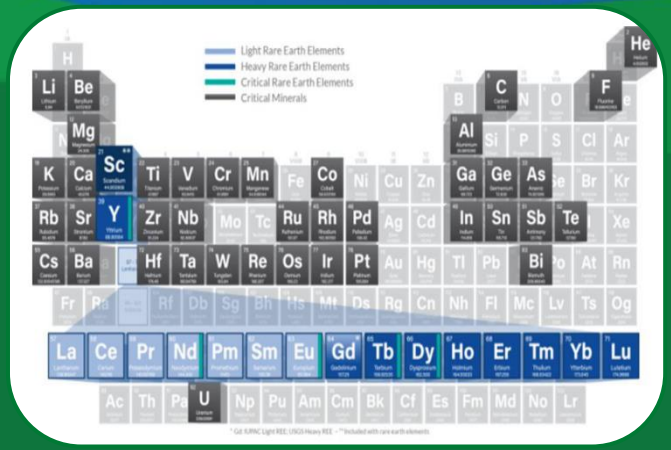
U.S. DEPARTMENT OF ENERGY
Fossil Energy and Carbon Management

NATIONAL ENERGY TECHNOLOGY LABORATORY

FECM REGIONAL NARRATIVES

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

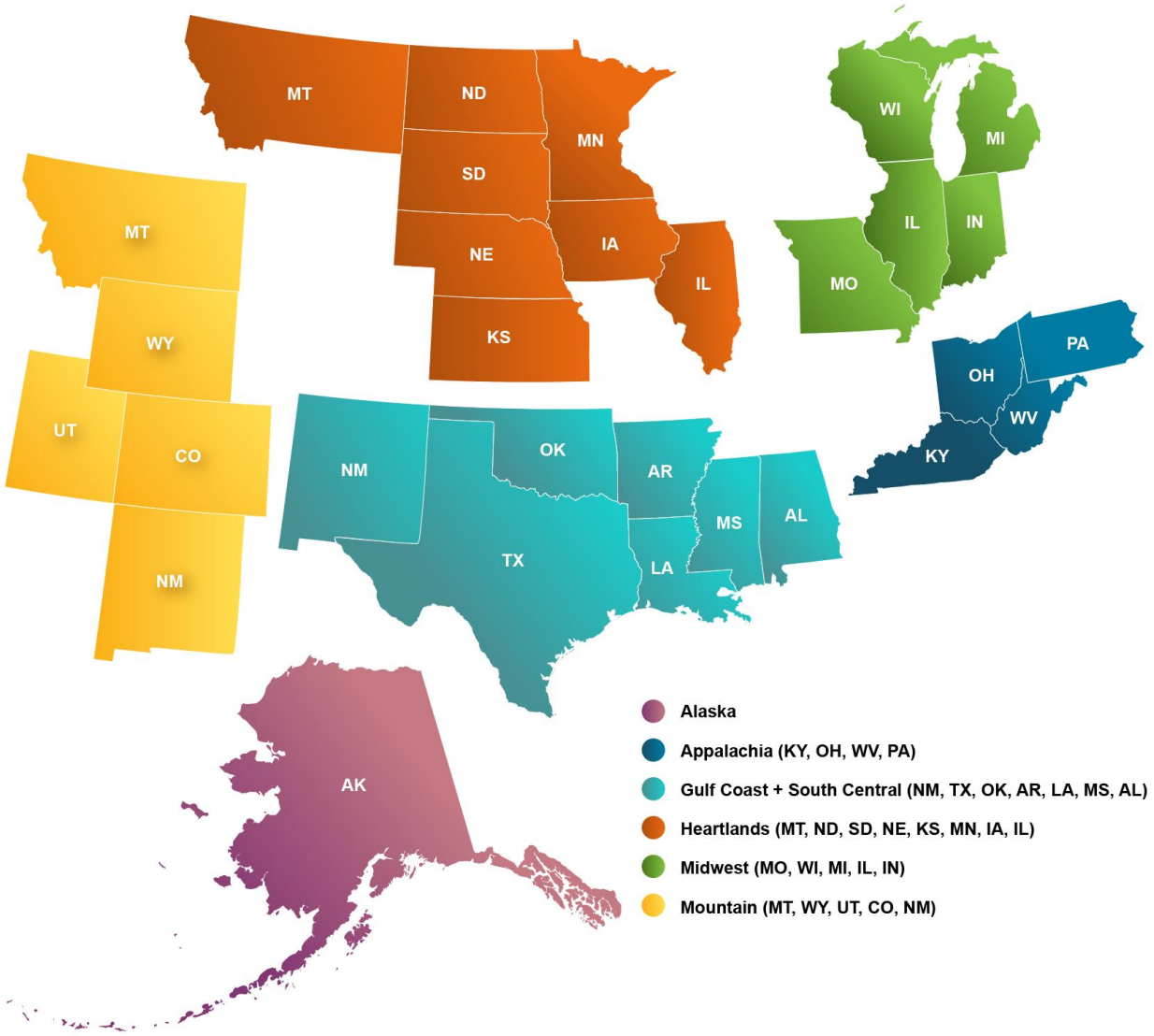
November 2024



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**

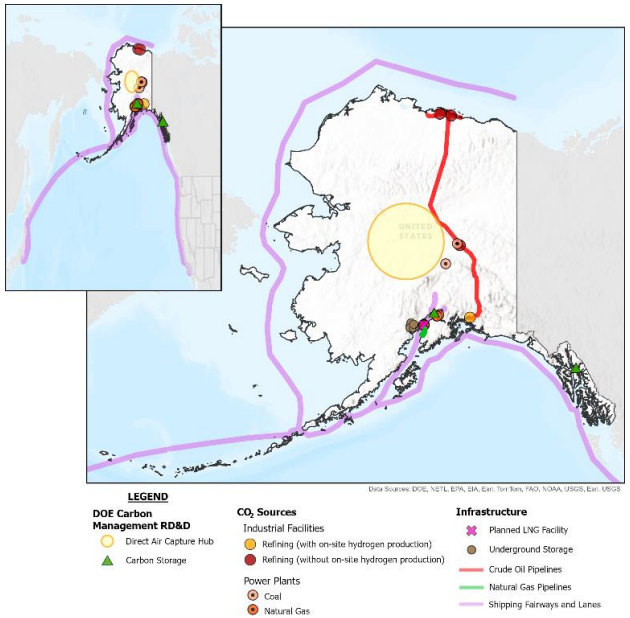


REGIONAL NARRATIVES

REGIONS HAVE DIFFERENT INDUSTRIES AND OPPORTUNITIES

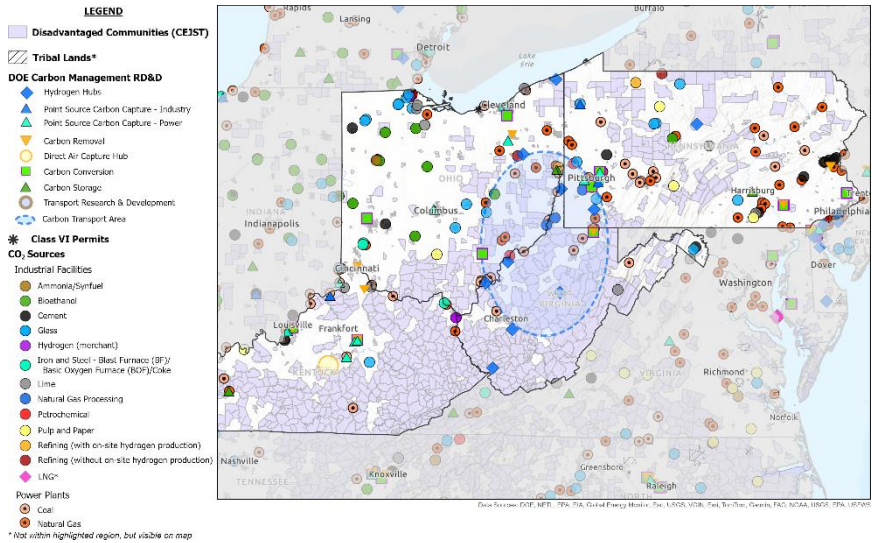
Alaska and International Trade in CO_2

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.



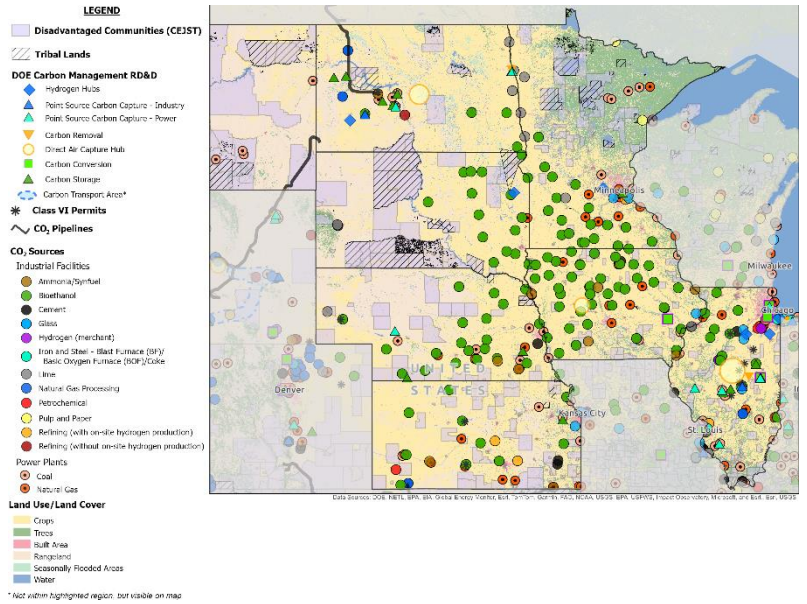
Redeveloping Appalachia

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)

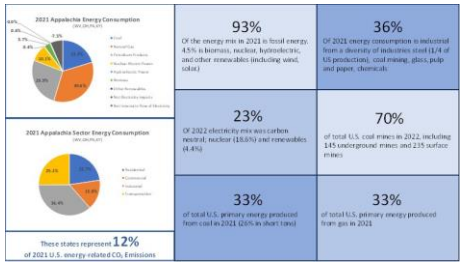
91% 2022 Energy Mix is Fossil Energy*	**52%** 2022 Sector Energy Consumption is Industrial
75% 2022 U.S. crude production	**54%** of 2022 U.S. natural gas production

*34% of 2023 electricity mix nuclear and renewables

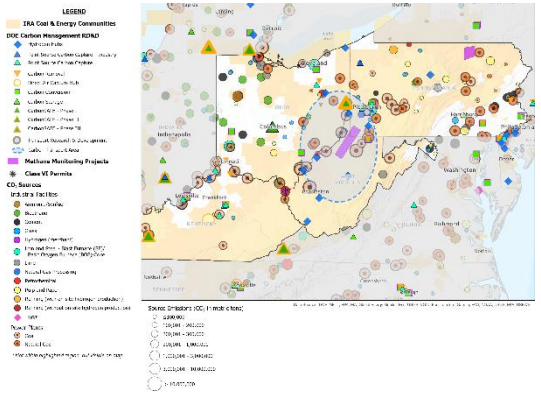
REGIONAL NARRATIVES

CONCEPT – BASED ON THE REGION'S CONTEXT, ILLUSTRATE THE RELEVANT OPPORTUNITIES AND ACTIVITIES IN THE REGION

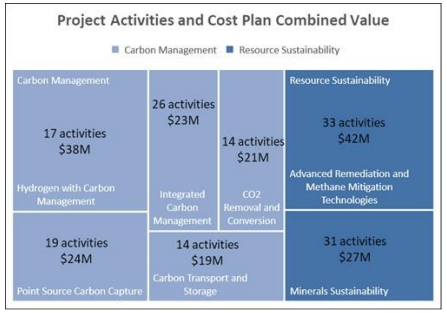
Region's Industry and Energy Mix



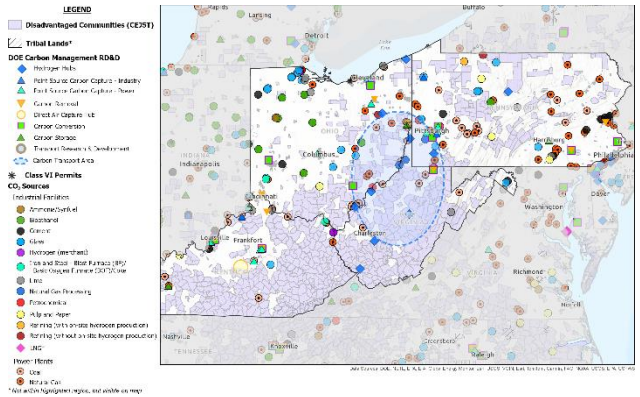
Energy Resources and DOE Projects



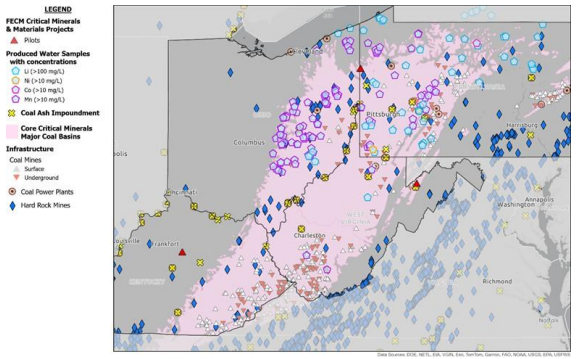
Investment in the Region from local participation in FECM Financial Assistance



Industry and DOE Projects



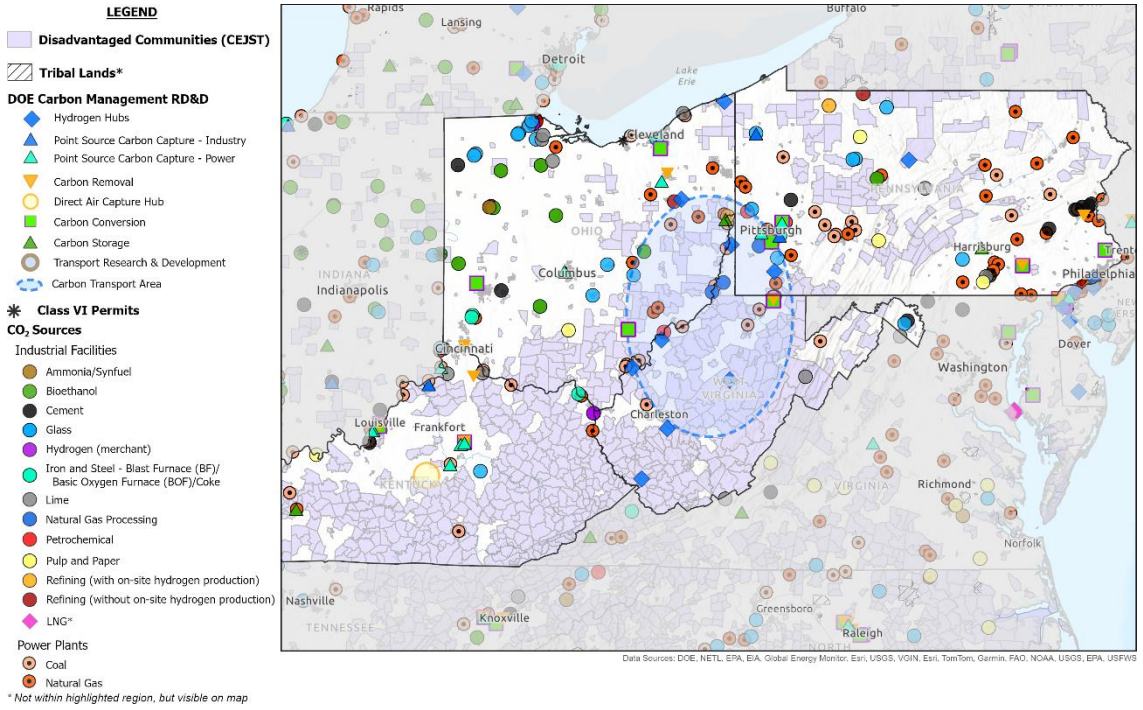
Critical Minerals



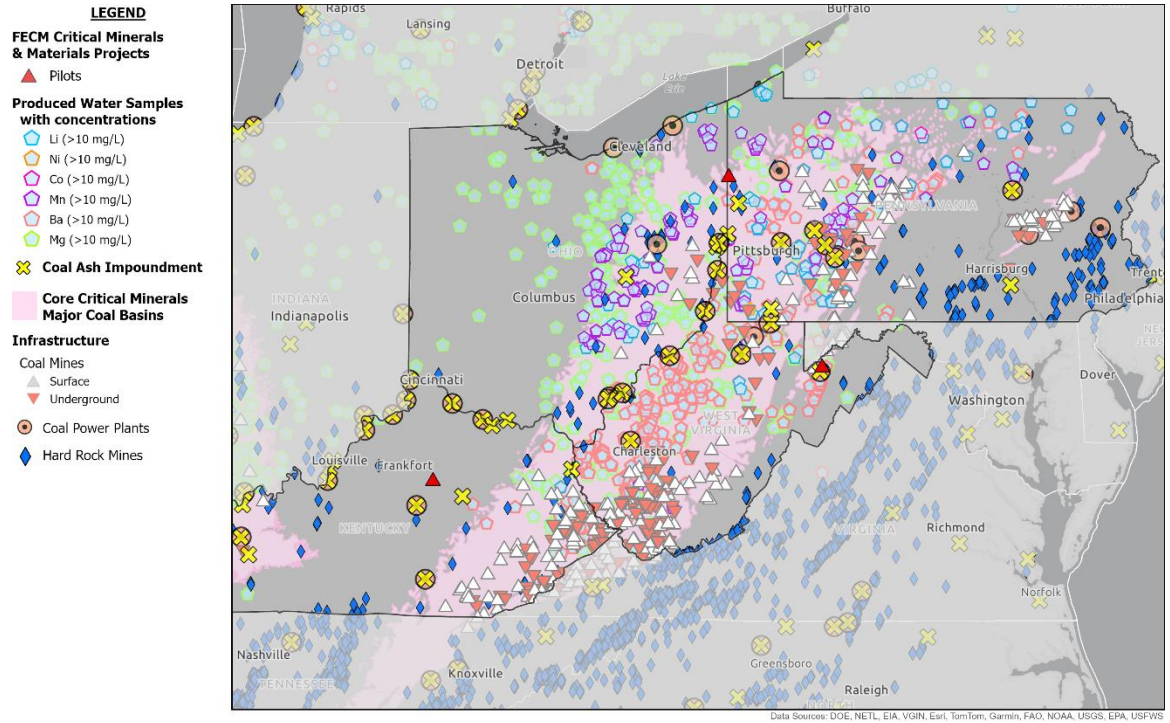
Selected FECM Projects in the Region

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.

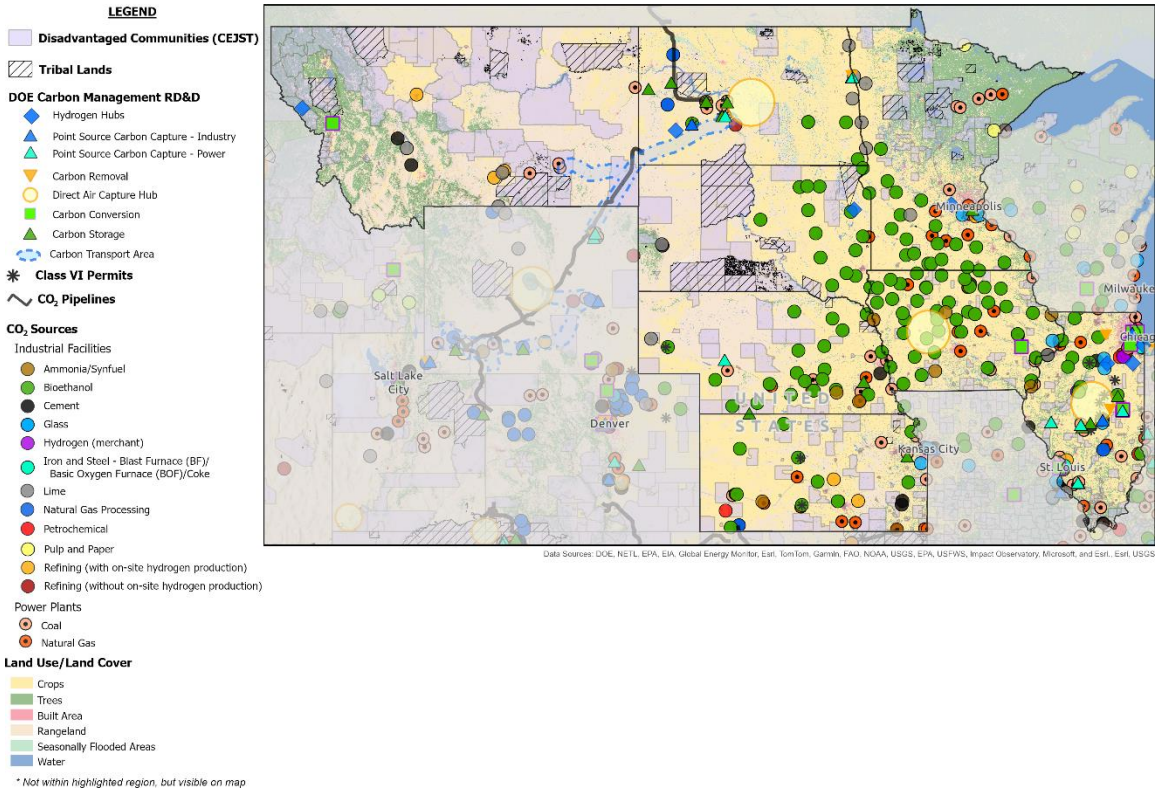


With 70% of U.S. coal mines and as the second largest onshore gas producer, Appalachia is well positioned to produce critical minerals and materials from coal and energy and mining waste streams (e.g., coal ash, acid mine drainage, and produced water) while remediating land and water.

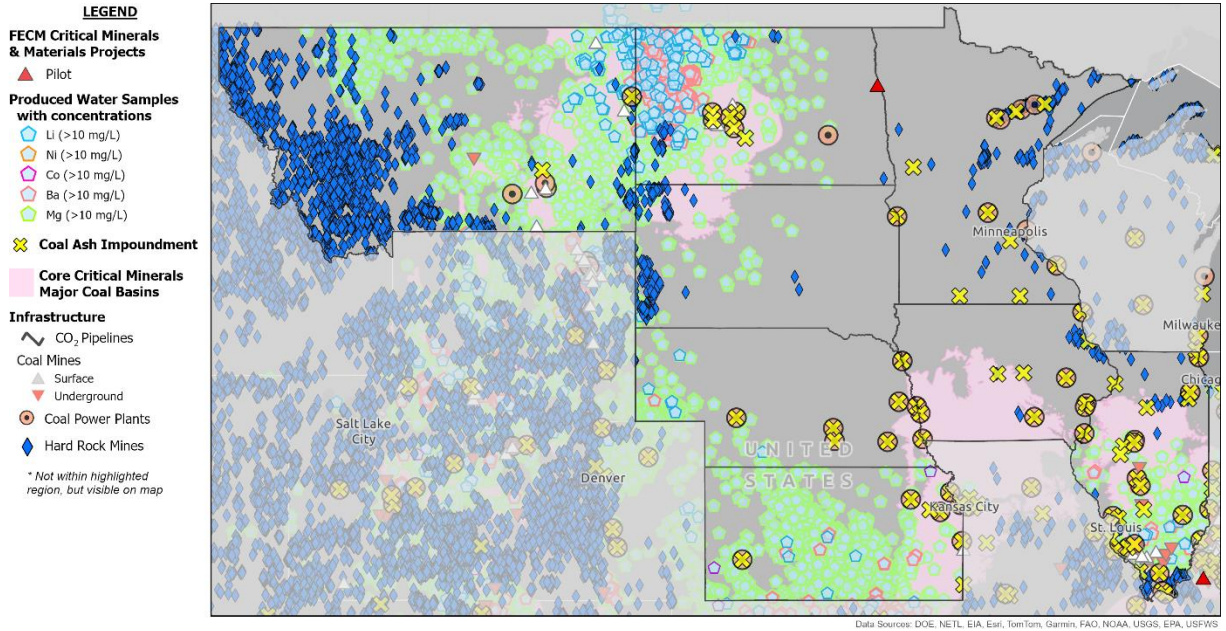


HEARTLANDS (MT, ND,SD,NE,KS,MN,IA,IL) - DIVERSIFYING A RURAL AGRICULTURE ECONOMY

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

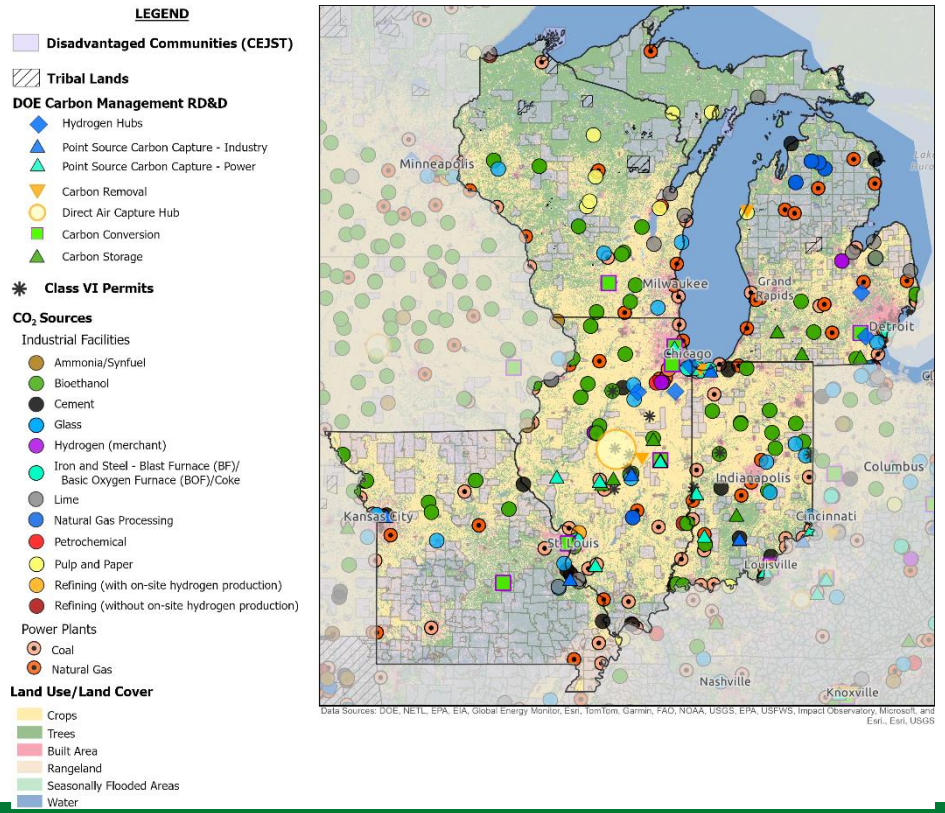


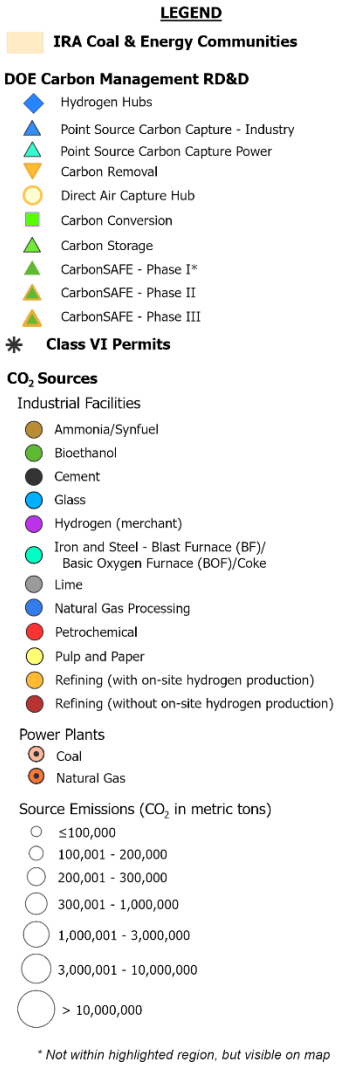
With 48% of the U.S. recoverable coal reserves and the 3rd largest crude producer, the Heartland Region has the opportunity to produce rare earth elements and critical minerals from coal, coal ash, produced water, acid mine drainage, and other energy and mining waste streams.

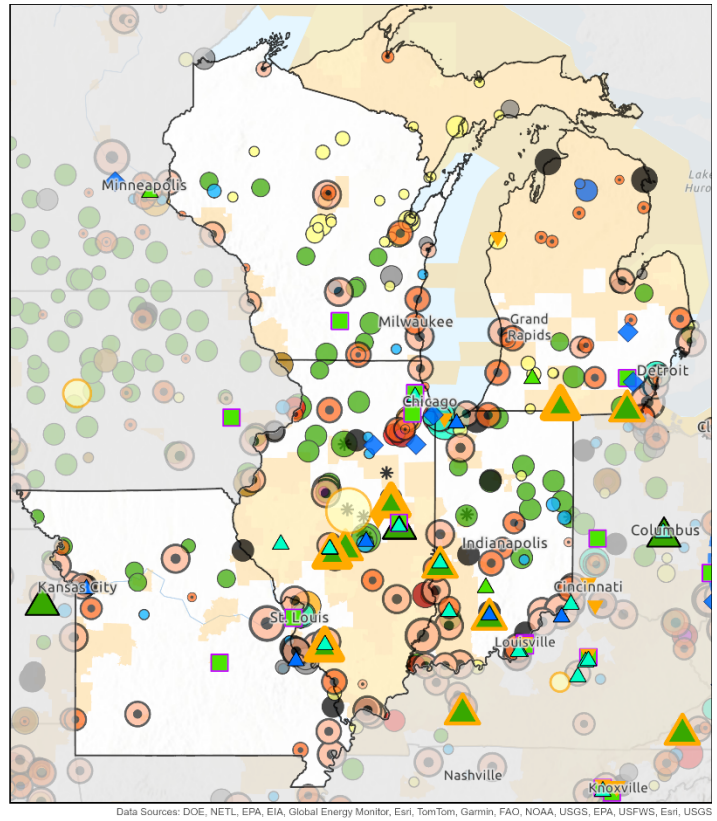


MIDWEST (IL, IN, WI, MI, MO) – THE EVOLUTION OF AN INDUSTRIAL MANUFACTURING AND TRANSPORT CENTER

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.



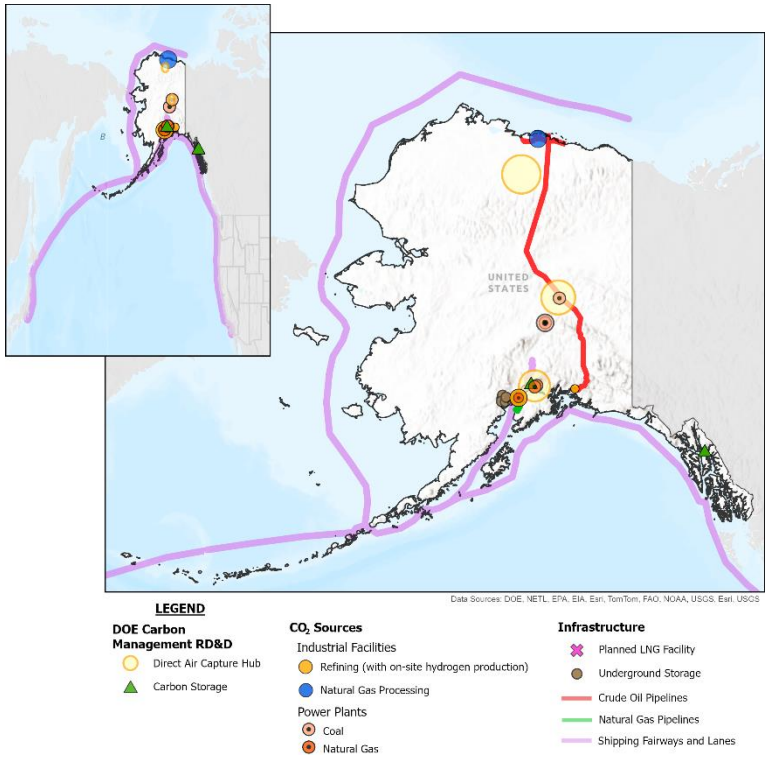




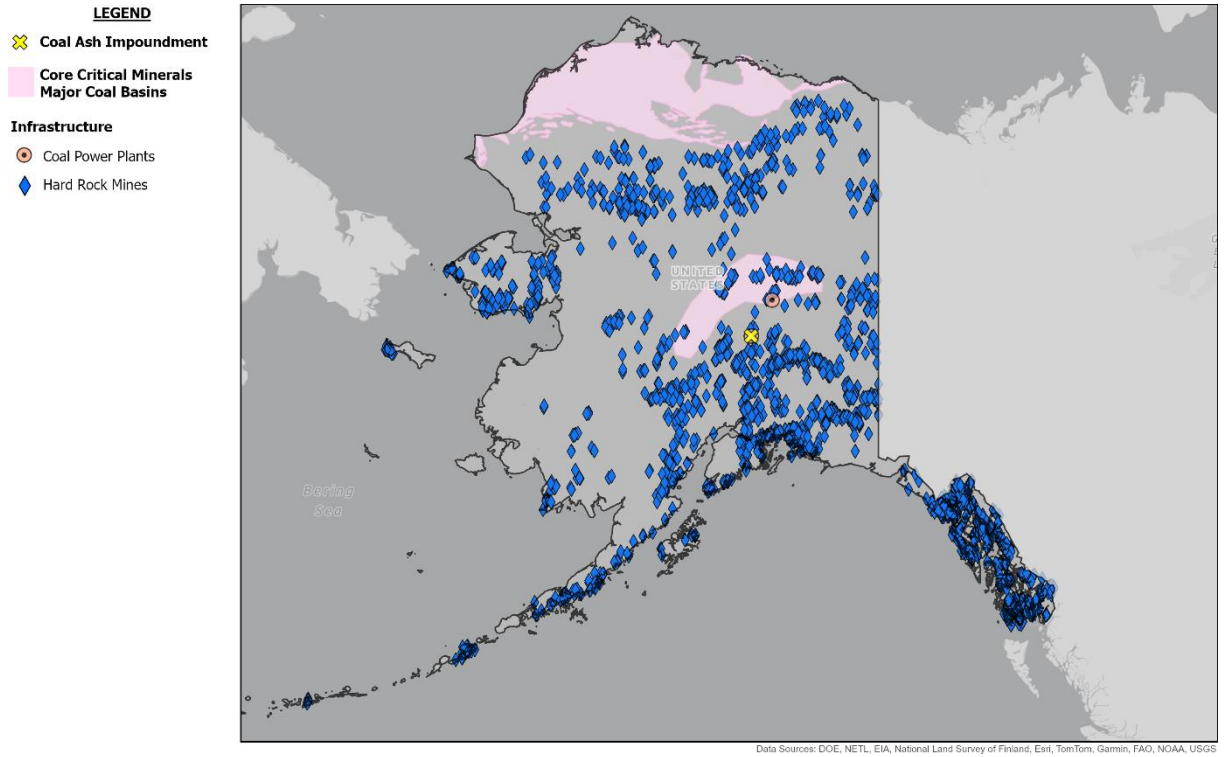
Abundant CO_2 storage resources close to industry and power emitters, a skilled industrial workforce, and financial incentives, make this an attractive region for storing CO_2 emissions from industry

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

Alaska's significant CO_2 storage potential, established energy trade, and proximity to Asia could be leveraged to import CO_2 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

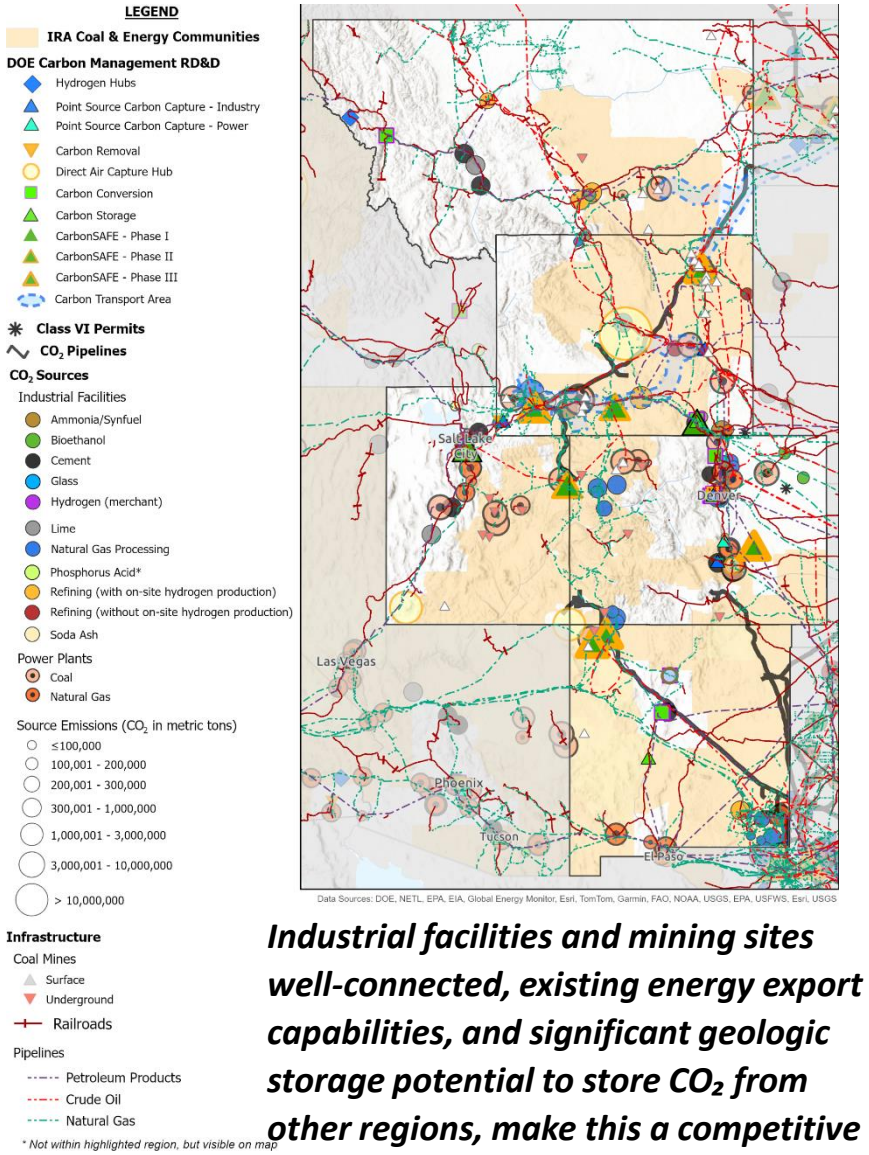


With Alaska home to 49 of the 50 critical minerals, Alaska has the opportunity to play a key role in establishing a domestic critical minerals supply chain from its rock mines, mining waste, and coal resources

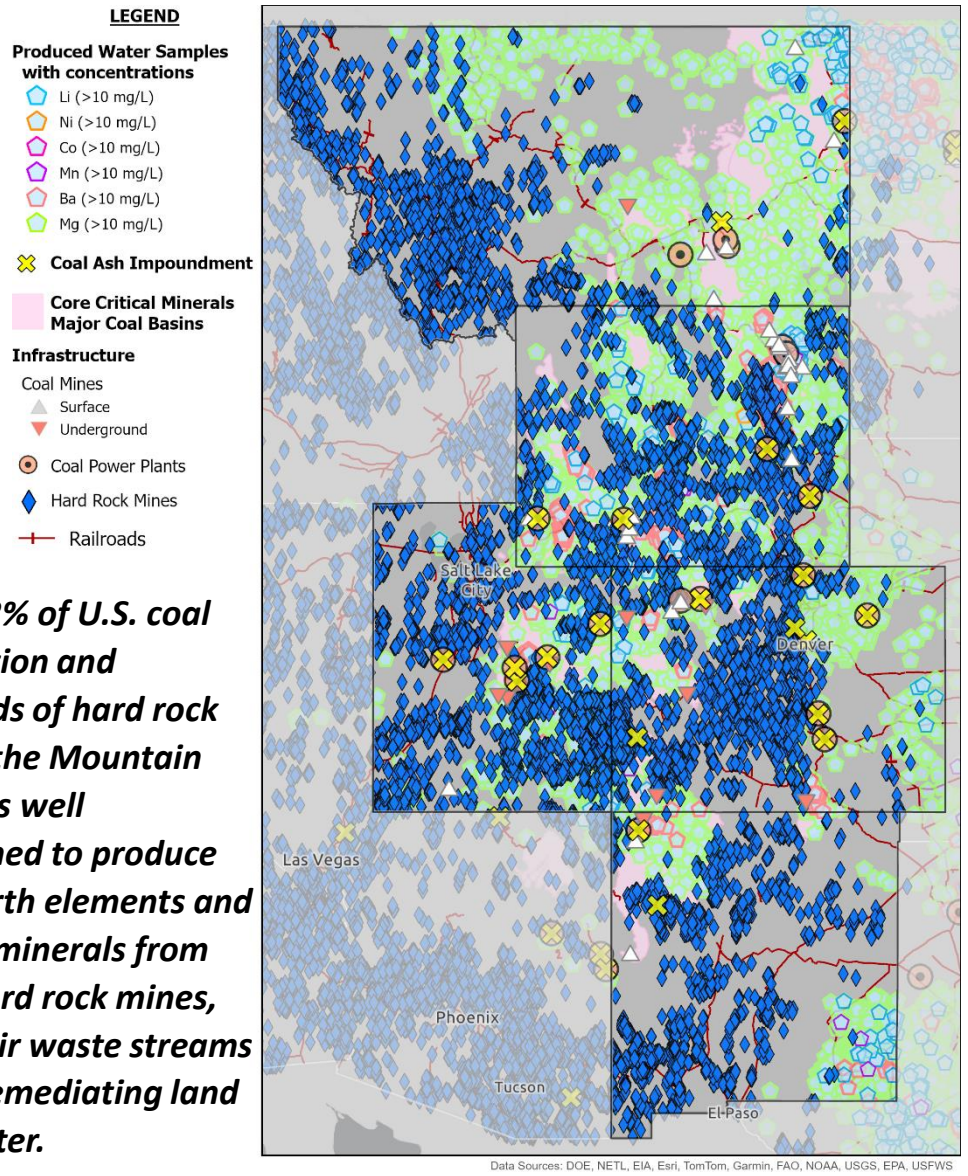


MOUNTAIN (MT, WY, UT, CO, NM) –

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



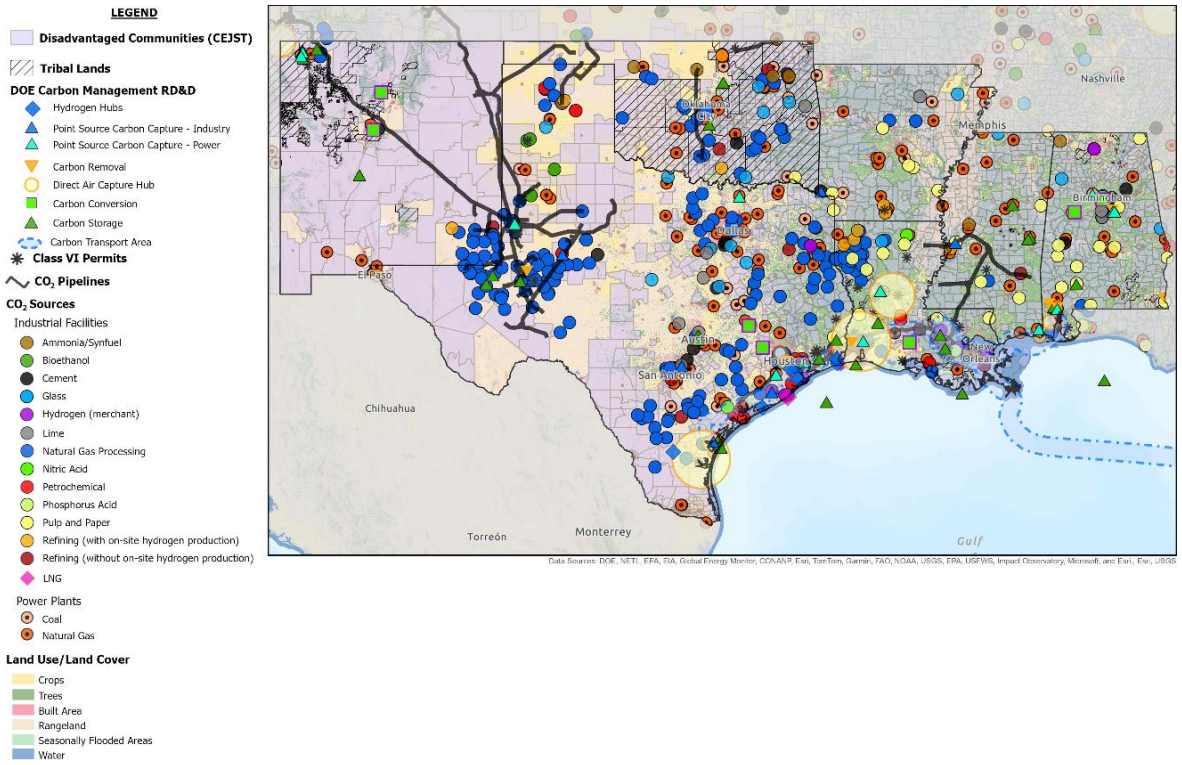
Industrial facilities and mining sites well-connected, existing energy export capabilities, and significant geologic storage potential to store CO_2 from other regions, make this a competitive region for shared infrastructure and CO_2 storage hubs.



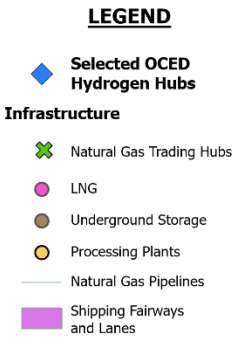
With 52% of U.S. coal production and hundreds of hard rock mines, the Mountain region is well positioned to produce rare earth elements and critical minerals from coal, hard rock mines, and their waste streams while remediating land and water.

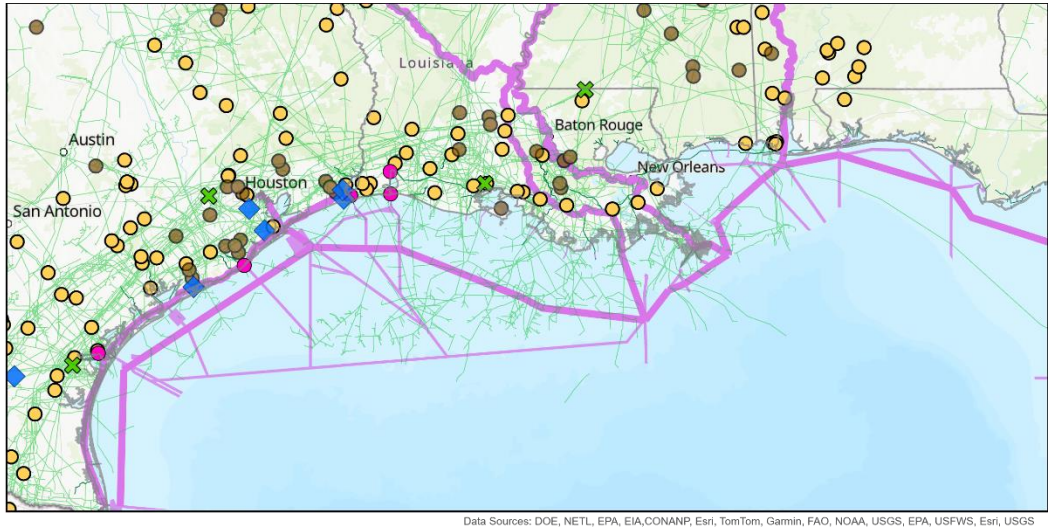
GULF COAST AND SOUTH CENTRAL (NM, TX, LA, OK, AR, MS, AL)– LEVERAGE GLOBAL ENERGY TRADE AND CAPABILITY CENTER

Abundant CO_2 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 CO_2) for storing CO_2.



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.

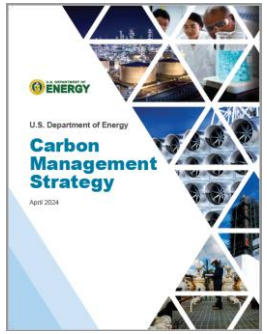


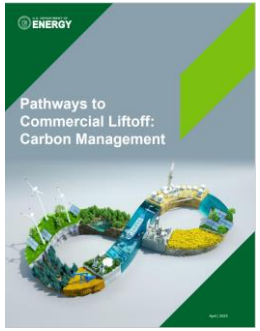


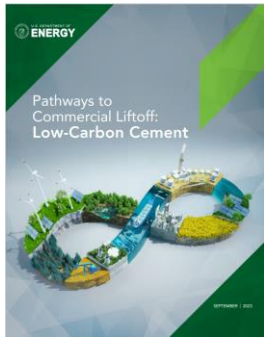
REGIONAL NARRATIVES

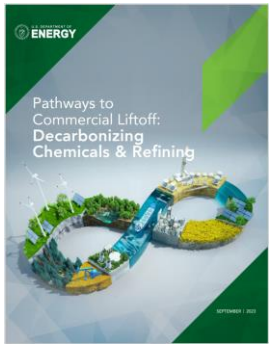
INDUSTRIAL DECARBONIZATION AND CARBON MANAGEMENT CROSS-CUTS

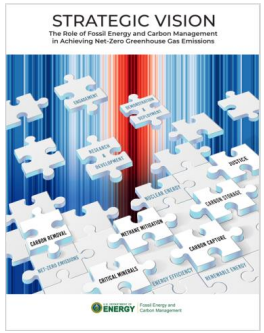
Department of Energy Research and Publications

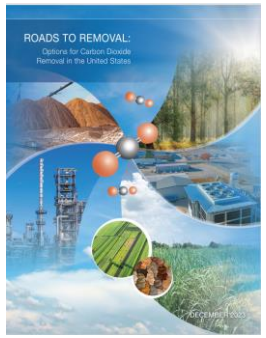


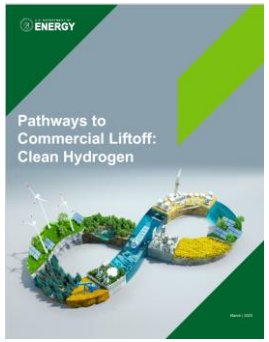












+ future reports

ENERGY earthshots
U.S. DEPARTMENT OF ENERGY

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™

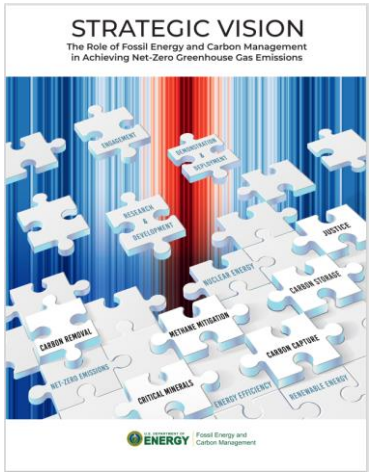
Develop cost-competitive industrial heat decarbonization technologies with at least 85% lower greenhouse gas emissions by 2035.

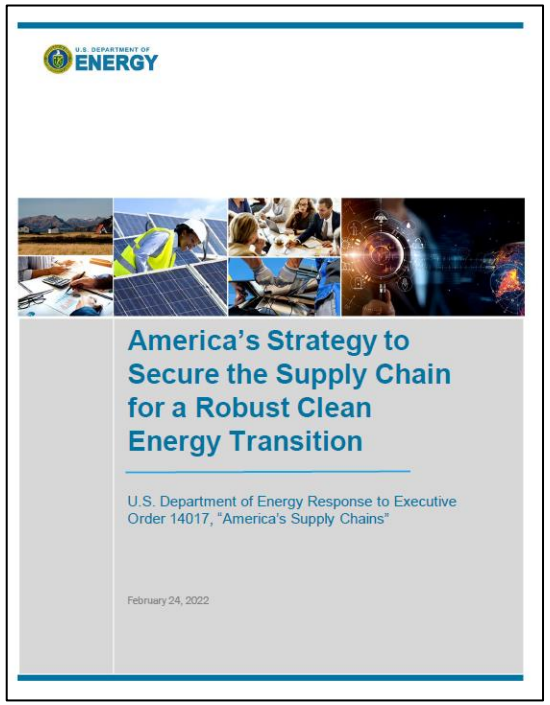
Carbon Negative Shot™

Remove CO2 from the atmosphere and durably store it at meaningful scales for less than $100/net metric ton of CO_2-equivalent within a decade.

REGIONAL NARRATIVES

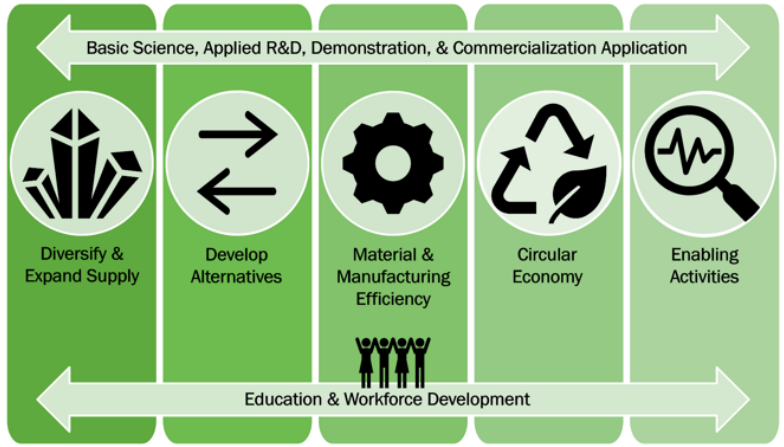
CRITICAL MINERALS CROSS-CUTS





DOE Critical Minerals/Materials (CMM) Vision & Strategy

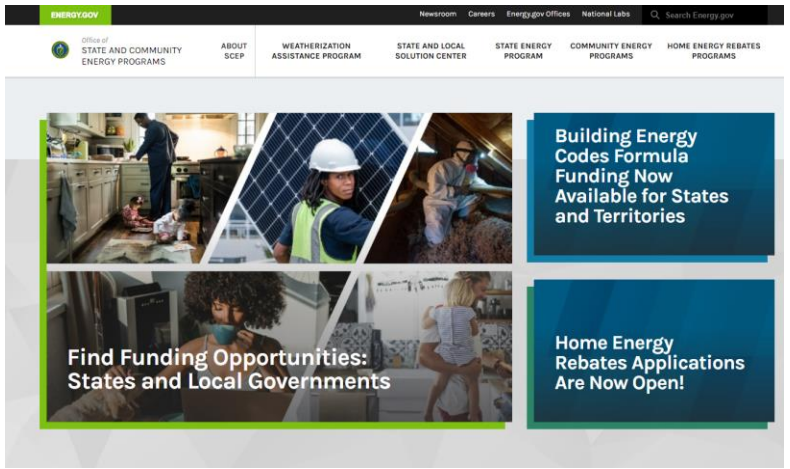
- Reliable, resilient, affordable, diverse, sustainable, and secure **domestic critical mineral and materials supply chains**.
- Support the clean energy transition and decarbonization of the energy, manufacturing, and transportation economies.
- Promote safe, sustainable, economic, and environmentally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



REGIONAL NARRATIVES

REGIONAL CROSS-CUTS

SCEP and REDI



White House Environmental Justice Advisory Council

Carbon Management Regional Initiative

Regional and Hub Initiatives

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]