



U.S. DEPARTMENT OF
ENERGY

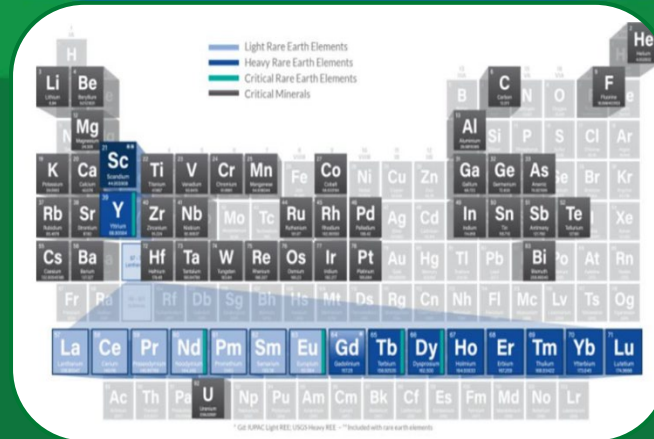
Fossil Energy and
Carbon Management

Office of Carbon Management Technologies Overview

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OFFICE OF FOSSIL ENERGY AND CARBON MANAGEMENT

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Agenda

- Office of Carbon Management Technologies Overview
- Funding Process
- Internships and Fellowships

Fossil Energy and Carbon Management (FECM)

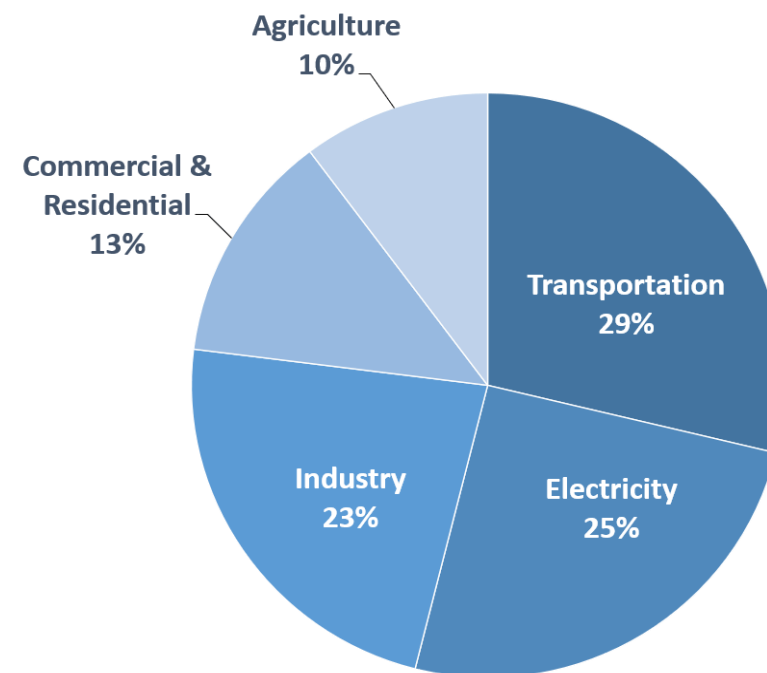
Office of Fossil Energy and Carbon Management

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 and Environmental Justice

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

Priority Technology Areas

1. Point source carbon capture
2. Carbon dioxide (CO₂) removal
3. CO₂ conversion into products
4. Reliable CO₂ storage
5. Hydrogen production

**Office of Carbon
Management**
(FECM-20)

6. Critical mineral production from industrial and mining waste
7. Methane mitigation

**Office of Resource
Sustainability**
(FECM-30)

Enacting Justice and Supporting Legacy Communities

- Good-paying jobs
- Job growth acceleration
- Healthy economic transitions
- Improve community conditions

Address hardest-to-decarbonize applications in the electricity and industrial sectors



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fecm.energy.gov

A Vision for Carbon Management



A carbon management framework that will guide FECM's engagement with offices across the Department, Federal agencies, tribal and international governments, industry, non-governmental organizations, and communities

Advancing Justice, Labor, and Engagement

Priorities: Justice, labor, and international and domestic partnerships

Advancing Carbon Management Approaches Toward Deep Decarbonization

Priorities: Point-source carbon capture (PSC), carbon dioxide conversion, carbon dioxide removal (CDR), and reliable carbon transport and storage

Advancing Technologies that Lead to Sustainable Energy Resource

Priorities: Hydrogen with carbon management, domestic critical minerals (CM) production, and methane mitigation

CCUS and CDR Facilitate Deep Decarbonization

Reduce the cost of capture/increase rates

- Power Sector
- Industry
- Carbon Dioxide Removal
- Design Studies and Demonstrations

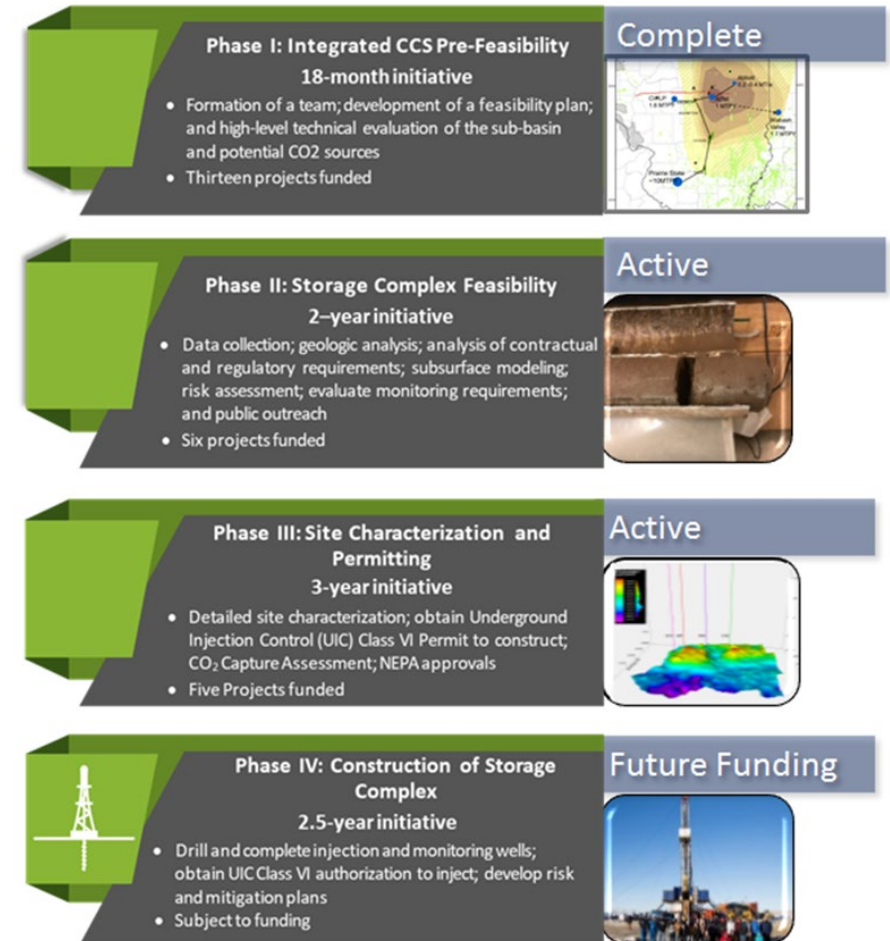
Develop low-carbon supply chains through conversion

- Aggregates
- Fuels and Chemicals
- Solid Carbon Products

Optimize geologic storage operations

- CarbonSAFE Infrastructure, Partnerships
- Geomechanics (pressure and state of stress)
- Conversion of fossil assets
- Enabling real-time decision making through AI

CarbonSAFE - Infrastructure





Carbon Dioxide Removal

Removal of atmospheric CO₂ and durable store



Carbon Utilization

Conversion of CO₂ to value-added products



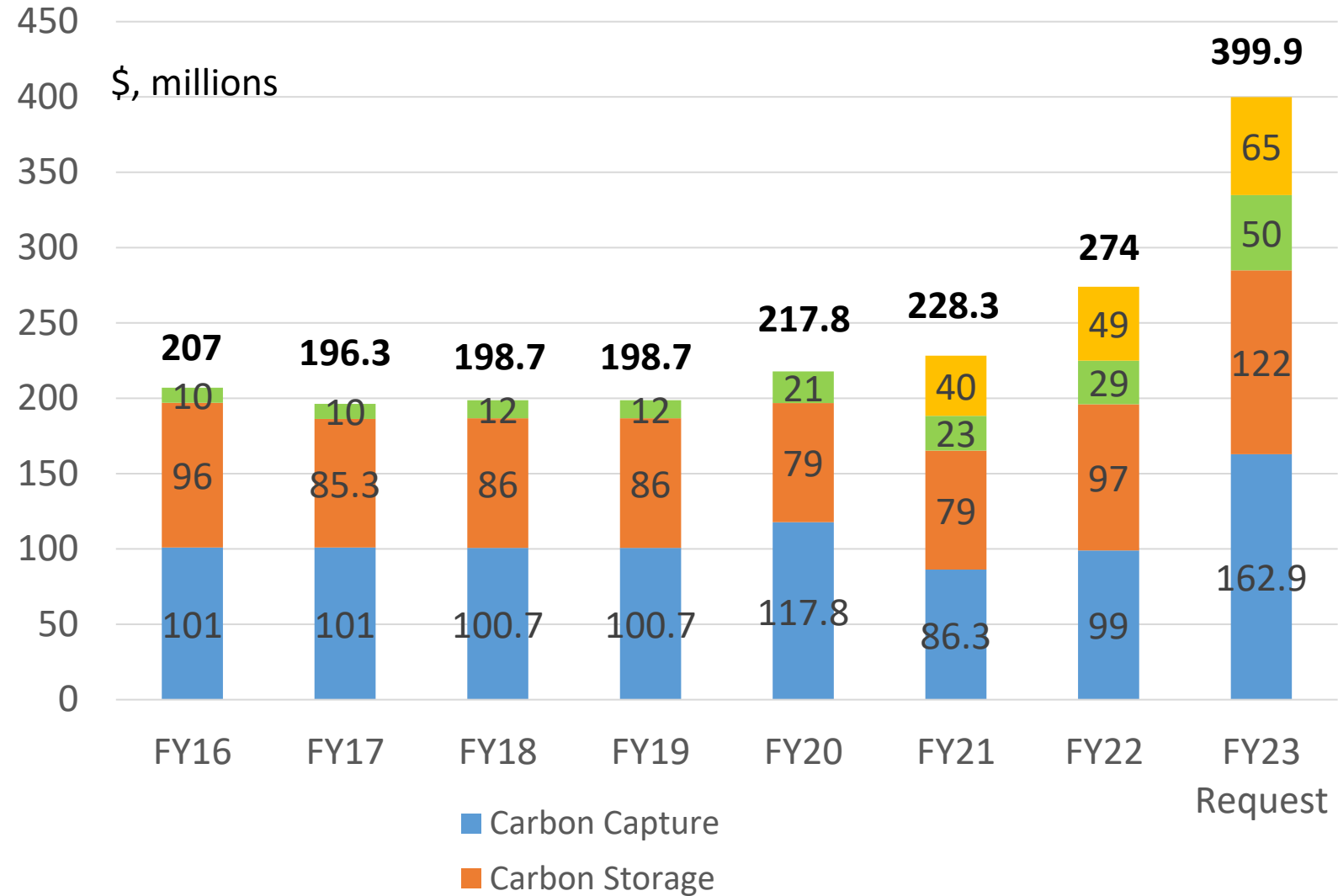
Carbon Storage

Safe, cost-effective, and permanent geologic storage of CO₂



Carbon Capture

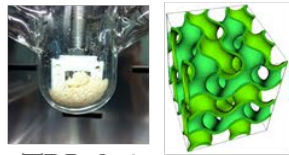
Capturing CO₂ from new and existing industrial and power plants



Point Source Capture Program

Integrated Approach to Accelerate Technology Development

Lab & Bench



TRL 2-4

Small Pilots



TRL 4-5

Large Pilots



TRL 5-7

FEED Studies

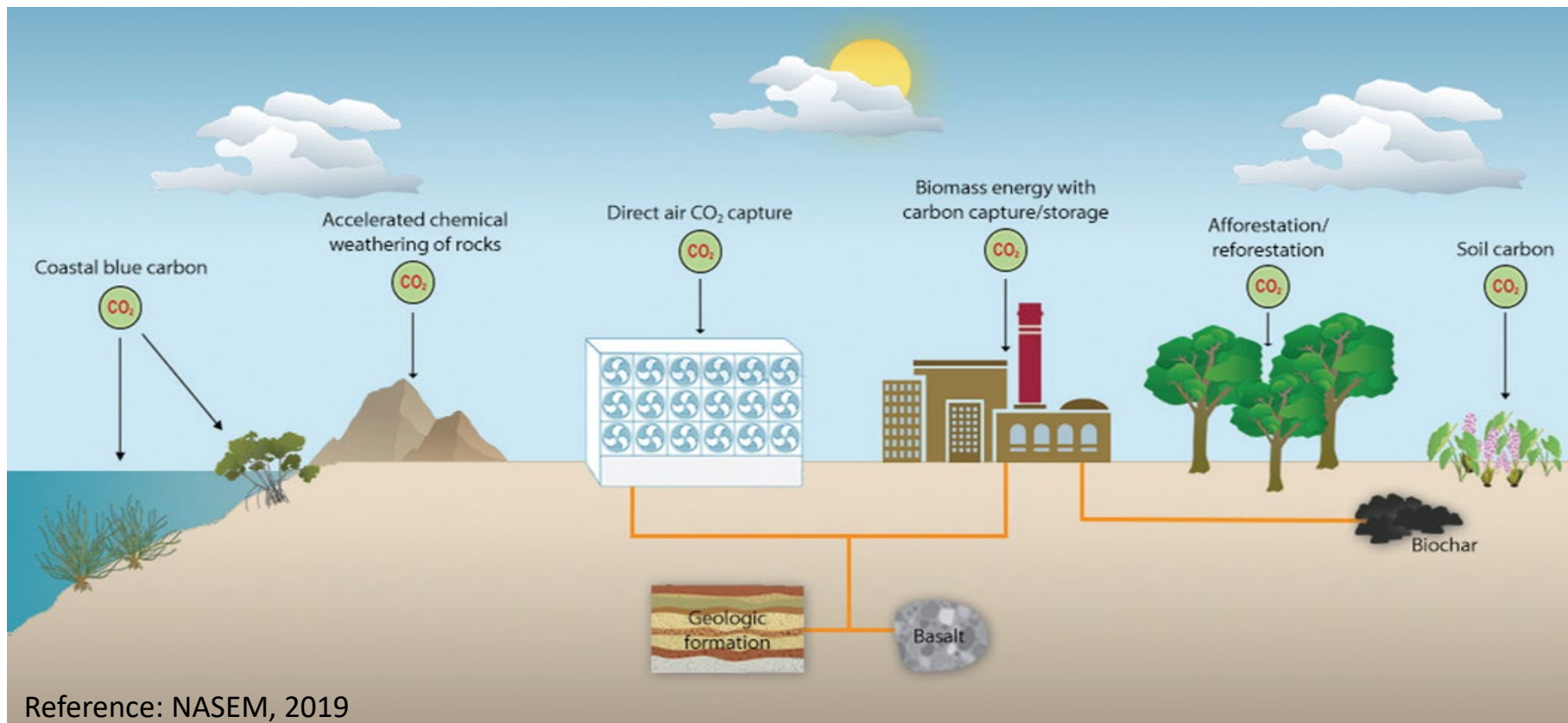


Point Source Capture Focus

- Develop capture technologies for the power and industrial sectors
- Reduce CAPEX/OPEX under a wide range of feed conditions
- Achieve high capture efficiencies (>95%)
- Maximize co-benefit pollutant removal
- Engineering-based Simulation (CCSI²)
- Create low-carbon supply chains (i.e., cement, steel, hydrogen, etc.)

CDR Areas of Interest in FECM

- Biomass with Carbon Removal and Storage
- Direct Air Capture (DAC)
- Direct Ocean Capture (DOC)
- Accelerated Weathering and Mineralization
- Rigorous LCA and TEA (net-removed costs)
- Low-carbon energy, land, water resources required
- Leveraging transport and storage infrastructure
- Justice and work force considerations

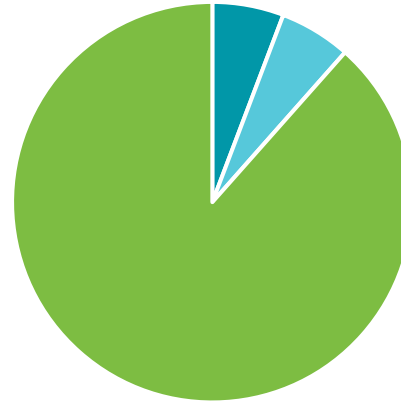


Carbon Negative Shot: Key Performance Elements

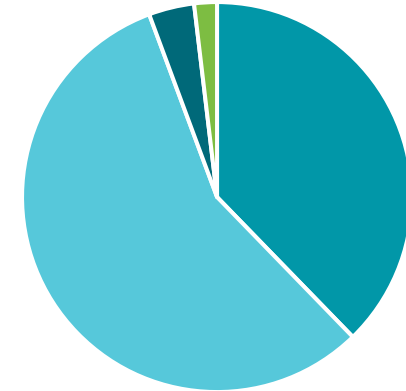
Carbon Negative Shot's key performance elements will guide a **responsible** industry that is **responsive** to the climate crisis, such that multiple true, durable removal pathways can be deployed at their most affordable cost at the scale required to address the climate crisis.

- 1 Less than **\$100/net metric ton CO₂e** for both capture and storage
- 2 Robust accounting of full life cycle emissions
- 3 High-quality, durable storage with costs demonstrated for MRV for **at least 100 years**
- 4 Enables necessary **gigaton-scale** removal

Soil Carbon Sequestration



Direct Air Capture and Storage



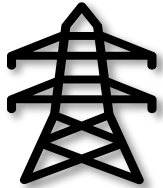
Blue are costs associated with ambient air capture
Green are costs associated with ensuring durable storage

Ensure the first ton of removal is true, durable removal

Ensure the last ton of removal is as affordable as it can be



Carbon Transport and Storage RD&D: An Iterative Process towards Deployment

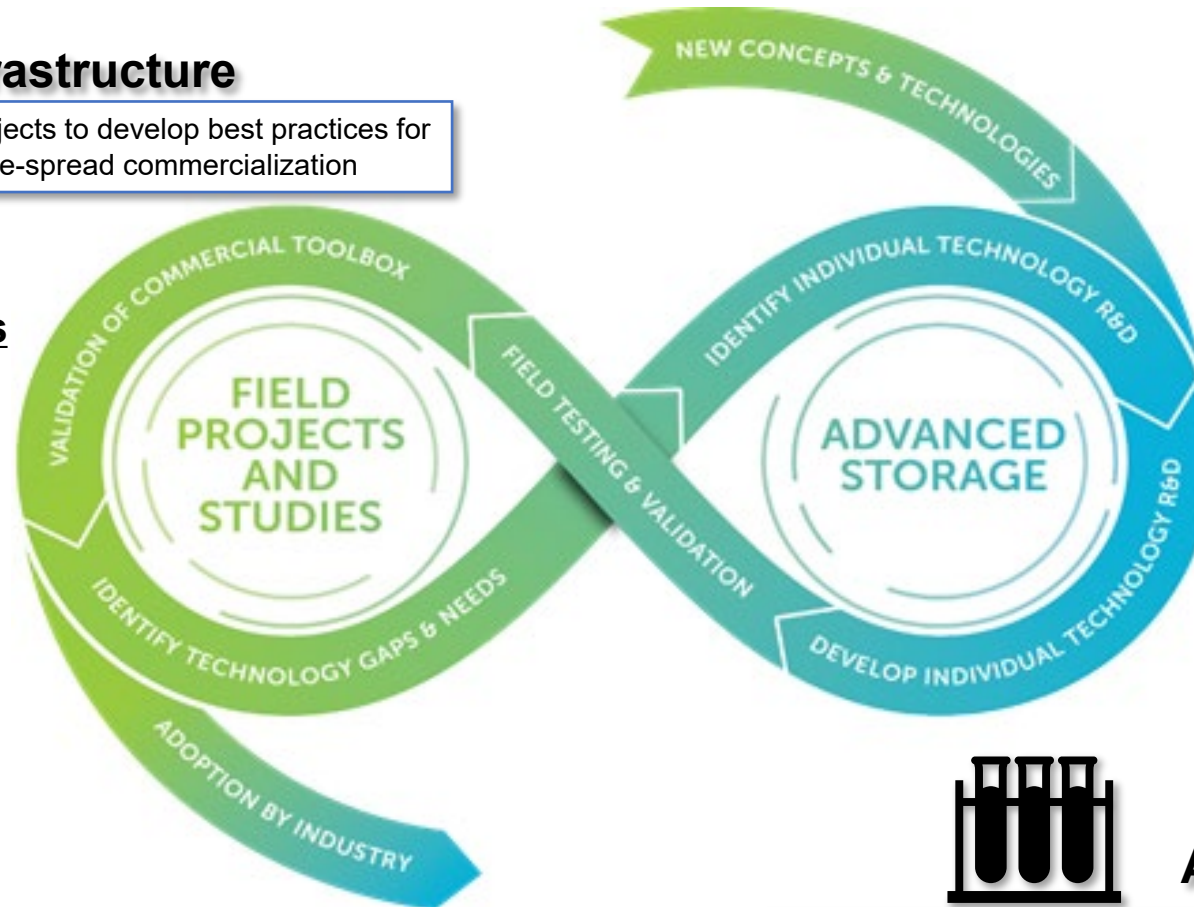


Storage Infrastructure

Large-scale demonstration projects to develop best practices for industry and facilitate wide-spread commercialization

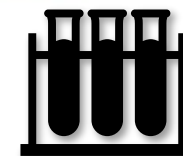
Storage Infrastructure Focus

- CarbonSAFE
- Regional Initiatives
- Offshore Storage
- Brine Extraction Strategy Test (**BEST**)
- Transition of O&G infrastructure



Advanced Storage Focus

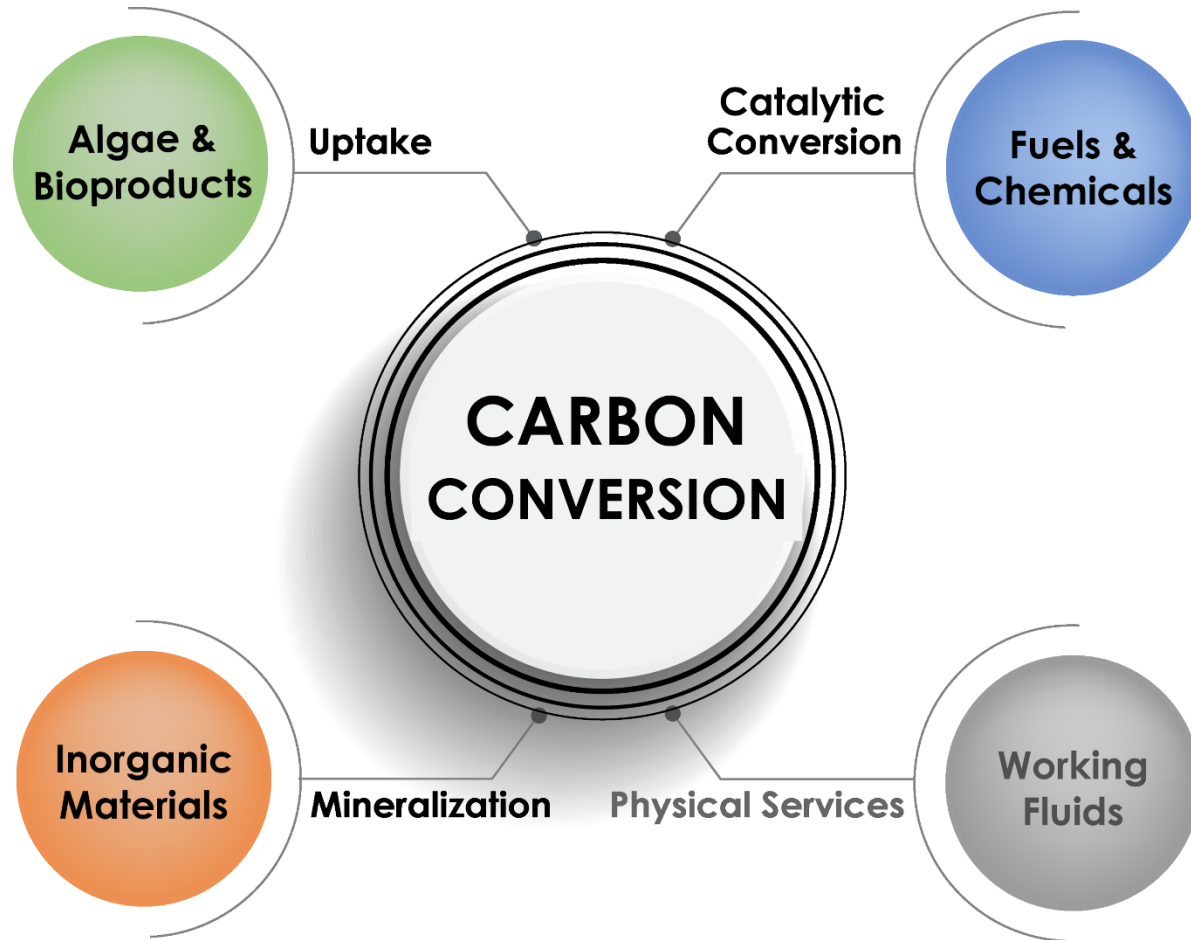
- Well Integrity and mitigation
- Monitoring, verification, and accounting
- Storage complex efficiency and security
- **SMART**: Science-Informed Machine Learning for Accelerating Real Time Decisions
- **NRAP**: National Risk Assessment Partnership



Advanced Storage

Harness early-stage storage concepts to technology demonstration

Carbon Conversion/Utilization Program



Challenges

- Scale & Rate of CO₂ emissions relative to of CO₂ conversion
- Determining economic viability and environmental impact requires significant resources -> very place-based
 - Technical viability is relatively easy to qualify
- Sweet spot of low carbon & low-cost energy like electricity, CO₂ sources, markets, and transportation between it all

Policy and Regulatory

- 45Q tax credit
- EPA UIC Class VI – geologic storage
- BOEM/BSEE – offshore
- DOT-PHMSA – pipelines

Funding Opportunity Announcements (FOAs)



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FOA Process Flow

I – Follow the Money

- President's Congressional Request Budget
- House Committee Mark
- Senate Committee Mark
- Annual FY Appropriation

V – Advance the Technology

- Evaluate Performance and Measure Progress
 - *Technology Maturation Planning*
 - *Technology Readiness Assessments*
 - *Independent Program/Project Peer Reviews*
- Inform Future R&D Needs

IV – Select, Negotiate and Award Projects

- Complete Initial Screening, Qualify Applications
- Develop Consensus Strengths and Weaknesses, Score Applications
- Prepare Senior Technical Briefing
- Select and Announce Winners
- Initiate Negotiations and Make Award

II – Structure the Opportunity

- Generate Annual Spend Plan for all Technology Areas
- Complete Acquisition Planning Process
- Identify Portfolio of FOA's to be Initiated
- Schedule FOA Critical Path Milestones

III – Initiate the Competitive Phase

- Develop Requirements Document
- Generate Procurement Strategy
 - *Craft Evaluation Criteria, Scoring Plan, Program Policy Factors, Selection Criteria*
 - *Select Merit Review Chair & Source Selection Official*
 - *Staff Scoring Panels with Subject Matter Experts*
- Publish & Issue FOA



Steps to Apply for Financial Assistance Award

<https://netl.doe.gov/business/solicitations>

- Identify opportunity of interest through **Funding Opportunity Announcement (FOA)**
- Meet registration requirements
- Prepare and submit application

The screenshot shows the NETL (National Energy Technology Laboratory) website. The browser address bar displays <https://netl.doe.gov/business/solicitations>. The page header includes the NETL logo, a search bar, and social media icons. A navigation menu lists: About, Research and Programs, Business, Education, Library, and News and Events. The main heading is "SOLICITATIONS AND FUNDING OPPORTUNITIES". Below this, a paragraph states: "NETL uses [FedConnect](#), [EERE Program Information Center](#) (open in Google Chrome), [Grants.gov](#), and [Contract Opportunities](#) to post solicitations and funding opportunity announcements and amendments, receive proposals and applications, and disseminate award information. Entities wishing to participate in these solicitations will need to register at these websites. Proposals will be accepted only through the websites indicated in the solicitation document." Another paragraph notes: "NETL solicitations and funding opportunities are listed below by program area, in descending order of posting date." Two links are provided: [Accessing Solicitations/Funding Opportunity Announcements in FedConnect](#) and [Solicitations and Funding Opportunities Archive](#). A green box contains a "Special Notice for Recipients of NETL Grants and Cooperative Agreements" regarding COVID-19 flexibilities, citing an OMB memo M-20-26 dated June 18, 2020. Below this, another green box mentions a "DOE Federal Resources During COVID-19 guide" dated April 10, 2020. The page is categorized under "Energy Efficiency and Renewable Energy". At the bottom, a table header is visible with columns: Posted Date, Announcement Type, Solicitation/Funding Opportunity Announcement Number, Title, Closing Date, and DOE Contact.



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Questions?



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: Krypton, Xenon, Radon. ** Included with rare earth elements.



Bipartisan Infrastructure Law (BIL)

FECM - **\$6.5 billion** in new carbon management funding over 5 years through the Infrastructure Investment and Jobs Act (Bipartisan Infrastructure Law).

Carbon Dioxide Removal - Direct Air Capture

Regional Direct Air Capture Hubs: \$3.5 billion

DAC Technology Prize Competition: \$115 million

Carbon Dioxide Utilization and Storage

Carbon Storage Validation and Testing: \$2.5 billion

Carbon Utilization Program: \$310 million

Front-End Engineering Design Studies

Carbon Capture Technology Program: \$100 million

Critical Minerals and Materials

Rare Earth Element Demonstration: \$140 million

Rare Earth Mineral Security: \$127 million

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 – thoughtful siting w/ focus on hard to avoid sectors (e.g., industry and committed emissions)
- Grid-scale energy storage
- Small modular reactors and more

FECM-OCED Project Coordination

Hydrogen Hubs

- \$8 billion (for at least four projects, including at least one using fossil fuels with carbon management)

Carbon Capture Demonstrations and Large Pilots

- \$3.5 billion

Carbon Dioxide Transportation Infrastructure Finance and Innovation Program Account

- Loan Programs Office: \$2.1 billion