Considerations in CCUS Industrial Clusters Development

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Co-PI Midwest Regional Carbon Initiative

MRCI
Midwest Regional Carbon Initiative

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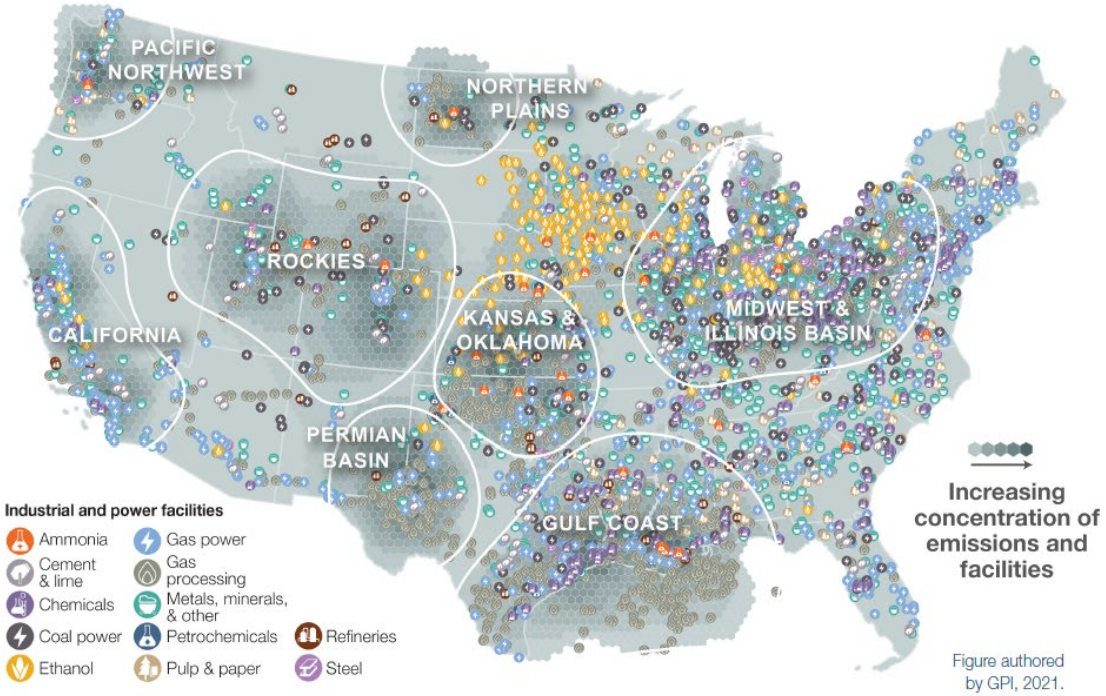
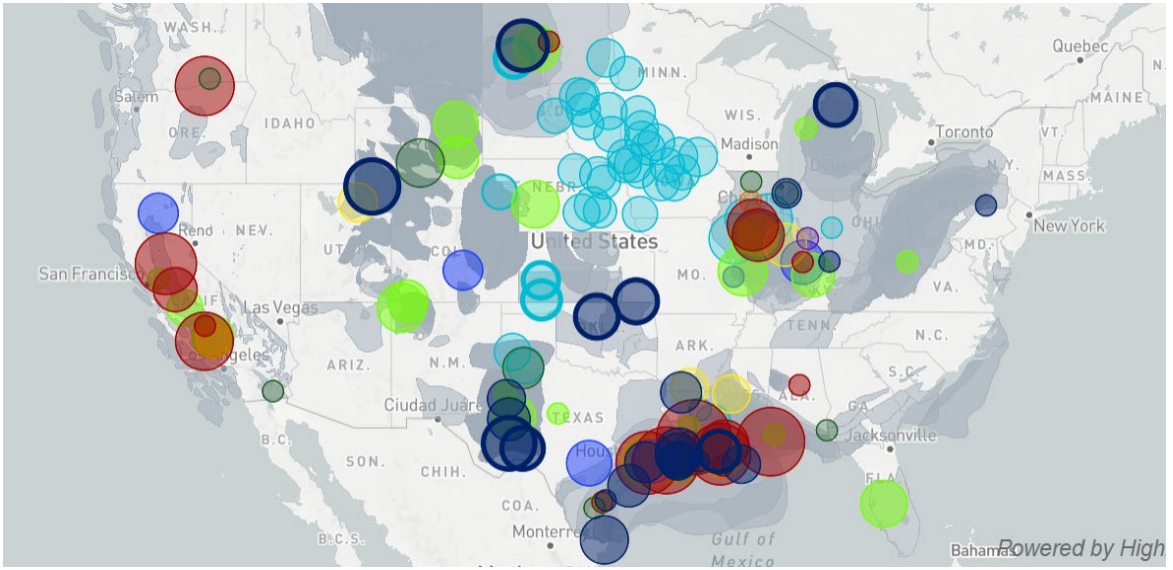
US Clusters – CO_2 Sources and Projects – An Emerging National Framework

- *Current CO_2 Sources Organizing into Clusters in many regions:*
  - *Midwest and Illinois Basin*
  - *Gulf Coast and Permian Basin*
  - *Rockies and northern Plans*





- *Future CO_2 Sources will likely to follow clusters and geologic storage resources:*
  - *Natural gas power generation*
  - *Industrial facilities*
  - *Bio energy*
  - *Natural gas to Hydrogen*
  - *Direct Air Capture*

Map Sources – Great Plains Institute and Clean Air Task Force

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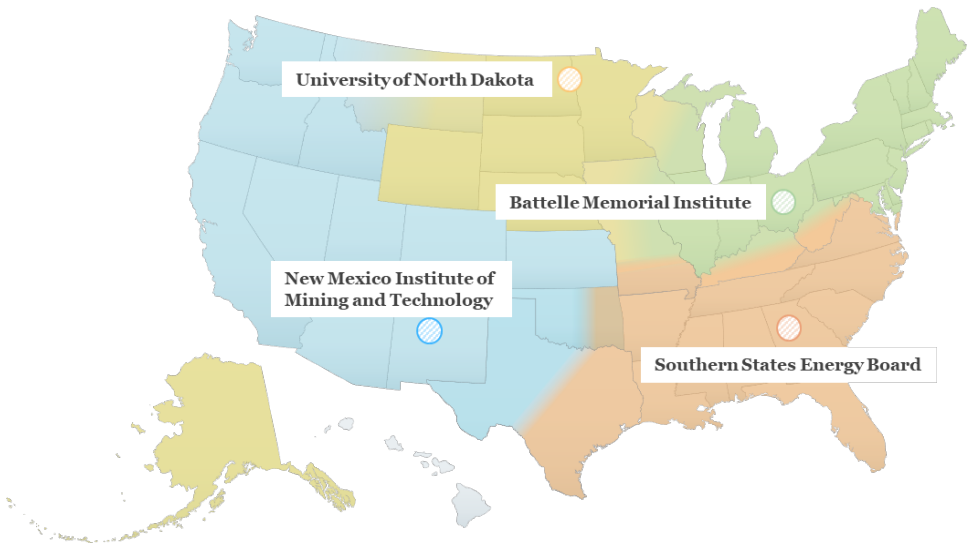
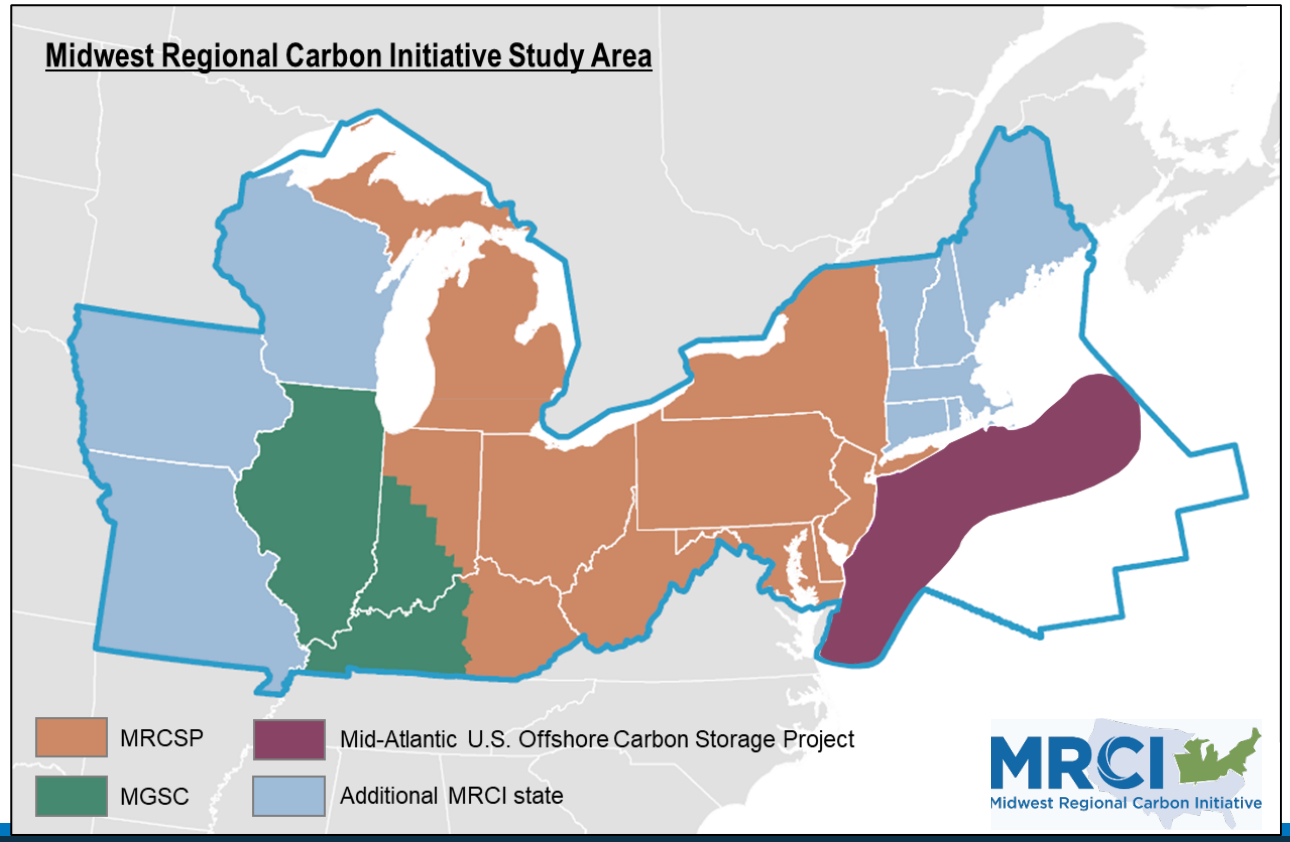
Midwest Regional Carbon Initiative

20 States in Midwest, Northeast, and Mid-Atlantic

- Battelle and Illinois State Geological Survey combine expertise from MRCSP and MGSC
- Work with Regional State Geological Surveys and Universities to accelerate CCUS deployment





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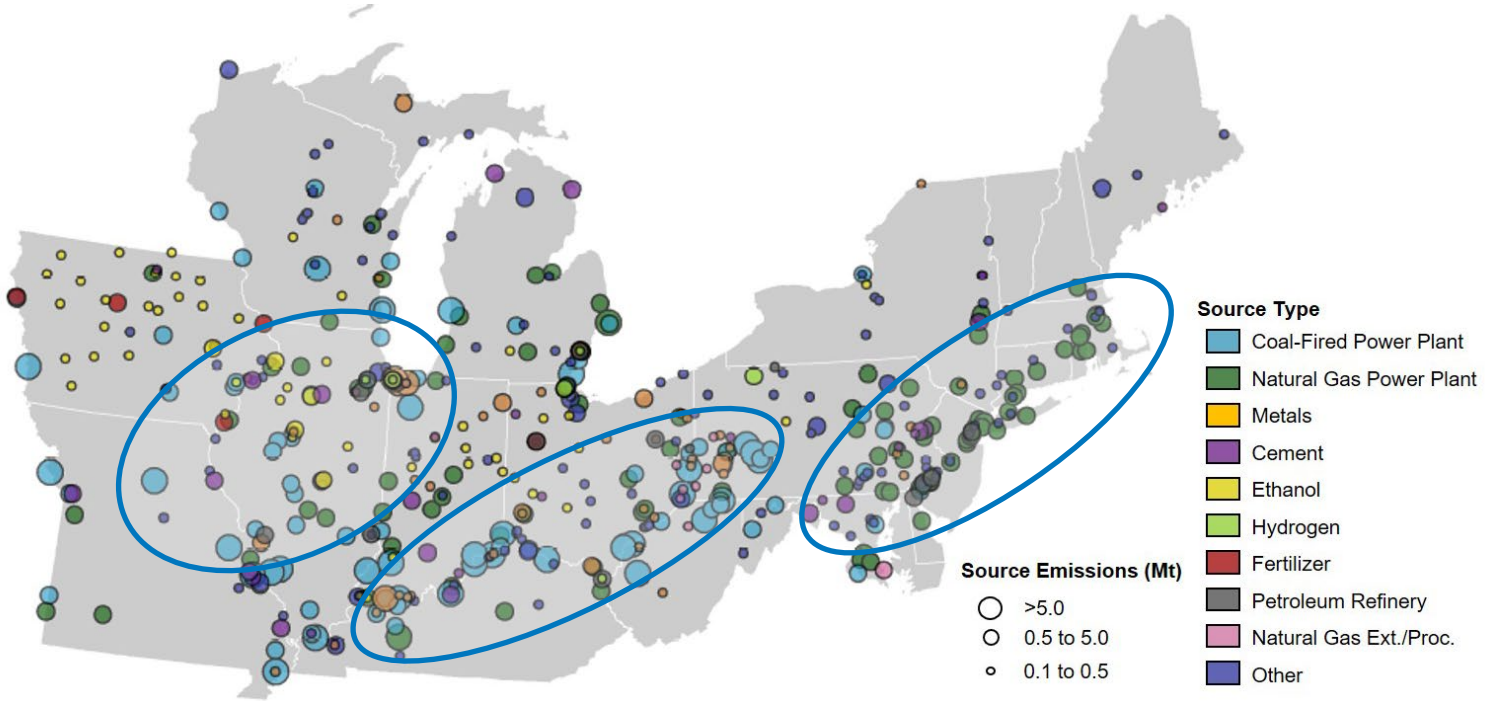
MRCI - CO_2 Source Diversity Influences Clusters

- More than 1/3 of the nation's CO_2 point sources
- Regional emissions from various industrial sources with power plants accounting for ~3/4
- Concentration along east coast and Ohio River Valley
- Future emissions sources may be different than present sources, e.g., hydrogen, BECCS, DAC



Source Type	2019 Emissions (MMt)	%
Hydrogen	4.2	<1%
Fertilizer	6.9	1%
Coal-Fired Power Plant	501.2	52%
Ethanol	23.2	2%
Metals	75.0	8%
Cement	24.2	3%
Natural Gas Power Plant	209.6	22%
NGL/LNG/NG Ext.	3.2	<1%
Other	77.9	8%
Petroleum Refinery	35.9	4%
TOTAL	961	-

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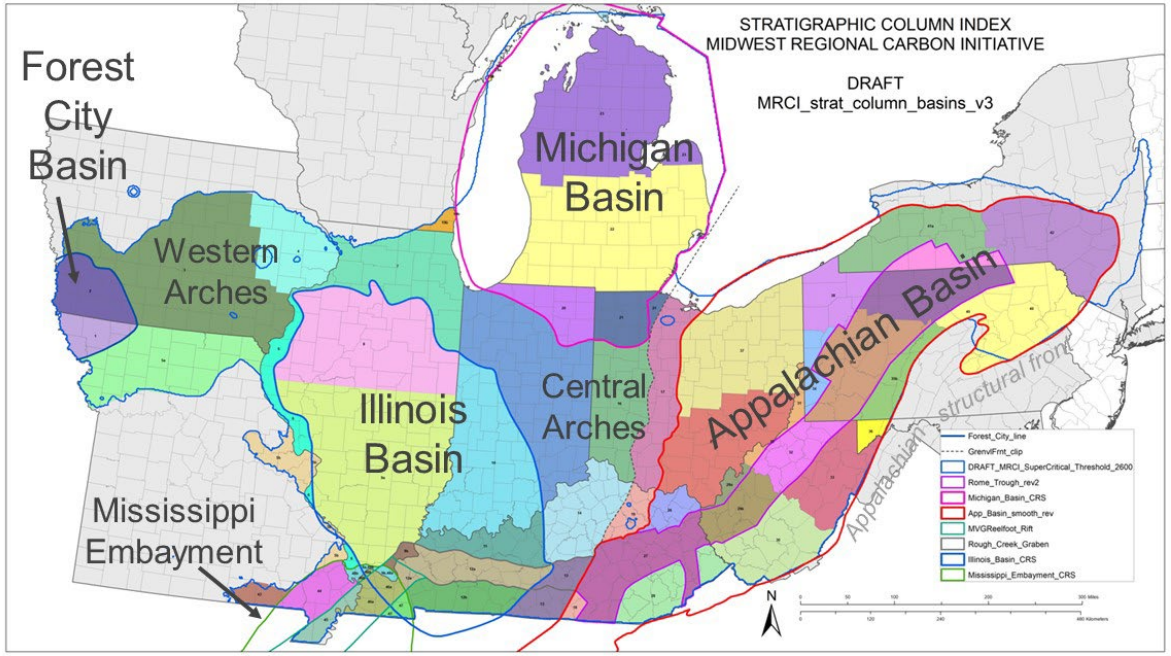
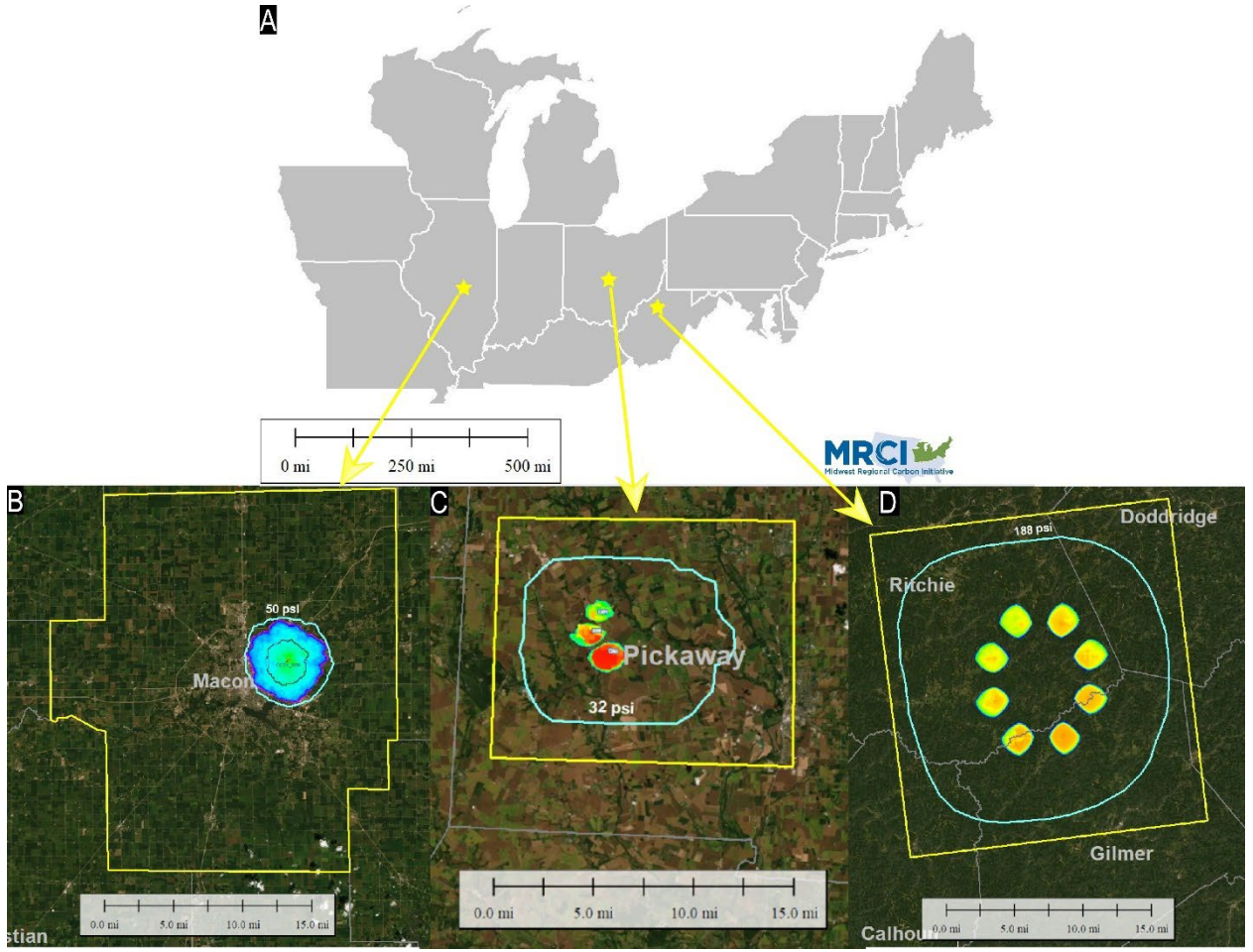
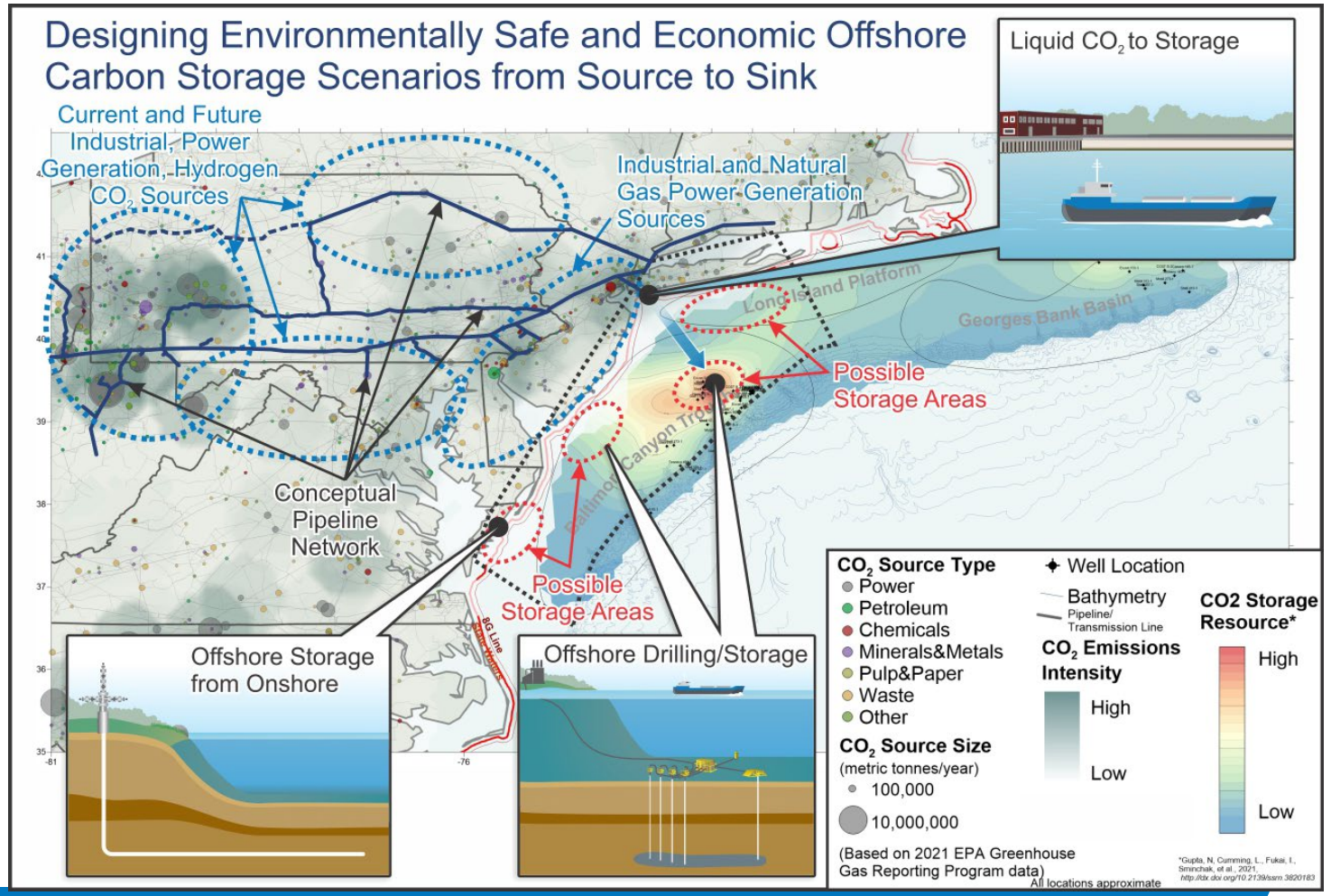
Geologic Storage Resource Development is Essential for Successful Clusters





Mid-Atlantic Offshore Storage Cluster – only major solution for Eastern US?

- Sources – East Coast, Central PA/MD, Appalachian Basin
- Sinks – Baltimore Canyon Trough; maybe Long Island Platform rift basins
- Hundreds of gigatonnes storage resources
- Transport – onshore pipelines, offshore pipeline or shipping
- Societal consideration emphasis



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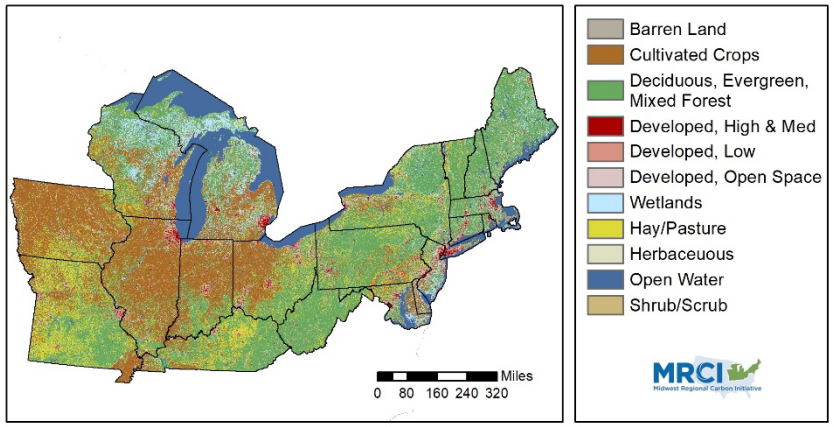
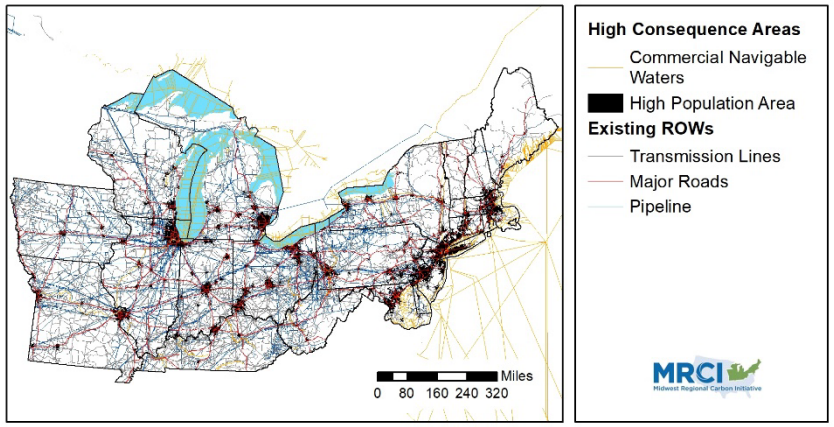
Regional Infrastructure and Societal Factors

Transport and storage infrastructure must consider more than sources and sinks

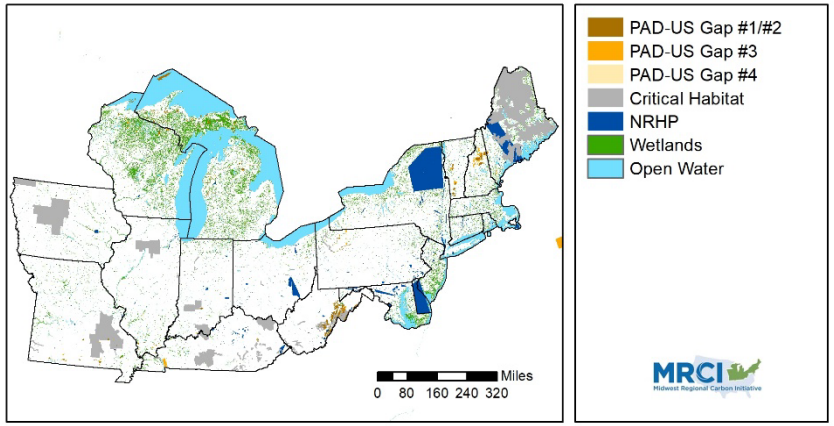
Land cover data = project feasibility



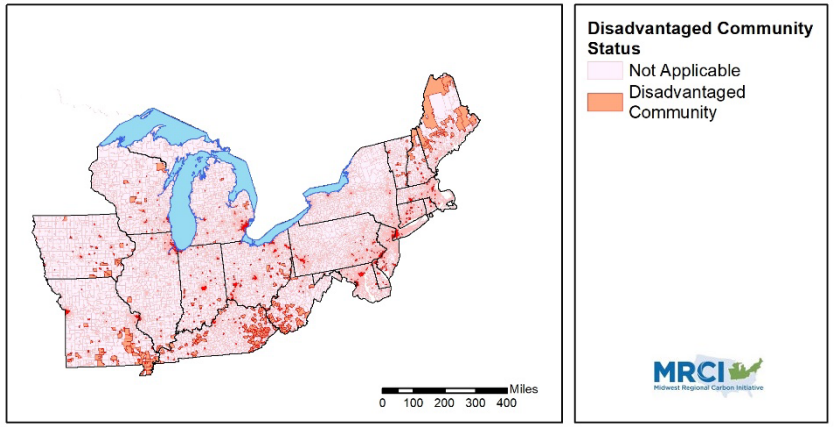
Existing infrastructure = obstacles or opportunities



Sensitive areas = potential project pitfalls



Environmental Justice = equity and project buy-in



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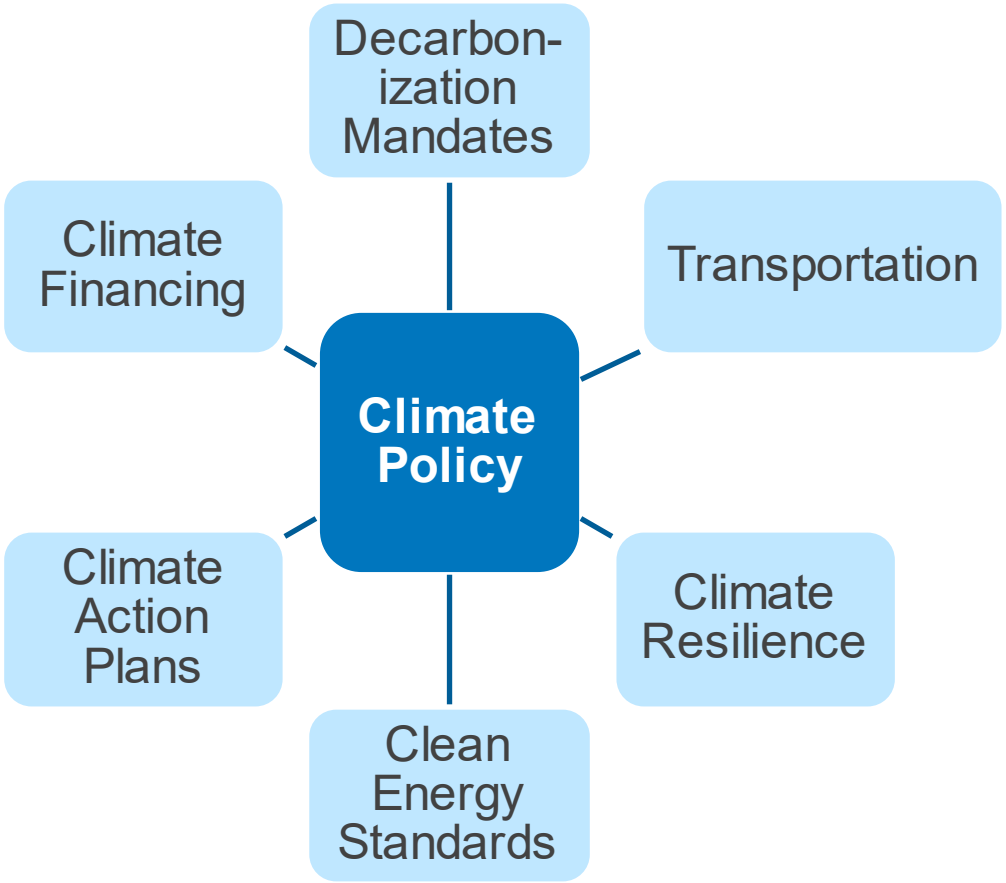
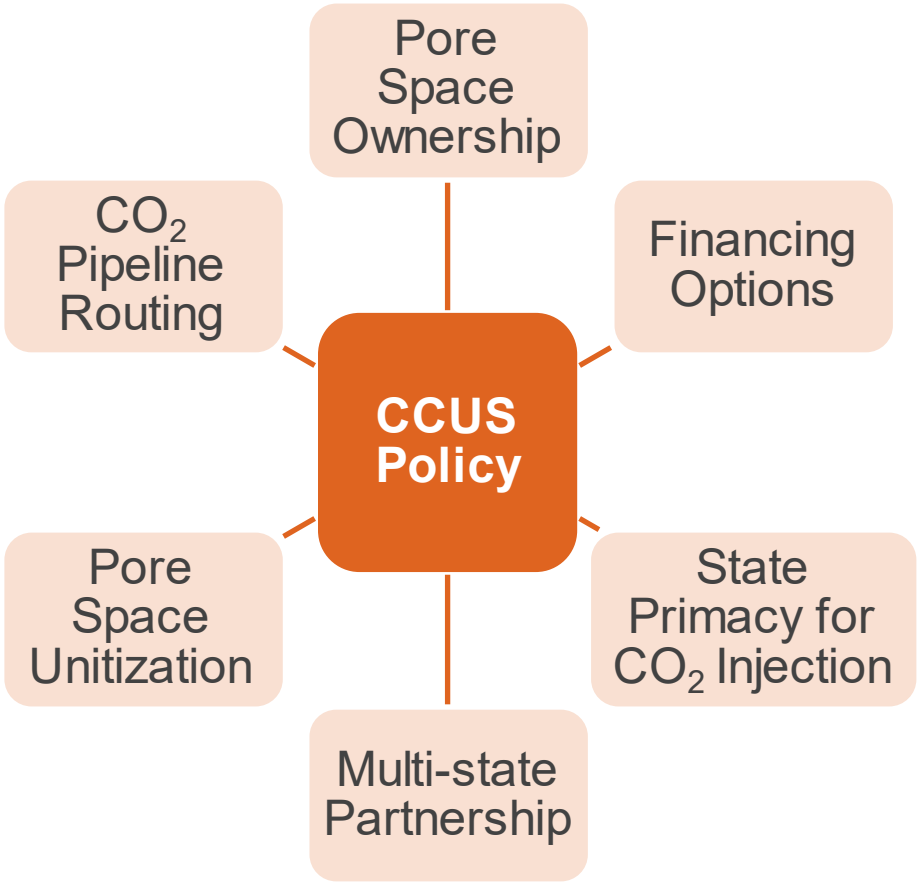
State/Regional Policies Influence Cluster Development

Codifying State and Regional Climate Goals



CCUS Rules Development by States



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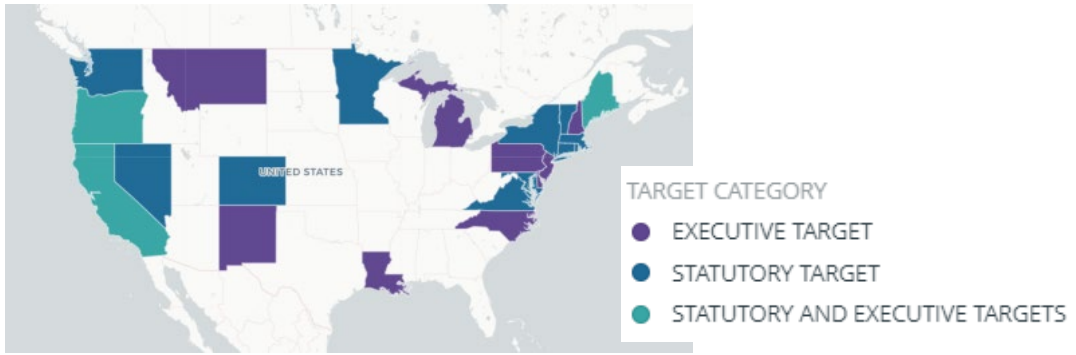
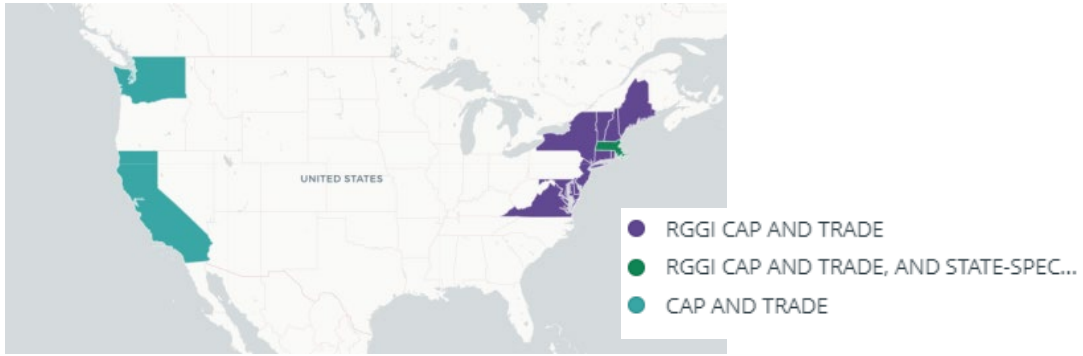
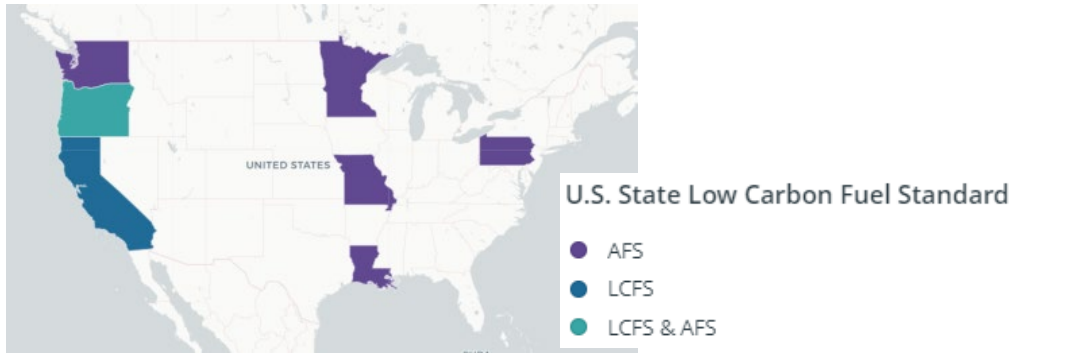
Climate Policies Implemented in the United States

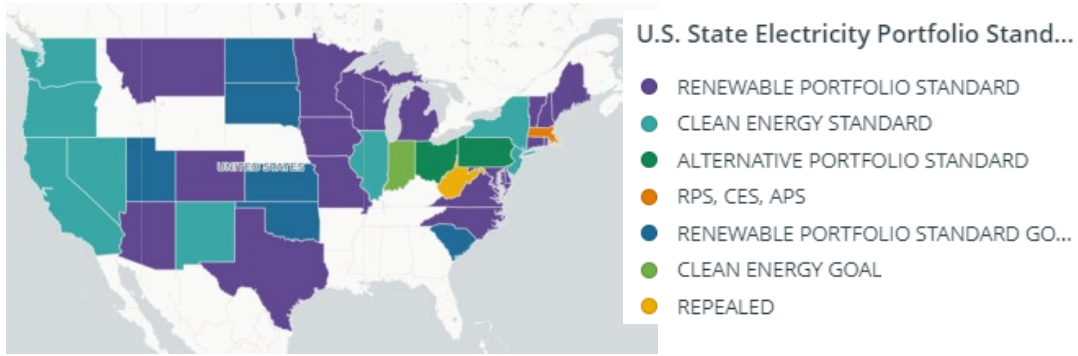
State Carbon Pricing





Electricity Portfolio Standards





From C2ES, 2022

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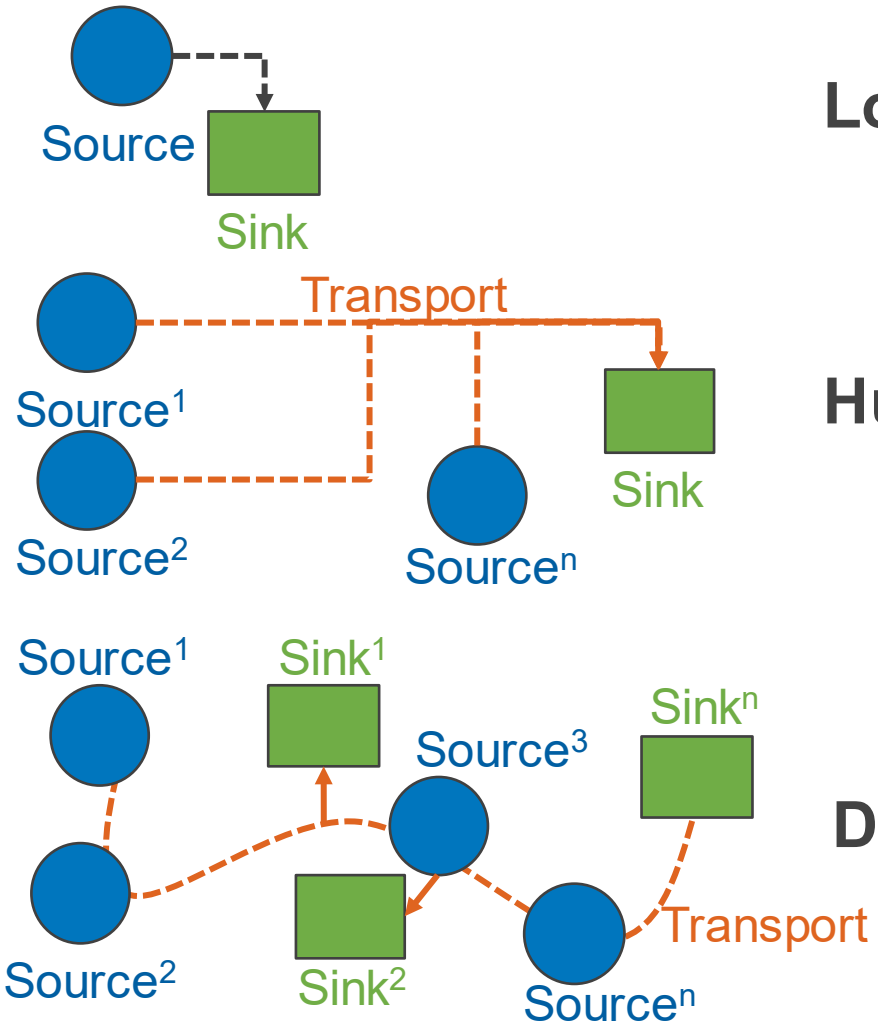
Infrastructure Buildout Considerations

Infrastructure development strategies onshore and offshore



Local

Hub

Distributed

Emerging Industry: Blue Hydrogen, Bioenergy with CCS (BECCS), and Direct Air Capture (DAC)

DAC

- Heat
- Low-carbon power
- Storage

H_2

- Blue to green H2
- Natural gas feedstock
- Demand for H2
- Storage

BECCS

- Energy crops
- Land use considerations

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It can be done

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