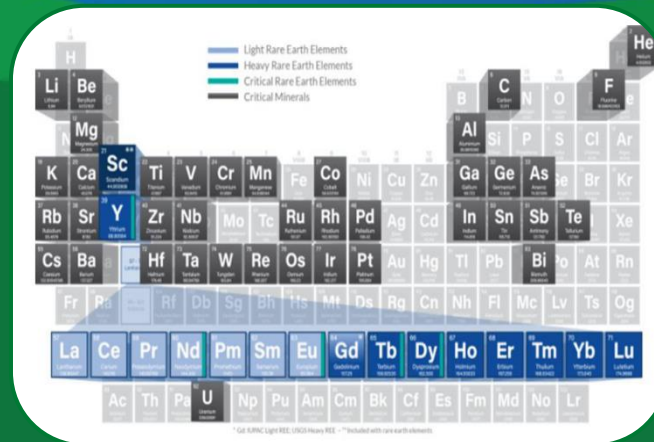


FECM REGIONAL NARRATIVES

FECM equities in support of regional efforts to build clean energy and industrial economies

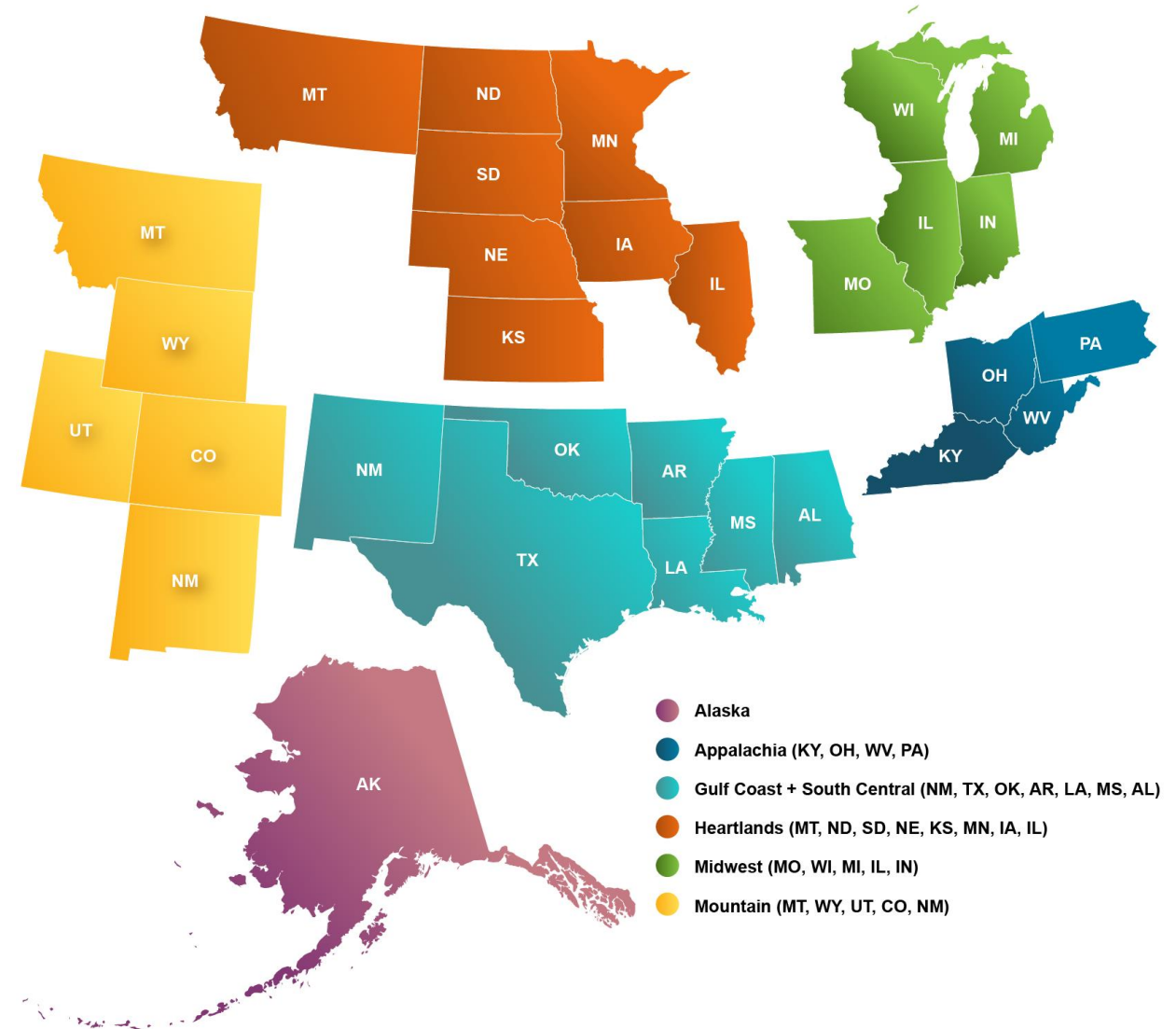
November 2024



REGIONAL NARRATIVES

CURATING FECM+ EQUITIES TO BEST SUPPORT REGIONS

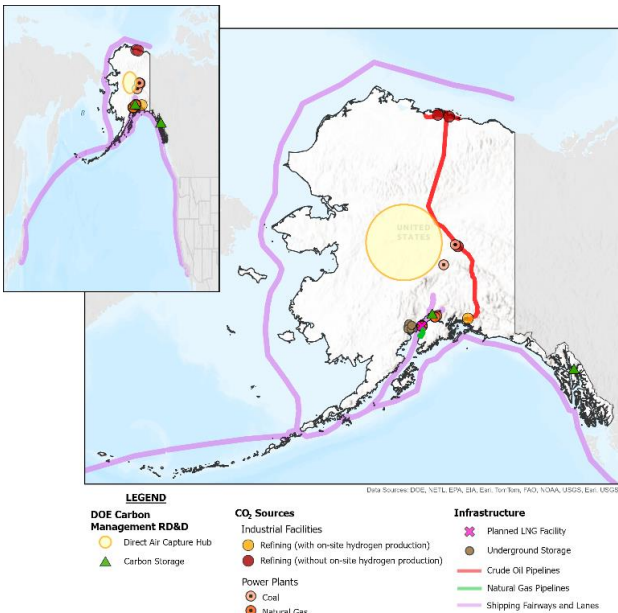
- Unique context (energy mix, industry mix, infrastructure, resources) of each region
- How FECM+ technology portfolio supports current energy plans and targets
- Focus on energy producing and industrial regions
- Maps to visualize infrastructure sharing and ecosystem opportunities
- Regional Dialogues and improved stakeholder engagement



REGIONAL NARRATIVES REGIONS HAVE DIFFERENT INDUSTRIES AND OPPORTUNITIES

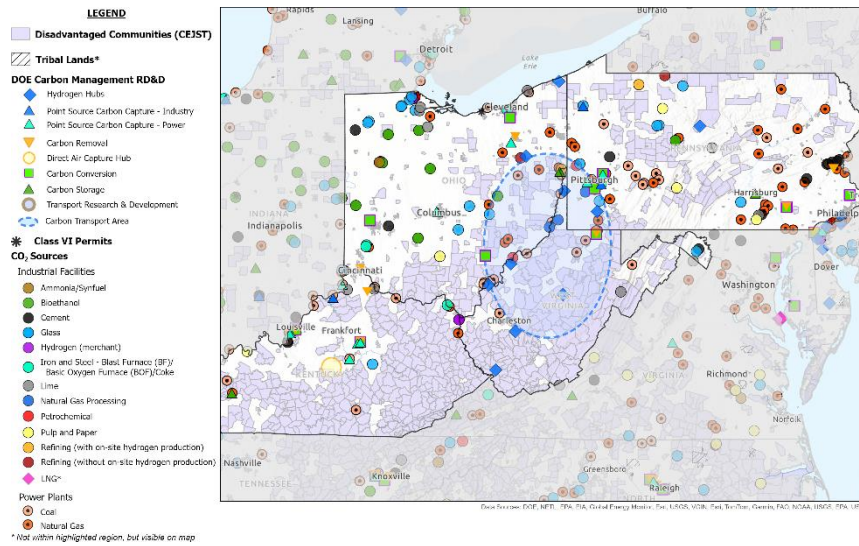
Alaska and International Trade in CO₂

Strategically located and resource rich in oil, natural gas, coal, and critical minerals, with high potential for geological storage. Net exporter of oil, with one quarter of the state's employment in the oil industry.



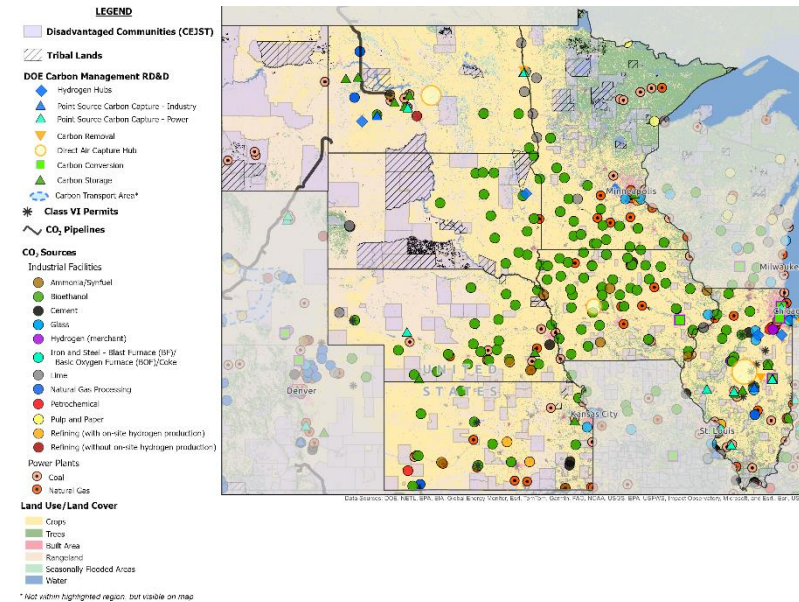
Redeveloping Appalachia

37% of energy consumption is in clustered, industrial high temperature industries incl. BF/BOF steel, lime, glass, chemicals. Second largest natural gas producer, and 70% of U.S. coal mines are in Appalachia. Large number of disadvantaged communities.



Diversifying Rural Heartlands Agriculture economy

Agriculture economy large bioethanol industry producing 73% of U.S. bioethanol, and expanding fertilizer sector (17 awardees of USDA fertilizer expansion program)



REGIONAL NARRATIVES

SIX REGIONAL NARRATIVES IN DEVELOPMENT

Appalachia (WV, OH, PA, KY)

92% 2022 Energy Mix is Fossil Energy	37% 2022 Sector Energy Consumption is Industrial
34% 2022 U.S. Gas Production	70% 2022 U.S. Coal Mines

*23% 2023 electricity mix nuclear and renewables

Heartlands (MT, ND, SD, NE, KS, MN, IA, IL)

80% of 2022 Energy Mix is Fossil Energy*	38% of 2022 Sector Energy Consumption is Industrial
48% 2022 U.S. estimated recoverable coal reserves	73% 2023 U.S. fuel ethanol capacity

*60% of 2023 electricity mix nuclear and renewables

Midwest (IL, IN, MI, WI, MO)

83% of 2022 Energy Mix Fossil Energy	30% of 2022 Sector Energy Consumption Industrial
70% U.S. pig iron producing capacity	1.1 tcf of underground storage

*40% of 2023 electricity mix nuclear and renewables

Scope of 6 Regional Narratives (27 states)

U.S. 2022 Fossil Energy Production

- 98% of coal production
- 99% of natural gas production
- 97% of crude oil production

U.S. Industrial Facilities

- 95% of bioethanol plants
- 99% of petrochemical plants
- 86% of ammonia plants
- 78% of refineries
- 100% of BF-BOF steel plants
- 100% of soda and ash plants
- 82% of lime
- 64% of cement plants
- 61% of glass plants
- 46% of pulp and paper

Most Critical Materials Regions in U.S.

Alaska

98% 2022 Energy Mix is Fossil Energy	59% 2022 Sector Energy Consumption is Industrial
#1 CO ₂ storage potential west coast U.S.	49/50 Critical Minerals

*23% 2023 electricity mix renewables

Mountain (MT, UT, WY, CO, NM)

102% of 2022 Energy Mix Fossil Energy*	32% 2022 Sector Energy Consumption Industrial
52% 2022 U.S. coal production	21% of 2022 U.S. crude production

*34% electricity mix renewables

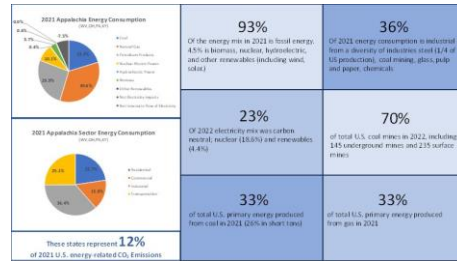
Gulf Coast + South Central (NM, TX, LA, AR, OK, MS, AL)

91% 2022 Energy Mix is Fossil Energy*	52% 2022 Sector Energy Consumption is Industrial
75% 2022 U.S. crude production	54% of 2022 U.S. natural gas production

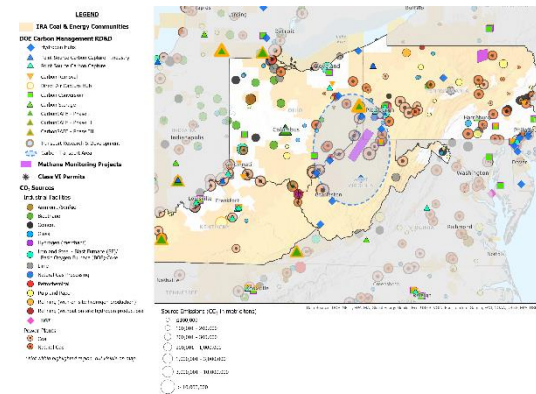
*34% of 2023 electricity mix nuclear and renewables

REGIONAL NARRATIVES CONCEPT – BASED ON THE REGION’S CONTEXT, ILLUSTRATE THE RELEVANT OPPORTUNITIES AND ACTIVITIES IN THE REGION

Region’s Industry and Energy Mix



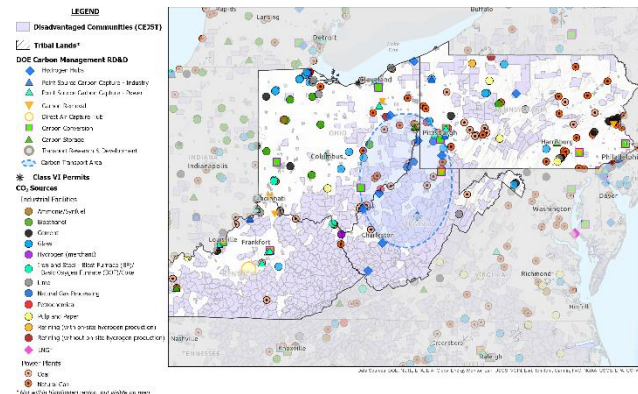
Energy Resources and DOE Projects



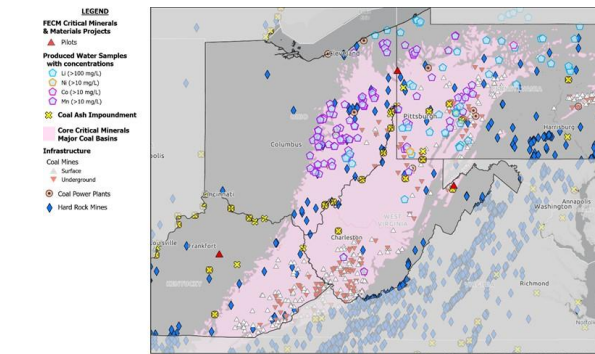
Investment in the Region from local participation in FECM Financial Assistance



Industry and DOE Projects



Critical Minerals



Selected FECM Projects in the Region

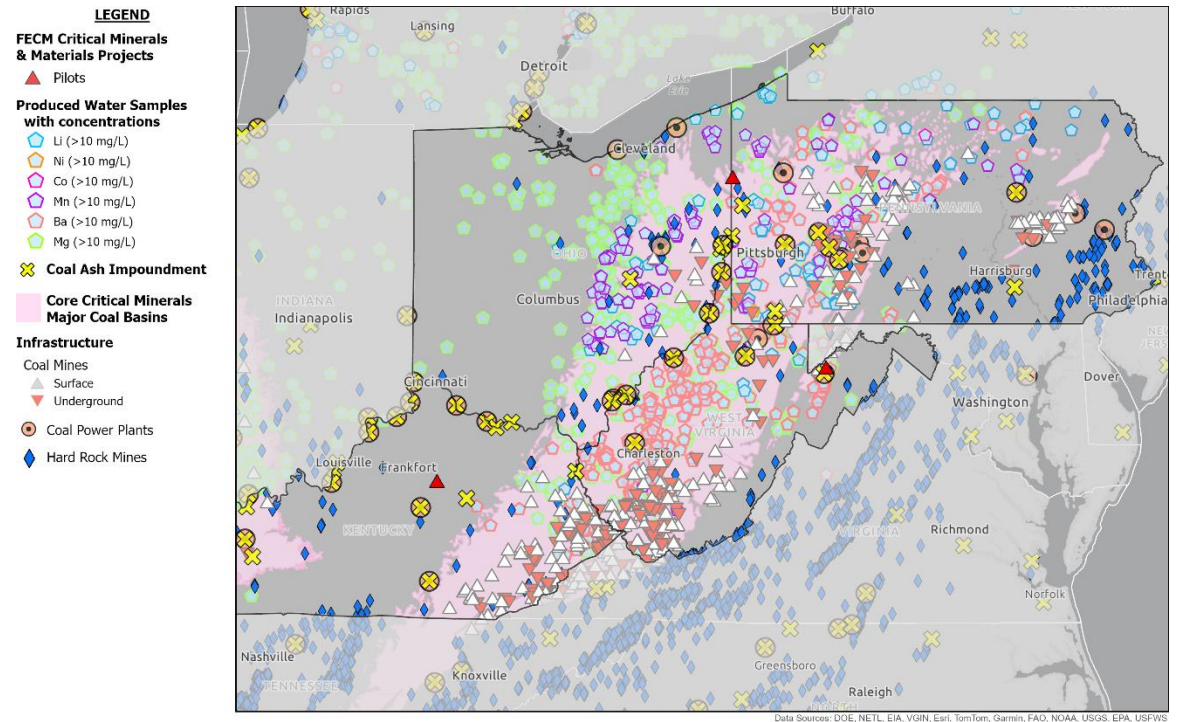
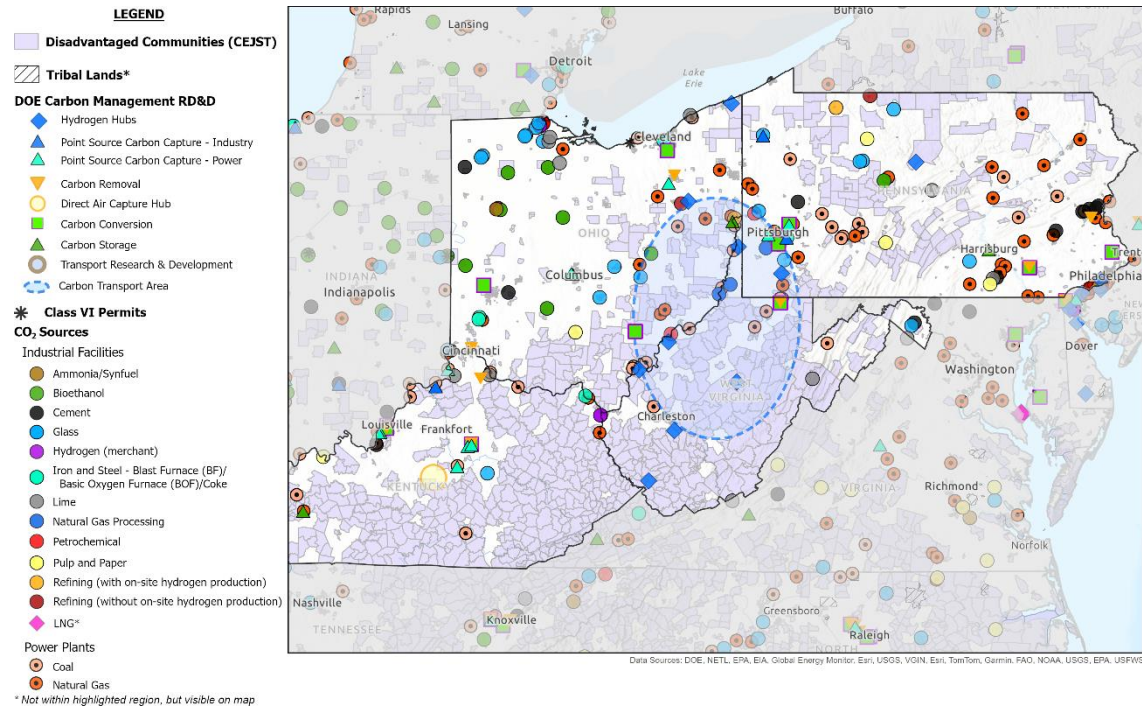
SPOTLIGHT ON FECM+ INVESTMENT AND SUPPORT IN THE APPALACHIA REGION (OH, PA, WV, KY)

- Point Source Carbon Capture (PCC) Demonstration** - U.S. Steel's PCC demonstration at its West Virginia facility, supported by DOE and the Appalachian Regional Commission (ARC).
- Carbon Dioxide Removal (CDR) Demonstration** - U.S. Steel's CDR demonstration at its West Virginia facility, supported by DOE and the ARC.
- Advanced Remediation and Methane Mitigation Technologies** - U.S. Steel's advanced remediation and methane mitigation technologies demonstration at its West Virginia facility, supported by DOE and the ARC.
- Hydrogen with Carbon Management** - U.S. Steel's hydrogen with carbon management demonstration at its West Virginia facility, supported by DOE and the ARC.
- CO₂ Removal and Conversion** - U.S. Steel's CO₂ removal and conversion demonstration at its West Virginia facility, supported by DOE and the ARC.
- Minerals Sustainability** - U.S. Steel's minerals sustainability demonstration at its West Virginia facility, supported by DOE and the ARC.

APPALACHIA (KY, OH, PA, WV) - RETOOLING AN INDUSTRIAL REGION POWERED BY FOSSIL ENERGY FOR A NET-ZERO ECONOMY

Clustered facilities spanning multiple industries, close to disadvantaged communities, that could share carbon management infrastructure creating the opportunity for competitive lower carbon products and supporting high-wage jobs, communities, and regional supply chains.

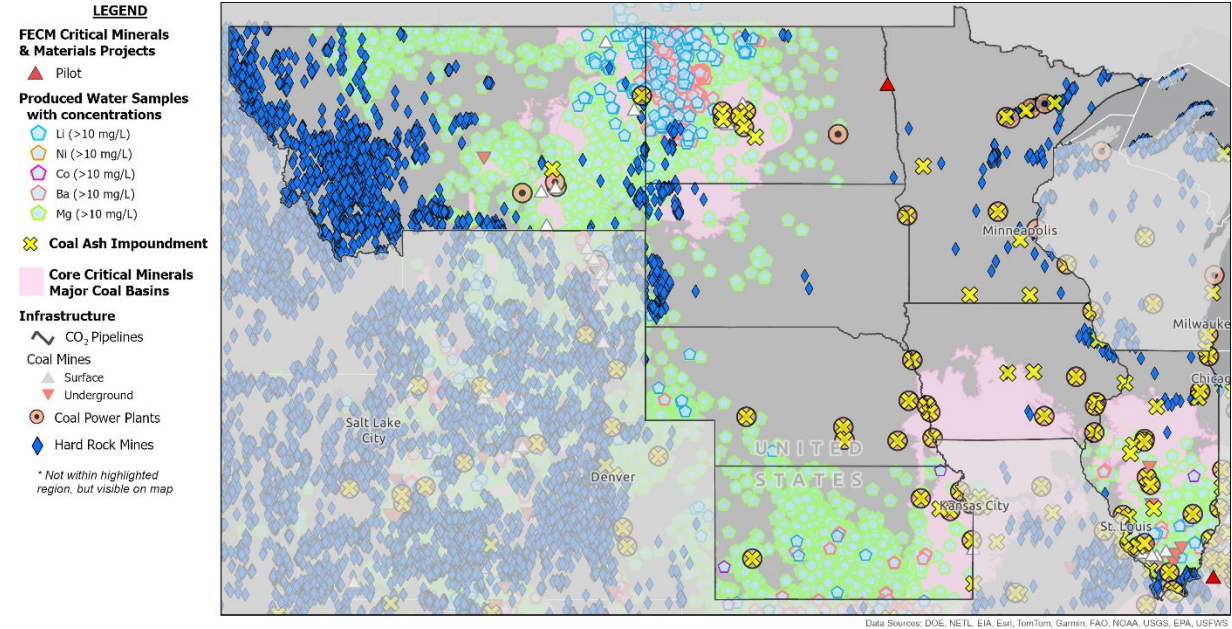
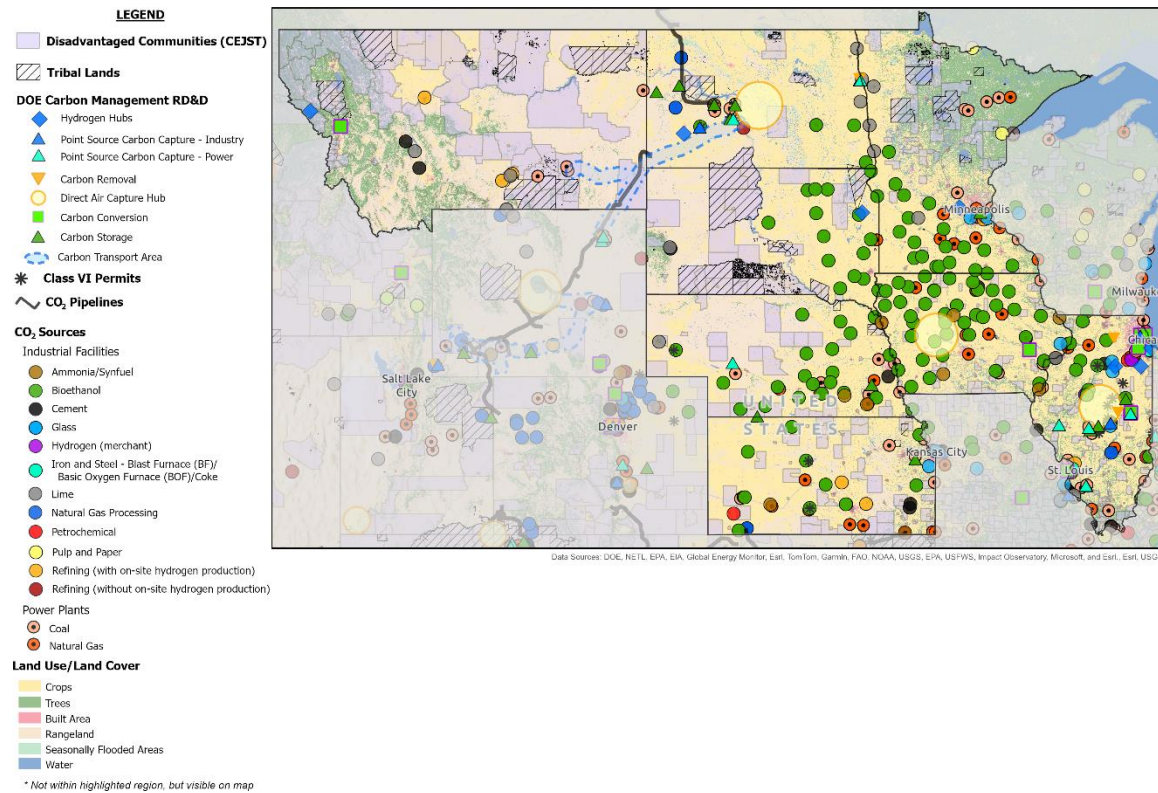
With 70% of U.S. coal mines and as the second largest onshore gas producer, Appalachia is well positioned to produce critical minerals and materials from coal and energy and mining waste streams (e.g., coal ash, acid mine drainage, and produced water) while remediating land and water.



HEARTLANDS (MT, ND, SD, NE, KS, MN, IA, IL) - DIVERSIFYING A RURAL AGRICULTURE ECONOMY

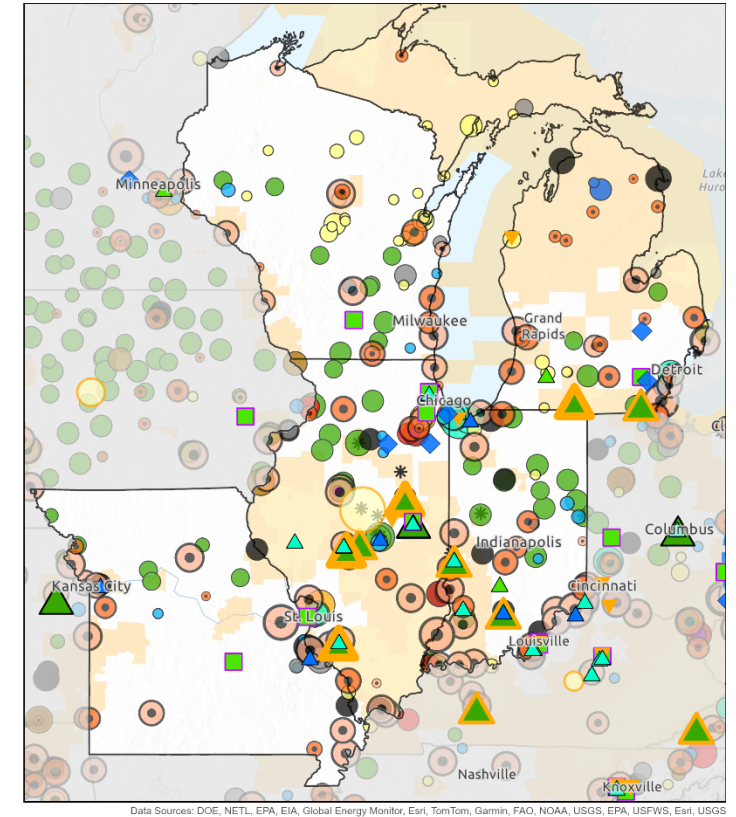
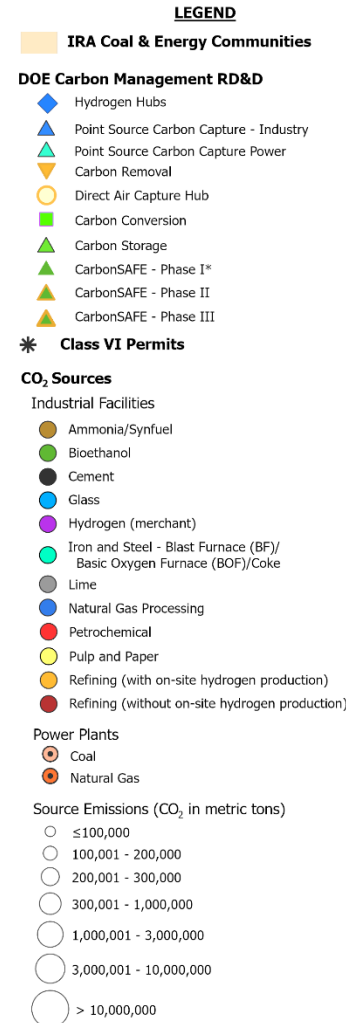
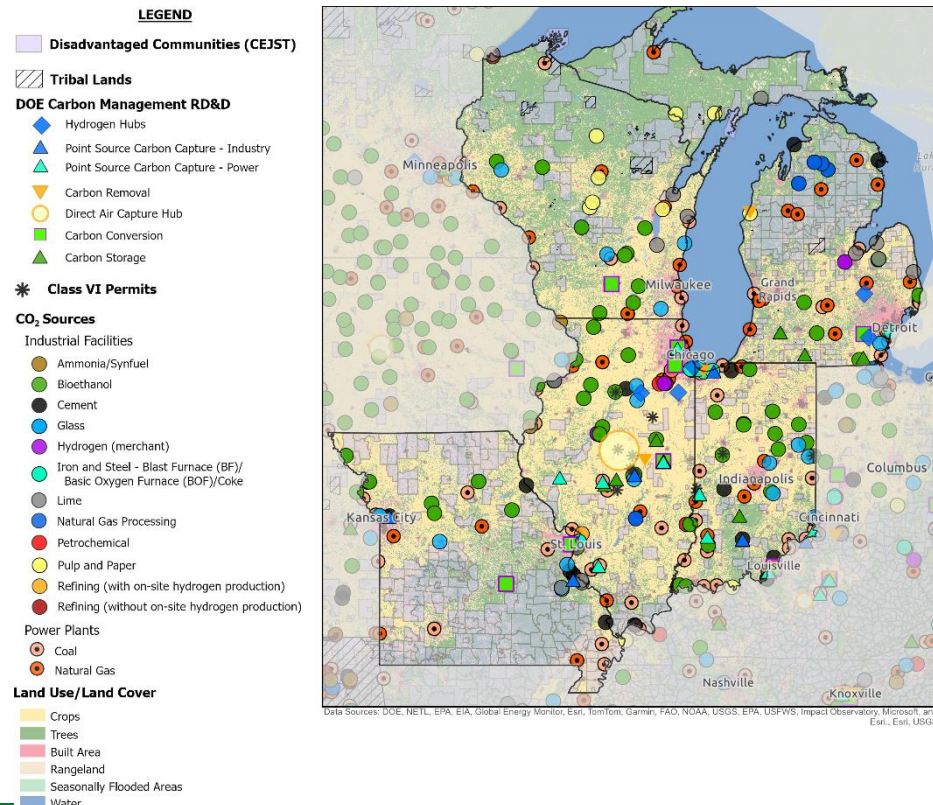
With 73% of the U.S. bioethanol capacity, there is the opportunity for the development of shared carbon management infrastructure to reduce bioethanol emissions and support new areas, e.g., SAF, use of waste and perennial, cover, and purpose-grown crops for low carbon fuels and chemicals

With 48% of the U.S. recoverable coal reserves and the 3rd largest crude producer, the Heartland Region has the opportunity to produce rare earth elements and critical minerals from coal, coal ash, produced water, acid mine drainage, and other energy and mining waste streams.



MIDWEST (IL, IN, WI, MI, MO) – THE EVOLUTION OF AN INDUSTRIAL MANUFACTURING AND TRANSPORT CENTER

A significant concentration of industrial facilities (e.g., 70% of U.S. pig iron capacity) creates the potential for shared carbon management infrastructure and the opportunity to produce low carbon fuels and chemicals as this region transitions its manufacturing to thrive in a low carbon economy.

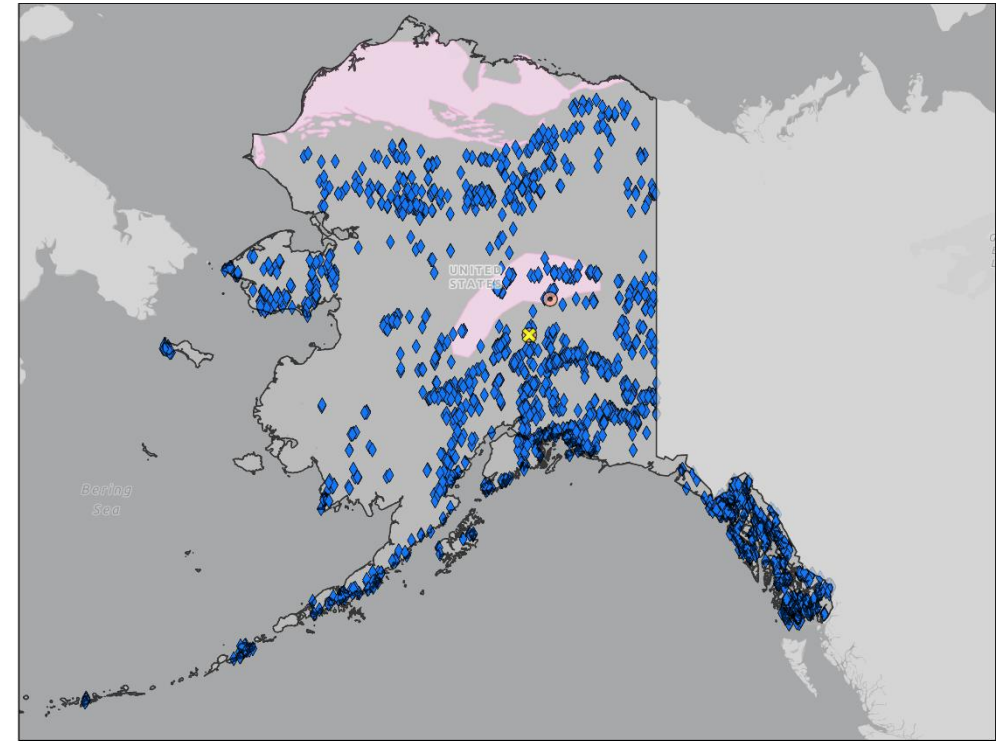
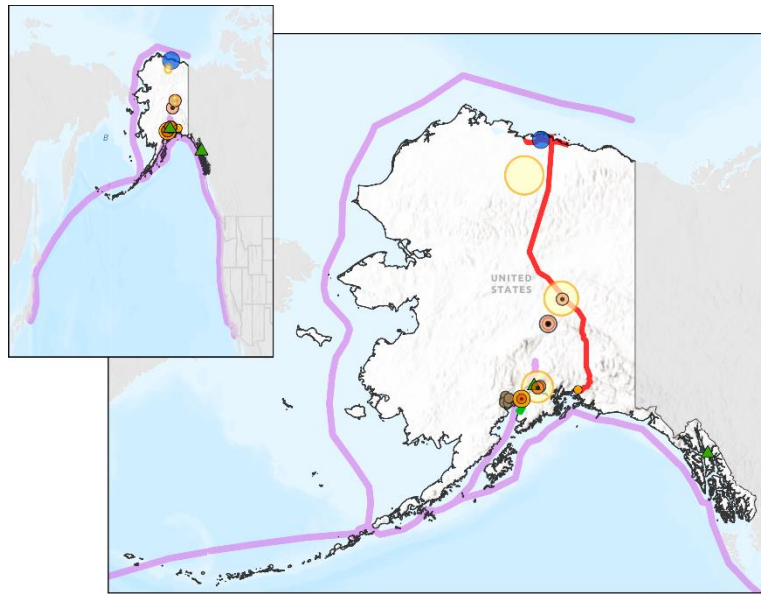


Abundant CO₂ storage resources close to industry and power emitters, a skilled industrial workforce, and financial incentives, make this an attractive region for storing CO₂ emissions from industry

ALASKA – STRATEGICALLY LOCATED ENERGY PRODUCING AND EXPORTING STATE WITH A WEALTH OF NATURAL RESOURCES

Alaska’s significant CO₂ storage potential, established energy trade, and proximity to Asia could be leveraged to import CO₂ and provide storage services to other markets. As the fourth largest producer of natural gas in the U.S. (but only 10% marketed), international trade is also an opportunity for the stranded natural gas in the North Slope

With Alaska home to 49 of the 50 critical minerals, Alaska has the opportunity to play a key role in establishing a domestic critical minerals supply chain from its rock mines, mining waste, and coal resources

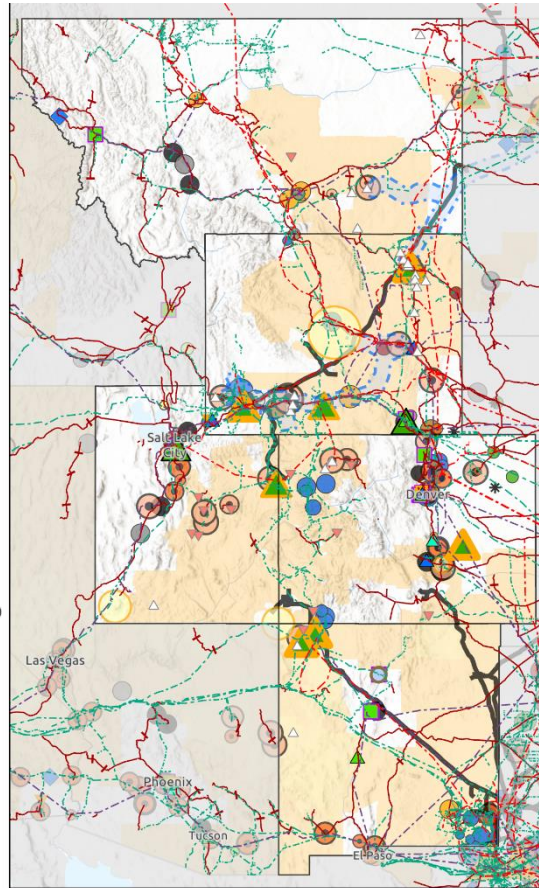


Data Sources: DOE, NETL, EIA, National Land Survey of Finland, Esri, TomTom, Gamin, FAO, NOAA, USGS

MOUNTAIN (MT, WY, UT, CO, NM) –

STRATEGICALLY LOCATED AND NET EXPORTER OF OIL, GAS, COAL, AND ELECTRICITY

- LEGEND**
- IRA Coal & Energy Communities
 - DOE Carbon Management RD&D
 - Hydrogen Hubs
 - Point Source Carbon Capture - Industry
 - Point Source Carbon Capture - Power
 - Carbon Removal
 - Direct Air Capture Hub
 - Carbon Conversion
 - Carbon Storage
 - CarbonSAFE - Phase I
 - CarbonSAFE - Phase II
 - CarbonSAFE - Phase III
 - Carbon Transport Area
 - * Class VI Permits
 - CO₂ Pipelines
 - CO₂ Sources
 - Industrial Facilities
 - Ammonia/Synfuel
 - Bioethanol
 - Cement
 - Glass
 - Hydrogen (merchant)
 - Lime
 - Natural Gas Processing
 - Phosphorus Acid*
 - Refining (with on-site hydrogen production)
 - Refining (without on-site hydrogen production)
 - Soda Ash
 - Power Plants
 - Coal
 - Natural Gas
 - Source Emissions (CO₂ in metric tons)
 - ≤100,000
 - 100,001 - 200,000
 - 200,001 - 300,000
 - 300,001 - 1,000,000
 - 1,000,001 - 3,000,000
 - 3,000,001 - 10,000,000
 - > 10,000,000
 - Infrastructure
 - Coal Mines
 - Surface
 - Underground
 - Railroads
 - Pipelines
 - Petroleum Products
 - Crude Oil
 - Natural Gas
- * Not within highlighted region, but visible on map

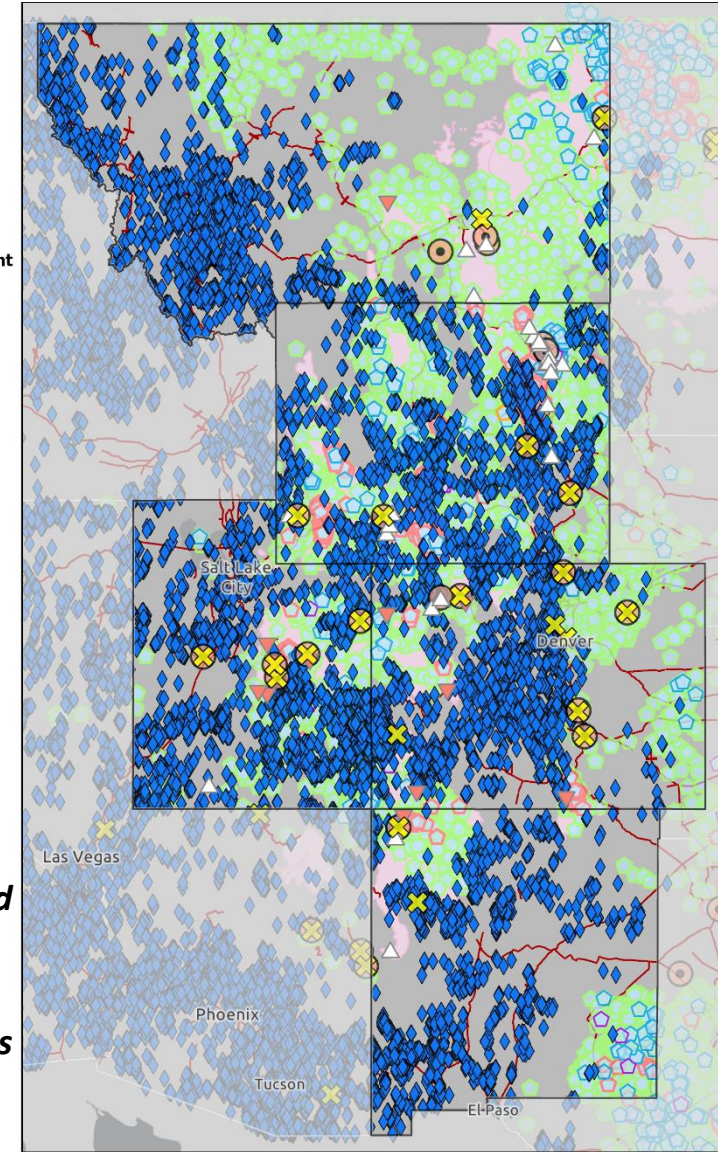


Data Sources: DOE, NETL, EPA, EIA, Global Energy Monitor, Esri, TomTom, Garmin, FAO, NOAA, USGS, EPA, USFWS, Esri, USGS

Industrial facilities and mining sites well-connected, existing energy export capabilities, and significant geologic storage potential to store CO₂ from other regions, make this a competitive region for shared infrastructure and CO₂ storage hubs.

- LEGEND**
- Produced Water Samples with concentrations
 - Li (>10 mg/L)
 - Ni (>10 mg/L)
 - Co (>10 mg/L)
 - Mn (>10 mg/L)
 - Ba (>10 mg/L)
 - Mg (>10 mg/L)
 - Coal Ash Impoundment
 - Core Critical Minerals Major Coal Basins
 - Infrastructure
 - Coal Mines
 - Surface
 - Underground
 - Coal Power Plants
 - Hard Rock Mines
 - Railroads

With 52% of U.S. coal production and hundreds of hard rock mines, the Mountain region is well positioned to produce rare earth elements and critical minerals from coal, hard rock mines, and their waste streams while remediating land and water.

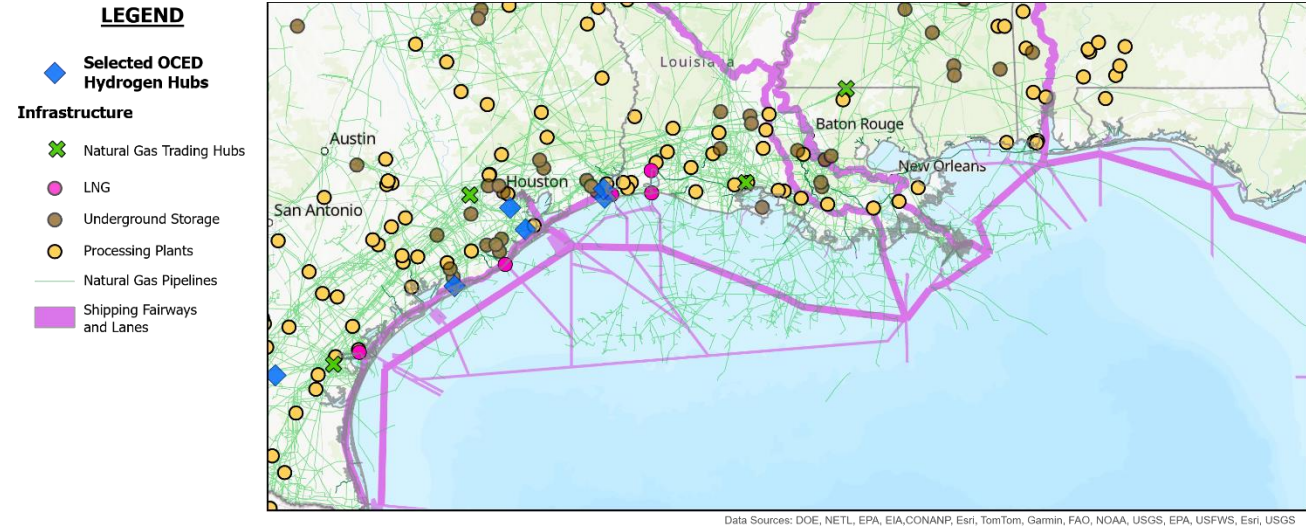
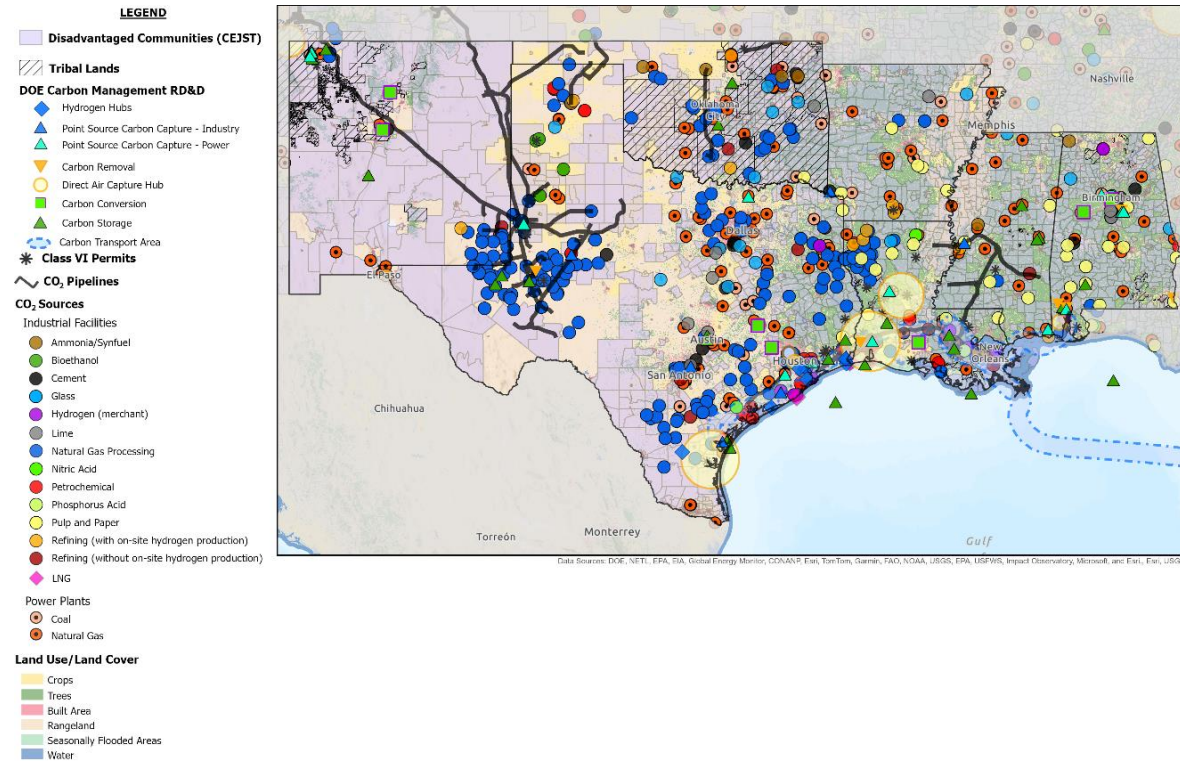


Data Sources: DOE, NETL, EIA, Esri, TomTom, Garmin, FAO, NOAA, USGS, EPA, USFWS

GULF COAST AND SOUTH CENTRAL (NM, TX, LA, OK, AR, MS, AL)– LEVERAGE GLOBAL ENERGY TRADE AND CAPABILITY CENTER

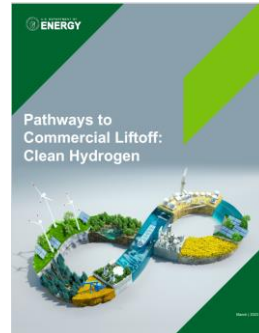
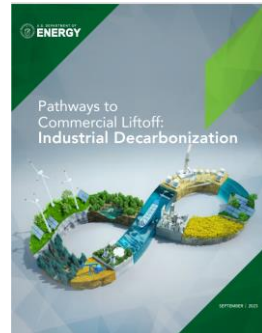
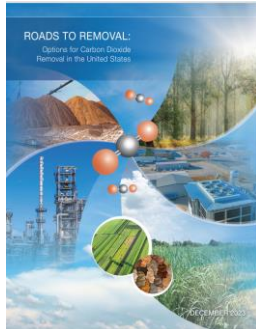
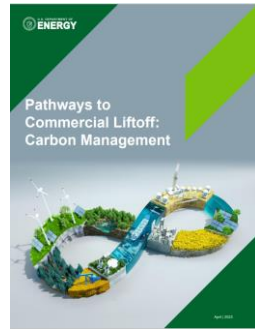
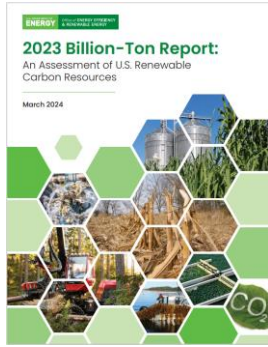
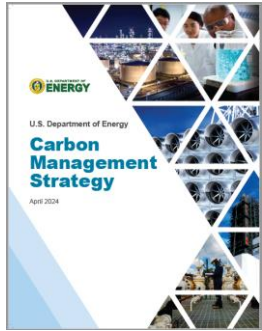
Abundant CO₂ storage resources and existing energy infrastructure close to emitting industries (incl. 88% of chemical facilities and 46% of refineries in the U.S.), and extensive skilled energy workforce can be leveraged to make this one of the most competitive regions (\$/ton of CO₂) for storing CO₂.

Reducing methane emissions of the natural gas supply chain is critical to LNG trade and low carbon hydrogen/ammonia production in the Gulf Coast. The existing LNG export and international trade infrastructure will enable the global trade of low carbon hydrogen/ammonia.



REGIONAL NARRATIVES INDUSTRIAL DECARBONIZATION AND CARBON MANAGEMENT CROSS-CUTS

Department of Energy Research and Publications



+ future reports



Hydrogen Shot™

Accelerate innovation and spur demand of clean hydrogen by reducing the cost by 80%, to \$1 per 1 kilogram of clean hydrogen within 1 decade.



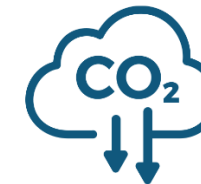
Clean Fuels & Products Shot™

Decarbonize the fuel and chemical industry through alternative sources of carbon to advance cost-effective technologies.



Industrial Heat Shot™

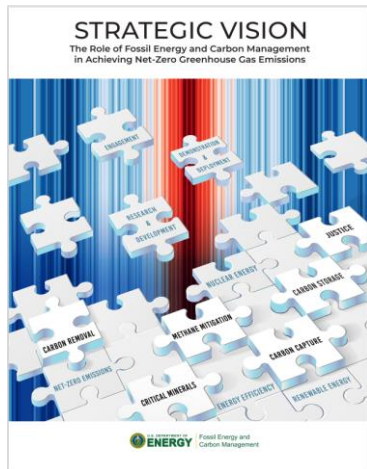
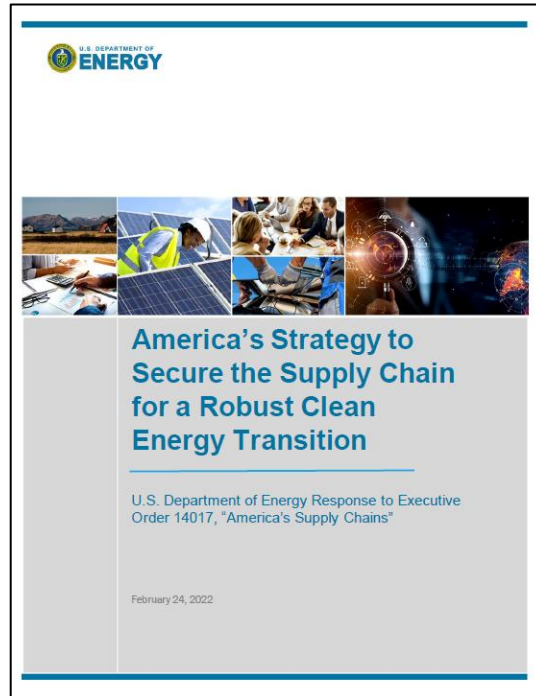
Develop cost-competitive industrial heat decarbonization technologies with at least 85% lower greenhouse gas emissions by 2035.



Carbon Negative Shot™

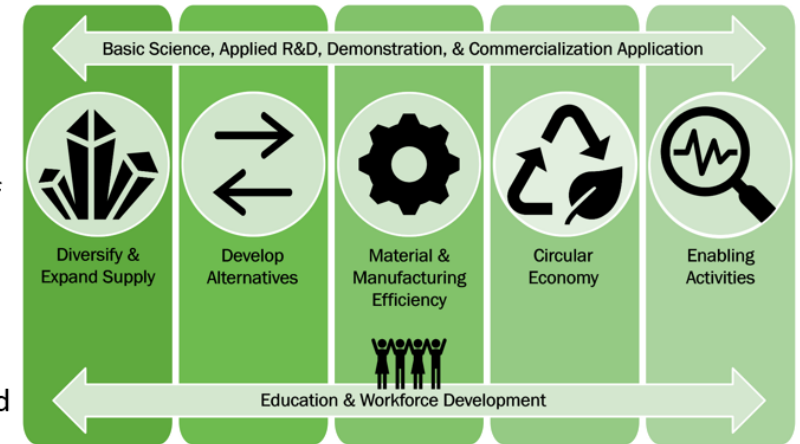
Remove CO2 from the atmosphere and durably store it at meaningful scales for less than \$100/net metric ton of CO₂-equivalent within a decade.

REGIONAL NARRATIVES CRITICAL MINERALS CROSS-CUTS



DOE Critical Minerals/Materials (CMM) Vision & Strategy

- Reliable, resilient, affordable, diverse, sustainable, and secure **domestic critical mineral and materials supply chains**.
- Support the clean energy transition and decarbonization of the energy, manufacturing, and transportation economies.
- Promote safe, sustainable, economic, and environmentally just solutions to meet current and future needs.



REGIONAL NARRATIVES REGIONAL CROSS-CUTS

SCEP and REDI

The screenshot shows the Energy.gov website with the following content:

- Navigation bar: ENERGY.GOV, Newsroom, Careers, Energy.gov Offices, National Labs, Search Energy.gov
- Sub-navigation: Office of STATE AND COMMUNITY ENERGY PROGRAMS, ABOUT SCEP, WEATHERIZATION ASSISTANCE PROGRAM, STATE AND LOCAL SOLUTION CENTER, STATE ENERGY PROGRAM, COMMUNITY ENERGY PROGRAMS, HOME ENERGY REBATES PROGRAMS
- Main content area:
 - Building Energy Codes Formula Funding Now Available for States and Territories
 - Find Funding Opportunities: States and Local Governments
 - Home Energy Rebates Applications Are Now Open!

The screenshot shows the Regional Energy Democracy Initiative (REDI) page with the following content:

- Navigation bar: Office of ENERGY JUSTICE AND EQUITY, ABOUT US, MINORITY PROGRAMS, CIVIL RIGHTS AND EEO, ENERGY JUSTICE, DIVERSITY, EQUITY, INCLUSION, AND ACCESSIBILITY
- Section Header: Regional Energy Democracy Initiative (REDI)
- Text: Office of Energy Justice and Equity
- Text: Office of Energy Justice and Equity • Regional Energy Democracy Initiative (REDI)
- Text: The U.S. Department of Energy's (DOE) Office of Energy Justice and Equity (EJE) Regional Energy Democracy Initiative (REDI) is a groundbreaking program aimed at empowering communities in the U.S. Gulf South region. With a commitment of \$5 million, the REDI pilot is designed to provide capacity building and technical assistance for communities in the region to maximize the benefits derived from the clean energy investments made by DOE.

White House Environmental Justice Advisory Council

The screenshot shows the EPA website with the following content:

- Navigation bar: EPA United States Environmental Protection Agency, Search EPA.gov
- Sub-navigation: Environmental Topics, Laws & Regulations, Report a Violation, About EPA
- Section Header: Environmental Justice
- Text: Environmental Justice (EJ) Home, Learn About Environmental Justice, Equity Action Plan, Grants and Resources, National Environmental Justice Advisory Council
- Section Header: White House Environmental Justice Advisory Council
- Text: CONTACT US
- Text: The White House Environmental Justice Advisory Council (WHEJAC) has been established pursuant to Executive Order 14008, titled [Tackling the Climate Crisis at Home and Abroad](#). The White House council will not only bring greater visibility to EJ issues across the federal government but will provide EPA's [National Environmental Justice Advisory Council](#) (NEJAC) with an excellent partner for providing horizon-expanding EJ advice and recommendations to our government's leadership. As EPA supports the formation of the White House council, we are continuing to support the consistent management of NEJAC, including with our annual membership recruitment process and convening public meetings.

Carbon Management Regional Initiative

The screenshot shows the Carbon Management Regional Initiative page with the following content:

- Section Header: Regional Initiatives to Accelerate CCUS Deployment
- Text: The Regional Initiatives will promote onshore regional technology transfer and knowledge sharing, and identify the best prospects for commercial deployment of Carbon, Capture, Utilization, and Storage (CCUS)
- Section Header: Regional Initiatives
- List of Initiatives:
 - Regional Initiative to Accelerate CCUS Deployment in the Midwest and Northeastern USA
 - Carbon Utilization and Storage Partnership of the Western United States
 - Southeast Regional Carbon Utilization and Storage Partnership
 - Plains Carbon Dioxide Reduction Partnership Initiative to Accelerate CCUS Deployment
- Map of the United States showing regional initiatives.

Regional and Hub Initiatives

The screenshot shows the Carbon Management Funding Notice page with the following content:

- Section Header: Carbon Management Funding Notice
- Image: Industrial facility with large storage tanks.
- Text: Technical Assistance for Large Scale Storage Facilities and Regional Carbon Management Hubs
- Logos: U.S. DEPARTMENT OF ENERGY, Fossil Energy and Carbon Management

The screenshot shows the Regional Direct Air Capture Hubs Selected and Awarded Projects page with the following content:

- Section Header: Regional Direct Air Capture Hubs Selected and Awarded Projects
- Text: Office of Clean Energy Demonstrations
- Image: Direct Air Capture Hub Sample Blueprint
- Text: Regional Clean Hydrogen for Award
- Text: Regional Clean Hydrogen
- Text: OCED

REGIONAL NARRATIVES

ROLL-OUT APPROACH – DEPLOY DIALOGUES AND IN COLLABORATION WITH OFFICES WITH EQUITIES IN THE REGIONS

**Alaska USEA
Regional Workshop**

**May 7-8, Industrial
Decarbonization**

May 9th Critical Minerals

**Appalachia Deploy
Dialogues**

July 17th Critical Minerals

Aug 6th Industrial Decarb.

Aug 7th Networked Infrastructure

... future dialogues + mapping tools

Target Audience

- Industry (facility owners, service providers) who will invest and deploy the technologies in the region
- Regional workforce (including labor) who work in the industries in scope and in energy and mining
- Regional and local government who can establish enabling policies
- Representation from the communities in the region





U.S. DEPARTMENT OF
ENERGY

Thank you

Regional Reports: Building a Clean Energy and Industrial Economy and the Supporting Role of DOE's Office of Fossil Energy and Carbon Management | Department of Energy

Office of Fossil Energy and Carbon Management

Regional Reports: Building a Clean Energy and Industrial Economy and the Supporting Role of DOE's Office of Fossil Energy and Carbon Management

JULY 8, 2024

Office of Fossil Energy and Carbon Management
Regional Reports: Building a Clean Energy and Industrial Economy and the Supporting Role of DOE's Office of Fossil Energy and Carbon Management

Overview

The U.S. Department of Energy's Office of Fossil Energy and Carbon Management (FECM) is developing a series of regional reports to highlight carbon management and resource sustainability decarbonization solutions in fossil energy – coal, oil, and gas – producing and industrial regions. Each report references the specific region's unique energy and industry mix, local energy resources, and current initiatives and priorities, and aligns them with FECM's research, development, and demonstration portfolio to curate relevant solutions.

The six regions covering 27 states account for 98% of coal, 99% of natural gas, and 97% of U.S. oil production. They also host a significant share of hard-to-abate industries, including almost all petrochemical, blast furnace basic oxygen furnace steel, soda and ash, and ethanol facilities; over 80% of lime and ammonia; almost 80% of refineries; and over 80% of cement and glass facilities. Additionally, these regions hold most of the potential to produce critical minerals and materials from carbon ore or energy (e.g. coal and produced water) wastes.

The following map provides an overview of the regions identified in the various FECM Regional Reports. Additional information will be forthcoming as the reports are finalized.

- Alaska
- Appalachia (KY, OH, WV, PA)
- Gulf Coast + South Central (NR, TX, OK, AR, LA, MS, AL)
- Heartland (MT, ND, SD, NE, KS, MN, IA, IL)
- Midwest (MO, WI, MI, IN, OH)
- Northeast (NY, VT, UT, CO, WY)

DOWNLOAD THE REPORT(S) AND SUPPLEMENTAL FACT SHEETS