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

Alaska Carbon Management Workshop: Developing a Carbon Management Hub

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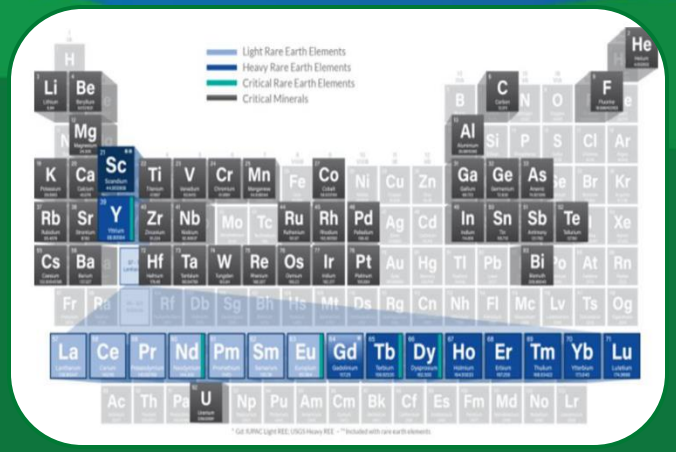
February 21st, 2023



Meeting the Challenges for Decarbonization…

U.S. DEPARTMENT OF ENERGY

CarbonSAFE Targets

	2025 VALIDATION	2030 ACTIVATION	2035 EXPANSION	2040 AT SCALE	. . .	2050 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

North Dakota CarbonSAFE

CarbonSAFE Project ECO2S, Mississippi

Wyoming CarbonSAFE Project

Illinois Basin CarbonSAFE Project

…every Region is Different, but ALL Regions Contribute!

Understanding the Industrial Carbon Management Ecosystem

:// ww.energy.gov/fecm/interactive-diagram-carbon-management-provisions

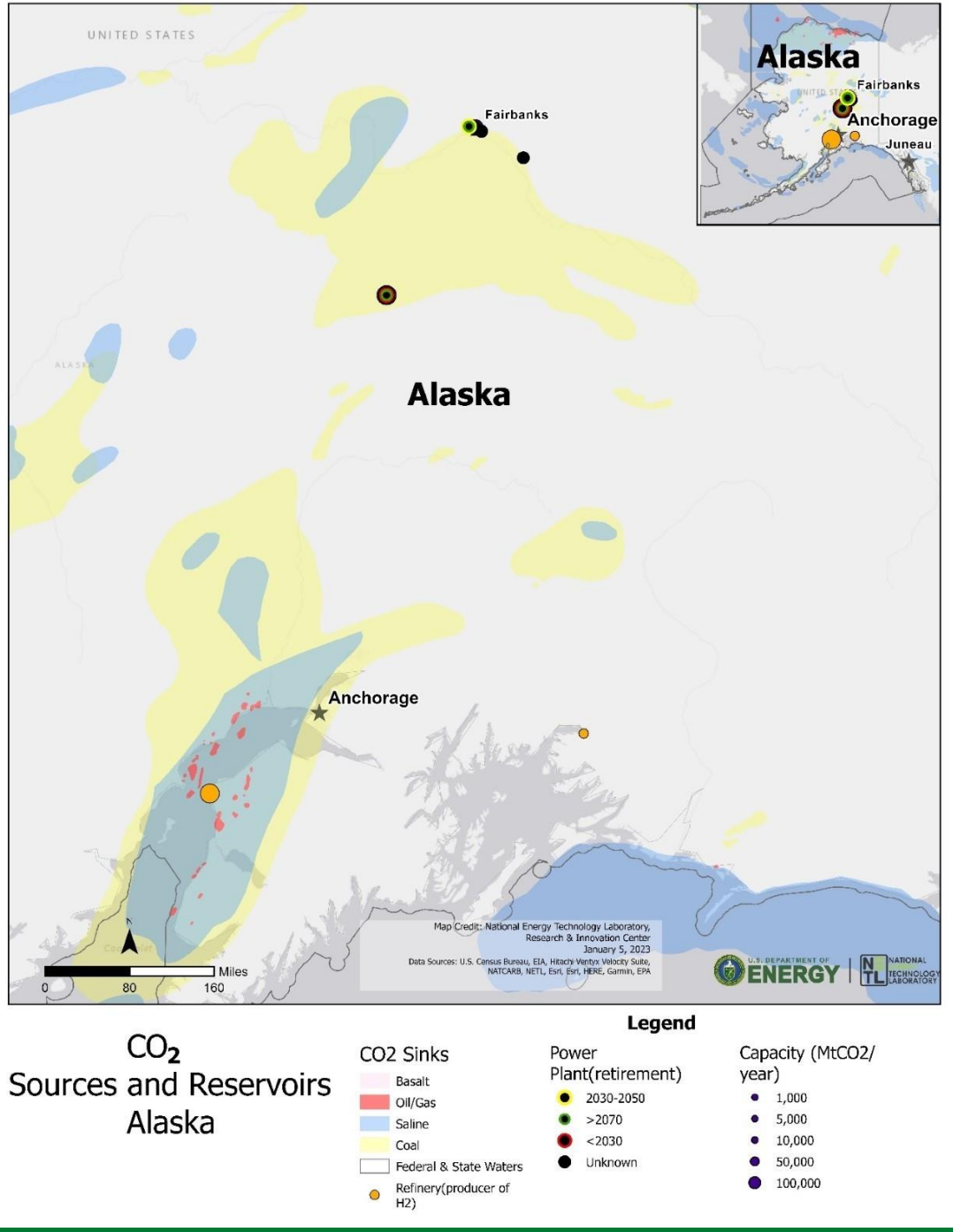
Alaska Infrastructure

Cook Inlet Region

Alaska		
CO_2 Source	Facilities	CO_2 emissions (MtCO2eq/yr)
Refining	2	110,675
Power Plant	23	1,160,470

Field	CO2 Storage Estimates		
Cook Inlet (Gt)	P_{10}	P_{50}	P_{90}
Hemlock Formation	0.91	4.33	16.61

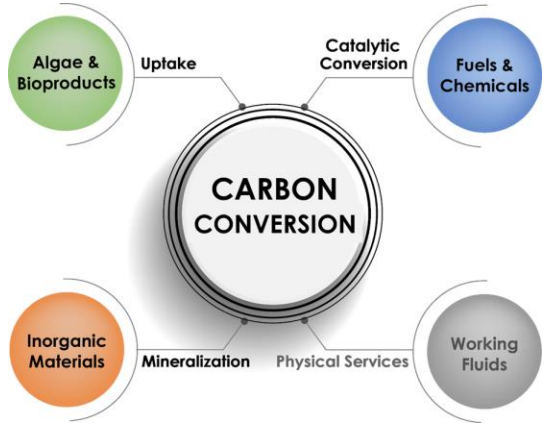
"Potential for carbon sequestration in the Hemlock Formation of the Cook Inlet basin, Alaska", Scott Pantaleone and Shuvajit Bhattacharya

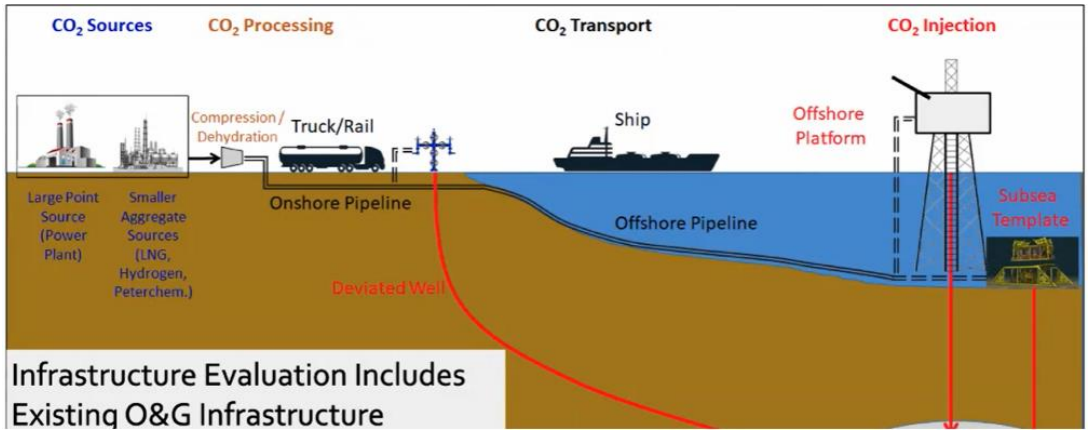


Developing a Hub…where are we today?

- **Funding and Incentives for Infrastructure**
  - *Catalyst for industry business models*
- **Federal and State Legislation for Carbon Capture and Storage**
  - *Permitting and pore space*
- **Advancing Capture Technologies**
  - *Industrial (multiple sources) and direct air capture*
- **Dedicated Storage and Hub Infrastructure**
  - *Preparing the way for capture sources*
- **CO_2 Transport Infrastructure**
  - *Multi-modal transport solutions*
- **Decision Support Tools**
  - *Enabling operators to better manage assets*

North Dakota CarbonSAFE Phase III:
Site Characterization and Permitting





Developing the Entire Value Chain: The 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

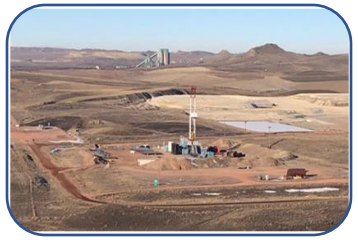
Project Applications Require New Components:

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

Bipartisan Infrastructure Law Programs at Department of Energy

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

CCS Incentives and Thresholds

Inflation Reduction Act--45Q Modifications

	Old	New
Commence construction by	January 1, 2026	January 1, 2033
Direct air capture facility	100,000 metric tons/year*	1,000 metric tons/year
Electric generator	500,000 metric tons/year*	18,750 metric tons/year
Industrial facilities	100,000 metric tons/year*	12,500 metric tons/year
Saline storage credit value	$50/metric ton	$85/metric ton (industry and power); $180/metric ton (direct air capture)
EOR storage and carbon conversion credit value	$35/metric ton	$60/metric ton (industry and power); $130/metric ton (direct air capture)

** Non-EOR Conversion facilities were previously 25,000 metric tons/year regardless of facility/source.*

Notes: New modifications allows up to 5 years for direct pay (up to 12 years for certain entities)

Text - H.R.5376 - 117th Congress (2021-2022): Inflation Reduction Act of 2022 | Congress.gov | Library of Congress

States Facilitating Carbon Capture and Storage through Legislation

Addressing Regulatory, Safety Oversight, and Leasing

- **Legal and regulatory frameworks**
- **Financial responsibility**
- **Long-term liability**
- **Ownership of CO_2-transfer of CO_2 over time**
- **Basin deployment – mineral/pore space ownership**

Alaska proposed Bill SB69

- Would establish:
  - Regulatory framework for carbon storage
  - Exploration licensing and leasing programs
  - Pathway for EOR projects to convert to sequestration
- Would direct Alaska to seek Class VI Primacy
- Governor Dunleavy Introduces Carbon Management and Monetization Bills Creating Statutory Structures - Mike Dunleavy (alaska.gov)

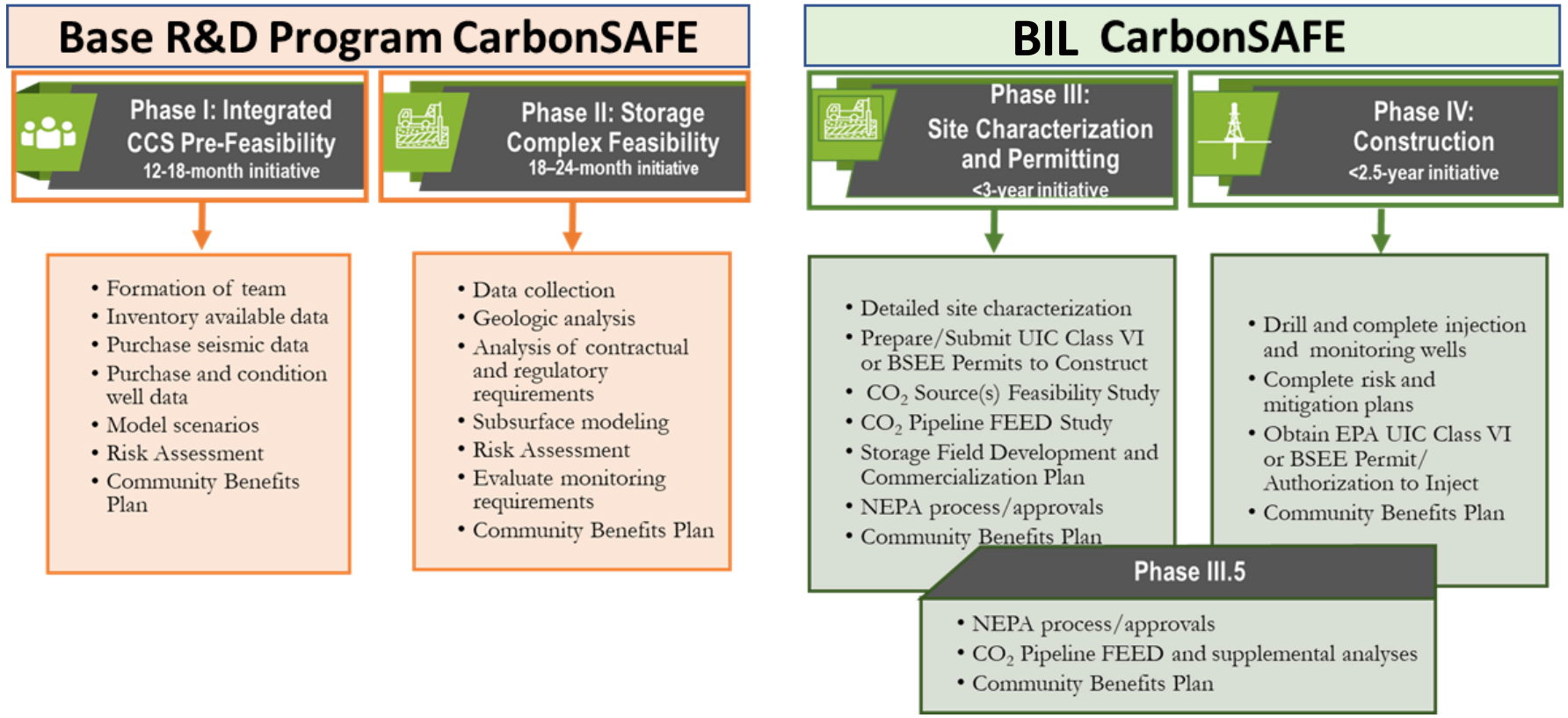
EPA Class VI Primacy –BIL Class VI UIC Grant Program – $50M one-time distribution

Submit Letter of Intent (LOI) no later than March 20, 2023

EPA Class VI Primacy State LOI Request Letter

Dedicated Storage and Hubs Infrastructure

Bipartisan Infrastructure Law (BIL): Storage, Validation and Testing (Section 40305): Carbon Storage Assurance Facility Enterprise (CarbonSAFE): Phases III, III.5, and IV



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

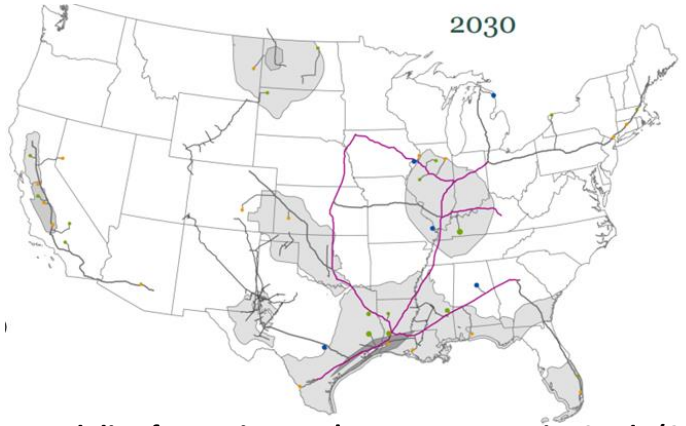
20-40 Facilities

~80-100 Class VI Wells

CO_2 Transport Infrastructure

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

- 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
- CO_2 transport should review all modes of transport (ship, barge, rail, truck)
- Supports CO_2 Transportation Infrastructure and Innovation Program (CIFIA $2.1 billion loan guarantees)



2030: ~11,000+ miles of CO2 pipelines

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

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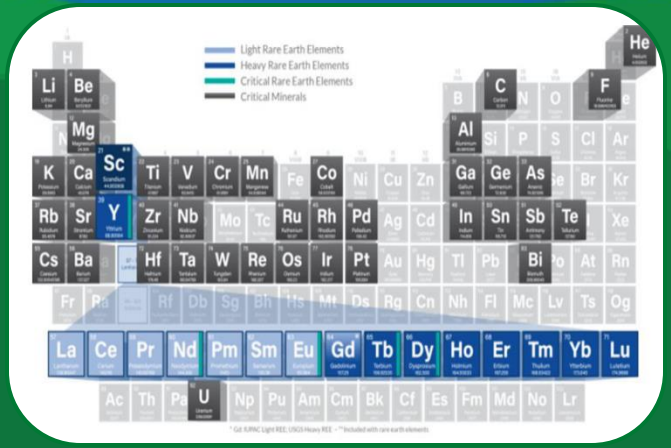
Fossil Energy and Carbon Management

Thank You!



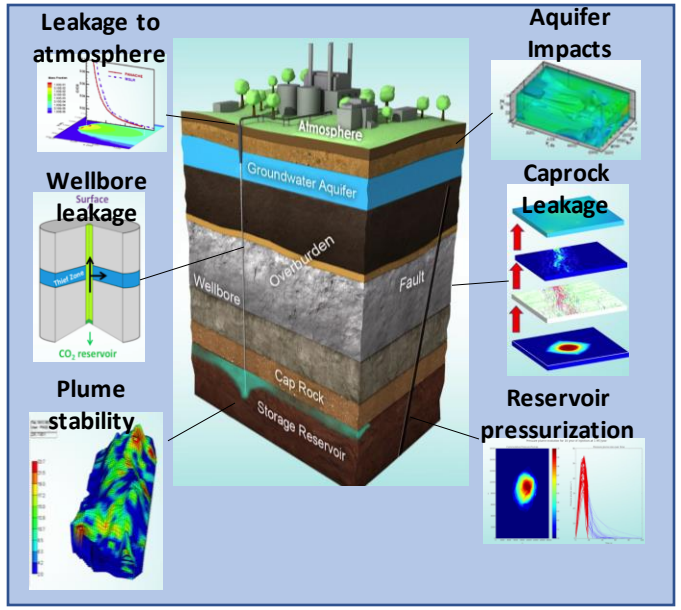
Storage Facilities Decision Support Tools

Technologies to improve performance and reduce costs

NRAP National Risk Assessment Partnership

[National Risk Assessment Partnership]

Site specific risk-based decision support tools for stakeholders



SMART

[SMART Initiative]

Real-time visualization, forecasting, and virtual learning for decision-makers

Primary Focus Areas of SMART

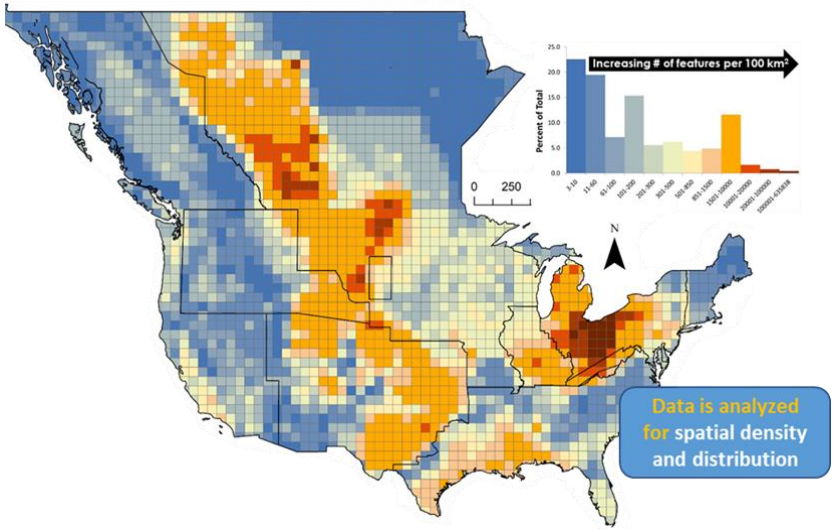
REAL-TIME VISUALIZATION	Enable dramatic improvements in the visualization of key subsurface features and flows by exploiting machine learning to improve speed and enhance detail.
REAL-TIME FORECASTING	Transform reservoir management: perform rapid analysis of real-time data to inform operational decisions.
VIRTUAL LEARNING	Develop a computer-based experiential learning environment to improve field development and monitoring strategies.

Science-informed **M**achine Learning for **A**ccelerating **R**eal-**T**ime Decisions in **C**arbon **S**torage Applications

EDX 4CCS Energy Data eXchange

[Welcome - EDX (doe.gov)]

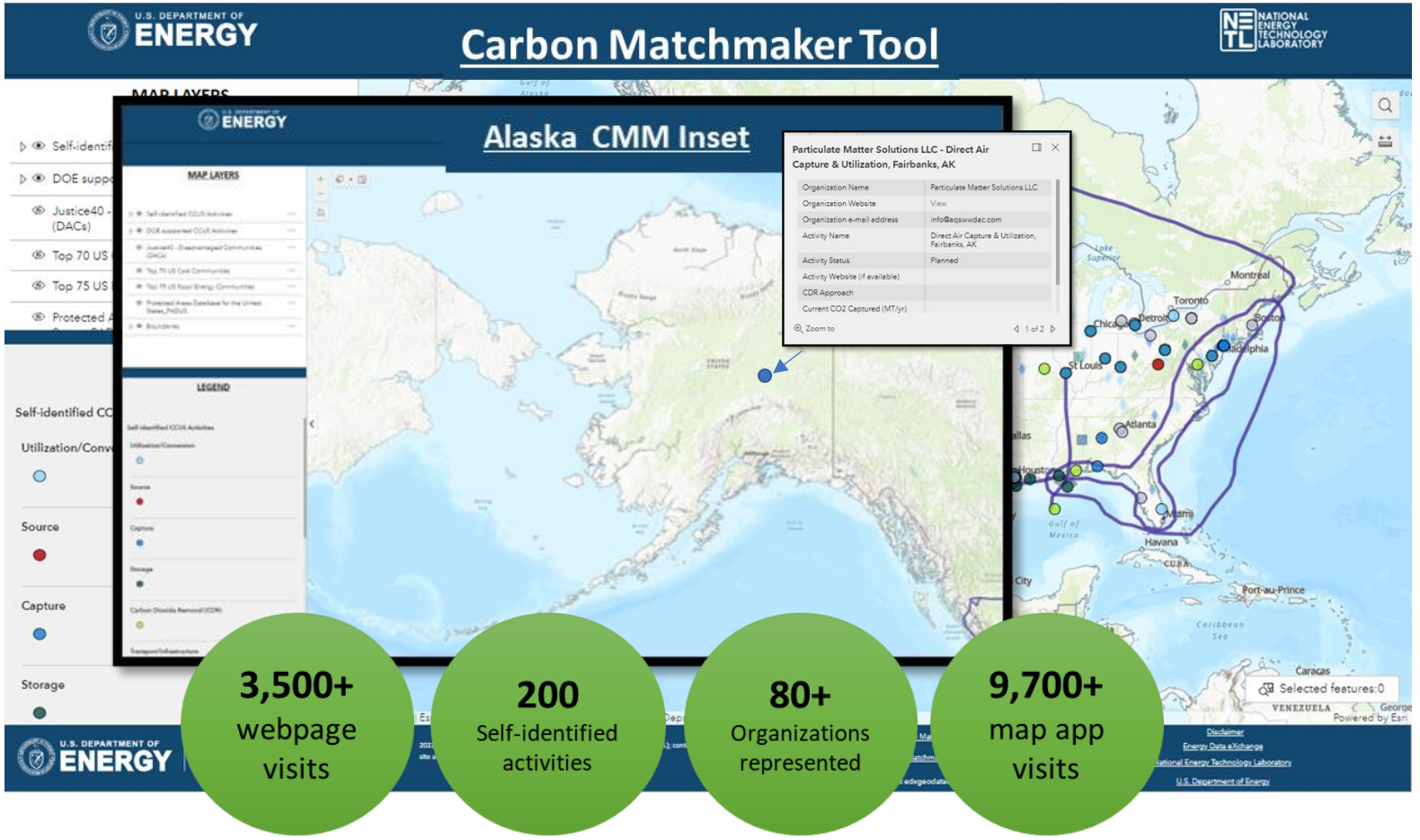
Providing stakeholders/community access to carbon management data resources



FECM Carbon Matchmaker

Online resource to connect users across CCUS and CDR

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



- 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

Doing Business with the Federal Government

Action Prior Submitting FOA—allow at least 44 days

01 System for Award Management (SAM)

*Register with the SAM. One **MUST** be registered with SAM to submit an application.*[1]

[1] For more information on SAM, visit this site.

02 Obtain a Unique Entity Identifier (UEI)

*Applicants **MUST** obtain a UEI from SAM to uniquely identify the entity. This has replaced the DUNS number as the primary of entity identification for Federal Awards. The UEI is already available in the SAM entity registration record.*

***NOTE:** Subawardees and subrecipients must also obtain a UEI from SAM and provide the UEI to the Prime Recipient before the subaward can be issued.*

[2] For more information about this process, visit this site.

03 Register with Grants.gov

1. *Authorized Organizational Representative must register here.*
2. *An email is sent to the E-Business (E-Biz) POC listed in SAM. The E-Biz POC must approve the AOR registration using their MPIN from their SAM registration.*
3. *AOR verifies that registration was completed.*

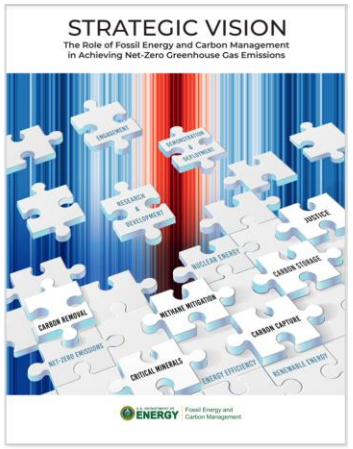
[3] For more information about this process, visit this site.

04 Register with FedConnect

Register with FedConnect® to submit questions.

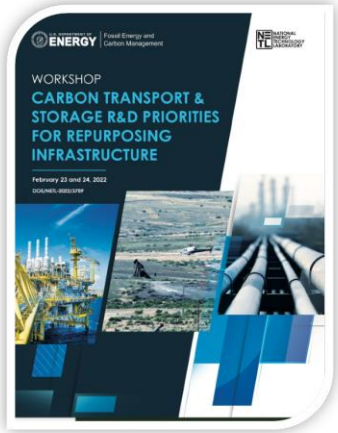
Doing Business with DOE - Applicant Education Workshop

Resources and Engagement Opportunities



[FECM Strategic Vision]

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

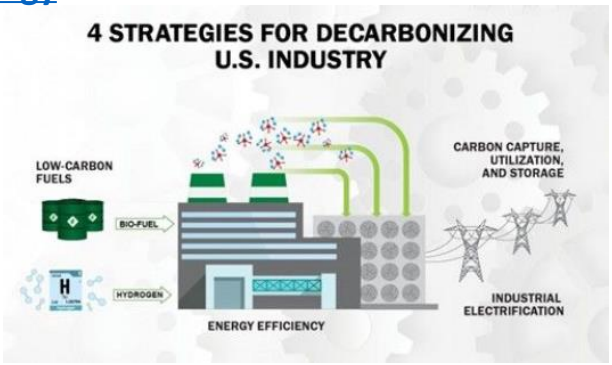


Online information resource to connect users across the carbon capture, utilization, and storage (CCUS) and carbon dioxide removal (CDR) supply chains.

[Carbon Matchmaker]

DOE-funded Carbon Management Projects—held Pittsburgh, PA

Over 700 registrants [2022 Conference Proceedings]



[Industrial Decarbonization Roadmap]

DOE Loan Program Office

Bipartisan Infrastructure Law Programs | Department of Energy

Carbon Dioxide Transportation Infrastructure and Innovation (CIFIA) Program.

- **Loan Authority** https://parc.loanprograms.energy.gov/Content/CIFIA/ConsultationRequest.html
  - $2.1 billion in loan/grant authority for large-capacity, common-carrier CO2 transportation
  - Transport infrastructure may include pipelines, rail, maritime, trucking, and others
- **Future Growth Grants**
  - Focused on expansion (increase flow rate/capacity) and building for **economies of scale** to form an interconnected CM hub/market ---- includes pipeline, barge, ship, rail, and truck

Inflation Reduction Act

- **Appropriates $11.7 billion for LPO to support new loans (increase existing loan program ~$100B)**
  - Innovative Clean Energy (Section 1703)-- $3.6 B credit subsidy up to a $40.0 B in loan authority
  - Energy Infrastructure Reinvestment Program (1706)-- appropriates $5.0 B with a total cap on loans of up to $250.0B
  - Tribal Energy Loan Guarantee provides $75M to carry out up to $20B in loan authority

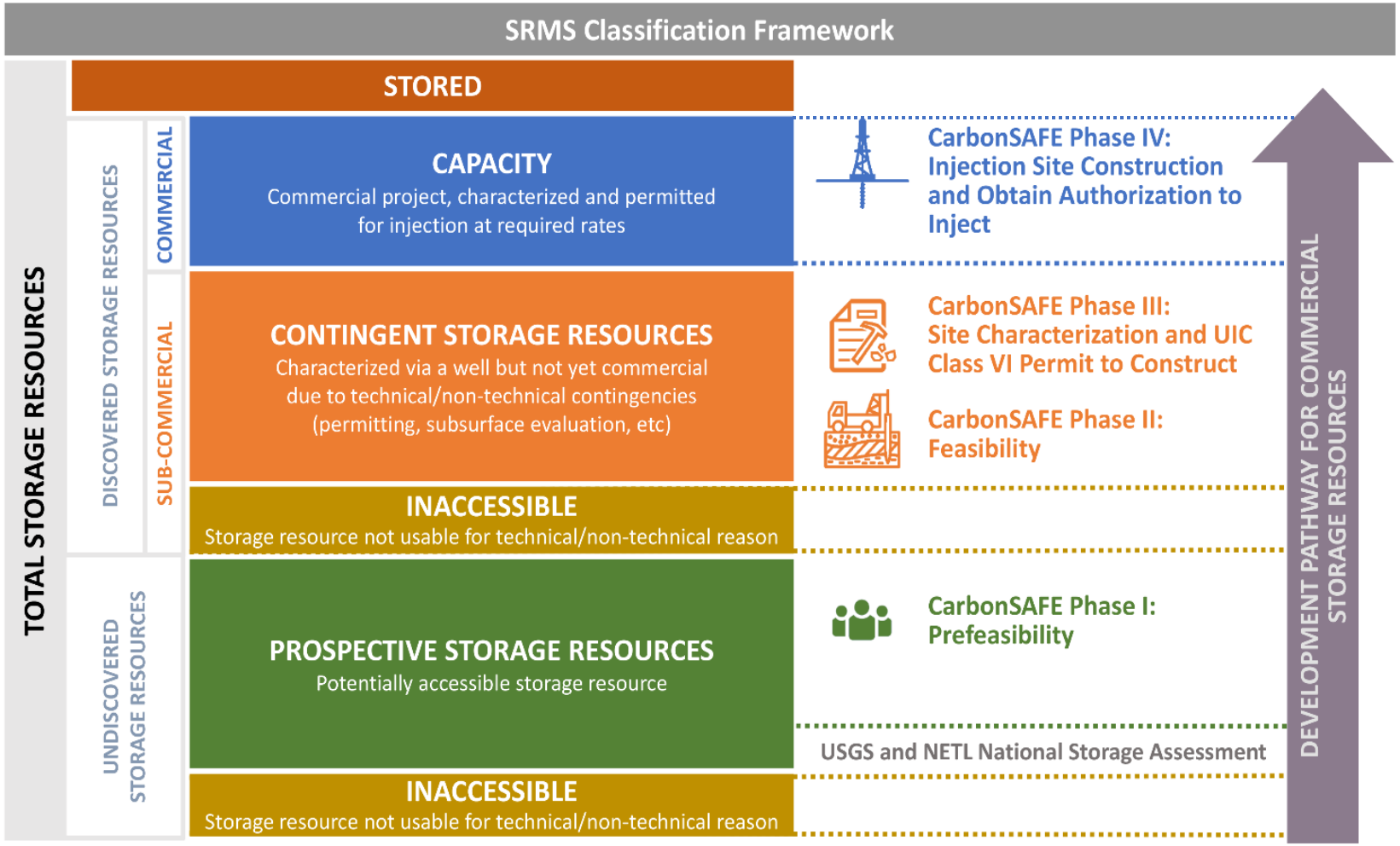
Loan Programs Office | Department of Energy

Inflation Reduction Act of 2022 | Department of Energy

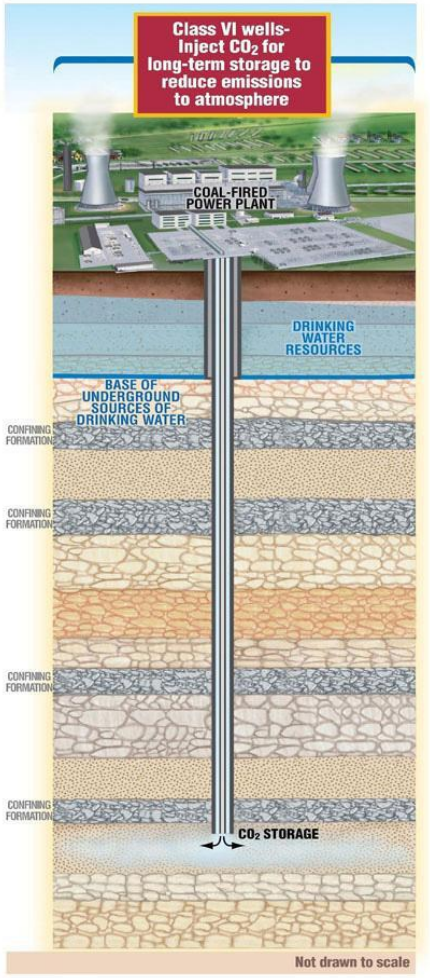
Storage Resources Management System (SRMS)

Commercial viability framework [CO2 Storage Resources Management System (spe.org)]

- Provides common terminology for stakeholders
- Improves global communications on storage resources
- Classifies storable quantities in the context of defined projects intended to be matured to commerciality



Key Elements of the Regulatory Framework



Regulated under EPA Underground Injection Control (UIC) Program, Class VI:

- **Protects drinking water resources**
  - Lower-most underground source of dinking water (USDW). Defined as formation fluids < 10,000 ppm total dissolved solids
  - Permit requires comprehensive monitoring that addresses all aspects of well integrity, CO2 injection and storage, and ground water quality during the injection operation and the post-injection phase
- **Emergency and Remedial Response Plan**
  - Permit requires owners or operators to develop and maintain an Emergency and Remedial Response Plan that describes actions to be taken to address events that could potentially cause endangerment to water resources during the construction, operation, and post-injection phases of a project
- **Financial Responsibility**
  - Permit requires the operator have demonstrated resources for financial responsibility to assure availability of funds for the life of a project, including emergency response
- **Reporting and Recordkeeping Requirements**
  - provides project-specific information to continually evaluate Class VI operations and confirm water resource protection