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1. Battelle 2. Illinois State Geological Survey, 3. Los Alamos National Laboratory, 4. Pennsylvania Geological Survey 5. Industrial Economics Consultants (IEc), 6. Carbon Solutions

# Addressing the Challenges of Infrastructure Development for Carbon Capture, Utilization, and Storage

Partners and Stakeholders Meeting
September 28th, 2022
Columbus, OH

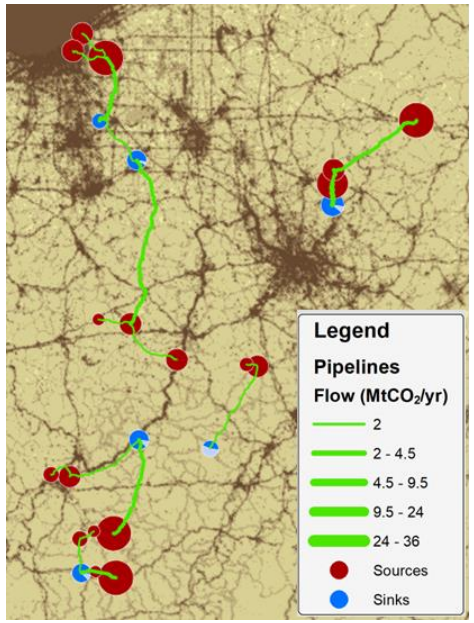
MRCI
Midwest Regional Carbon Initiative

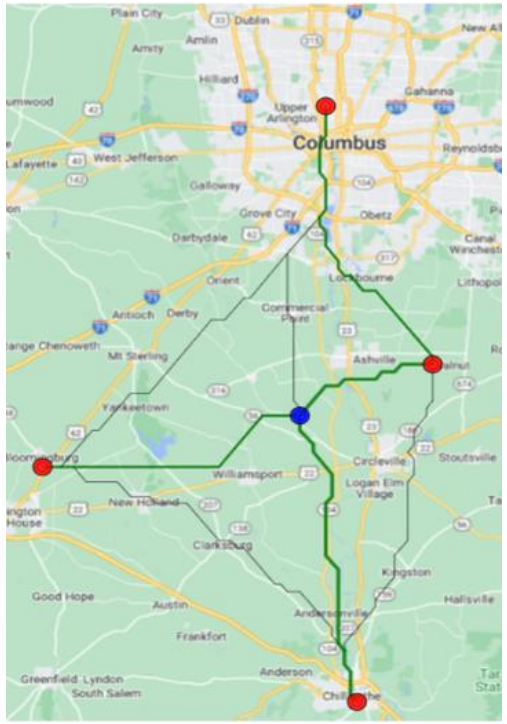
U.S. DEPARTMENT OF ENERGY | NATIONAL ENERGY TECHNOLOGY LABORATORY | BATTELLE | ILLINOIS

# Rethinking infrastructure for Carbon Capture, Utilization, and Storage (CCUS)

## Researching the infrastructure of CCUS includes the policy, economics, and people that make CCUS work.

- 4.1-Conduct a screening level assessment of surface and subsurface infrastructure,
- 4.2-Assess **site readiness** to rank areas,
- 4.3-Conduct analysis of **social, economic, and workforce developmen**t factors
- 4.4-Analyze current **regulatory, pore space issues**, gaps, policy, and tax incentives




**This presentation focuses on Subtask 4.1 and 4.3**



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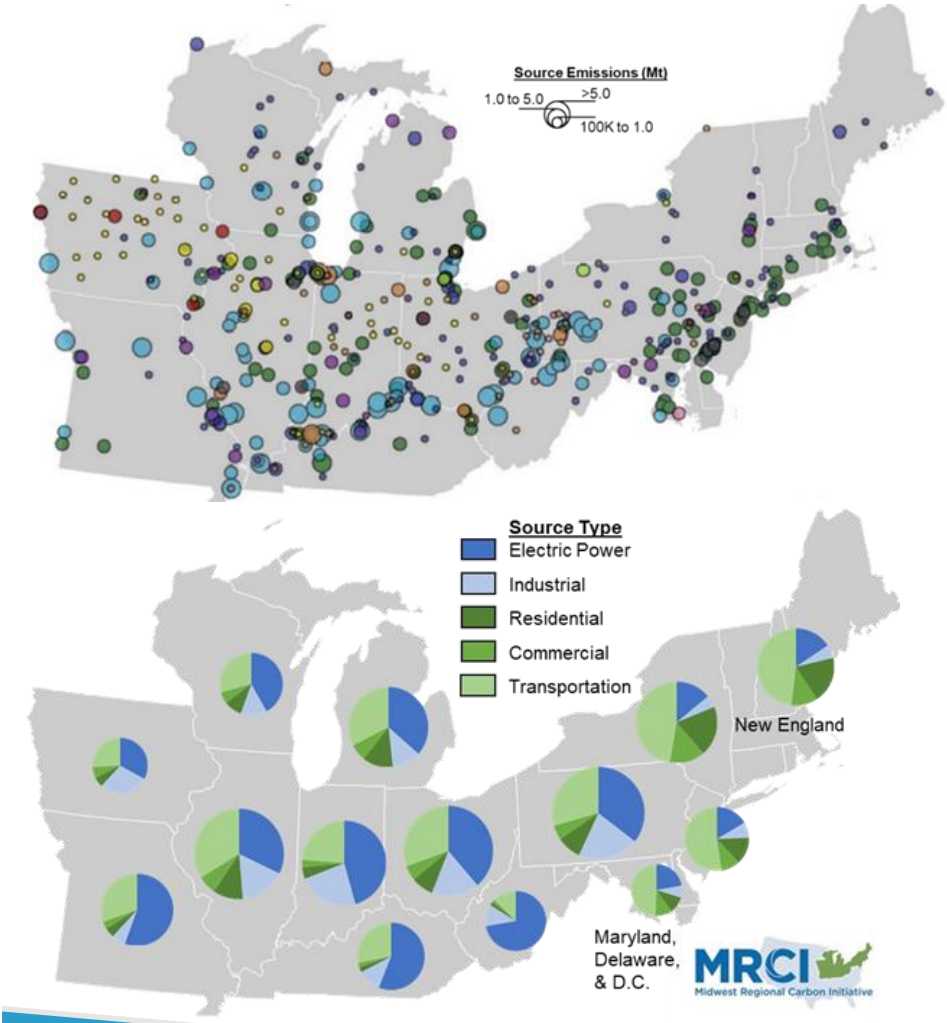
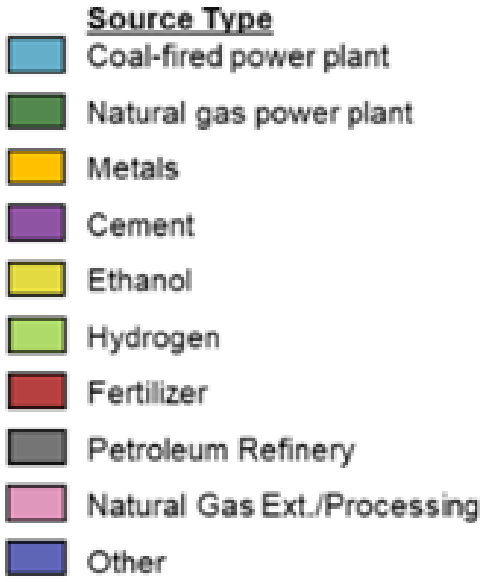
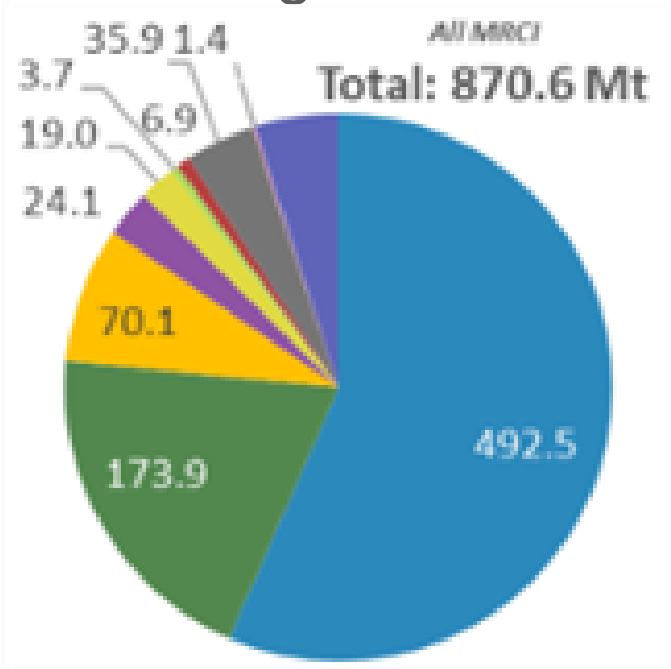
# Evaluating Regional Infrastructure Progress

## Sources of $CO_2$ and industry in the MRCI region are shifting




- Shift in sources of power
- New industry: hydrogen, bioenergy with CCS, and direct air capture
- State $CO_2$ emissions profiles



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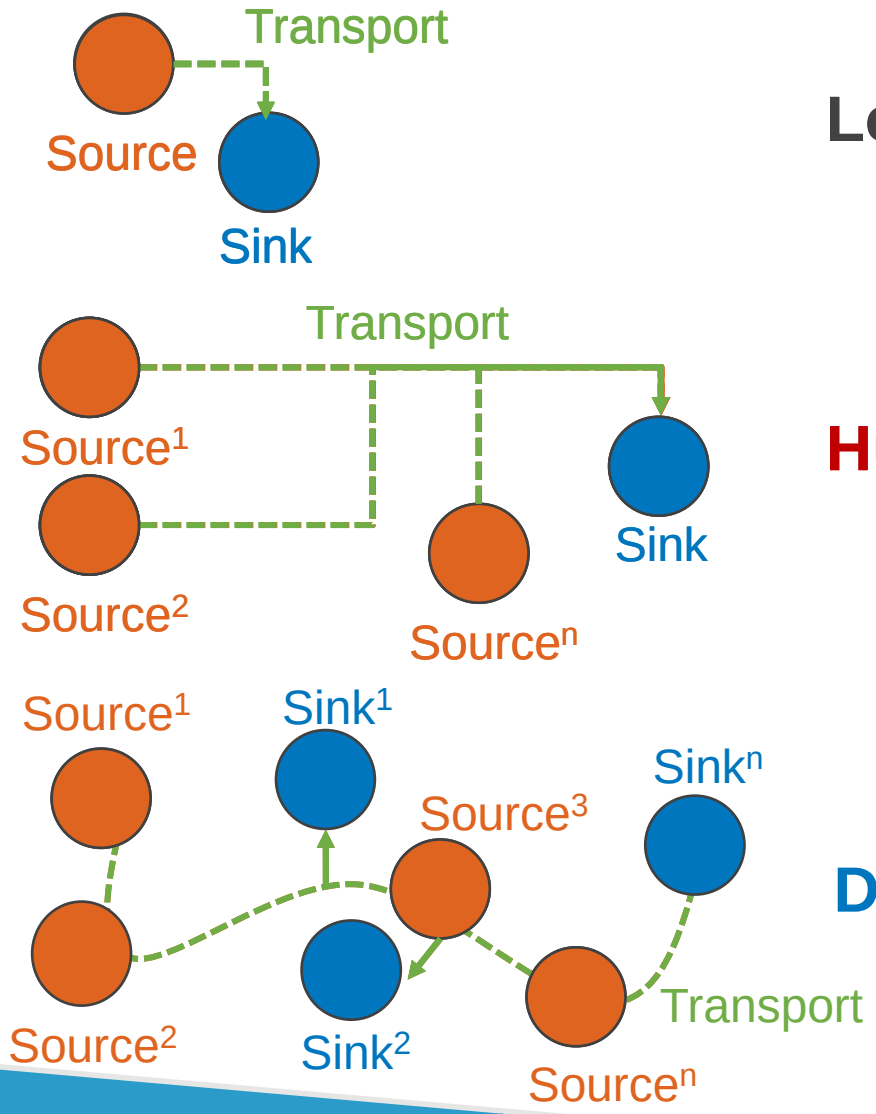
# Infrastructure development assessment

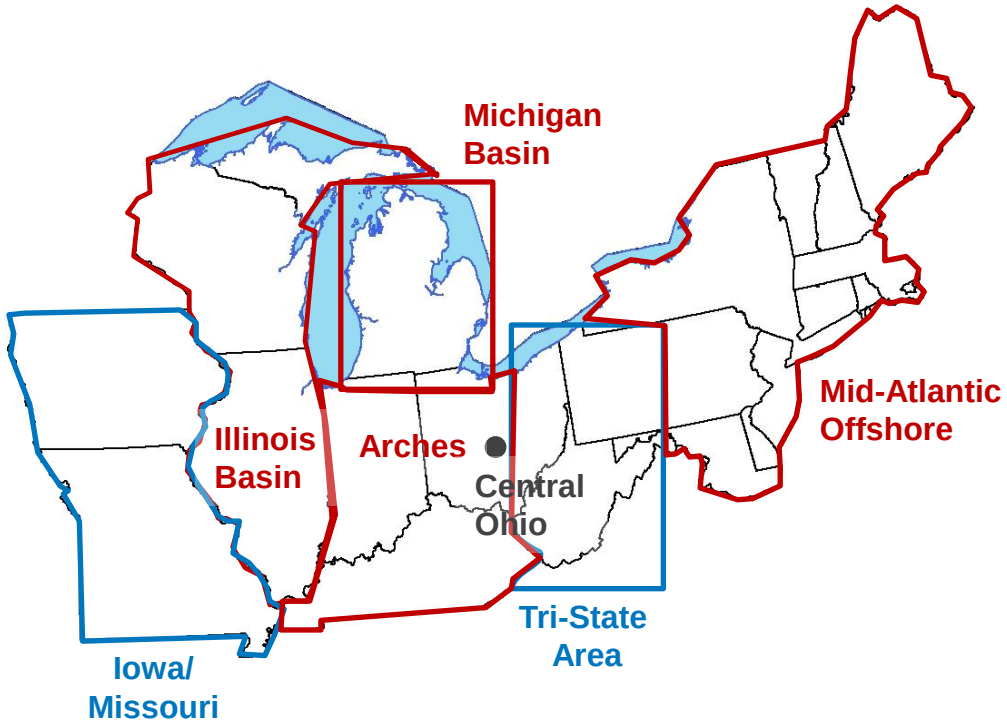
## Investigate infrastructure development strategies onshore and offshore




**Local**

**Hub**

**Distributed**




- Seven development scenarios planned
- Initial results from three scenarios
- High-level trends explored



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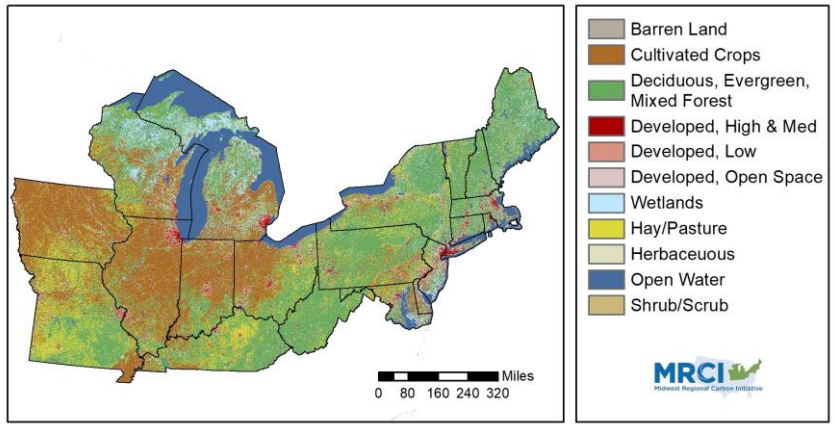
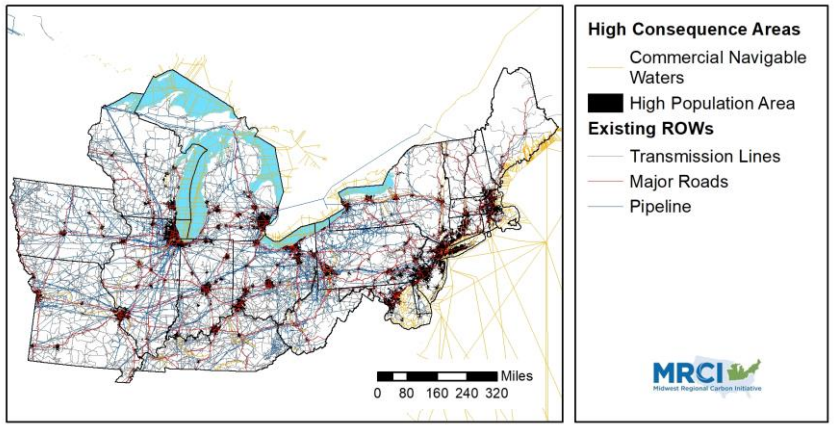
# Evaluating Regional Infrastructure Progress

Transport and storage infrastructure must consider more than sources and sinks

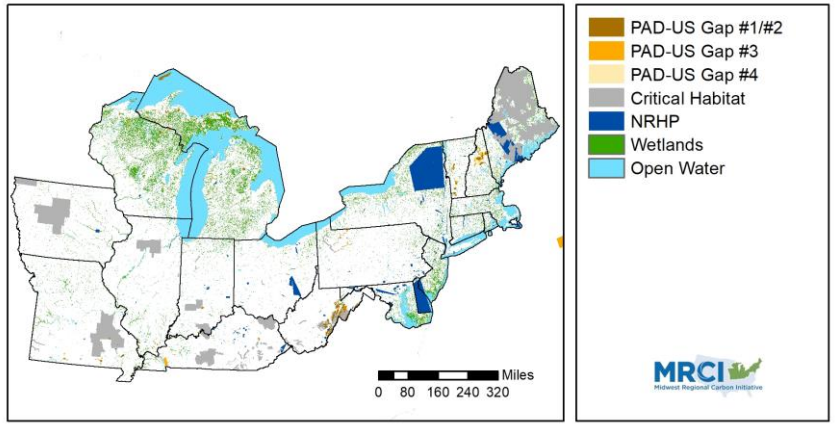
## Land cover data = project feasibility



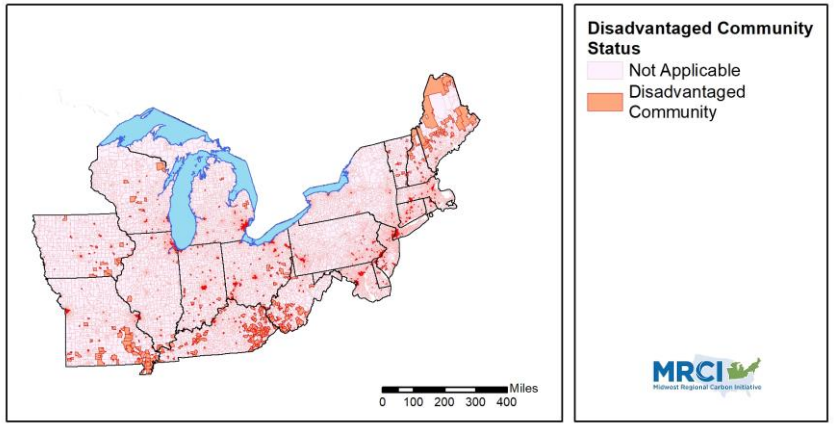

## Existing infrastructure = obstacles or opportunities




## Sensitive areas = potential project pitfalls




## Environmental Justice = equity and project buy-in



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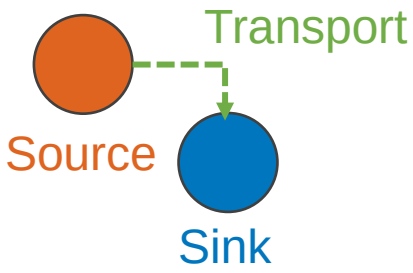
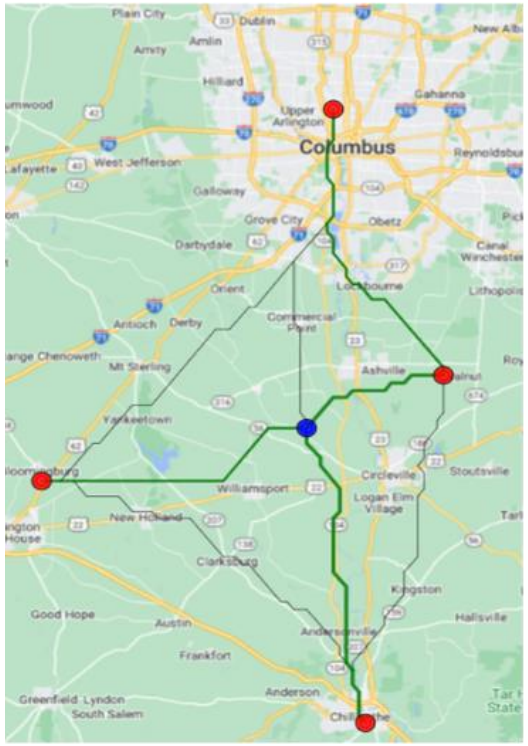
# Infrastructure development – Local

## Differing scenarios lead to differences in pipeline routes even in smaller scale scenarios

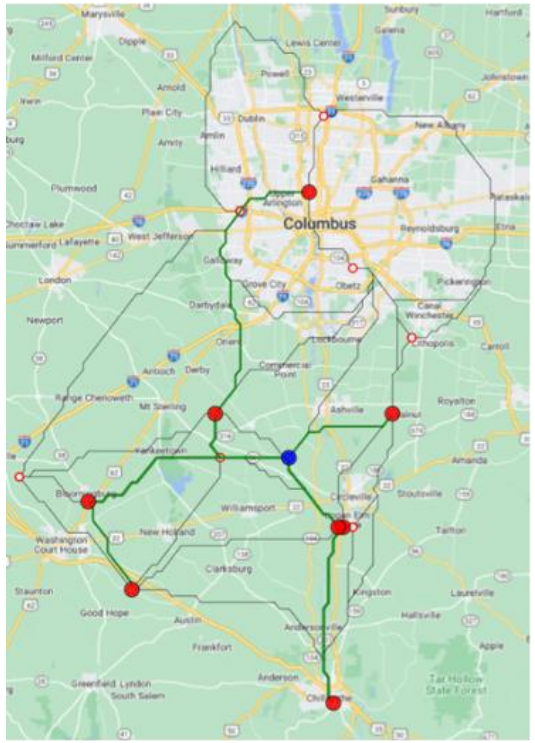



- Initial source assumptions are very important
- Selecting sources that are farther afield can improve economics

Local larger sources




Local, all sources




Subregional sources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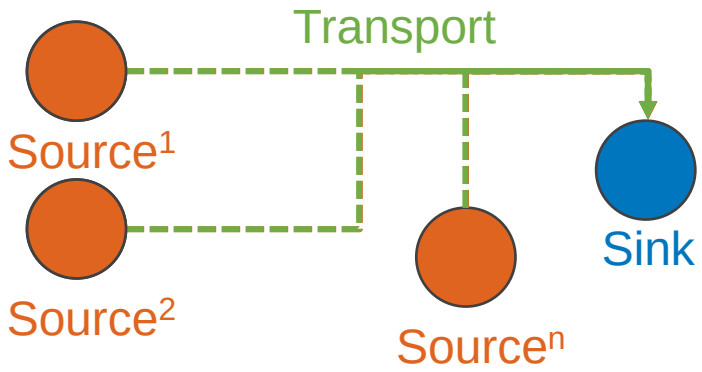
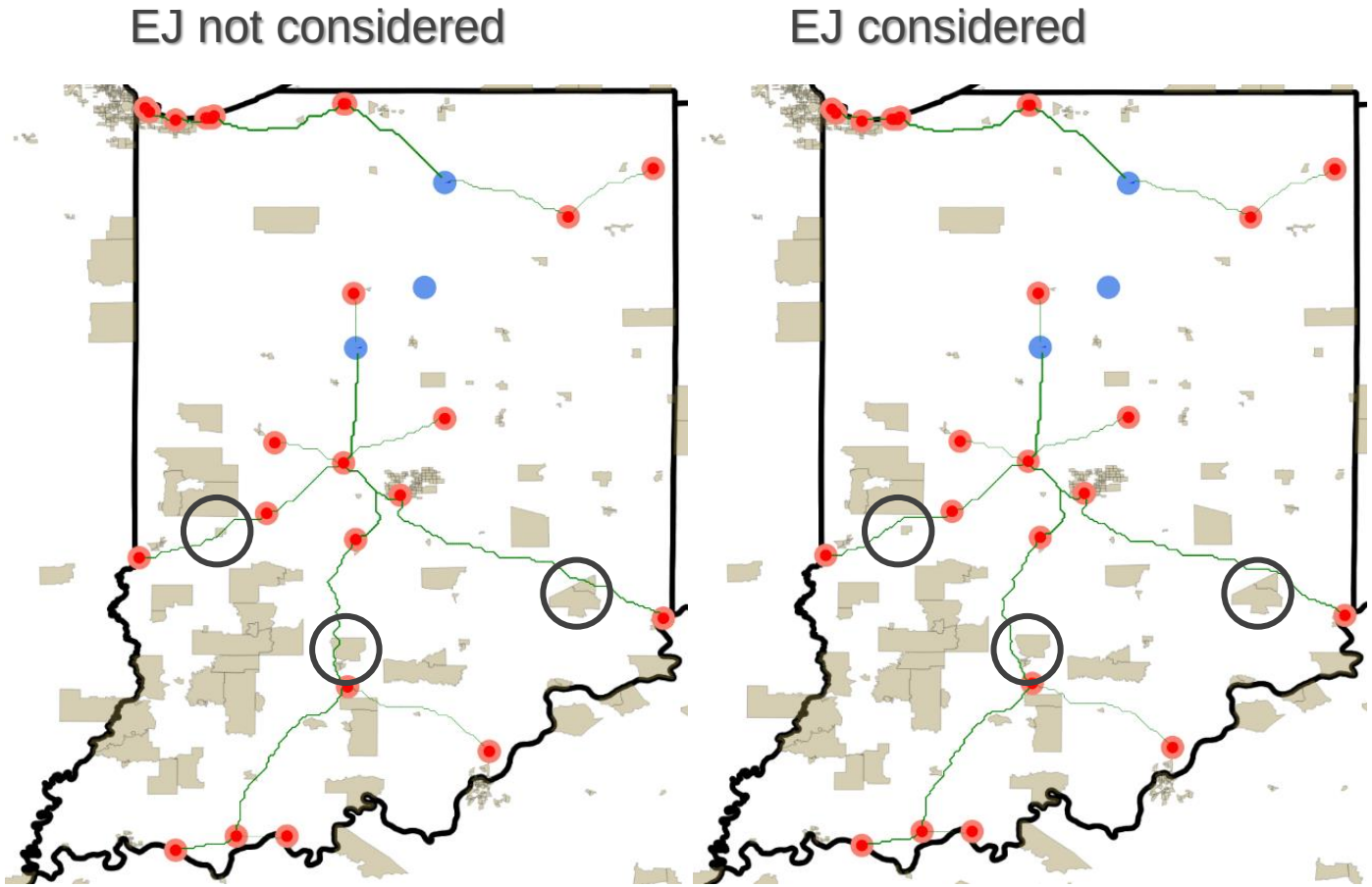
# Infrastructure development – Hub

**Considering environmental justice may not significantly affect the regional-scale routing of pipelines.**




**Addressing EJ issues is not only the right thing to do but does not significantly impact the complexity of the pipeline route.**



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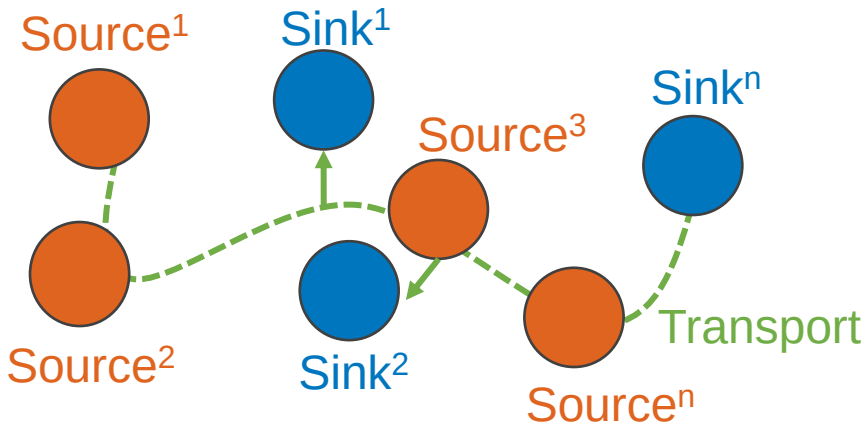
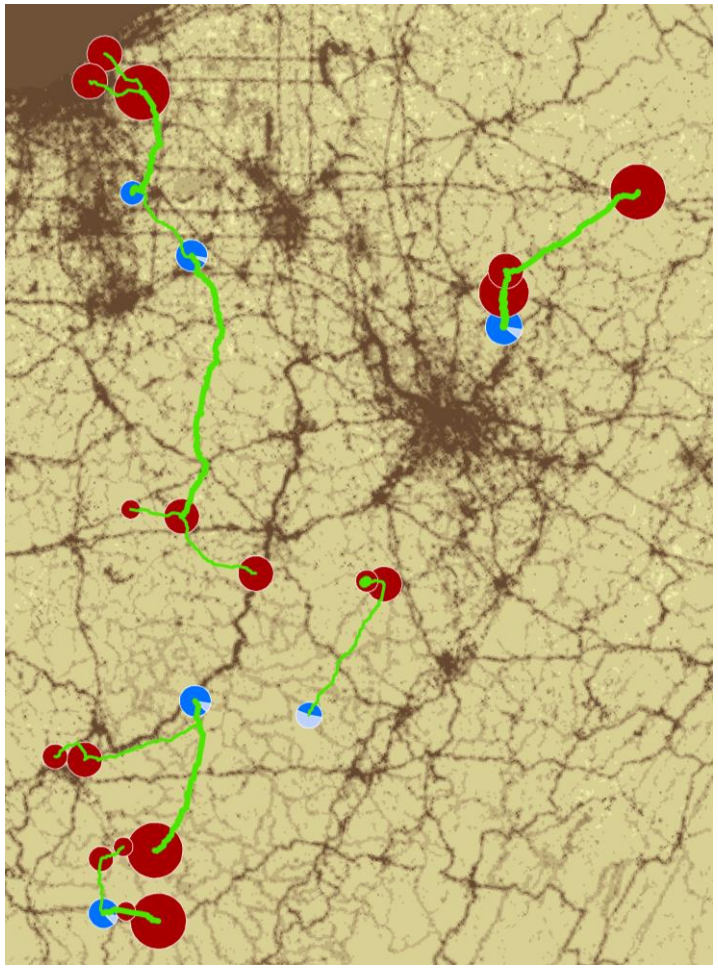
# Infrastructure development assessment

## The number of viable potential sinks significantly affects the needed pipeline infrastructure

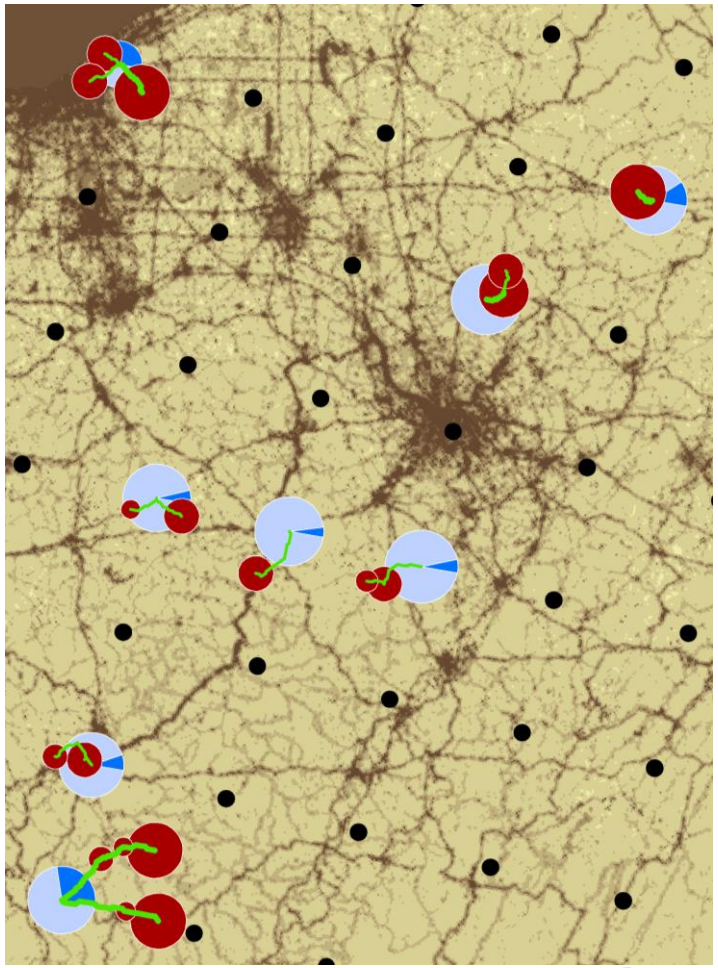



- The geology and source placement will dictate development
- Targeted potential sinks is likely more realistic

Targeted potential sinks



Potential sink grid





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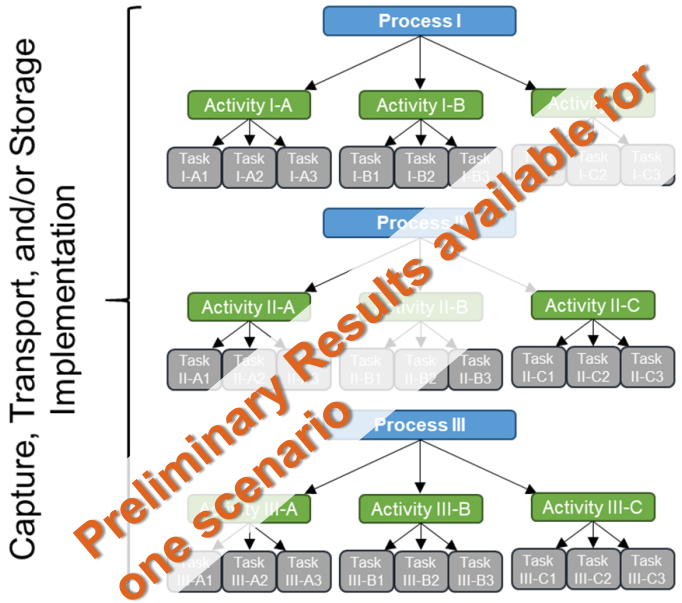
# Jobs and economic impacts

An important part of implementation is equitable sharing of benefits

## Jobs and Economic Impact




Preliminary Results available for one scenario

## Social Characteristics

United States Census Bureau

2020 Census Results

Data available for entire MRCI study area. Ready for use when scenarios are completed.

United States Environmental Protection Agency

EJScreen

## Workforce Development

United States Census Bureau

Quarterly Workforce Indicators

Identifying workforce needs and education/experience requirements. Identifying relevant institutions.

NCES National Center for Education Statistics

CIP CLASSIFICATION OF INSTRUCTIONAL PROGRAMS

Data, Information, and methodologies presented here have been applied to DOE proposal applications and commercially-funded work.



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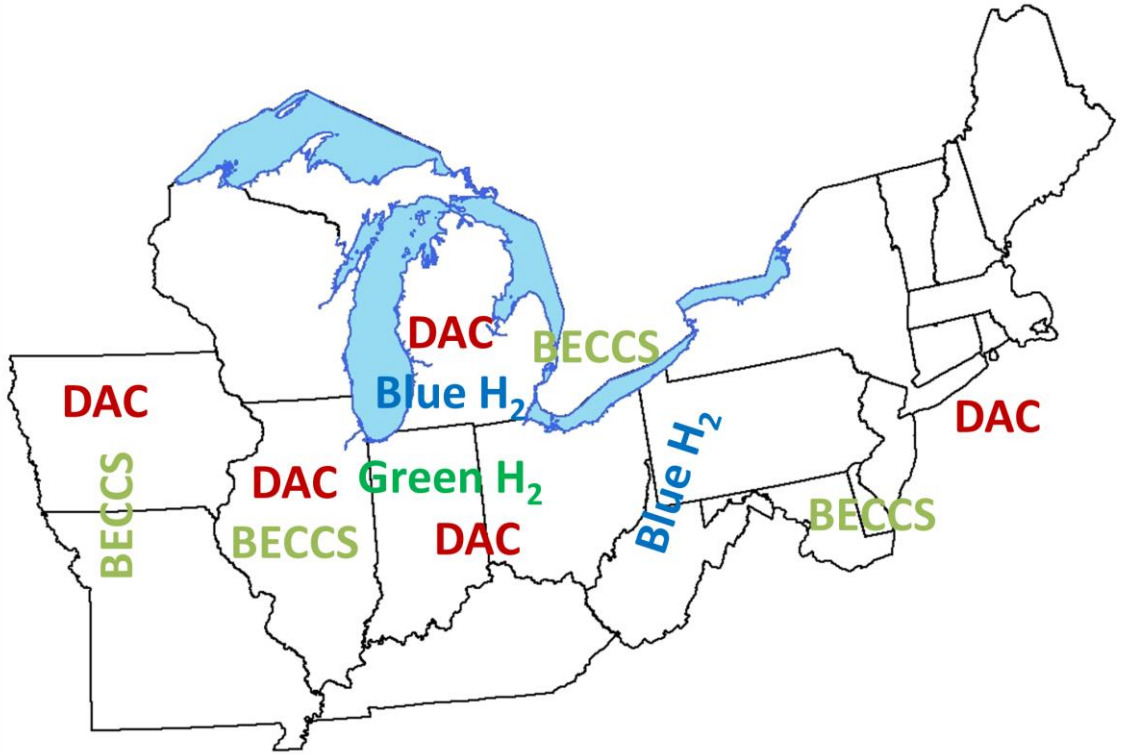
# Emerging Issues: Blue Hydrogen, Bioenergy with CCS (BECCS), and direct air capture (DAC)

**DAC**
- Heat
- Low-carbon power
- Land
- Storage

**$H_2$**
- Blue to green $H_2$
- Natural gas feedstock
- Demand for $H_2$
- Storage

**BECCS**
- Availability of Biomass
- Energy crops
- Land use considerations




The project team has put together a preliminary summary of where each emerging technology would be most effective in the MRCI study area.



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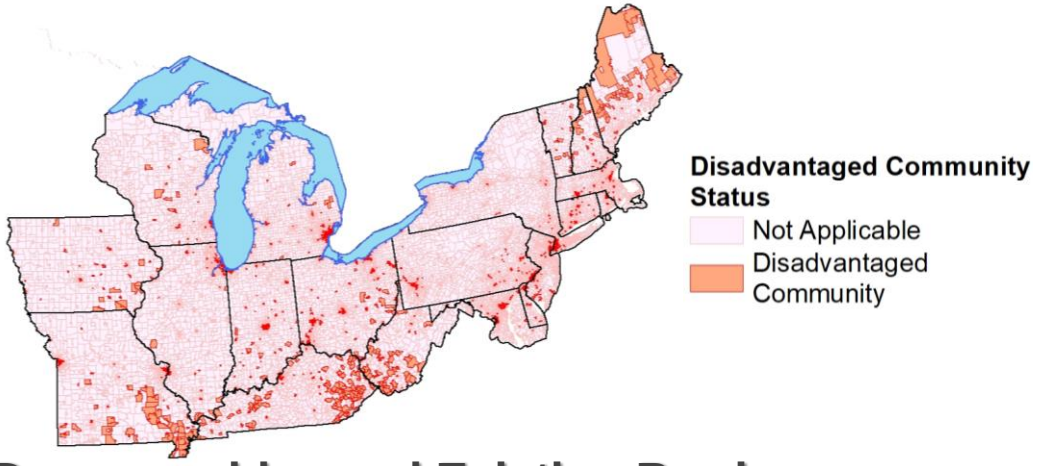
# Emerging Issues: Security and Environmental Justice

**Security.** Infrastructure security is important for CCS because of digital and physical proximity and interconnections to critical infrastructure.

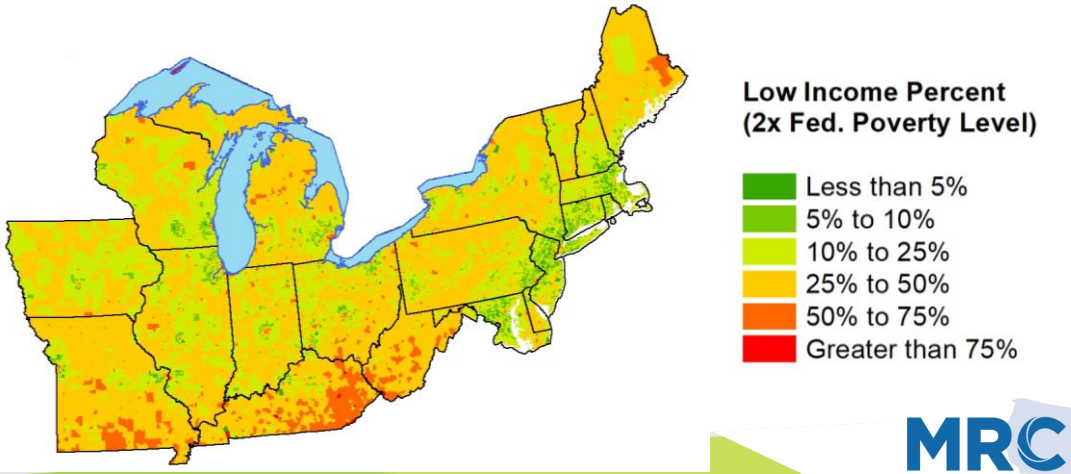
| CCS Project Component | Potential issues for interconnections |
|---|---|
| Capture | Sector/subsector of source<br>Physical and digital design of source<br>Physical and digital design of the capture system<br>Connection to transport or storage system<br>The amount of automation for the capture system |
| Transport | Physical and digital design of the pipeline including the SCADA system<br>The existing pipeline ROWs<br>Connection to transport or storage system<br>The amount of automation for the pipeline |
| Storage | Physical and digital design of the storage system<br>Amount of automation for the storage project |

**Environmental Justice.** Equitable development be accomplished through a review of Environmental Justice.

## Disadvantaged Communities




## Demographics and Existing Burdens



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# Big picture assessment of infrastructure

- Large scale infrastructure development needed
- Unique opportunity to provide jobs in emerging industries
- Meaningful engagement with communities required
- Community dynamics, regulations, and policy must align

# Task 4 – Summary of Accomplishments

- Initial results of three of seven development scenarios
- Preliminary assessment of the emerging issues
- Preliminary results of jobs and economic impacts
- Processes developed for stakeholder characterization, business case analysis, and workforce development (ongoing)
- Development of mapping and evaluation tools to address sensitive areas and environmental justice
- Development of Site Readiness Factsheets
- State policy database

# Next steps for the Infrastructure Assessment

- Complete the three initial and the four additional development scenarios, including Mid-Atlantic Offshore
- Use results from these scenarios to investigate additional questions:
  - What are the jobs and economic revitalization prospects of these scenarios?
  - How do emerging technologies and issues fit into these scenarios?
  - What are the business cases for each of these scenarios?
  - What policy is needed for CCS implementation?
  - Environmental Justice: What are the benefits/disbenefits of CCS implementation? How can disadvantaged communities be included in decision making and equitable sharing of benefits? What are the community priorities?
- Work with the other tasks and Initiatives to ensure coordinated efforts.

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