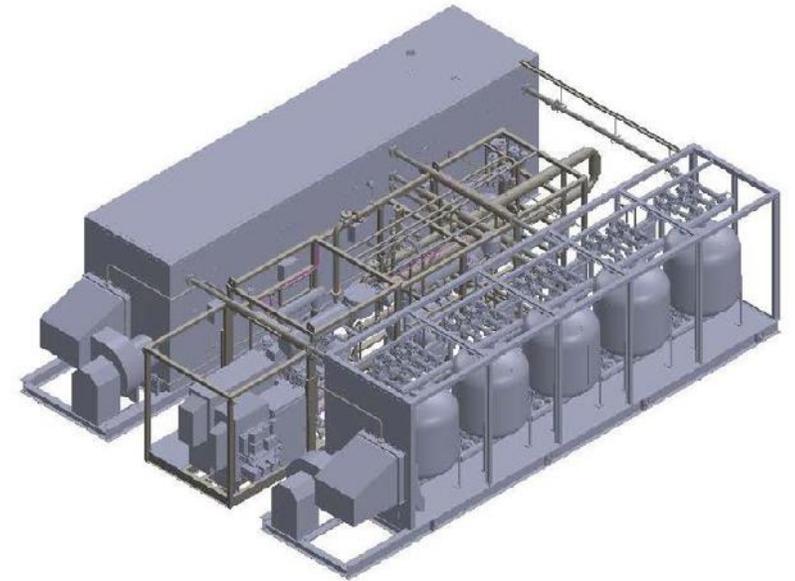
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Sorbent-Based Carbon Capture



Svante: Sorbent Process



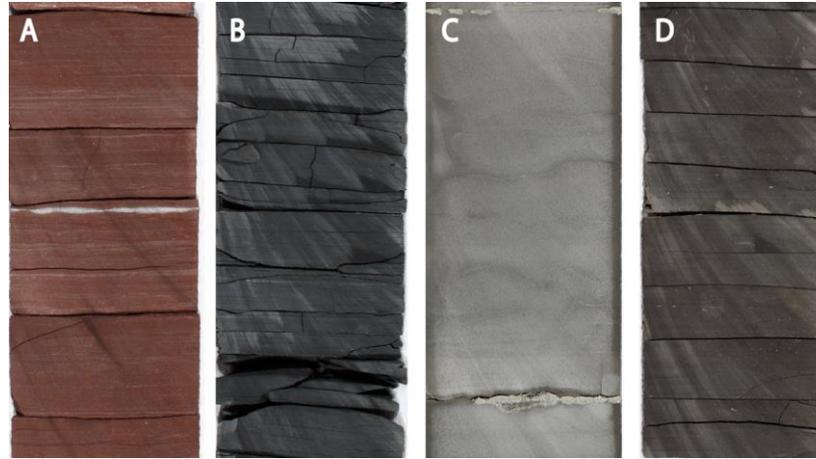
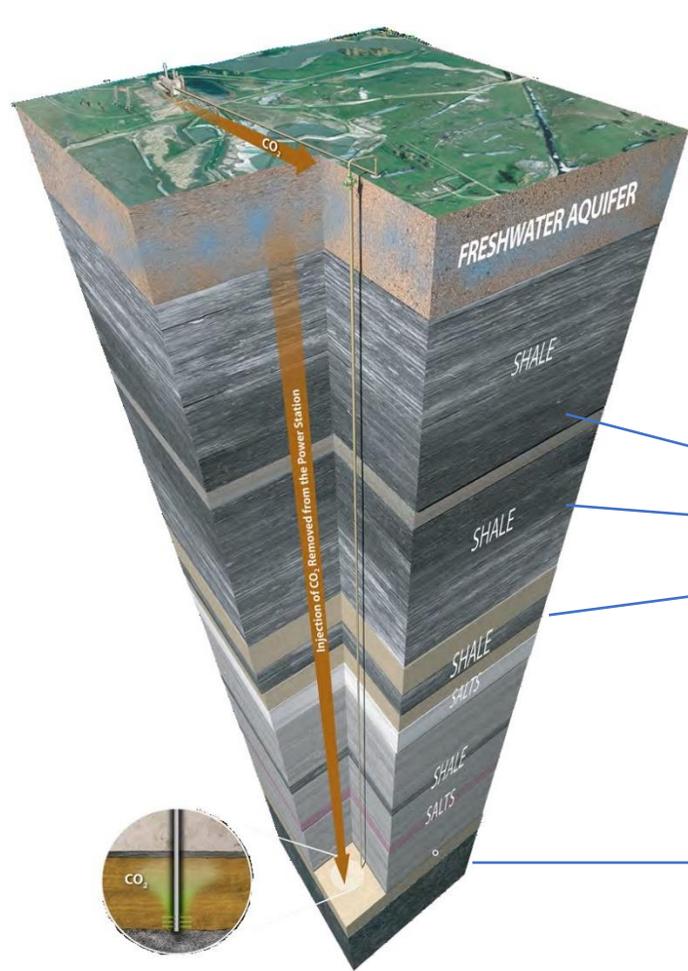
TDA: Sorbent Process



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Geologic Carbon storage: What keeps CO₂ safely stored underground?



Caprock
Shale as seal

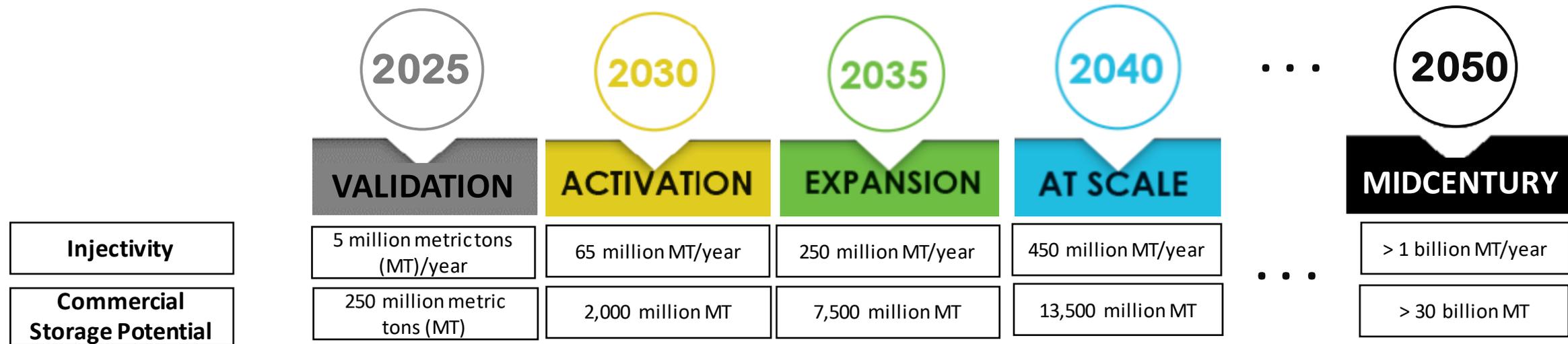
1000's of ft beneath surface –
at these depths, **supercritical**
CO₂ is stored in
porous sandstones



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Rapid CCUS and CDR Industry Growth Needed for Achieving U.S. Decarbonization Goals



Biden Administration Executive Order 14008
Tackling the Climate Crisis at Home and Abroad

50-52 percent reduction in economy-wide net greenhouse gas pollution in 2030 from 2005 levels

Net-zero emissions from the power sector by 2035

Net-zero emission economy by 2050

External Metrics and Goals

The National Academies of SCIENCES
ENGINEERING
MEDICINE
↑ CCUS 10X by 2030

ipcc
INTERGOVERNMENTAL PANEL ON climate change
Cumulatively sequester 350-1000 GT by 2050

CO₂ Transport Infrastructure:

The build out of CO₂ transport infrastructure enables CCUS and CDR industry growth and meeting midcentury decarbonization goals.

Today



2030

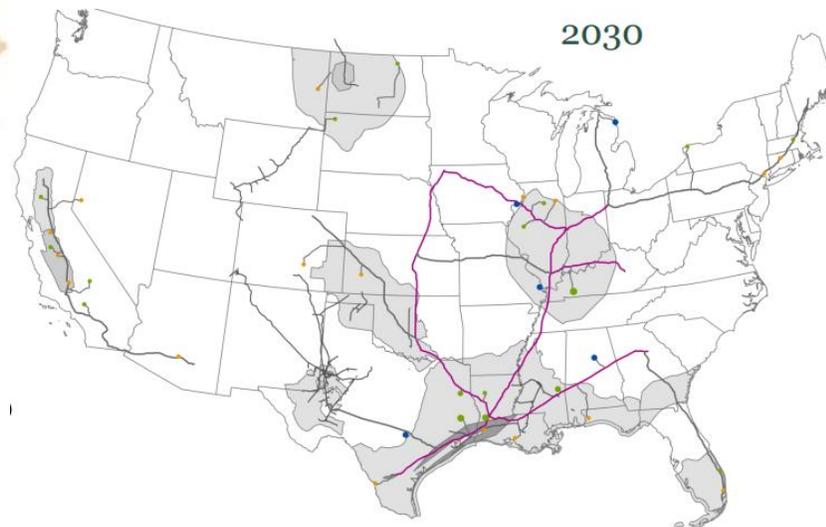


2050



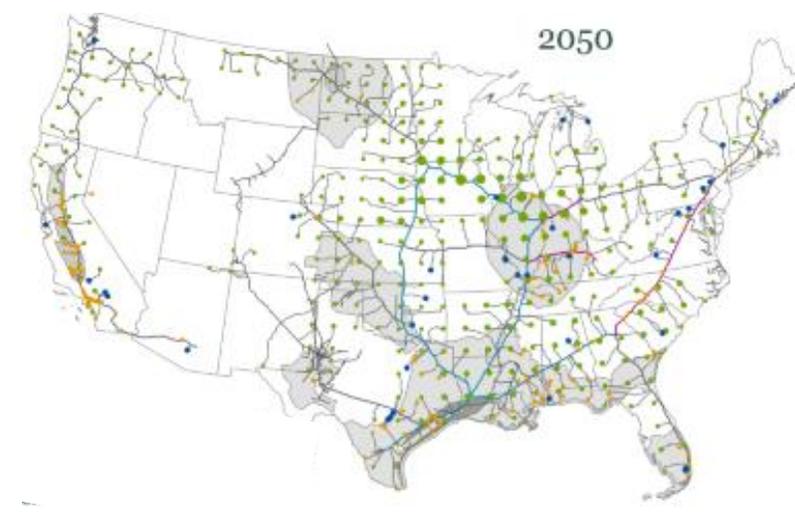
NPC: Meeting the Dual Challenge (2019)

5,000 miles of pipelines



Modeling from Princeton's Net-Zero America Study (2020)

11,000+ miles of pipelines



Modeling from Princeton's Net-Zero America Study (2020)

13,000+ miles of trunk pipelines
52,000+ miles of spur pipelines



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Administration's goals:

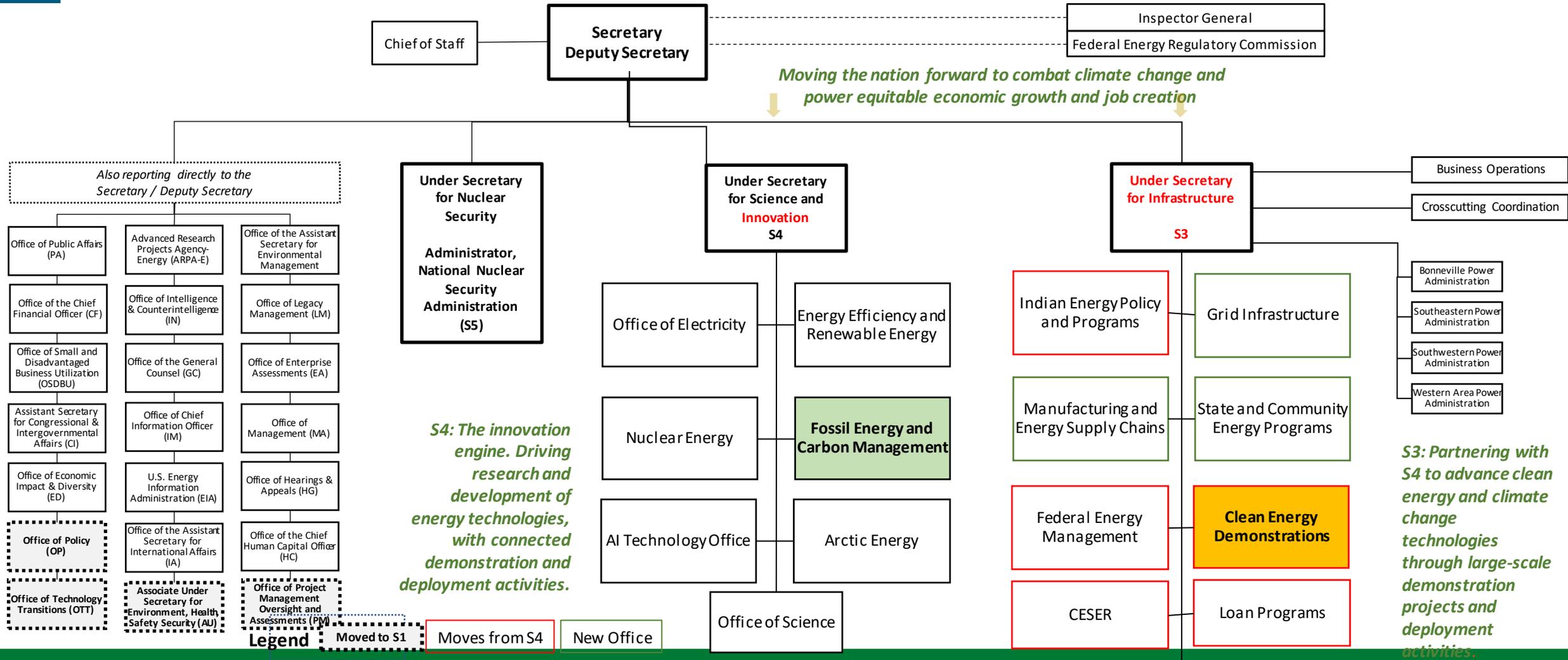
- ✓ *50% emissions reduction by 2030*
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Realigned DOE



Fossil Energy and Carbon Management (FECM)

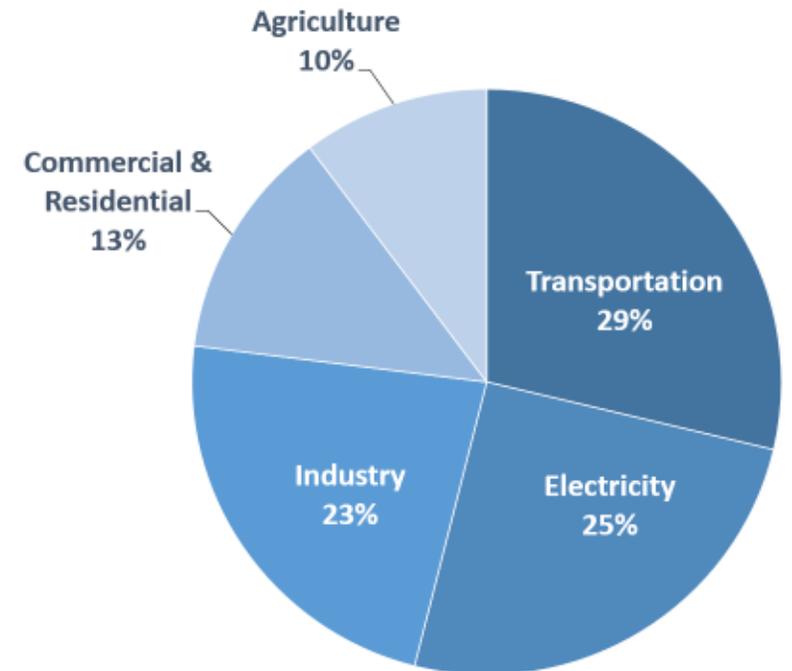
Office of Fossil Energy and Carbon Management

DOE-FE is now DOE-FECM

New name for our office reflects our new vision

- President Biden's goals:
 - 50% emissions reduction by 2030
 - CO₂ emissions-free power sector by 2035
 - Net zero emissions economy by no later than 2050

Total U.S. Greenhouse Gas Emissions
by Economic Sector in 2019



U.S. Environmental Protection Agency (2021). Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2019

FECM Mission: Deep Decarbonization

Minimize environmental and climate impacts of fossil fuels from extraction to use



Point-Source Carbon Capture (PSC)

Reduce the cost, increase the efficacy, and advance the deployment of commercial-scale point source capture technologies in the power and industrial sectors, coupled to storage.



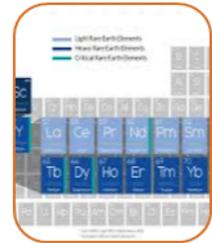
Methane Mitigation

Develop technologies and deploy regional initiatives to quantify and reduce methane emissions from fossil fuel infrastructure including coal, oil, and gas.



Carbon Dioxide Removal (CDR)

Invest in a diverse set of CDR approaches to support DOE's Carbon Negative Shot of just, sustainable, and scalable CDR at costs below \$100/net metric ton of CO₂-equivalent.



Domestic Critical Minerals (CM) Production

Support demonstrations for extraction and remediation to processing and refining for building a strong CM supply chain while creating good-paying jobs.



Carbon Transport and Storage

Make advancements in storage technologies and transport mechanisms, provide technical assistance in Class VI well permitting, and support large-scale transport and storage facilities and regional hubs.



Hydrogen with Carbon Management

Hydrogen production coupled with carbon capture and storage using sustainably sourced carbon-based feedstocks. Invest in the advancement of hydrogen storage, fuel cells, and 100 percent hydrogen-fired turbines, supporting DOE's Hydrogen Shot target.



Carbon Dioxide Conversion

Accelerate capabilities for large-scale conversion of CO₂ into products that advance net-zero goals, facilitated by markets that use CO₂ as a feedstock.



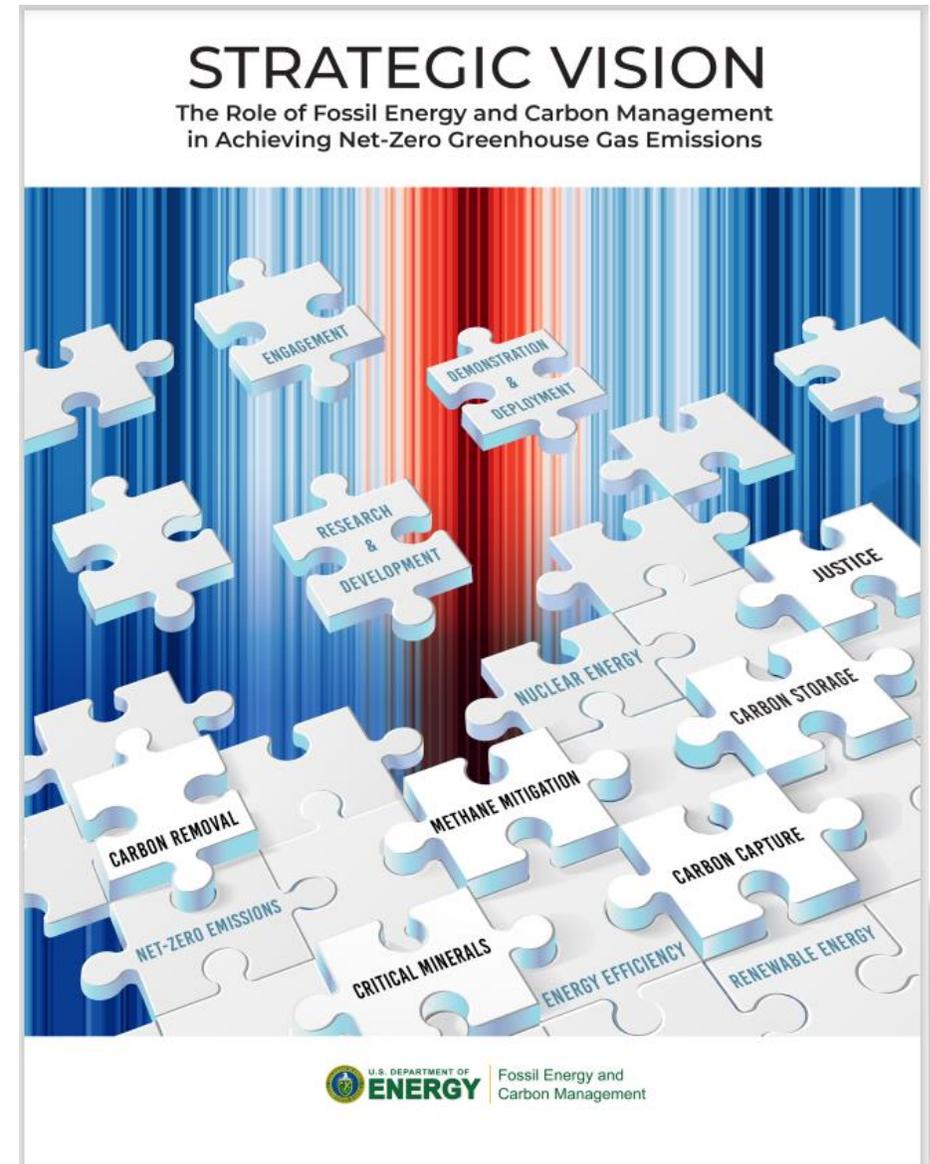
Justice, Labor, and Domestic and International Collaboration

Collaborate with domestic and international partners to create a sustainable energy infrastructure with equity and justice at the core of FECM's work.

FECM Strategic Vision

Released April 5, 2022

Chapter 1 Crosscutting Themes for the Future of The Office of Fossil Energy and Carbon Management (FECM)	1
Chapter 2 Point-Source Carbon Capture (PSC)	9
Chapter 3 Carbon Dioxide (CO ₂) Conversion	15
chapter 4 Carbon Dioxide Removal (CDR)	22
Chapter 5 Dedicated and Reliable Carbon Storage and Transport	26
Chapter 6 Hydrogen with Carbon Management	35
chapter 7 Critical Minerals (CMs)	42
Chapter 8 Methane Mitigation	48



<https://www.energy.gov/fecm/strategic-vision-role-fecm-achieving-net-zero-greenhouse-gas-emissions>

Integrated Carbon Management Approach



<https://www.energy.gov/fecm/interactive-diagram-carbon-management-provisions>



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Office of Clean Energy Demonstrations (OCED)

OCED established December 2021

- Builds on existing DOE investments in clean energy research and development
- Increases DOE's partnership with industry leaders

OCED Projects Areas:

- Clean hydrogen
- Carbon capture
- Grid-scale energy storage
- Small modular reactors and more

DOE Will Oversee \$20 Billion Federal Investment to Stand Up Clean Energy Projects Across the U.S. to Reach President Biden's Net-Zero Goals

[DOE Establishes New Office of Clean Energy Demonstrations Under the Bipartisan Infrastructure Law | Department of Energy](#)

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Bipartisan Infrastructure Law

\$10+ billion in new carbon management funding over 5 years through the Infrastructure Investment and Jobs Act (Bipartisan Infrastructure Law).

Carbon Capture Demonstrations and Large Pilots

Carbon Capture Demonstrations: \$2.5 billion
Carbon Capture Technology Program: \$950 million

Carbon Dioxide Removal - Direct Air Capture

Regional Direct Air Capture Hubs: \$3.5 billion
DAC Technology Prize Competition: \$115 million

Front-End Engineering Design Studies

Carbon Capture Technology Program: \$100 million

Carbon Dioxide Utilization and Storage

Carbon Storage Validation and Testing: \$2.5 billion
Carbon Utilization Program: \$310 million

Inflation Reduction Act

\$369B for Clean Energy and Climate Provisions **For Carbon Management: Enhanced 45Q**

- *Direct Pay Option*
- *Broadens Qualifying Facilities: Capture Thresholds*
- *Extends Commence Construction Date to 2033*
- *Increases 45Q Credit Values (\$35/\$50 previously)*
 - *\$60/metric ton for point source capture and utilization*
 - *\$85/metric ton for point source capture and carbon storage in saline formations*
 - *\$130/metric ton for Direct Air Capture and utilization*
 - *\$180/metric ton for DAC and Saline Geologic Storage*

[Text - H.R.5376 - 117th Congress \(2021-2022\): Inflation Reduction Act of 2022 | Congress.gov | Library of Congress](#)

Carbon Capture Demonstrations – Key Provisions

Demonstration projects (16 962(b)(2)(C) of the Energy Policy Act of 2005 (42 U.S.C. 17 16292(b)(2)(C))



\$2.5B

- Establish a demonstration program through a competitive, merit-reviewed process,
- Enter into cooperative agreements for demonstration projects to demonstrate the construction and operation of 6 facilities to capture carbon dioxide from coal electric generation facilities (2 projects), natural gas electric generation facilities (2 projects), and industrial facilities (2 projects).

Each demonstration project shall be designed to further the development, deployment, and commercialization of technologies to capture and sequester carbon dioxide emissions from new and existing coal electric generation facilities, natural gas electric generation facilities, and industrial facilities;

<https://uscode.house.gov/view.xhtml?hl=false&edition=prelim&req=granuleid%3AUSC-prelim-title42-section16292&num=0&saved=%7CKHRpdGxIOjQyIHNIY3Rpb246MTYyOTMgZWVpdGlvbjpwcmVsaW0p%7C%7C%7C0%7Cfalse%7Cprelim>



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fcm.energy.gov

Bipartisan Infrastructure Law
Funding Opportunity



Carbon Capture Demonstration
Projects Program



Office: Clean Energy Demonstrations

FOA number: DE-FOA-0002738

[Funding Notice: Bipartisan Infrastructure Law: Carbon Capture Demonstration Projects Program | Department of Energy](#)



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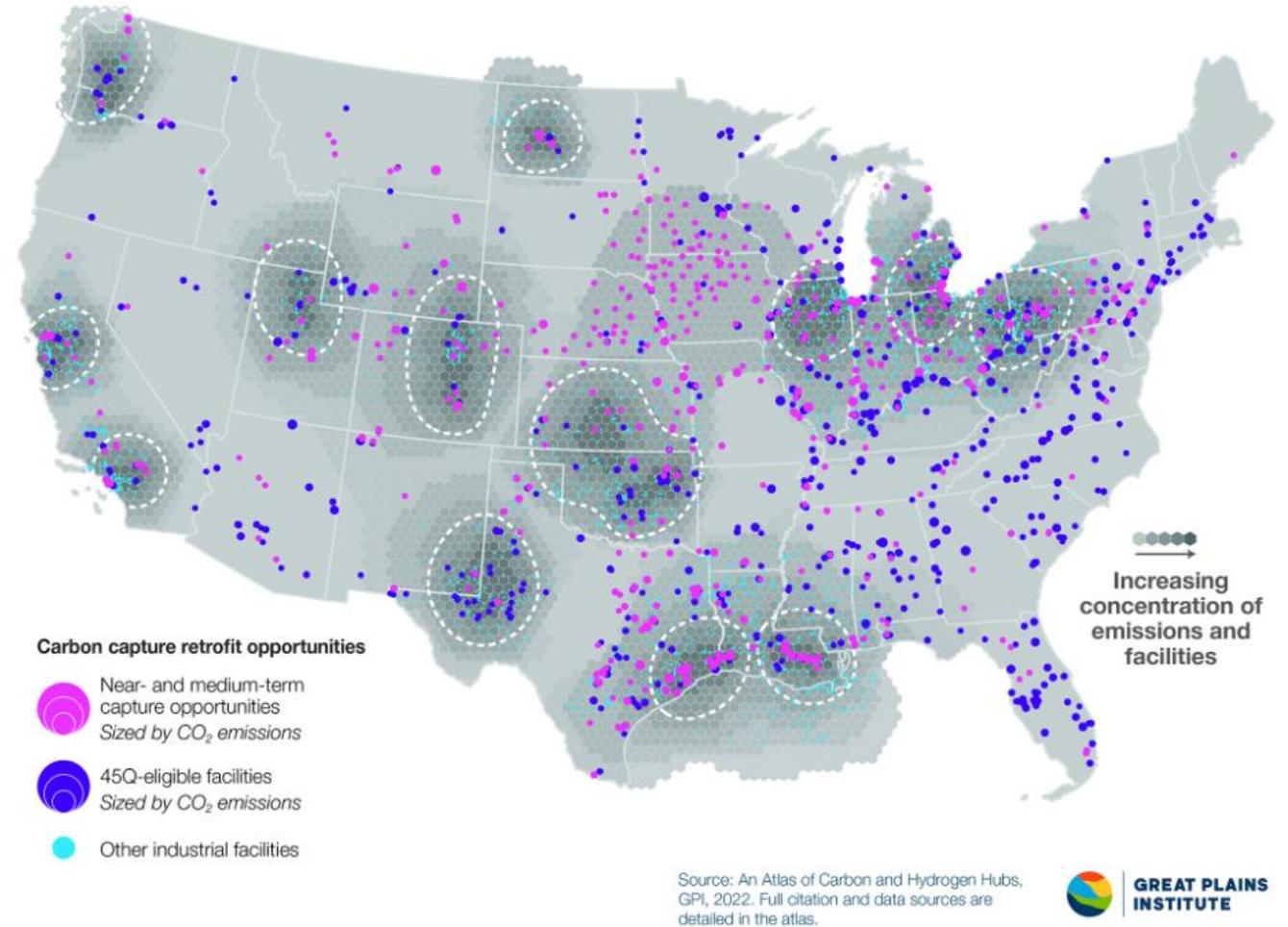
Bipartisan Infrastructure Law: CO2 Transport Front-End Engineering Design (FEED) Studies

Objective:

- \$100 million, \$20M/year for FY22-26
- Supporting front-end engineering design (FEED) studies to enable **new carbon transport buildout or repurposing of existing infrastructure to CO2 use**
- Successful FEED studies can apply for DOE Loan Program Office (LPO)'s **loan guarantees or future growth grants (CIFIA)**
- Carbon transport can include pipeline, barge, ship, rail, and truck transport

Estimated funding opportunity release:

- In development, Fall 2022





Bipartisan Infrastructure Law Funding Opportunity

Carbon Capture Technology Program, Front-End
Engineering Design for Carbon Dioxide Transport



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Office: Carbon Management

FOA number: DE-FOA-0002730

Download the full FOA: [FedConnect](#)[®]

FOA Amount: \$92 million

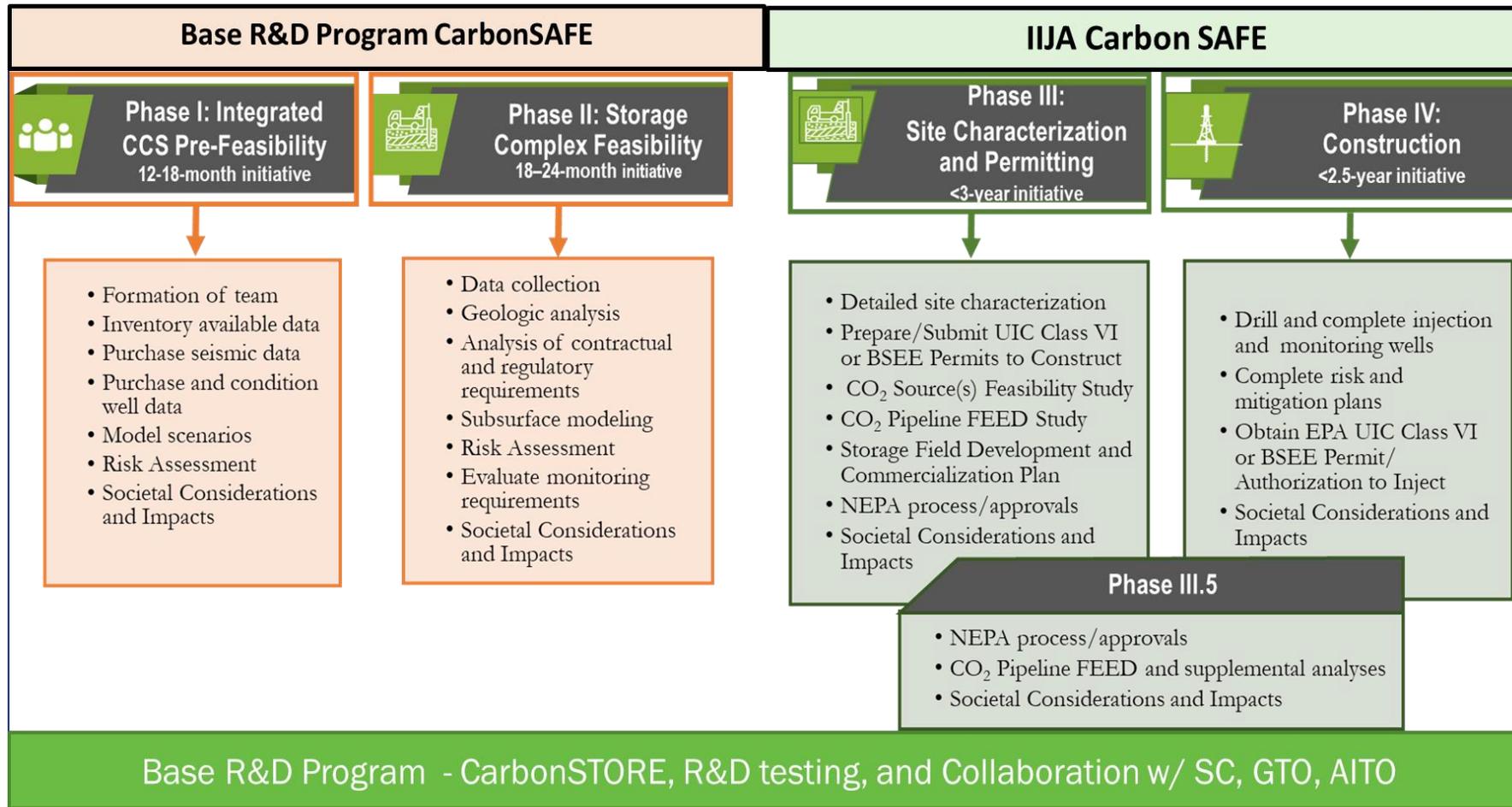
[Funding Notice: Bipartisan Infrastructure Law: Carbon Capture Technology Program, Front-End Engineering Design for Carbon Dioxide \(CO₂\) Transport | Department of Energy](#)



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Carbon Storage Assurance Facility Enterprise (CarbonSAFE)



BIL 40305—Storage Validation and Testing

\$2.5 billion over 5 years

New or Expanded large-scale commercialization carbon sequestration facilities

50 MMT Hubs and Large-Scale Storage

20-40 Facilities

~80-100 Class VI Wells

Carbon Management Funding Opportunity

Carbon Storage Validation and Testing



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Office: Carbon Management

FOA number: DE-FOA-0002711

[Funding Notice: Carbon Storage Validation and Testing | Department of Energy](#)



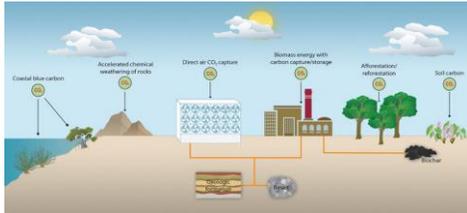
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DAC Hubs– Key Provisions

Direct Air Capture Hubs

SEC. 40308. CARBON REMOVAL; *Amended Section 969D of the Energy Policy Act of 2005 (42 U.S.C. 16298d)*



Regional DAC Hubs \$3.5 B

FY 22 – FY 26: \$700M / yr.

HUB DEFINITION:

a network of direct air capture projects, potential carbon dioxide utilization offtakers, connective carbon dioxide transport infrastructure, subsurface resources, and sequestration infrastructure located within a region.

Each of the 4 regional direct air capture hubs developed shall be a regional direct air capture hub that has the capacity to capture and sequester, utilize, or sequester and utilize at least 1,000,000 metric tons of carbon dioxide from the atmosphere annually from a single unit or multiple interconnected units.

Four Regional Clean Direct Air Capture Hubs

Bipartisan Infrastructure Law

Bipartisan Infrastructure Law » Four Regional Clean Direct Air Capture Hubs

Office: Office of Clean Energy Demonstrations

Funding amount: \$3,500,000,000

Period of Availability: \$700,000,000 annually for the period of fiscal years 2022 through 2026 (to remain available until expended)

Funding Mechanism: Grant, Cooperative Agreement, or Other

New Program: Yes



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



Notice of Intent No.: DE-FOA-0002746

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-0002735**

Bipartisan Infrastructure Law (BIL): Regional Direct Air Capture (DAC) Hubs (Section 40308):

The Department of Energy (DOE) National Energy Technology Laboratory (NETL) intends to issue a Funding Opportunity Announcement (FOA) on behalf of the Office of Fossil Energy and Carbon Management (FECM). The FOA is anticipated to be issued in the fourth quarter of Fiscal Year 2022 and will be funded by the BIL.

BACKGROUND

On November 15, 2021, President Joseph R. Biden, Jr. signed the Infrastructure Investment and Jobs Act (Public Law 117-58), also known as the BIL. The BIL authorizes and appropriates a total of \$3.5 billion for the five (5) year period encompassing fiscal years (FYs) 2022 through 2026 for Regional Direct Air Capture (DAC) Hubs (Section 40308). If issued, this FOA will implement Section 40308 of the BIL to contribute to the development of regional DAC Hubs while incorporating environmental justice, community engagement



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Carbon Capture Large Pilots.. Key Provisions

Key BIL Sec. 41004(a)

PROJECTS.—There are authorized to be appropriated to the Secretary to carry out activities under section 7962(b)(2)(B) of the Energy Policy Act of 2005 (42 U.S.C. 816292(b)(2)(B))—

- (1) \$387,000,000 for fiscal year 2022;
- (2) \$200,000,000 for fiscal year 2023;
- (3) \$200,000,000 for fiscal year 2024; and
- (4) \$150,000,000 for fiscal year 2025.*



The term “large-scale pilot project” means a pilot project that—

(A) represents the scale of technology development beyond laboratory development and bench scale testing, but not yet advanced to the point of **being tested under real operational conditions at commercial scale**;

(B) represents the scale of technology necessary to gain the operational data needed to understand the technical and performance risks of the technology before the application of that technology at commercial scale or in commercial-scale demonstration; and

(C) **is large enough—**

(i) to **validate scaling factors**; and

(ii) to demonstrate the interaction between major components so that control philosophies for a new process can be developed and enable the technology to **advance from large-scale pilot project application to commercial-scale demonstration** or application.

<https://uscode.house.gov/view.xhtml?hl=false&edition=prelim&req=granuleid%3AUSC-prelim-title42-section16292&num=0&saved=%7CKHRpdGxIOjQyIHNIY3Rpb246MTYyOTMgZWRpdGlvbjpwcmVsaW0p%7C%7C%7C0%7Cfalse%7Cprelim>



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fecm.energy.gov

Carbon Matchmaker



Carbon Matchmaker will:

- ✓ Enable a teaming mechanism to support geographically diverse CCUS/CDR projects across the United States.
- ✓ Increase awareness and facilitate development of regional carbon management hubs, including alongside hydrogen hub development where relevant.
- ✓ Provide community, industry, and technology development stakeholders domestically and internationally with carbon dioxide supply and demand maps for current and planned projects.
- ✓ Highlight past and currently funded DOE carbon management projects in a geospatial map.

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



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Carbon Capture Program...Mission

- Mission

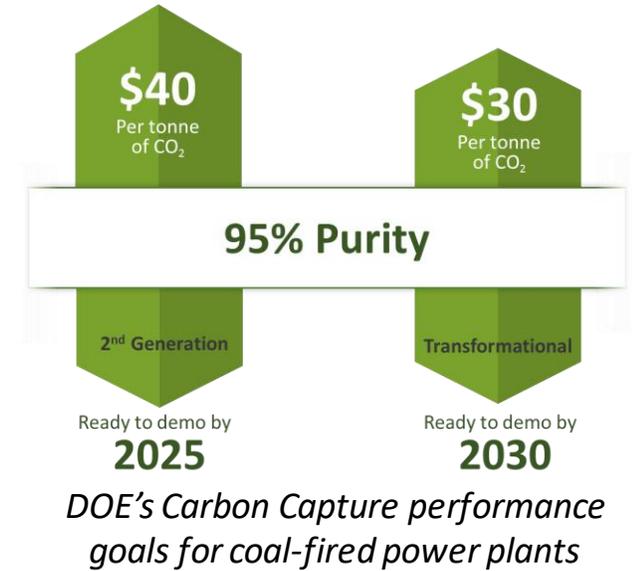
- Develop cost-effective point source capture throughout the power-generation and industrial sectors and CDR technologies
- Ensure the U.S. will continue to have access to safe, reliable, & affordable low-carbon energy generation

- Drivers/Challenges

- Reduce carbon capture CAPEX/OPEX under a wide range of feed conditions and high capture efficiencies
- Demonstrate first-of-a-kind carbon capture coupled to dedicated and reliable carbon storage, that will lead to commercially viable nth-of-a-kind opportunities for widescale deployment

- Goal & Metrics

- Support U.S goal to achieve carbon pollution-free power sector by 2035 and zero-carbon economy by 2050



National Carbon Capture Center

Photo Source: Southern Company Services

Carbon Capture Program...Evolution

1st and 2nd Generation Technologies

2025: \$40/tonne CO₂



2008 -

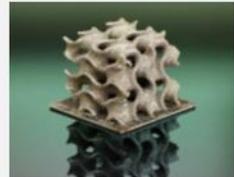
- ✓ Lower CAPEX/OPEX
- ✓ Reduced regeneration energy
- ✓ Increased working capacity

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

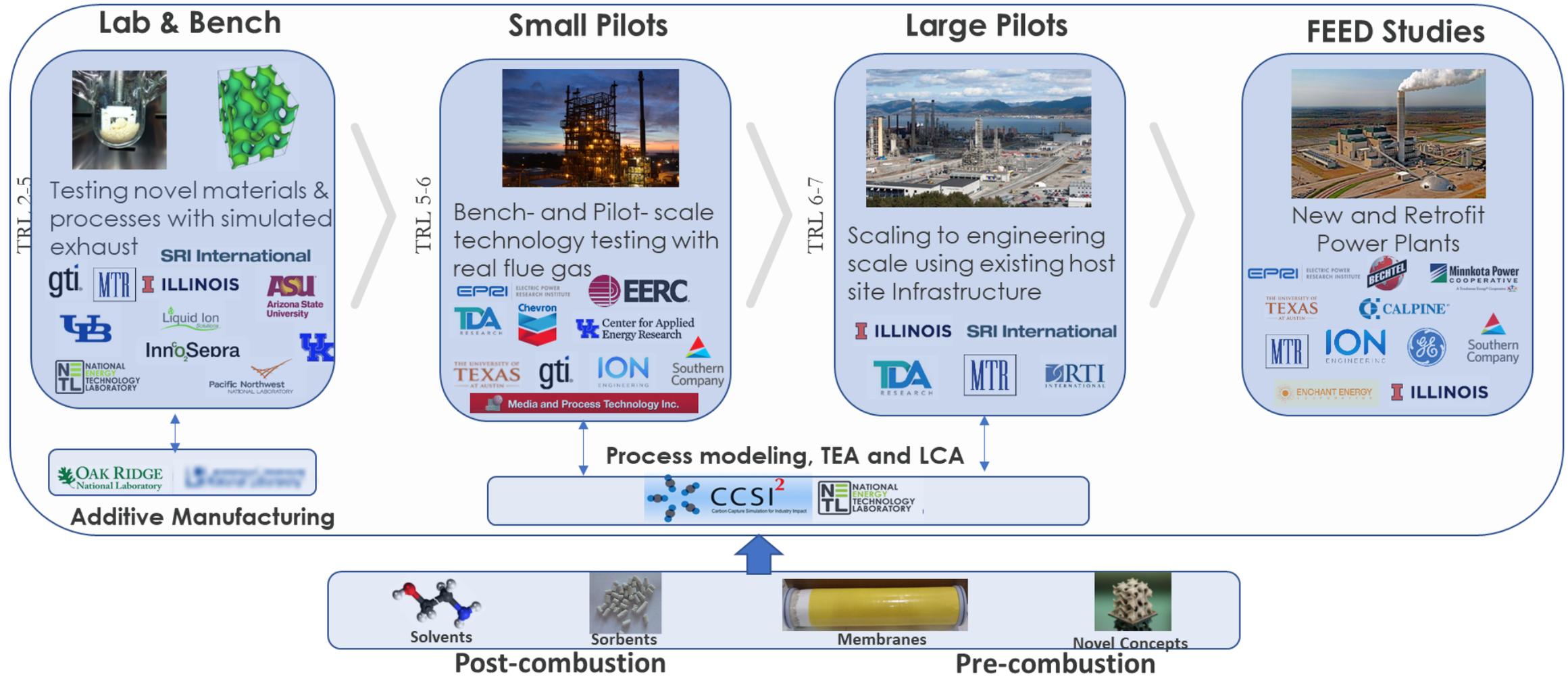


Ethanol Plant

2020 -

- ✓ DAC & BiCRS
- ✓ Industrial
- ✓ NG

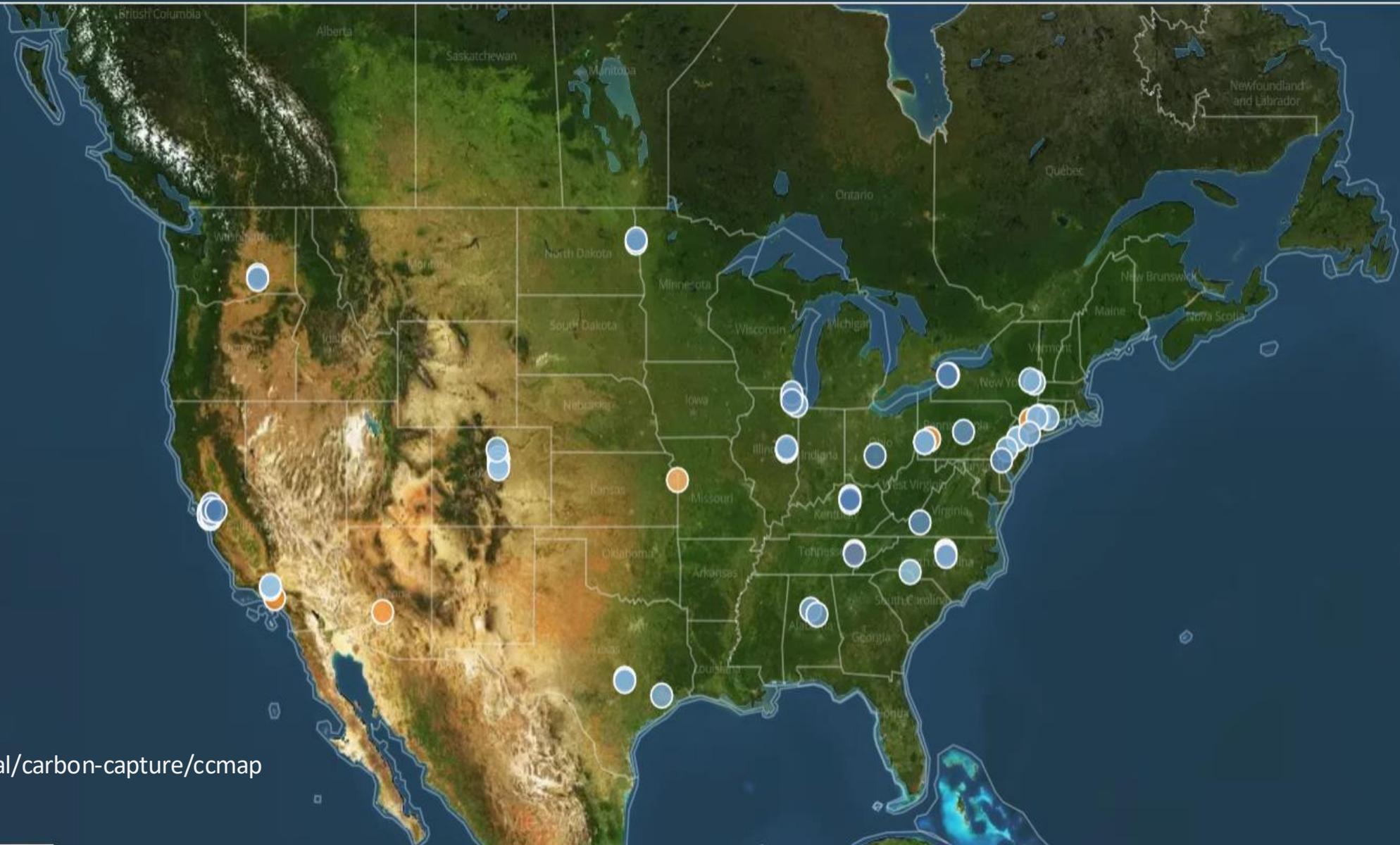
Point Source Carbon Capture.. Program Structure



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Carbon Capture Interactive Project Map

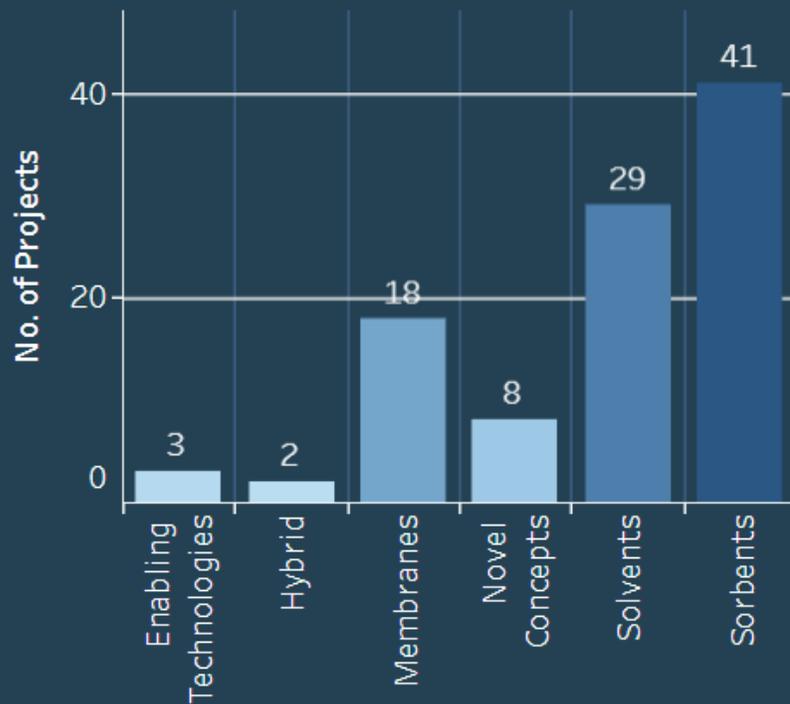


<https://netl.doe.gov/coal/carbon-capture/ccmap>

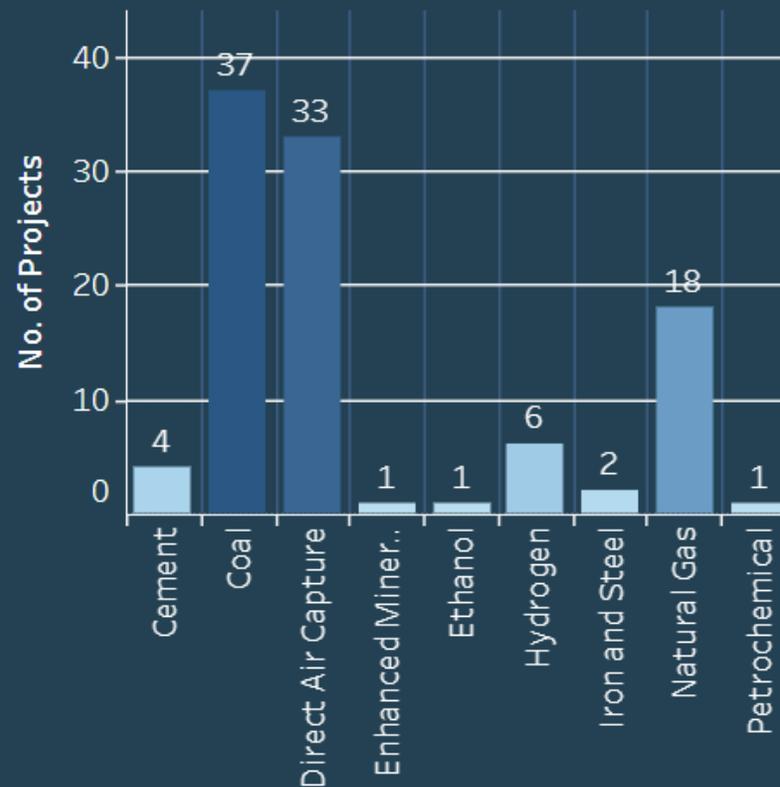
Point Source Capture & CDR Programs

Active Project Distribution

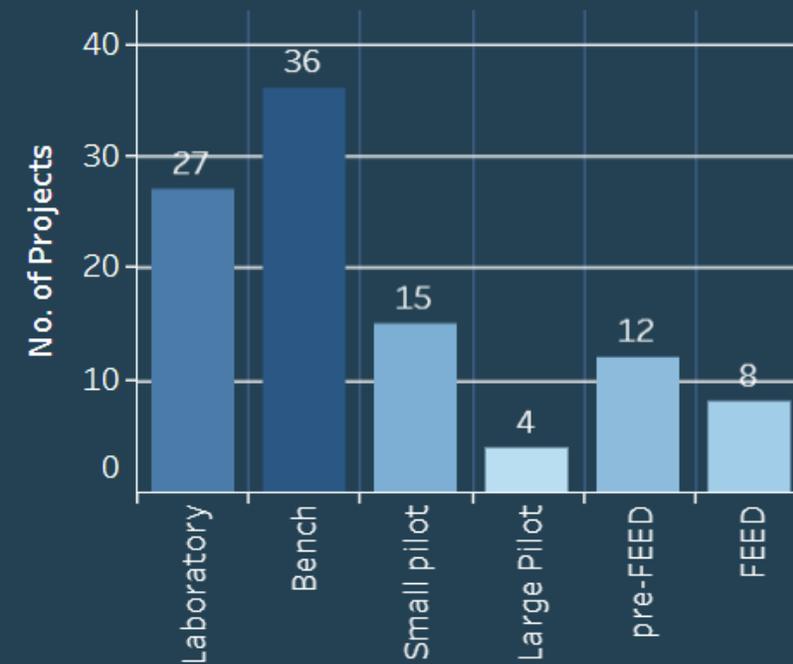
Key Technology



Application Type



Ending Scale



<https://netl.doe.gov/coal/carbon-capture/ccmap>

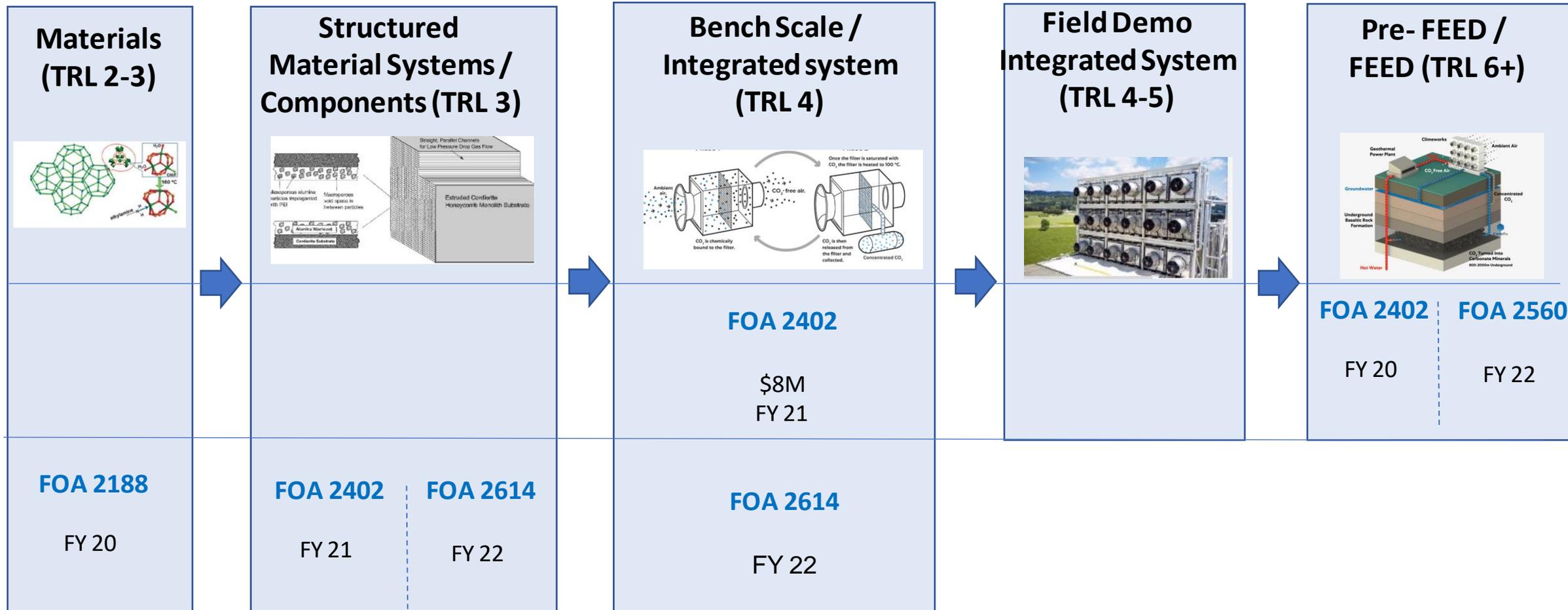


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fecm.energy.gov

FECM DAC Technology Development



Carbon Capture Program.. Outreach

NATIONAL ENERGY TECHNOLOGY LABORATORY
NOVEMBER 2022
CARBON CAPTURE NEWSLETTER
U.S. DEPARTMENT OF ENERGY | OFFICE OF FOSSIL ENERGY AND CARBON MANAGEMENT | NATIONAL ENERGY TECHNOLOGY LABORATORY

HIGHLIGHTS
The newsletter is compiled by the National Energy Technology Laboratory to provide information on recent activities and publications related to carbon capture.
To subscribe, click here.

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DOE Announces Funding to Deploy Infrastructure Necessary to Manage and Store Carbon Emissions
The U.S. Department of Energy (DOE) released three funding opportunity announcements (FOAs) to bolster investments in the carbon management industry and to significantly reduce carbon dioxide (CO₂) emissions released into the atmosphere through power generation and industrial operations. The funding from President Biden's Bipartisan Infrastructure Law (BIL) will support three programs to help drive the demonstration and deployment of carbon capture systems, along with carbon transport and storage infrastructure. **Carbon Storage Validation and Testing** supports the Carbon Storage Assurance Facility Enterprise (CarbonSAFE) Initiative and provides up to \$2.25 billion to support the development of new and expanded large-scale, commercial carbon storage projects with capacities to store 50 or more million metric tons of CO₂, along with associated CO₂ transport infrastructure. The **Carbon Capture Demonstration Projects Program** provides up to \$2.54 billion to develop six integrated carbon capture, transport, and storage demonstration projects that can be readily replicated and deployed at fossil energy power plants and major industrial sources of CO₂. **Carbon Dioxide Transport Engineering and Design** provides up to \$100 million to design regional CO₂ pipeline networks to safely transport captured CO₂ from key sources to centralized locations.

Carbon Capture Newsletter

CARBON CAPTURE PROGRAM R&D COMPENDIUM of CARBON CAPTURE TECHNOLOGY
2022
U.S. DEPARTMENT OF ENERGY | NATIONAL ENERGY TECHNOLOGY LABORATORY

Carbon Capture Program R&D Compendium

CARBON CAPTURE PROGRAM
DOE Invests \$45 Million to Decarbonize the Natural Gas Power and Industrial Sectors Using Carbon Capture and Storage
Funding Opportunity Announcement

Advancing technologies for the removal of carbon dioxide (CO₂) from point sources, such as fossil fuel-based power plants and industrial processes, or directly from the atmosphere, with minimum cost and energy penalty
The Carbon Capture Program aims to develop the next generation of advanced carbon dioxide (CO₂) capture concepts. The U.S. Department of Energy (DOE) Fossil Energy Program has adopted a comprehensive multi-pronged approach for the research and development (R&D) of advanced CO₂ capture technologies that have the potential to provide emissions reductions in both cost and energy requirements as compared to currently available technologies. The success of this research will enable cost-effective implementation of carbon capture and storage (CCS) technologies that can be applied to the existing fleet of fossil-fueled power plants, refineries, industrial facilities, and the removal of CO₂ from the atmosphere. Cost-competitive carbon capture technologies have the potential to support the fossil sector while advancing U.S. leadership in high-efficiency, low-emission (HLE) generation technologies.

The Carbon Capture program includes two core research areas: **Post-Combustion Capture** and **Pre-Combustion Capture**. **Post-Combustion Capture** comprises projects ranging from conceptual engineering and materials design to 25 MW electrical (MWe) equipment pilot testing. Additionally, the program advances technologies in emerging research areas of **Capture from Industrial Sources** and **Negative Emissions Technologies**.

Core Research Areas:

- Post-Combustion Capture:** Post-Combustion capture systems separate CO₂ from the flue gas stream produced by conventional fossil-fueled power plants after fuel combustion in air. In this approach, CO₂ is separated from nitrogen (N₂), the primary constituent of the flue gas. R&D is underway to develop technologies based on advanced solvents, sorbents, membranes, hybrid systems, and other novel concepts in post-combustion capture.
- Pre-Combustion Capture:** Pre-Combustion capture systems are designed to separate CO₂ and hydrogen (H₂) from the surplus stream produced by the gasifier in integrated gasification combined cycle (IGCC) power plants. R&D is underway to develop technologies based on advanced solvents, sorbents, membranes, hybrid systems, and other novel concepts in pre-combustion capture.

Emerging Research Areas:

- Capture from Industrial Sources:** CO₂ capture from industrial facilities, such as petroleum refineries, iron and steel processing plants, and ethanol plants in which CO₂ emissions may be present at a higher concentration than coal-fired power plants is a refinement in reducing CO₂ emissions. R&D is underway to develop carbon capture technologies specific to industrial CO₂ sources.
- Negative Emissions Technologies:** Negative emissions technologies aim to remove CO₂ from the atmosphere with the resultant carbon stored or utilized. R&D is underway to develop chemical processes and materials for application of direct air capture (DAC), which allows for CO₂ capture from all emissions sources to address both current and legacy emissions. This research area also includes investigating biomass co-firing to reduce emissions from coal-fueled power plants.

Explore the Site

Carbon Capture Program Website



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fecm.energy.gov

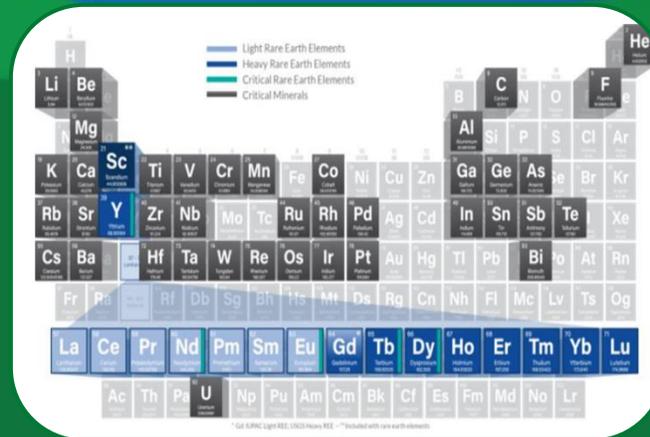
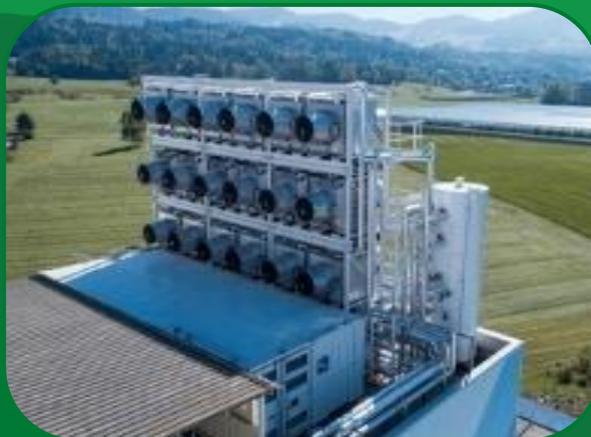


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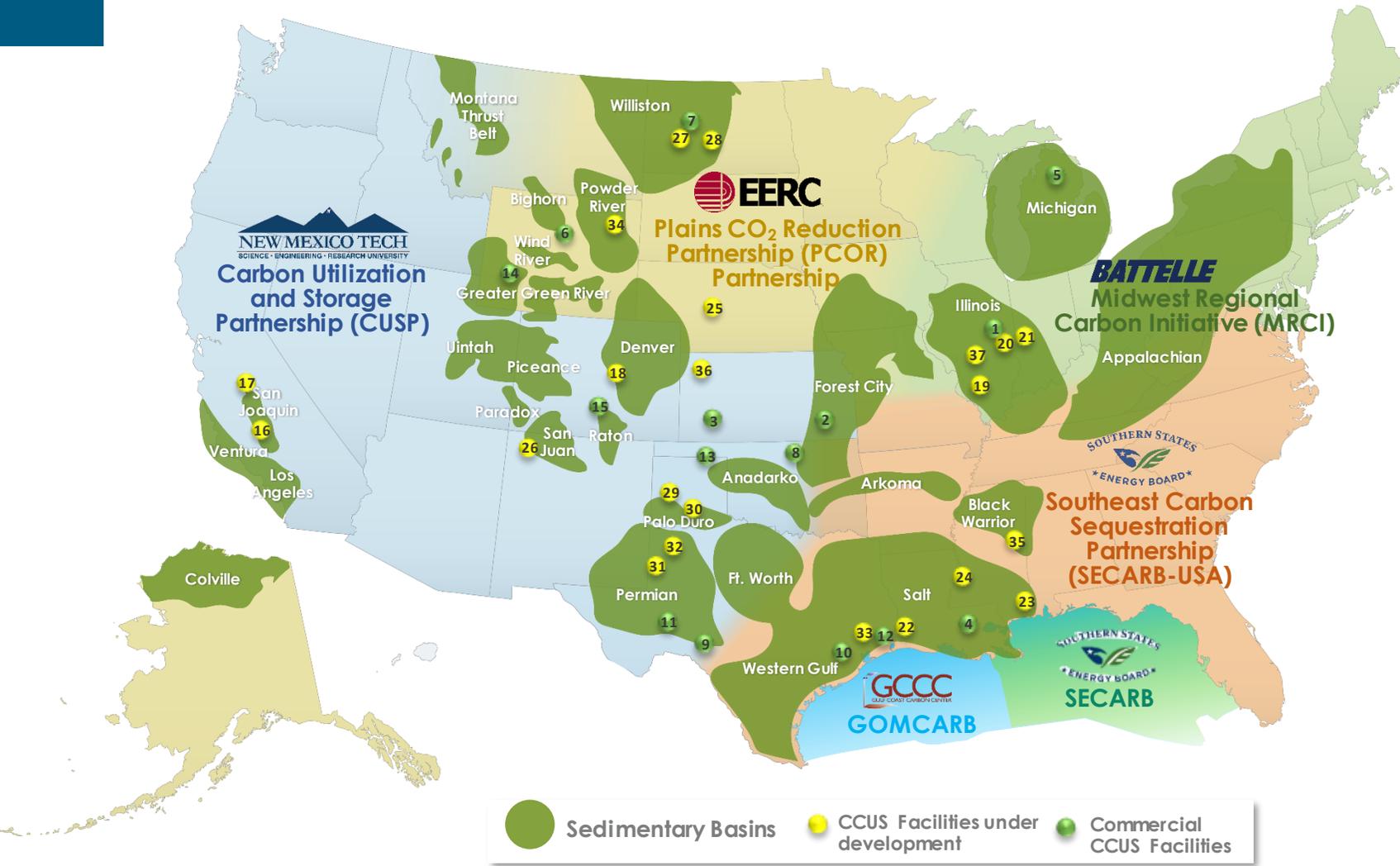
Questions?

dan.hancu@hq.doe.gov



Current U.S. CCUS Projects and Infrastructure

CCUS Facilities, Regional and Offshore Partnerships, and Onshore Sedimentary Basins



- ❖ DOE is accelerating CCS deployment through
 - ❖ 5 CarbonSAFE projects
 - ❖ 4 Regional Initiatives
- ❖ Over 5,000 miles of carbon transport pipelines today.
- ❖ 36 facilities have the capacity to capture **188 million metric tons (MT)** a year of anthropogenic CO₂.
- ❖ CarbonSAFE is developing storage capacity for over **250 million metric tons (MT)**.