



U.S. DEPARTMENT OF
ENERGY

Fossil Energy and
Carbon Management

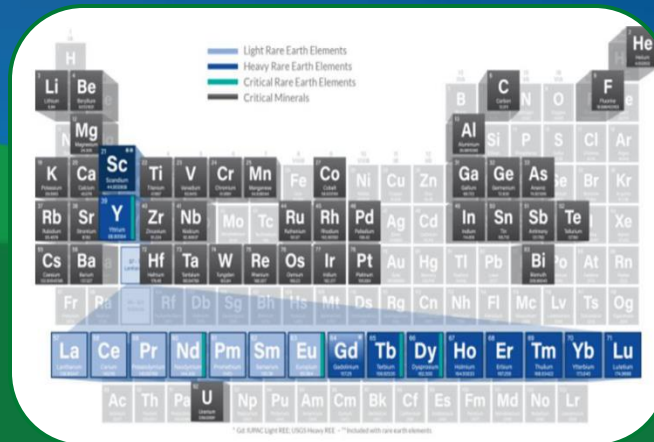
Carbon Capture Program at DOE

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

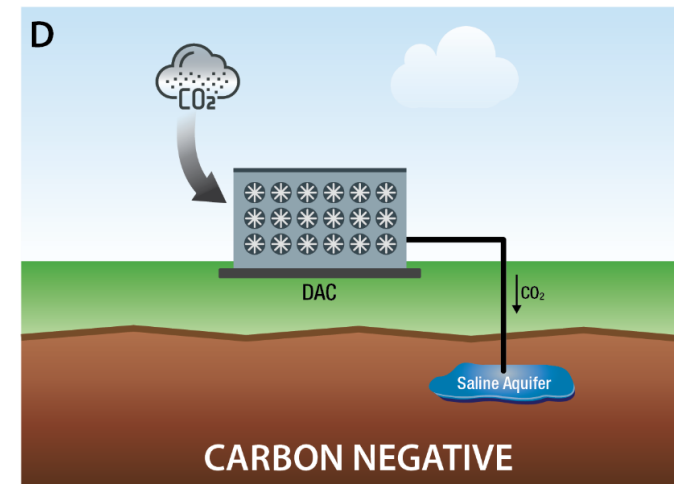
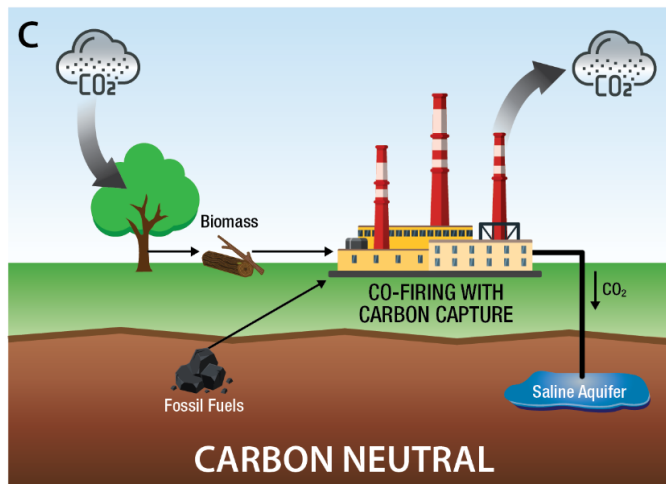
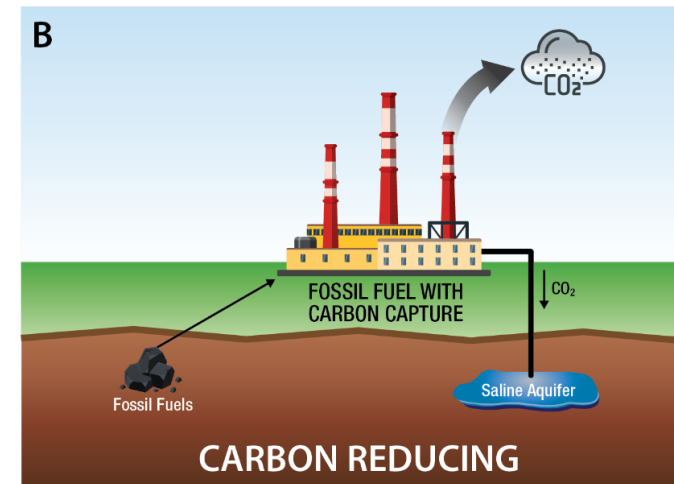
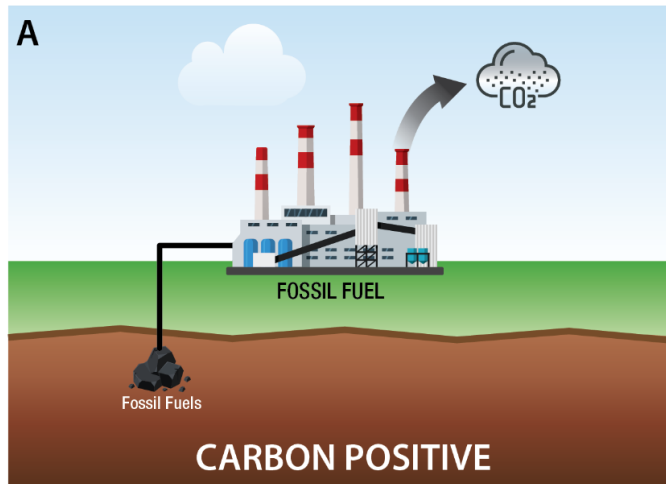
Dan Hancu

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

February 22nd, 2023



Carbon Dioxide Removal vs Carbon Reducing



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Carbon Negative vs. Carbon Reducing

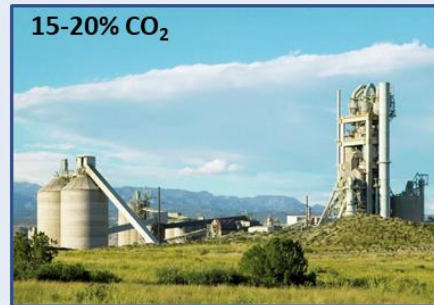
CARBON REDUCING

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



NG: 4 % CO₂

Power Plants



15-20% CO₂

Cement Plants



20% CO₂

Steel Plants

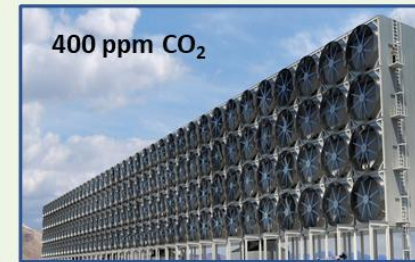


15 – 45% CO₂

Hydrogen Plants

CARBON NEGATIVE

Carbon Dioxide Removal (CDR) from Air



400 ppm CO₂

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

Carbon Capture DOE Program...**Evolution**

1st and 2nd Generation Technologies

2025: \$40/tonne CO₂

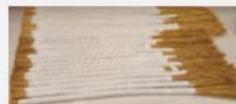


2008 -

- ✓ 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

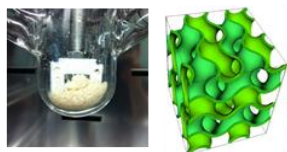


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Carbon Capture DOE Program...Implementation

Lab & Bench



TRL 2-4

Small Pilots



TRL 4-5

Large Pilots



TRL 5-7

FEED Studies



Demonstration



What we've learned in 20+ years:

- “First generation” (e.g. liquid solvent) systems work:
 - At commercial scale at some power plants and industrial facilities
 - With high efficiency (90+%) at moderate cost
 - With manageable non-CO2 pollution

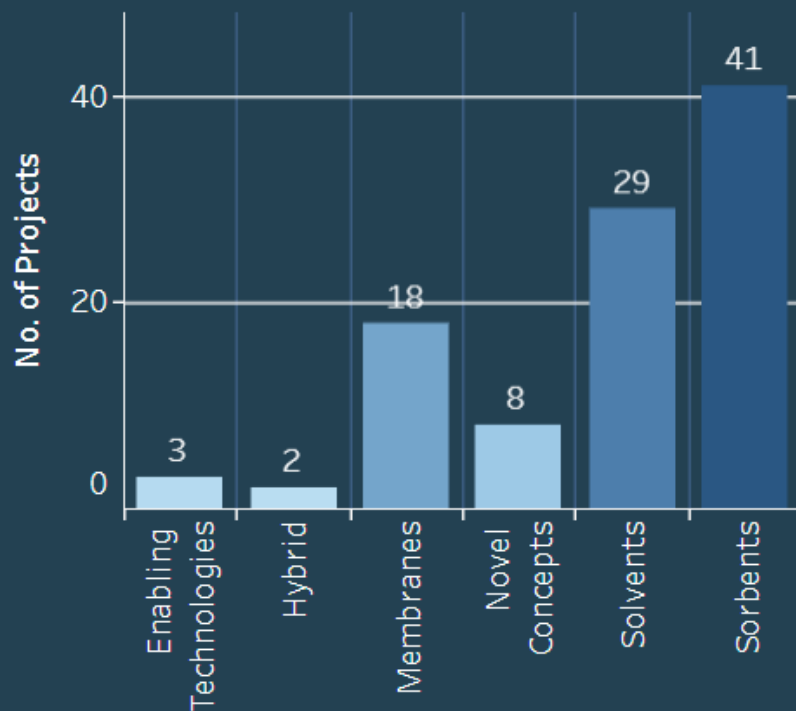
What we're learning now:

- Which “next generation” systems have the greatest potential
- How to increase capture efficiencies (>95%)
- How to enable low carbon supply chains (i.e., cement, steel, hydrogen, etc.)
- Co-Benefits Analysis..How to further reduce other pollutants
- How to accelerate deployment

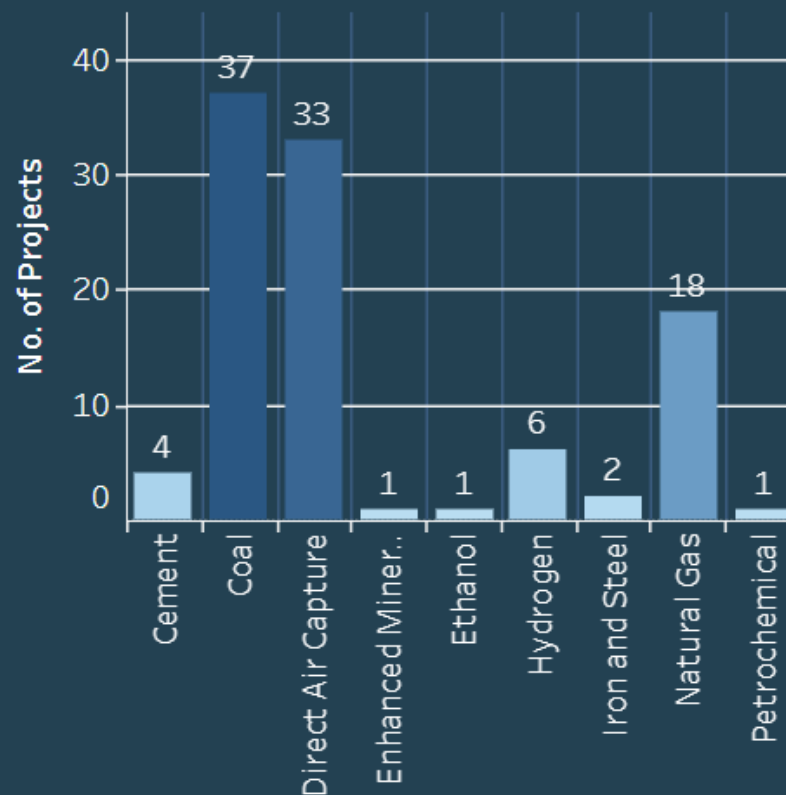
Point Source Capture & CDR Programs

Active Project Distribution

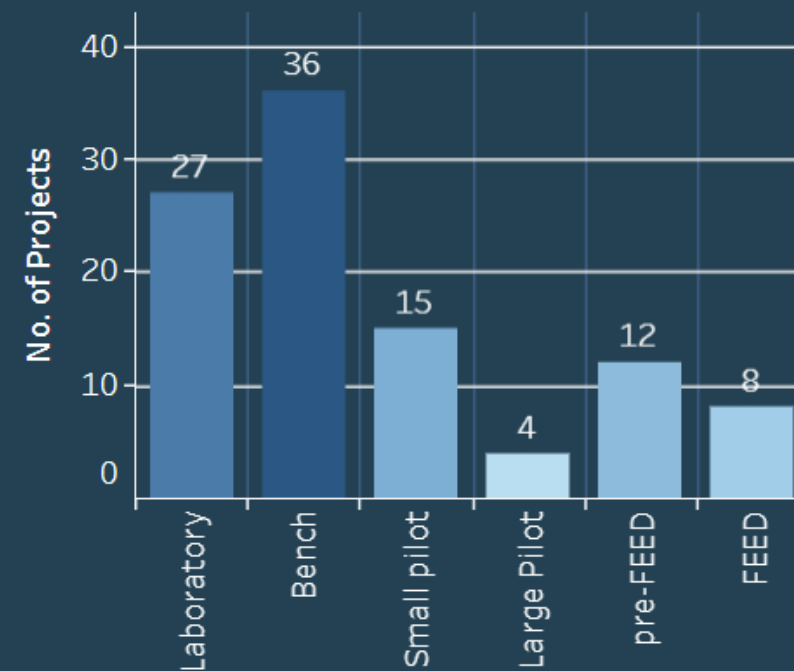
Key Technology



Application Type



Ending Scale



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



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fecm.energy.gov

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

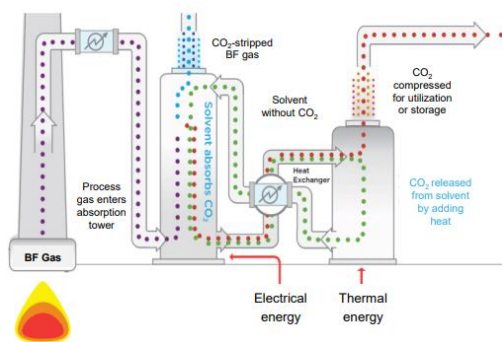
- Establish a demonstration program through a competitive, merit-reviewed process,
- Enter into cooperative agreements for projects to demonstrate the construction and operation of 6 facilities to capture carbon dioxide from coal electric generation facilities (2 projects), natural gas electric generation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

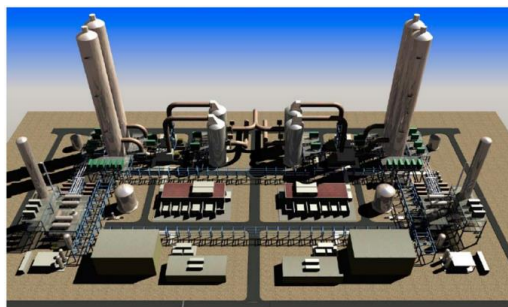
<https://uscode.house.gov/view.xhtml?hl=false&edition=prelim&req=granuleid%3AUSC-prelim-title42-section16292&num=0&saved=%7CKHRpdGxIOjQyIHNIY3Rpb246MTYyOTMgZWVpdGljbWcmVsaW0p%7C%7C%7C0%7Cfalse%7Cprelim>

CCS Deployment...**Phased Approach**

**Pre-feasibility
(12-18 months)**



**Front End Engineering Design
(12-18 months)**



**Detailed Design
Transport/Permits/NEPA
(24 Months)**



**Construction
(36-48 Months)**



**Operation
(36 Months)**



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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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=%7CKHRpdGxIOjQyIHNIY3Rpb246MTYyOTMgZWRRpdGlvbJpwcmVsaW0p%7C%7C%7C0%7Cfalse%7Cprelim>

Office of Clean Energy Demonstrations

Advanced Notice for Issuance of Funding Opportunities for Carbon Capture Large-Scale Pilot Projects and Carbon Capture Demonstration Projects Program

JANUARY 27, 2023



[Office of Clean Energy Demonstrations »](#)

Advanced Notice for Issuance of Funding Opportunities for Carbon Capture Large-Scale Pilot Projects and Carbon Capture Demonstration Projects Program

<https://www.energy.gov/oced/articles/advanced-notice-issuance-funding-opportunities-carbon-capture-large-scale-pilot>



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Carbon Capture Program.. Outreach



Carbon Capture Newsletter

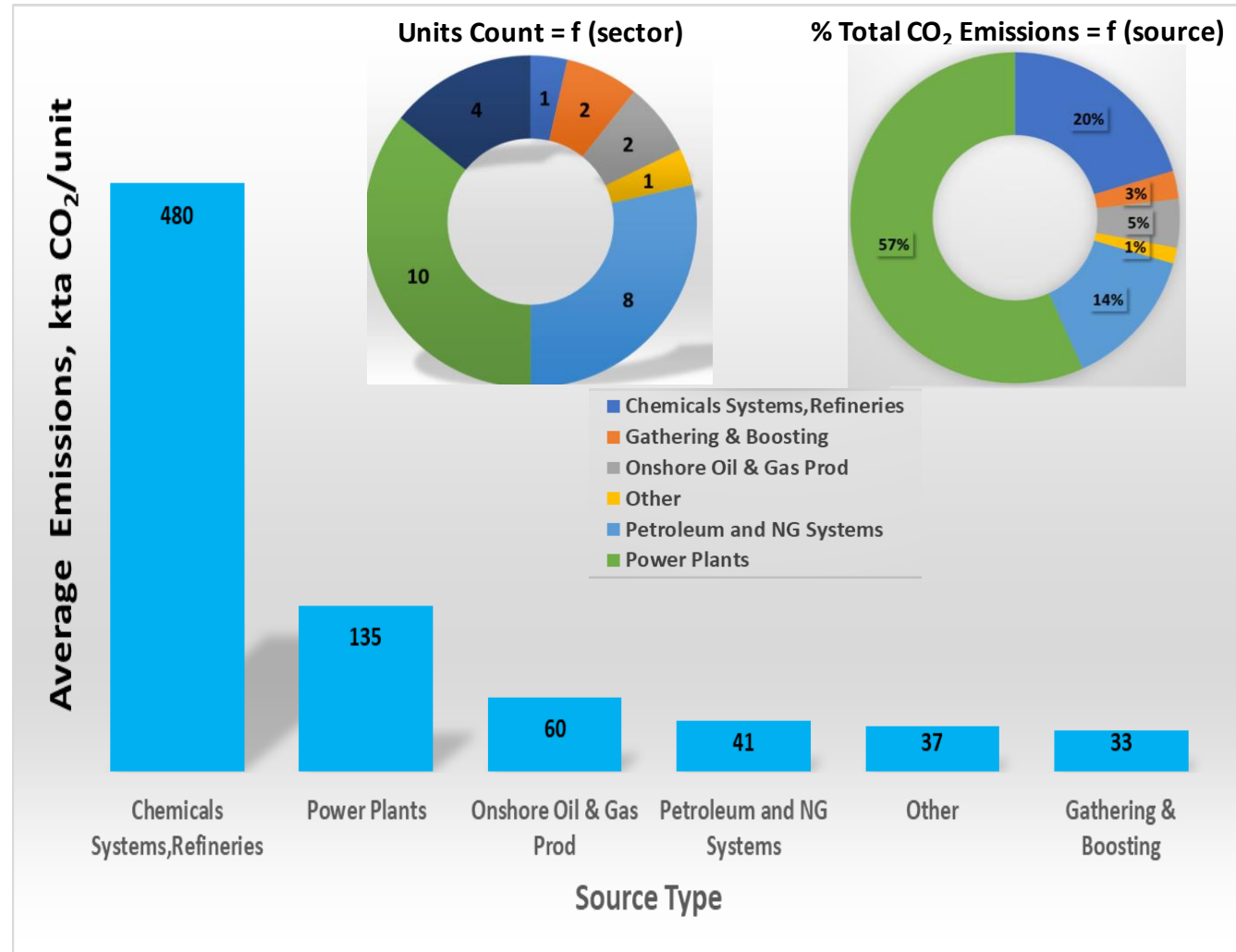
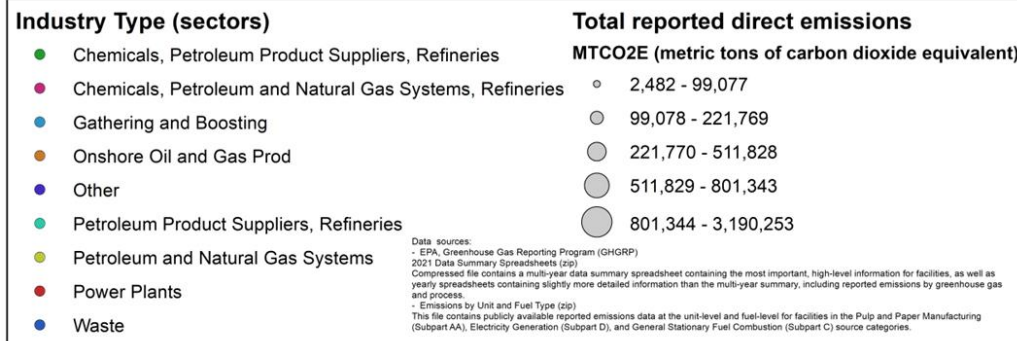
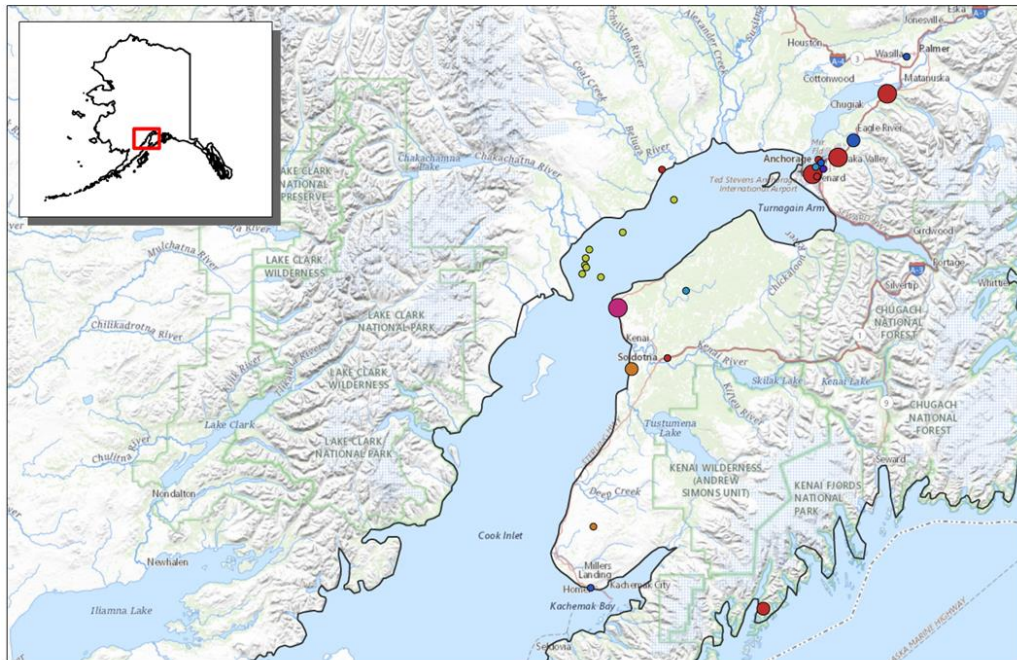


Carbon Capture Program
R&D Compendium



Carbon Capture
Program Website

CO₂ Emissions Sources in Anchorage / Cook Inlet Region



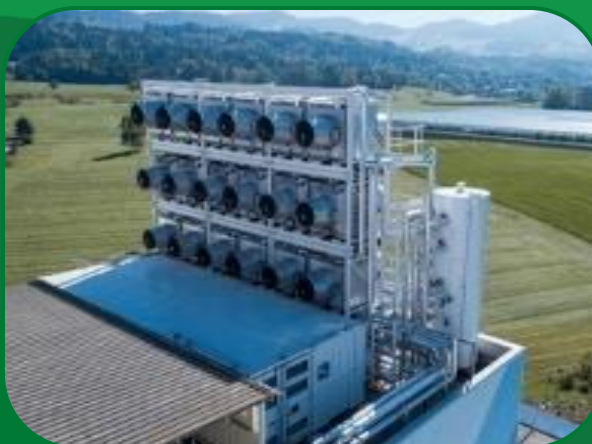


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Questions?

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Legend:

- Light Rare Earth Elements
- Heavy Rare Earth Elements
- Critical Rare Earth Elements
- Critical Minerals

H	He																	He					
Li	Be																	B	C	N	O	F	Ne
Mg																	Al	Si	P	S	Cl	Ar	
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr						
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe						
Cs	Ba		Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn						
Fr	Ra		Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	Nh	Fl	Mc	Lv	Ts	Og						
La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu									
Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr									

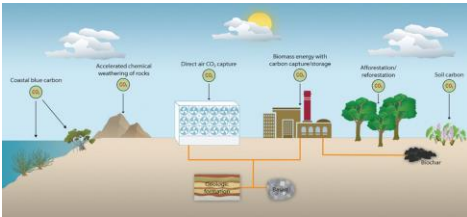
* Gas, Liquid, Solid, Critical Minerals, ** Included with rare earth elements



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)*



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.

Regional DAC Hubs

\$3.5 B

FY 22 – FY 26: \$700M / yr.

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.