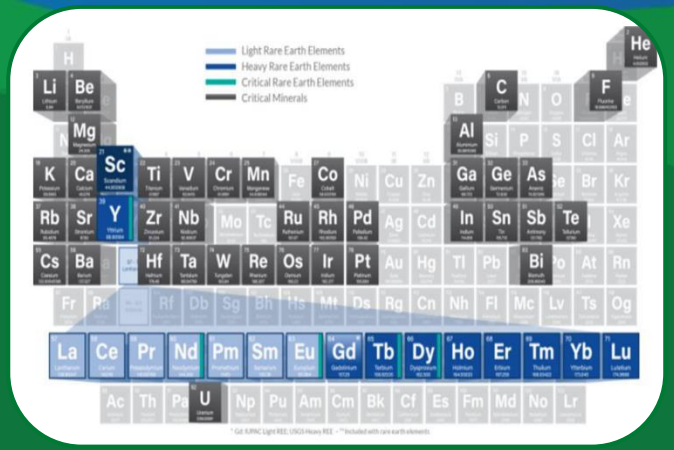
U.S. DEPARTMENT OF ENERGY
Fossil Energy and Carbon Management

An Overview of DOE's Fossil Energy and Carbon Management Carbon Transport and Storage Program

Darin Damiani, Carbon Storage Program Manager
Office of Fossil Energy and Carbon Management

MRCI Annual Meeting
Sept 28, 2022



Fossil Energy and Carbon Management (FECM)

Advancing Carbon Management Approaches toward Deep Decarbonization & Advancing Technologies that Lead to Sustainable Energy Resources

Priority Technology Areas

1. Point source carbon capture
2. Carbon dioxide (CO_2) removal
3. CO_2 conversion into products
4. Reliable CO_2 storage
5. Hydrogen production (non-electrolytic)

Office of Carbon Management (FECM-20)

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

Office of Resource Sustainability (FECM-30)

Supporting Legacy Communities (Justice40)

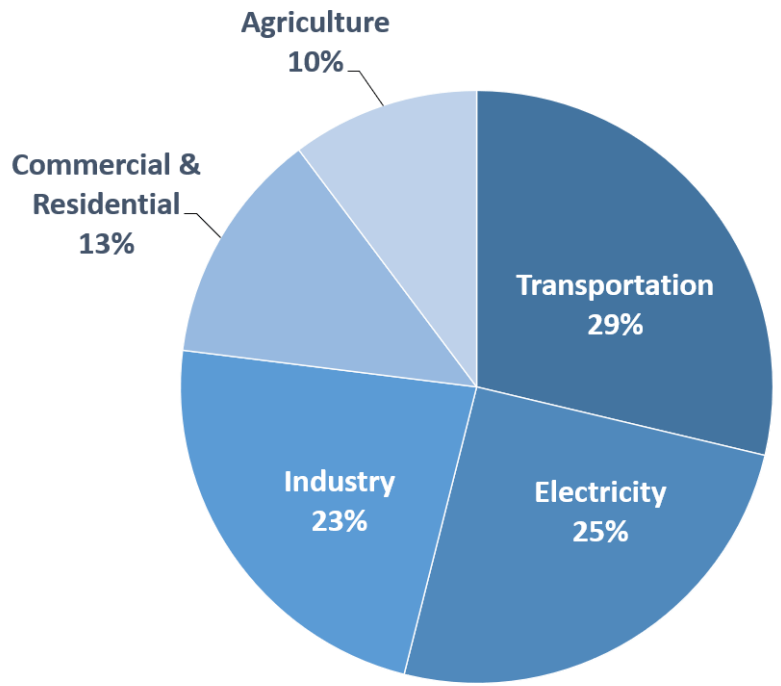
- Good-paying jobs
- Job growth acceleration
- Healthy economic transitions
- Improve community conditions
- **J40/DEI Plans will be required in FOA applications**

Address hardest-to-decarbonize applications in the industrial sector

FECM mission is driven by President Biden's goals (Executive Order 14008):

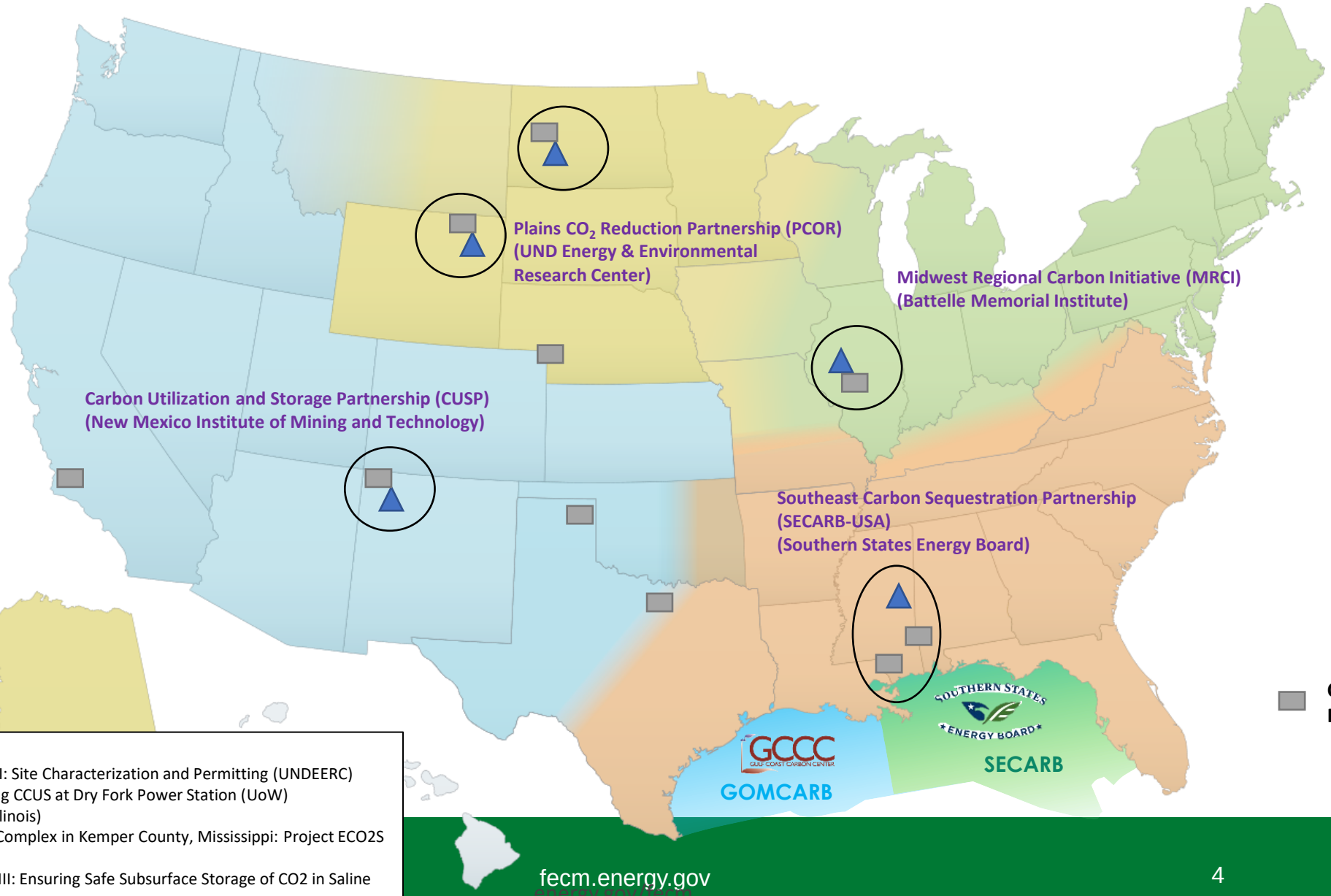
- 50-52% emissions reduction by 2030
- CO_2 emissions-free power sector by 2035
- Net zero emissions economy by no later than 2050
  - With assurance of social equity and environmental justice

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

Regional Initiatives and CarbonSAFE



CarbonSAFE Phase III Projects

- North Dakota CarbonSAFE Phase III: Site Characterization and Permitting (UNDEERC)
- Wyoming CarbonSAFE: Accelerating CCUS at Dry Fork Power Station (UoW)
- Illinois Storage Corridor (Univ. of Illinois)
- Establishing an Early CO2 Storage Complex in Kemper County, Mississippi: Project ECO2S (SSEB)
- San Juan Basin CarbonSAFE Phase III: Ensuring Safe Subsurface Storage of CO2 in Saline Reservoirs

Carbon Capture FEED Studies

Rapid CCS industry growth needed for achieving U.S. decarbonization goals

U.S. DEPARTMENT OF ENERGY

CarbonSAFE Targets

	2025	2030	2035	2040	. . .	2050
	VALIDATION	ACTIVATION	EXPANSION	AT SCALE		MIDCENTURY
Injectivity	5 million metric tons (MT)/year	65 million MT/year	250 million MT/year	450 million MT/year	. . .	> 1 billion MT/year
Commercial Storage Potential	250 million metric tons (MT)	2,000 million MT	7,500 million MT	13,500 million MT		> 30 billion MT

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 8X by 2030**

IPCC INTERGOVERNMENTAL PANEL ON climate change

Cumulatively sequester 350-1000 GT by 2050

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 FEED Studies for Pipelines/Infrastructure: $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
Principal Deputy Director, Kelly Cummins

- 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

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

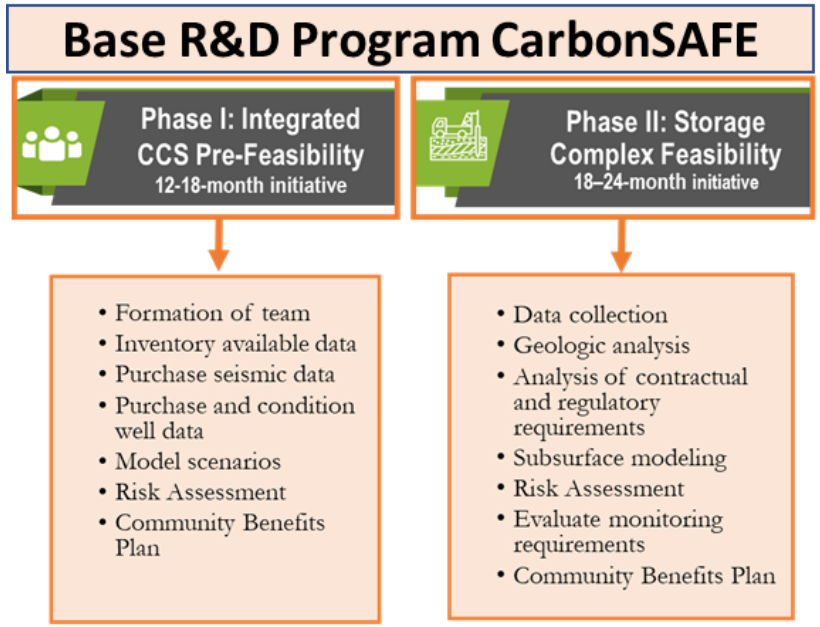
- $3.5 billion

Carbon Dioxide Transportation Infrastructure Finance and Innovation Program Account

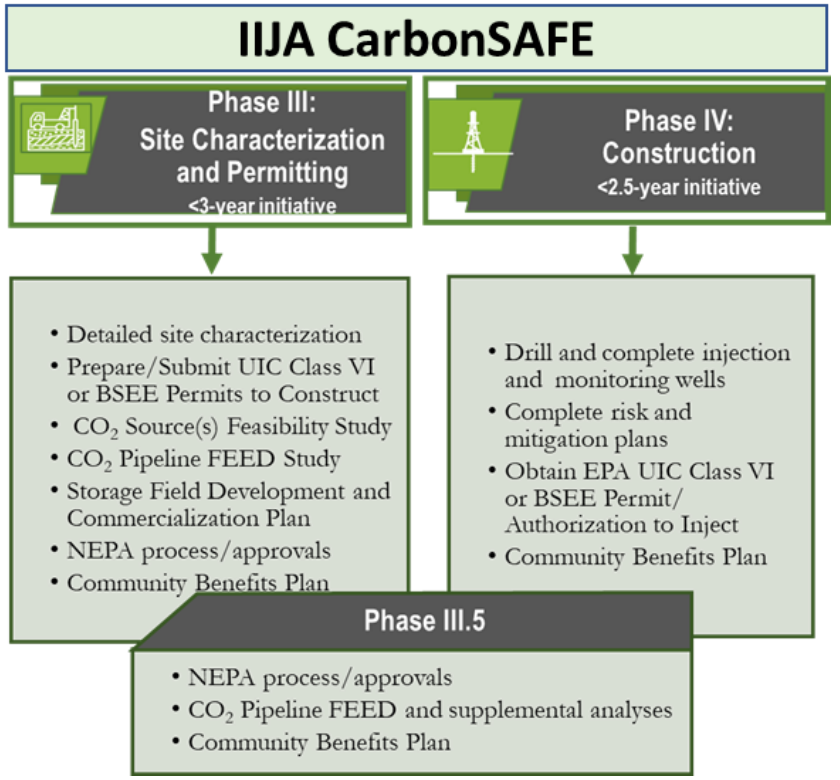
- Loan Programs Office: $2.1 billion

Carbon Storage Assurance Facility Enterprise (CarbonSAFE) Dedicated Storage and Hubs Infrastructure

FOA2610



FOA2711



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

CarbonSTORE

(Carbon **S**torage **T**echnology and **O**perations **RE**search Facility)

CarbonSTORE leverages DOE investments today to drive down the cost of CCS tomorrow

Key functions…

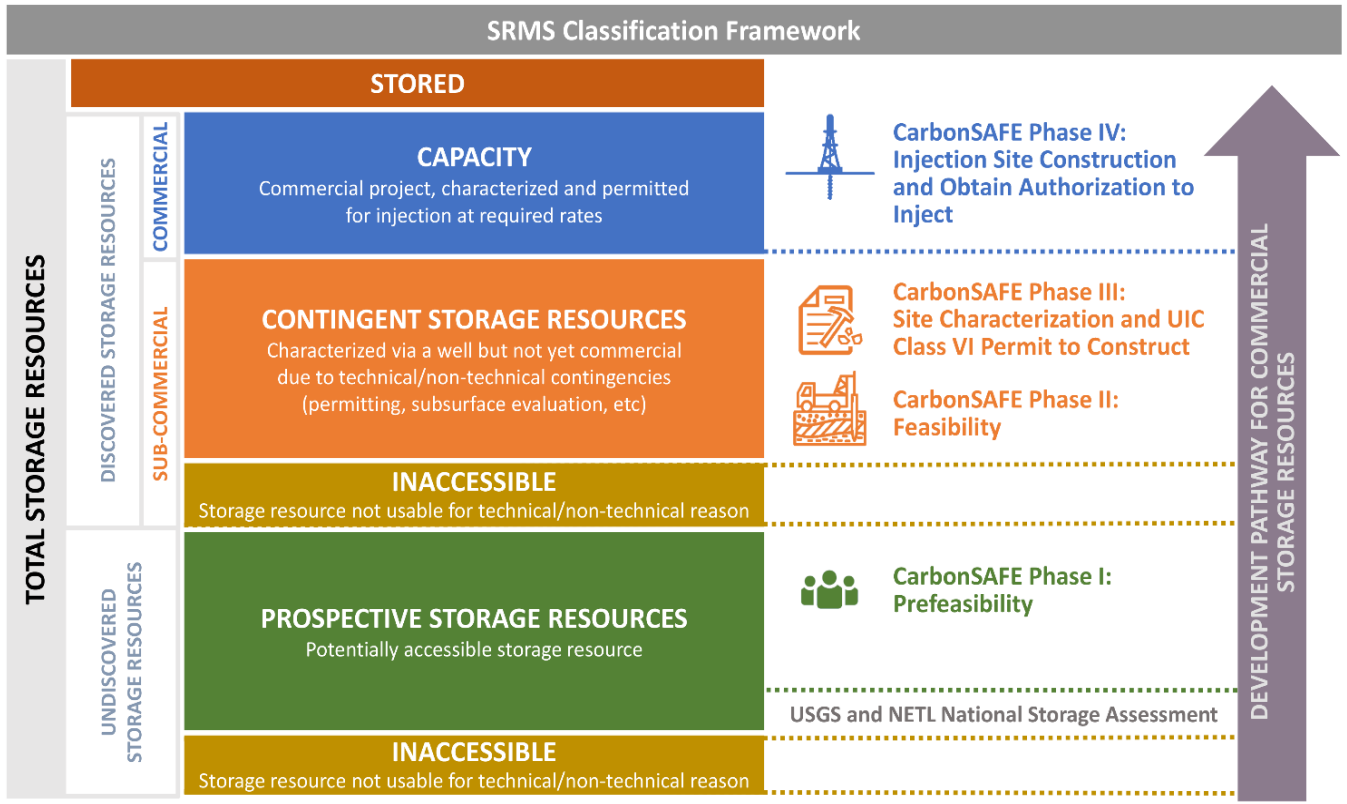
⇒ Facilitates enhanced data gathering for new tech development.

⇒ Fast tracks emerging technology validation.

⇒ Provides real-world performance feedback for operational improvements and optimization.

Storage Resource Management System

Metric for measuring success



Year	Target Commercial Capacity (MMT)	CarbonSAFE Project Equivalents
2025	250	5
2030	2,000	40
2035	7,500	150
2040	13,500	270
2050	30,000	600

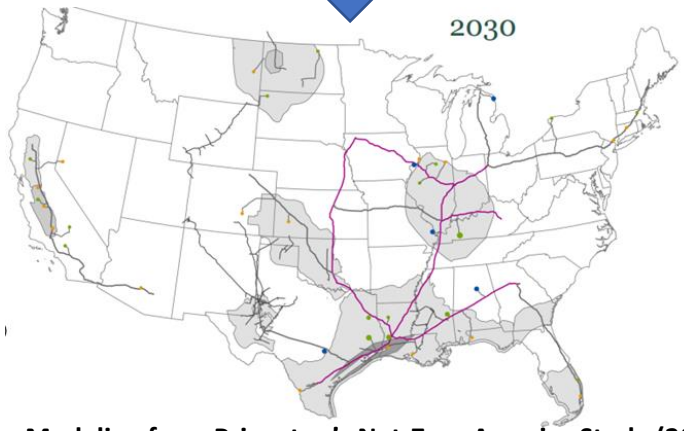
In February large gas-producer in Australia, Santos, announced it booking 100 Million tons in storage capacity. First use of SRMS!

Future Needs for CO_2 Transport Infrastructure

- BIL Provision 40303—CO_2 Transport FEED Studies, $100 million authorized over 5 years
- New carbon transport buildout or repurposing of existing infrastructure
- Working with DOT PHMSA to inform future regulatory and safety considerations
- Supports CO_2 Transportation Infrastructure and Innovation Program (CIFIA $2.1 billion loan guarantees)
- CO_2 transport should review all modes of transport (ship, barge, rail, truck)

NPC: Meeting the Dual Challenge (2019)

Today: ~5,000 miles of CO2 pipelines



2030: ~11,000+ miles of CO2 pipelines

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

Funding Opportunity Announcements

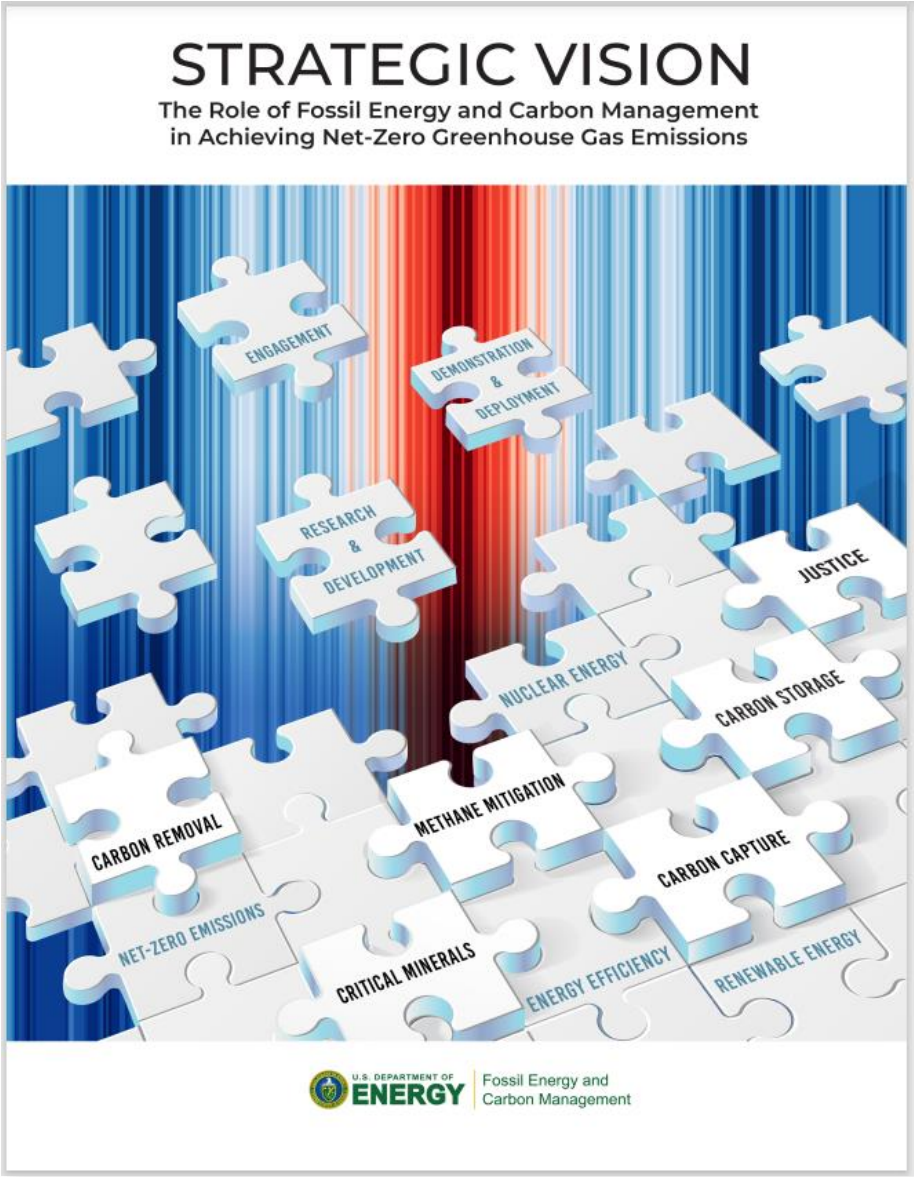
- **Base CTS Program to fund new CarbonSAFE Phase II projects – on and offshore ($40M FY22)**
  - FOA2610 released. Offshore restricted to GoM. Applications under review.
- **Bipartisan Infrastructure Law (BIL) Carbon Storage Validation and Testing ($500M/yr over 5 years)**
  - FOA2711 release September 22. Applications due in 60 days
- **Carbon Capture FEED Studies for Pipelines/Infrastructure ($100M)**
  - FOA2730 release September 22. Applications due in 60 days.
  - Starting with pipelines; following FOAs will consider other modes of transportation
- **Notice of Intent released for FOA2799: DOE Regional Initiatives to Accelerate Carbon Management Deployment: Technical Assistance for Large Scale Storage Facilities and Regional Carbon Management Hubs"**

Base Carbon Transport & Storage Program R&D Interests Going Forward

- **Strategies and tools for basin-scale carbon storage** resource management
- **Repurposing of O&G infrastructure** for dedicated CO_2 storage (including injection back into reservoirs of natural CO_2)
- Advancing technologies for enabling **more intuitive visualization and more rapid decision making**
- **Strategies for expanding characterization efforts** to support practical storage resource assessment.

FECM Strategic Vision Released April 5, 2022

Federally-funded RD&D to enable energy innovation and carbon management commercialization



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

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Questions?

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