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ENERGY

Fossil Energy and
Carbon Management

Joint Annual Briefing to Southern Legislative Leaders and Committee on Carbon Management Meeting

New Priorities and Strategic Progress in Carbon Management

Joseph Giove III

Director of Business Operations
Office of Carbon Management (FECM-20)



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	Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr							
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									



Office of the Assistant Secretariat of Fossil Energy and Carbon Management (FECM)

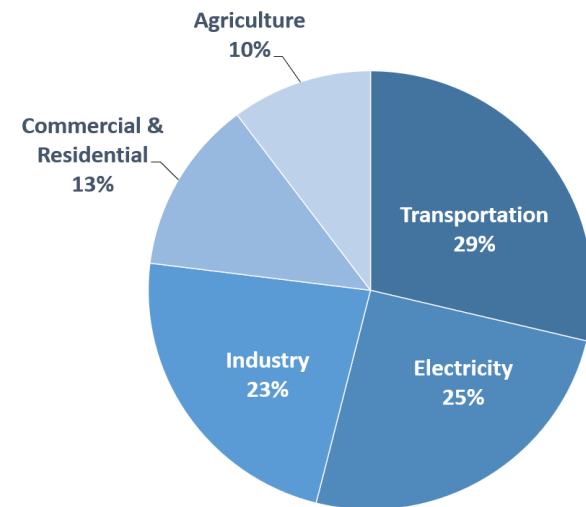
Office of Fossil Energy and Carbon Management

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



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FECM Mission

Minimize environmental and climate impacts of fossil fuels and industrial processes, while working to achieve net-zero emissions across our economy.

Priority Technology Areas

1. Carbon capture from industry and power generation
2. Carbon dioxide (CO₂) removal
3. Conversion of captured carbon emissions into products
4. Geologic storage of CO₂
5. Hydrogen production with carbon management

Office of Carbon Management
(FECM-20)

6. Methane mitigation
7. Critical minerals production and processing

Office of Resource Sustainability
(FECM-30)

Providing Benefits to Communities and Workers

- Improved economic and environmental conditions
- Retention and creation of high-wage jobs
- Workforce development



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Bipartisan Infrastructure Law and Inflation Reduction Act

Recently Passed Legislation Provides Opportunity for Funding and Spurs US Innovation

Bipartisan Infrastructure Law - \$62B over 5 years for DOE, including \$12B for carbon management, over \$8B for hydrogen and more

- Demonstrate mission critical technologies in first-of-a-kind projects at pilot and commercial scales
- Build out essential infrastructure to enable technology deployment at climate scale

Inflation Reduction Act – 10-yr, 350+ billion package of clean energy and industrial tax credits to stimulate private sector investment and leverage federal infrastructure funding. Example of enhancements to 45Q credit for geologic storage of CO₂ or conversion of captured carbon emissions into products:

- Up to \$85/tCO₂ for carbon capture from power plants and industrial facilities
- Up to \$180/tCO₂ for direct air capture to remove CO₂ from ambient air
- Credit available for first 5 yrs as a direct cash payment to facilitate project financing
- Greatly expanded project eligibility to include smaller facilities across industries



Congressional Direction: 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



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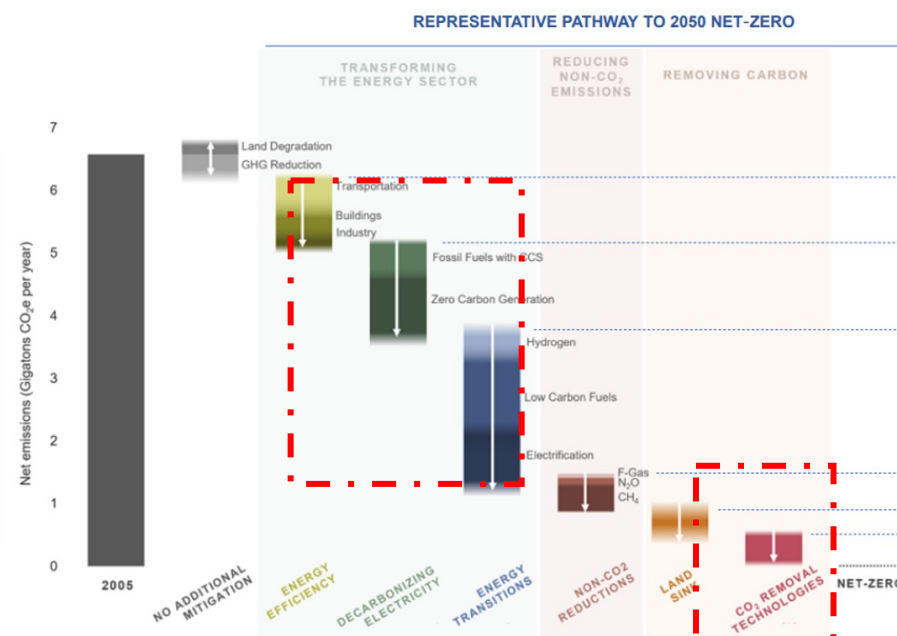
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Program Highlights

Role of Carbon Capture and Carbon Removal in Achieving Net-Zero

- Carbon capture is necessary to achieve net-zero in industry and the power sector, with an especially important role for industries with limited decarbonization options, such as cement and steel
- Carbon dioxide removal from the atmosphere is critical for counterbalancing emissions from the very hardest to abate sectors, such as aviation and agriculture
- All scenarios in the US long-term climate strategy shows the need for both carbon capture and removal to meet climate goals



<https://www.whitehouse.gov/wp-content/uploads/2021/10/US-Long-Term-Strategy.pdf>



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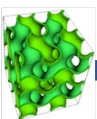
Industrial and Power Plant Capture Program

Integrated Approach to Accelerate Technology Development

Lab & Bench



TRL 2-4



Small Pilots



TRL 4-5

Large Pilots



TRL 5-7

FEED Studies



- Develop capture technologies across industrial and power 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.)



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Direct Air Capture Hubs

<https://www.energy.gov/oced/regional-direct-air-capture-hubs>



Issued a Request for Information (RFI) in December 2021 that received thousands of pages of responses

Conducted applicant education workshops in person (OH, LA, and UT) and virtually

Issued a Notice of Intent in May 2022 – First major step towards getting the funding out the door and into the field

\$3.5 billion funding announcement for Direct Air Capture Hubs in December 2022 implemented in partnership with the DOE Office of Clean Energy Demonstration



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CO₂ Transport and Storage

Storage Targets to Meet
2050 Decarb Goal



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Injectivity

**Commercial
Storage Potential**

2025

VALIDATION

5 million metric tons
(MT)/year

250 million metric
tons (MT)

2030

ACTIVATION

65 million MT/year

2,000 million MT

2035

EXPANSION

250 million MT/year

7,500 million MT

2040

AT SCALE

450 million MT/year

13,500 million MT

...

2050

MIDCENTURY

>1 billion MT/year

> 30 billion MT

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

- **BIL 40305—Storage Validation and Testing**
- **\$2.5 billion** over 5 years (**CarbonSAFE**)
- **New or Expanded** large-scale commercialization of geologic storage facilities
- **50 MMT Hubs and Large- Scale Storage**
- 20-40 Facilities; ~80-100 Class VI Wells
- **BIL 40303—CO₂ Transport FEED Studies**
- **\$100 million** over 5 years
- **New CO₂ transport buildout or repurposing of** existing infrastructure
- **Working with DOT PHMSA** to inform future regulatory and safety considerations



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Carbon Transport and Storage Base Program R&D support to BIL projects

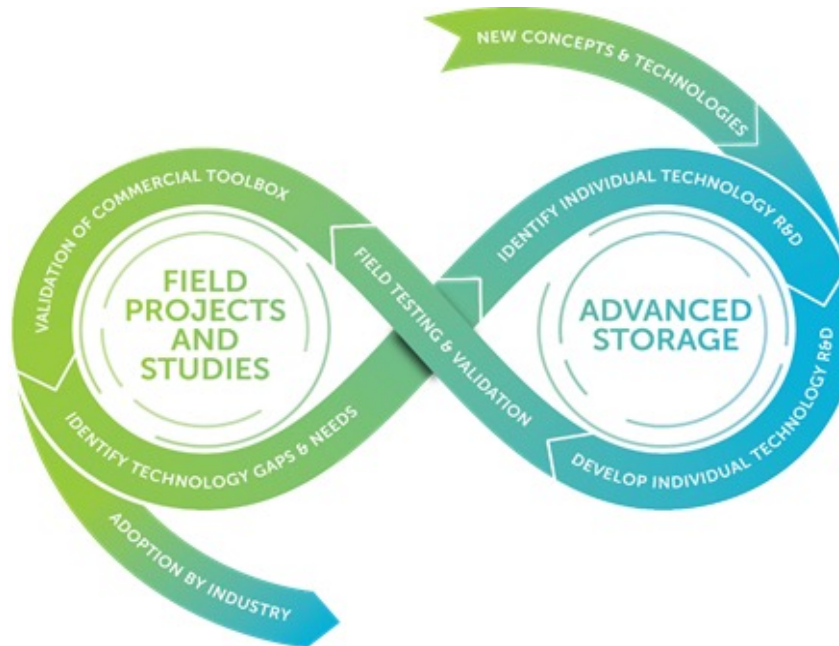
Infrastructure Focus

CarbonSAFE Phase II feasibility studies

Regional Initiatives to provide technical assistance to stakeholder

CarbonSTORE field labs to test and validate next-generation technology

Offshore storage characterization



Iterative Process Towards Deployment

Advanced R&D Focus

New sensors, wireless power and telemetry systems

Basin-scale storage impact and optimization analyses

CO₂ mineralization resource assessments

Early leakage detection

Induced seismicity risk forecasting

Pipeline network modeling (SimCCS)

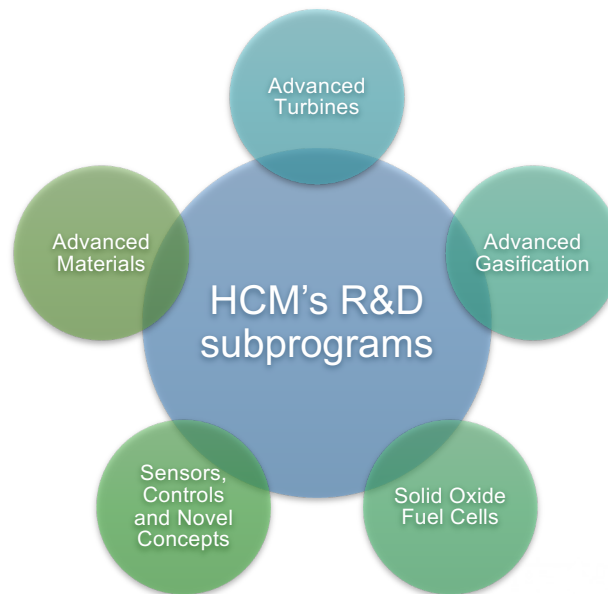


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Hydrogen with Carbon Management



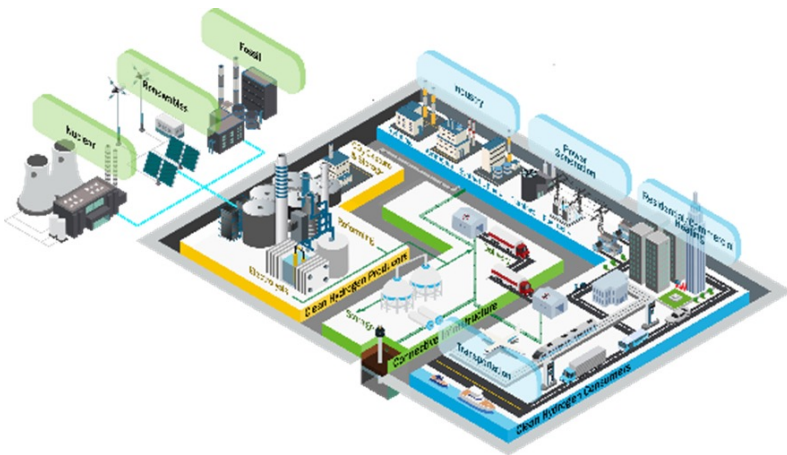
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Regional Clean Hydrogen Hubs

<https://www.energy.gov/oced/regional-clean-hydrogen-hubs>



Issued a Request for Information (RFI) in March 2022 that received thousands of pages of responses

Conducted stakeholder workshops and webinars, including a webinar on the RFI and listening sessions with Tribal leaders and energy justice communities

Issued a Notice of Intent in June 2022 – our first major step towards getting the funding out the door and into the field

\$7 billion funding announcement for regional clean hydrogen hubs in December 2022



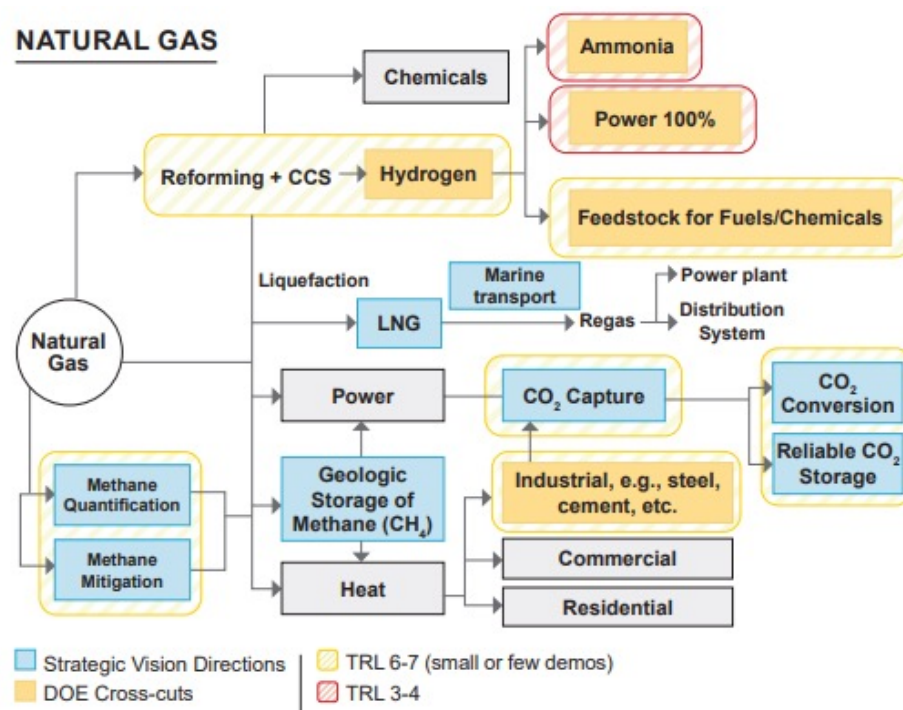
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Developing a Secure and Sustainable Natural Gas Strategy



Three pronged-approach:

1. Meet energy security needs of the U.S. and our allies;
2. Decarbonize the natural gas value chain and mitigate methane emissions; and
3. Protect U.S. consumers and the competitiveness of U.S. industry and manufacturing.



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Natural Gas Exports

Meeting the energy security needs of our allies

Aligning natural gas export regulatory approaches to ensure transparency while scrutinizing environmental and domestic market impacts and recognizing energy security priorities



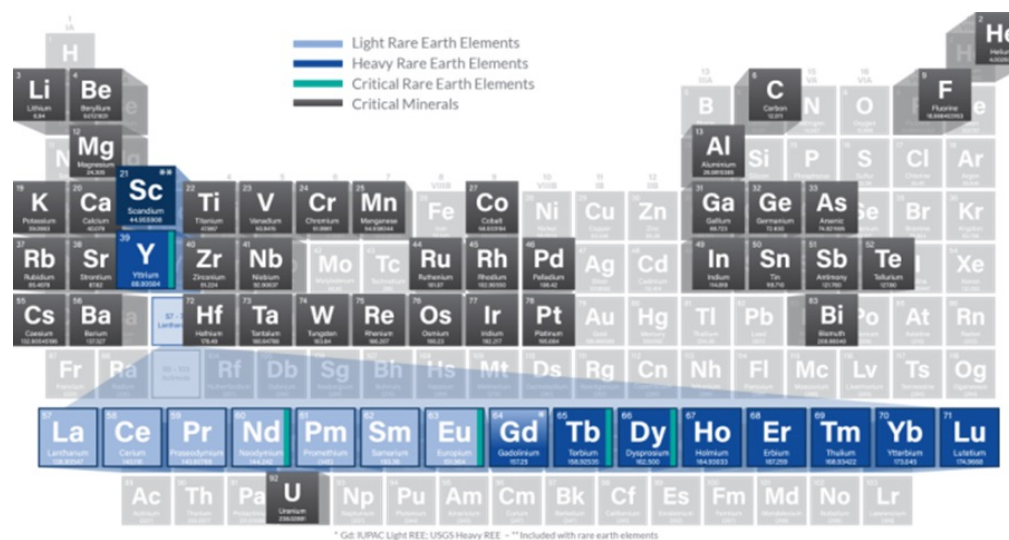
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Developing Domestic Critical Mineral Supply Chains



- Import-dependent (>50% from foreign source) on 32 of 35* critical minerals
- Import-reliant (100% from foreign source) for at least 14 critical minerals

**Source: USGS Minerals Commodity Summaries*



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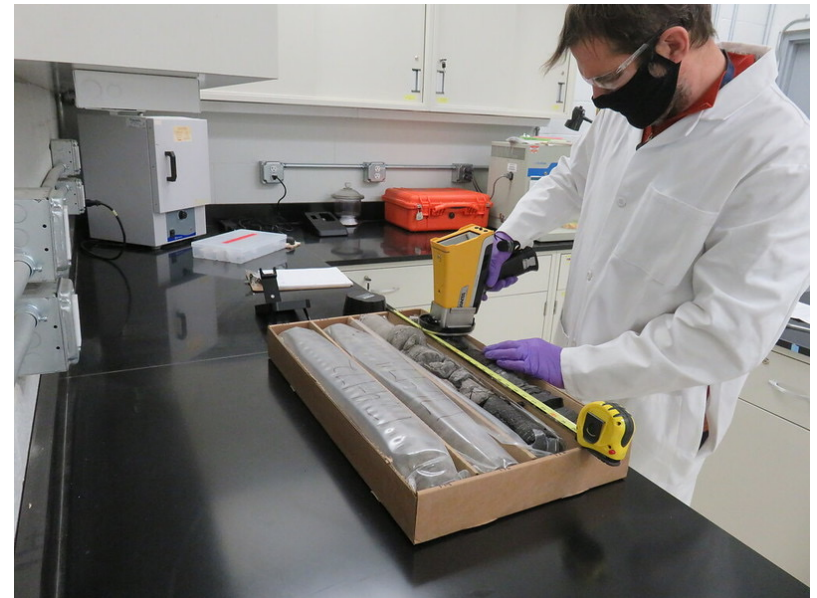
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Expanding Our Critical Minerals Portfolio

New and strategic part of FECM

- Implement Rare Earth Element Demonstration Facility for extracting and processing REEs from coal and mining and oil & gas waste streams
- Participate in Administration initiatives to diversify critical mineral supply chains domestically and globally.
- Expand RD&D to include the “mine of the future”



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Scaling Up Community, Stakeholder, and Tribal Engagement to Help Ensure Project Success

Successful deployment of carbon management projects and infrastructure to meet our climate goals will depend on public acceptance and support.

- Engagement framework developed
- Implementation of strategies, partnerships, and priority activities underway
- Goal: deliver tangible community and worker participation and benefits to ensure support for deployment at climate scale



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Thank You

Learn More About Us

The Office of Fossil Energy and Carbon Management

<https://www.energy.gov/fecm>

Our Office of Carbon Management

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

Our Office of Resource Management

<https://www.energy.gov/fecm/office-resource-sustainability>

Our Strategic Vision

https://www.energy.gov/sites/default/files/2022-04/2022-Strategic-Vision-The-Role-of-Fossil-Energy-and-Carbon-Management-in-Achieving-Net-Zero-Greenhouse-Gas-Emissions_Updated-4.28.22.pdf



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Questions?



Periodic table of elements with color-coded categories:

- Light Rare Earth Elements (blue)
- Heavy Rare Earth Elements (green)
- Critical Rare Earth Elements (yellow)
- Critical Minerals (orange)

