



U.S. DEPARTMENT OF
ENERGY

Fossil Energy and
Carbon Management

Department of Energy Carbon Management Infrastructure Opportunities

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U.S. Department of Energy

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Legend:

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

H																	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									

* Gd, Yb, Pr, Ce, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu are included with rare earth elements.



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

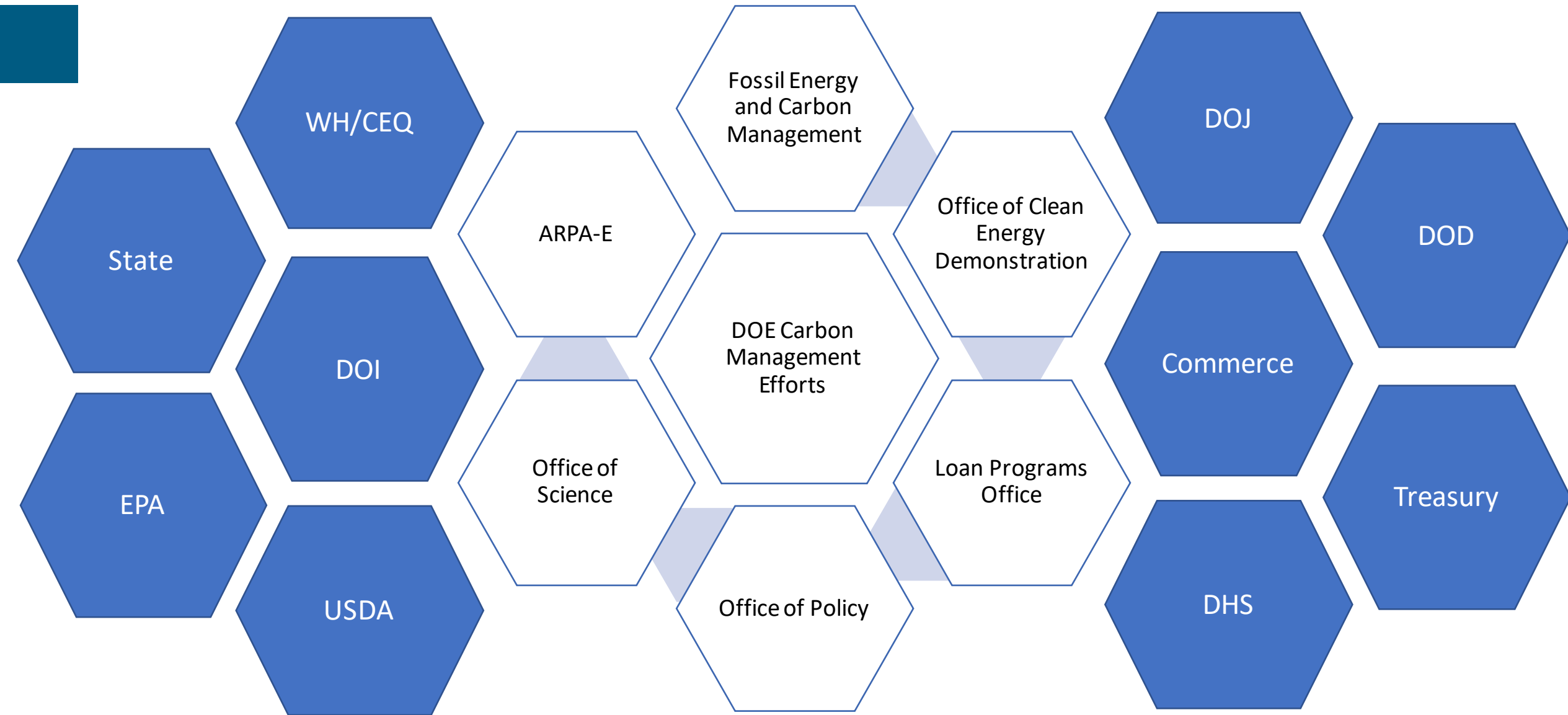
Priorities: Hydrogen with carbon management, domestic critical minerals (CM) production, and methane mitigation



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All-of-DOE and Government support for Carbon Management



Rapid CCS industry growth for decarbonization



CarbonSAFE Targets

Injectivity
Commercial Storage Potential

2025	2030	2035	2040	...	2050
VALIDATION	ACTIVATION	EXPANSION	AT SCALE	...	MIDCENTURY
5 million metric tons (MT)/year	65 million MT/year	250 million MT/year	450 million MT/year	...	>1 billion MT/year
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 10-fold by 2030

ipcc
INTERGOVERNMENTAL PANEL ON
climate change

Cumulatively sequester 350-1,000 GT by 2050



Fossil Energy and Carbon Management

[The Long-Term Strategy of the United States, Pathways to Net-Zero Greenhouse Gas Emissions by 2050 \(whitehouse.gov\)](https://www.whitehouse.gov/the-press-office/2021/04/22/eo-14008-tackling-the-climate-crisis-at-home-and-abroad)

Opportunities for the Entire Value Chain: Bipartisan Infrastructure Law (BIL)



Industrial and Power Plant Carbon Capture

- CCUS Integrated Demos: \$2.5 billion (OCED)
- Carbon Capture Large Pilot: \$1 billion (OCED)



Direct Air Capture

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



Carbon Transport Systems

- FEED Studies for Transport Systems: \$100 million
- CIFIA – Loans and Future Growth Grants: \$2.1 billion



Carbon Dioxide Utilization and Storage

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

Project Applications Require New Components:

- Community and Stakeholder Engagement
- Diversity, Equity, Inclusion, and Accessibility
- Justice40 Initiative
- Quality jobs

Bipartisan
Infrastructure Law
Programs at
Department of Energy



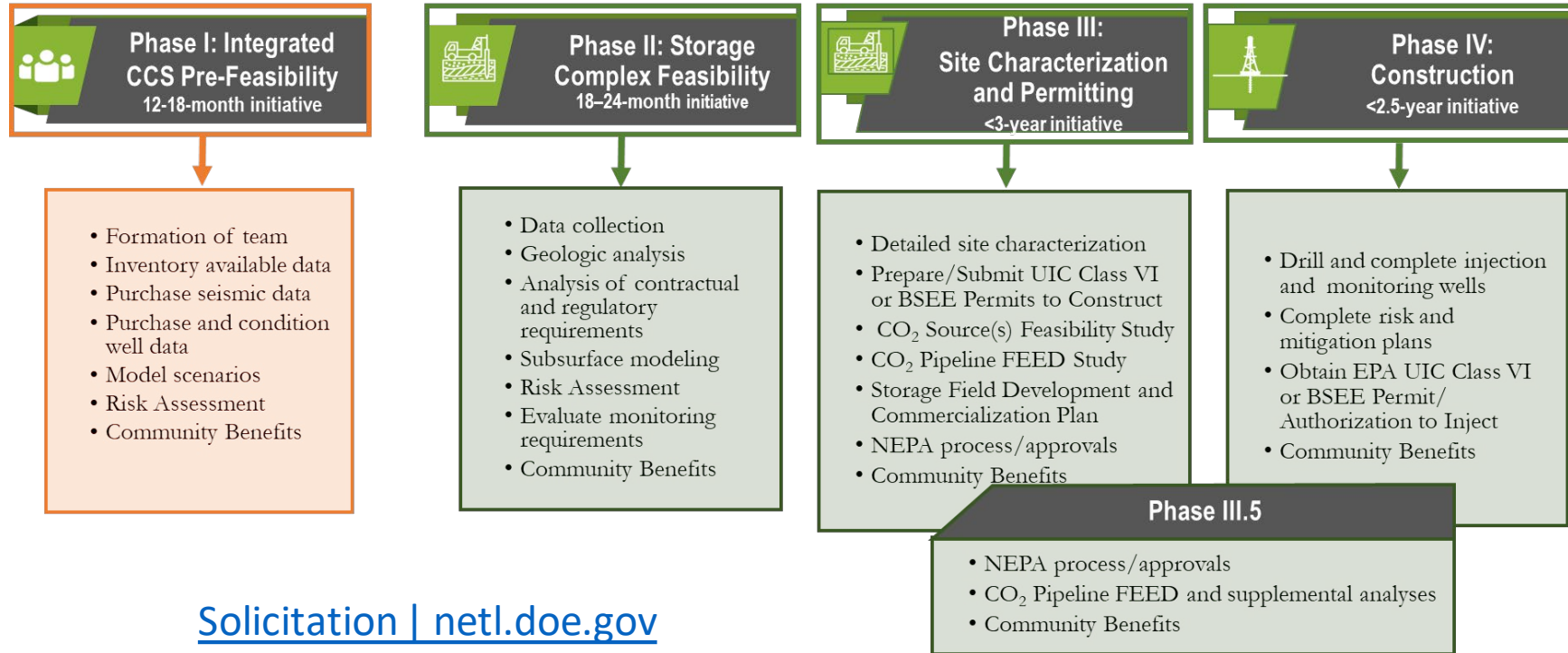
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<https://www.energy.gov/fecm/solicitations-and-business-opportunities>

Dedicated Storage and Hubs Infrastructure

Key BIL Sec 40305

[NETL To Expand BIL-Funded Carbon Storage Validation And Testing Program | netl.doe.gov](https://netl.doe.gov)



[Solicitation | netl.doe.gov](https://netl.doe.gov)

\$2.5 billion over 5 years--
apply to phase based on
project readiness.

New or Expanded large-
scale commercialization
carbon sequestration
facilities

**50 MMT Hubs and Large-
Scale Storage**

20-40 Facilities

~80-100 Class VI Wells

CO₂ Transport Infrastructure Investments

Key BIL Sections 40303 and 40304

CO₂ Transport FEED Studies \$100 Million (5-years)

- New buildout or repurposing of existing infrastructure
- Incorporate DOT-PHMSA's guidance into RDD&D—work to ensure the continued safe operations of commercial CO₂ pipelines
- CO₂ transport should review all modes of transport (ship, barge, rail, truck)

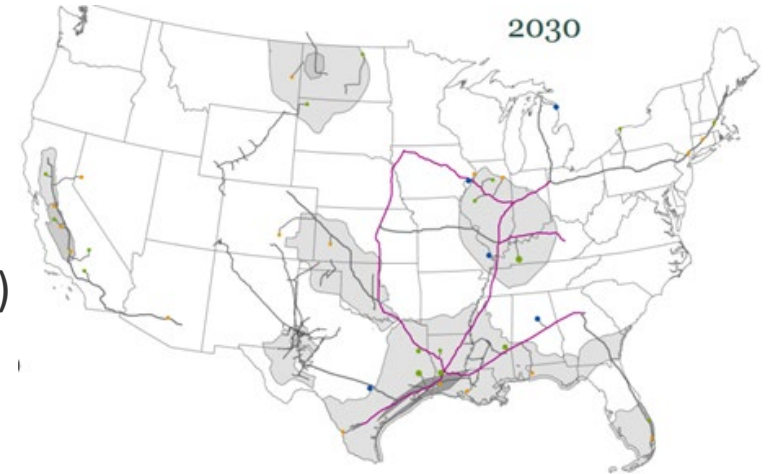
Bipartisan Infrastructure Law (BIL): Carbon Capture Technology Program, Front-End Engineering and Design for Carbon Dioxide (CO₂) Transport

- Feasibility studies – FECM Carbon Management FOA 2614 – AOI4

CO₂ Transportation Infrastructure Finance and Innovation (CIFIA)

- \$2.1 Billion (Loan Authority) large-capacity common carrier transportation or repurposing existing infrastructure
- Future Growth Grants to support expansion of CO₂ transport systems by increasing flow rate or capacity

<https://www.energy.gov/fecm/request-information-carbon-dioxide-transportation-infrastructure-finance-and-innovation-cifia>



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











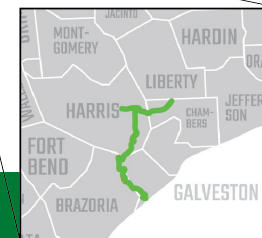
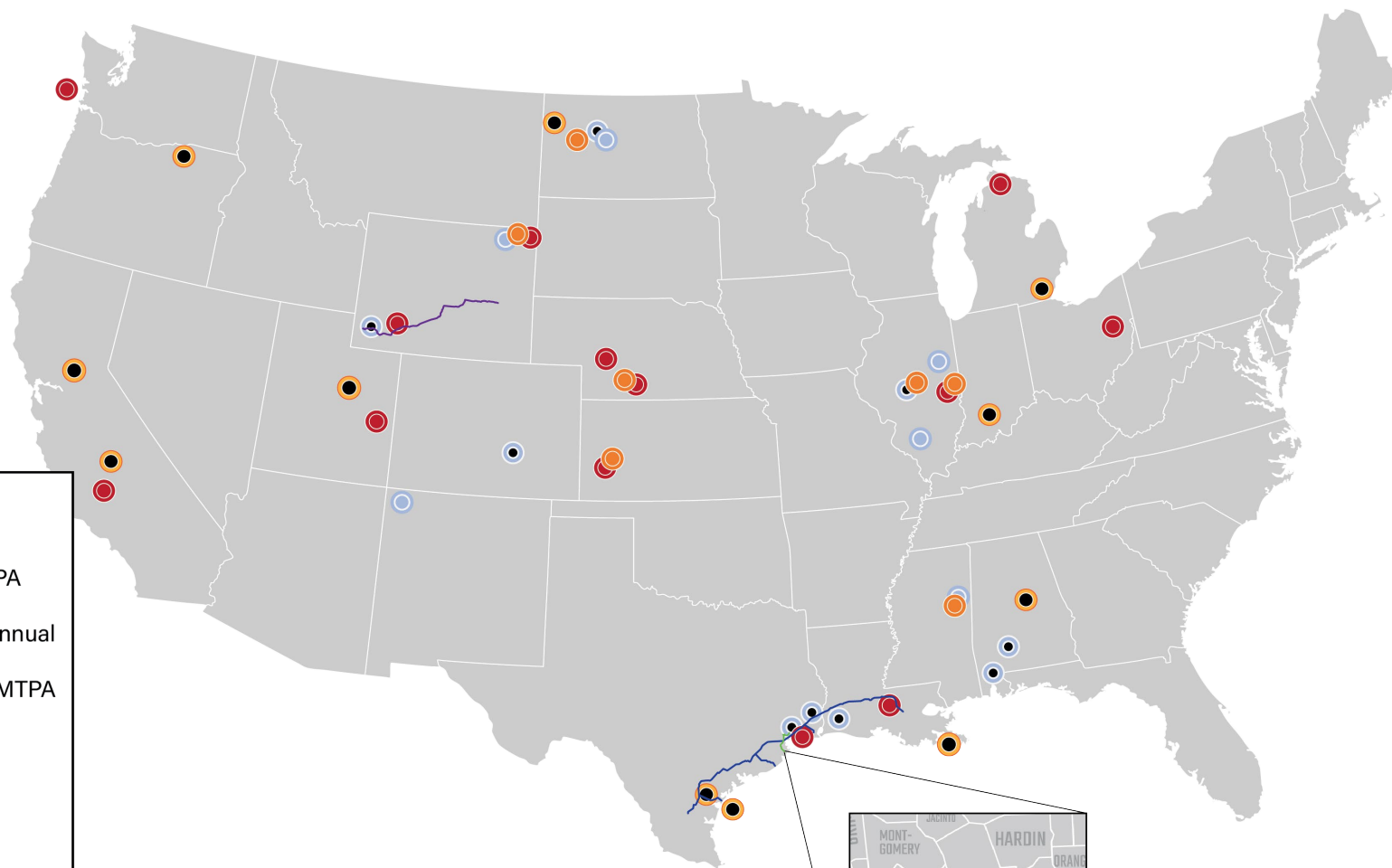
CarbonSAFE and Transport Projects in the U.S.

FOA 2711 selected projects represent several billion tons of commercial storage capacity

Legend

FEED Pipeline Study - Selected FOA 2730

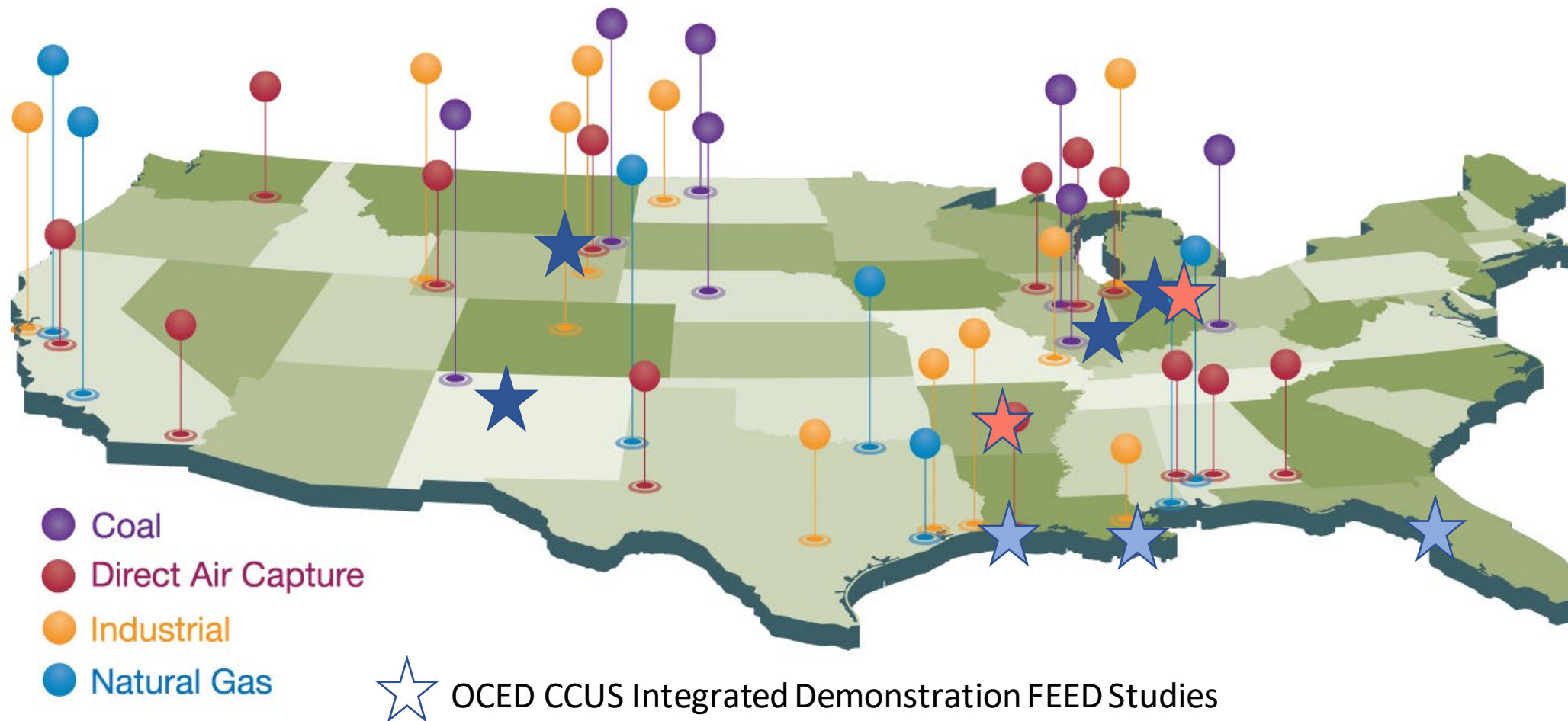
-  Carbon Solutions - WyoTECH 12/24" diameter, 18 MMTPA Annual CO₂ Rate
-  SSEB - Project Diamond 16/20" diameter, 7.7 MMTPA Annual CO₂ Rate
-  HEP - Gulf Coast Decarb System 36" diameter, 100+ MMTPA Annual CO₂ Rate Regionally
-  **Phase I**
- Phase II:**
 -  Phase II - Existing
 -  Phase II- Selected FOA 2610
- Phase III:**
 -  Phase III - Existing
 -  Phase III - Selected FOA 2711



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FECM FEEDs and pFEEDs.. Overall Portfolio



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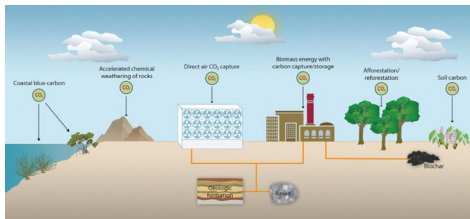
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Direct Air Capture Hubs

Key BIL Sec. 41005

Direct Air Capture Hubs <https://www.netl.doe.gov/node/12240> Closed

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.

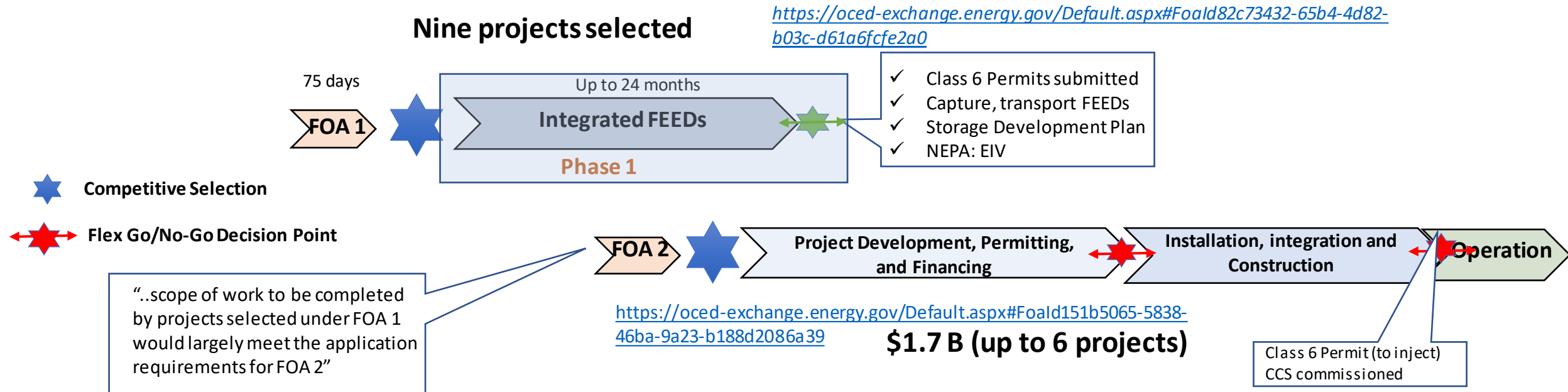
HUB DEFINITION:

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.

CCS Integrated Demonstrations

Key BIL Sec. 41004



- **Demonstrate the construction and operation of 6 facilities to capture carbon dioxide:**
 - two projects at new or existing coal electric generation facilities,
 - two projects at new or existing natural gas electric generation facilities, and
 - two projects at new or existing industrial facilities not purposed for electric generation.
- **New or existing** facilities transformational domestic, commercial-scale, integrated CCS, demonstration projects designed to further advance the development, deployment, and commercialization of technologies to capture, transport (if required), and store CO₂ emissions



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Regional Clean Hydrogen Hubs

Key BIL Sec. 40314

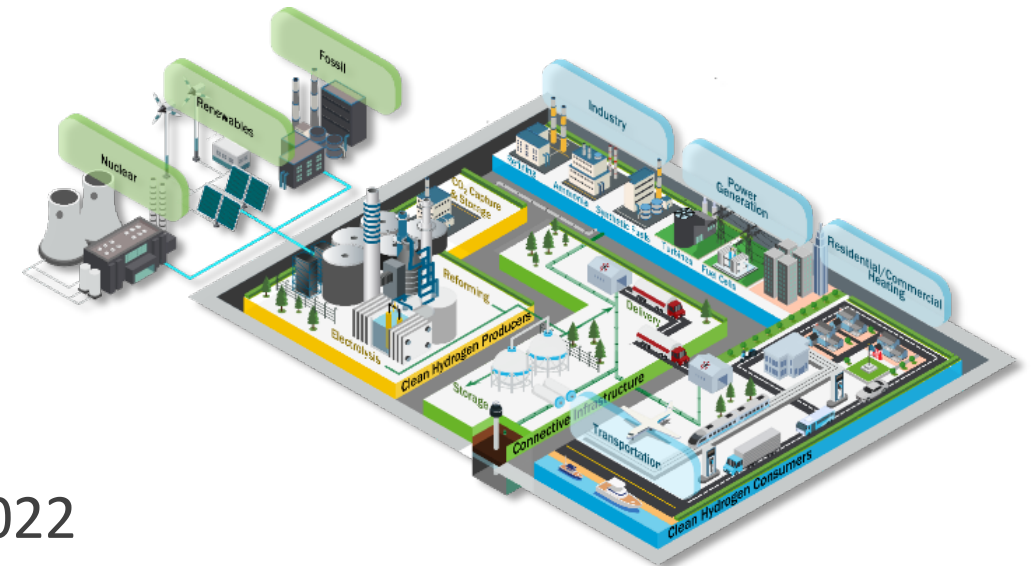
<https://www.energy.gov/oced/regional-clean-hydrogen-hubs>

Build 6-10 regional clean H2 Hubs across the country to create networks of hydrogen producers, consumers, and local connective infrastructure to accelerate use of hydrogen

- Feedstock diversity
- End use diversity
- Geographic diversity
- Employment and training

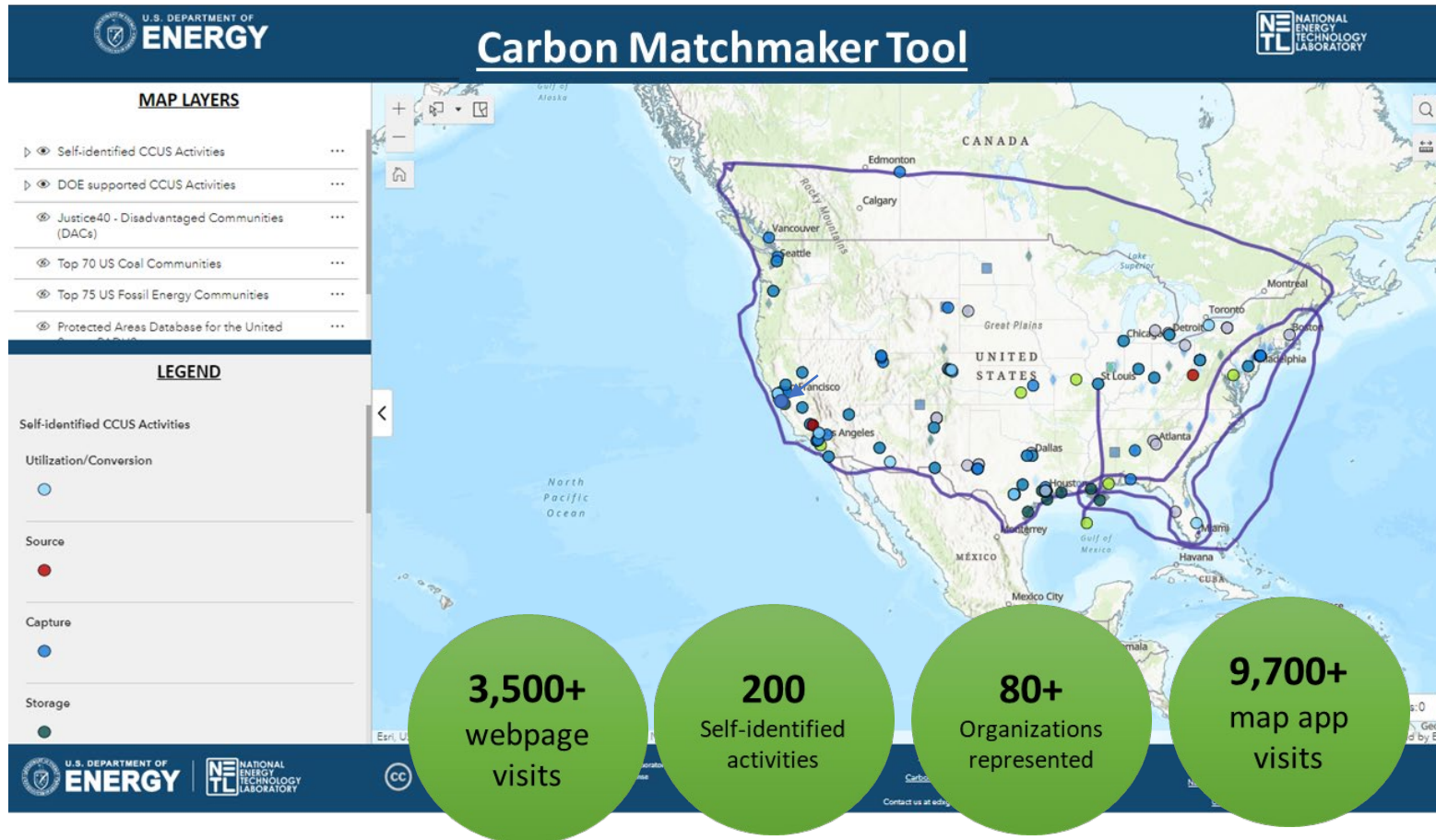
Current Status

- Issued funding announcement in September 2022
 - Planning 6-10 awards ranging from \$400M-\$1.2B
 - Applications under review



FECM Carbon Matchmaker

Online resource to connect users across CCUS and CDR



- Enable team-building
- Increase awareness
- Facilitate development of regional carbon management hubs
- Provide community, industry, and technology stakeholders supply and demand maps for current and planned projects
- Highlight DOE carbon management projects in a geospatial map

Tool released on July 13, 2022, stats as of 2/1/2023

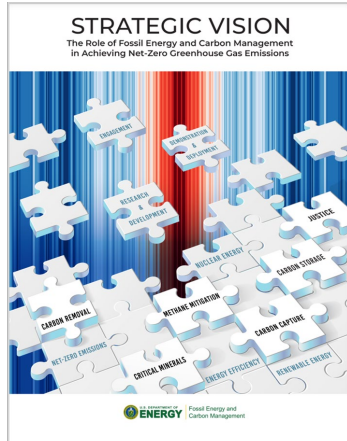
<https://www.energy.gov/fecm/carbon-matchmaker>



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Resources and Engagement Opportunities



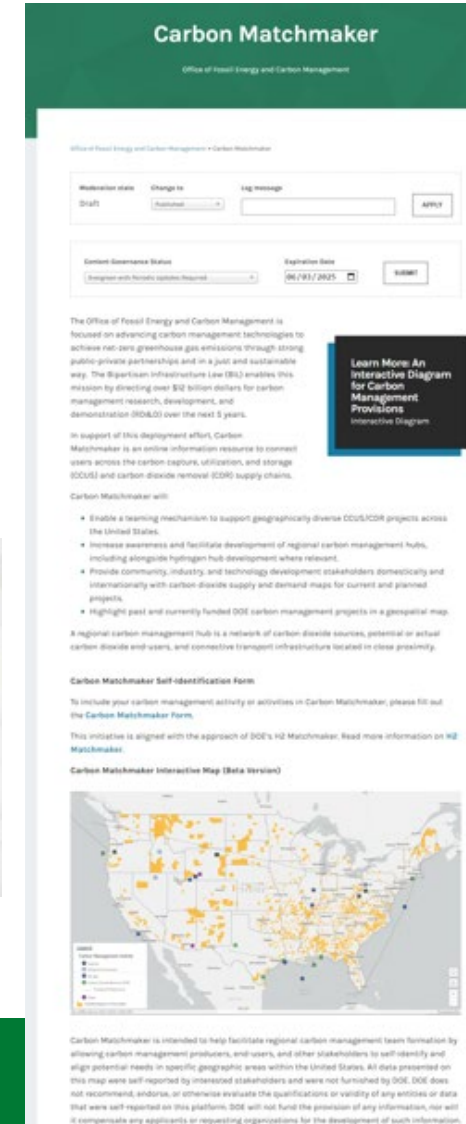
[FECM Strategic Vision](#)



[Justice & Engagement: Planning for Societal Considerations & Impacts in FECM Projects | Department of Energy](#)



[Industrial Decarbonization Roadmap](#)



Online information resource to connect users across the carbon capture, utilization, and storage (CCUS) and carbon dioxide removal (CDR) supply chains.

[Carbon Matchmaker](#)

DOE-funded Carbon Management Projects—held Pittsburgh, PA
Over 700 registrants [2022 Conference Proceedings](#)



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energy.gov/fecm

DOE Annual Carbon Management Meeting & Expo

- Held annually in Pittsburgh, PA, typically in August
- DOE-funded carbon management projects present
- Adding Carbon Management Expo to event
- 2022 Event Proceedings: <https://netl.doe.gov/events/conference-proceedings>
- **2023 Event: August 28-September 1, 2023 in Pittsburgh, PA**

<https://netl.doe.gov/events/23CM>



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Thank you

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