



# Battelle

*The Business of Innovation*

“Managing Climate Change and Securing a Future for the Midwest’s Industrial Base”



## MRCSP

MIDWEST REGIONAL  
CARBON SEQUESTRATION  
PARTNERSHIP

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Presentation to:  
GTSP Annual Steering Group Meeting  
Washington, DC  
May 25, 2005  
DOE Cooperative Agreement No. DE-FC26-03NT41981

# MRCSP Mission

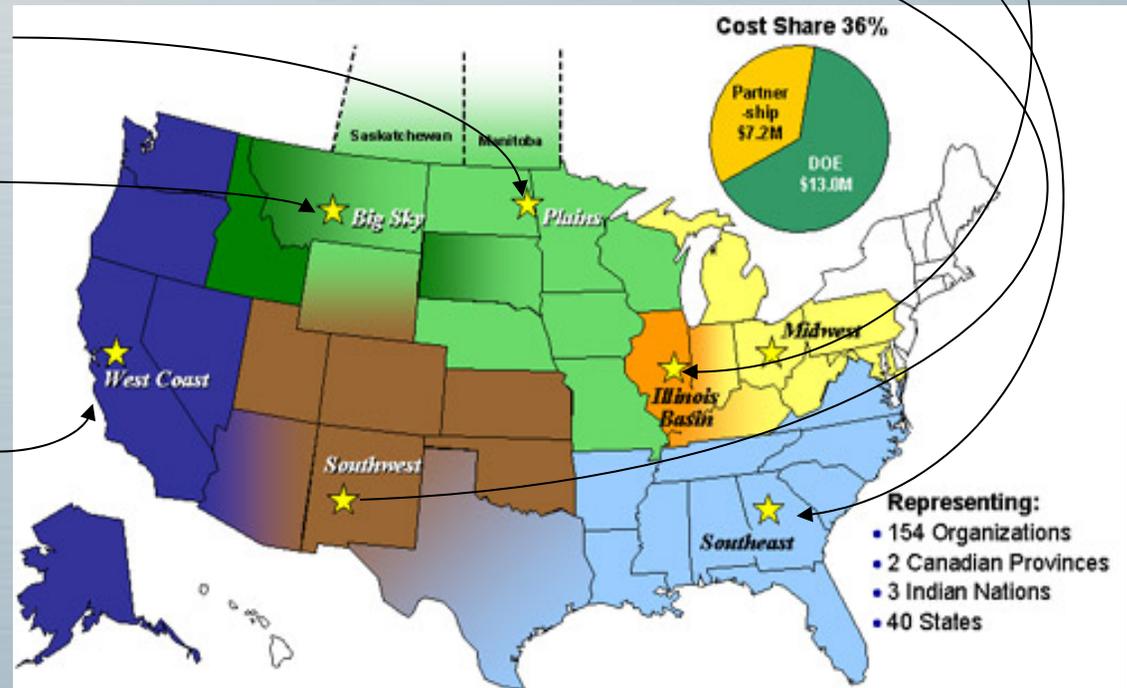
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be the premier resource in its Region for identifying the technical, economic, and social considerations associated with CO<sub>2</sub> sequestration and creating viable pathways for its deployment.

# The MRCSP is One of Seven Regional Partnerships Across the U. S.

*The other six are:*

- Geological Carbon Sequestration Options in the **Illinois Basin**
- **Southeast** Regional Carbon Sequestration Partnership
- **Southwest** Regional Partnership for Carbon Sequestration
- **Plains** CO<sub>2</sub> Reduction Partnership
- **Big Sky** Regional Carbon Sequestration Partnership
- **West Coast** Regional Carbon Sequestration Partnership



See <http://www.netl.doe.gov/coal/Carbon%20Sequestration/partnerships/index.htm> for more information from NETL on the seven partnerships.

# The MRCSP Region: The Nation's Engine Room

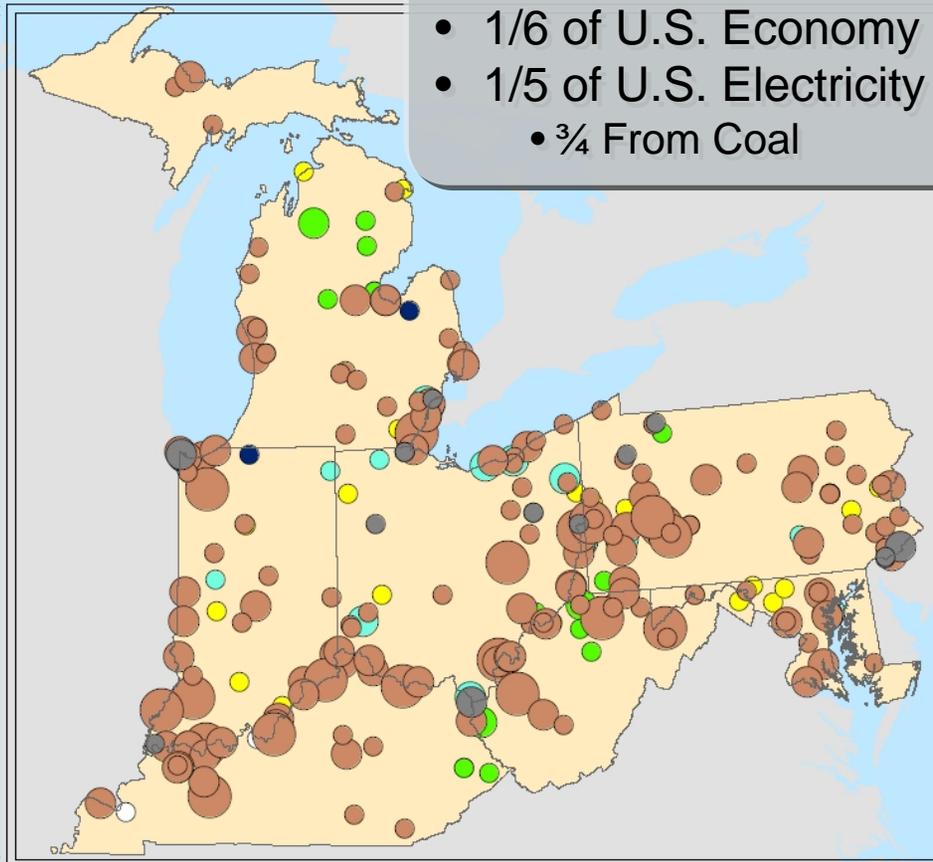
- One in six Americans
- 1/6 of U.S. Economy
- 1/5 of U.S. Electricity Generated
  - $\frac{3}{4}$  From Coal

## MRCSP Large CO<sub>2</sub> Point Sources (100+ kt CO<sub>2</sub>/yr)

- Cement
- Ethanol
- Ethylene
- Gas processing
- Hydrogen
- Iron & steel
- Power
- Refineries

ktCO<sub>2</sub>/yr

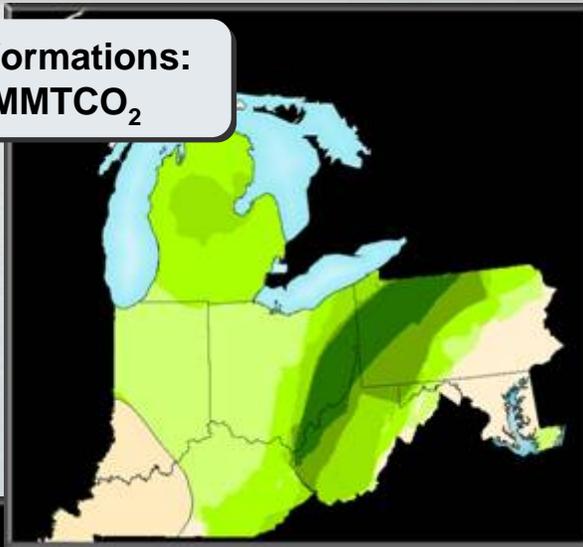
- 100 - 2,000
- 2,000 - 10,000
- 10,000 - 20,000



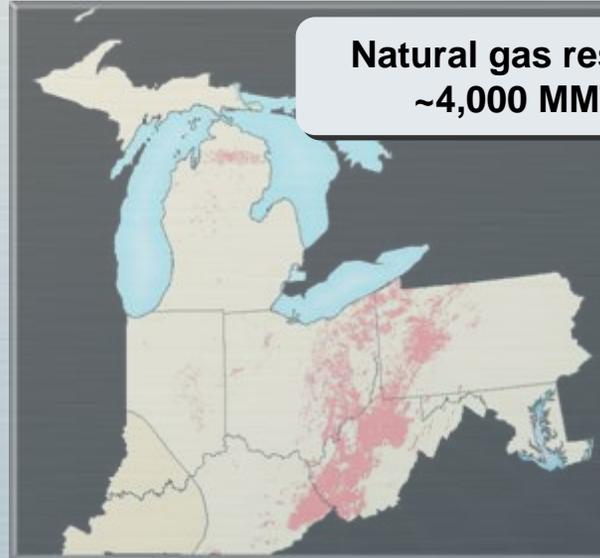
- 274 Large Point Source Locations
- Over 750 MMtCO<sub>2</sub>/year

# Geologic Sequestration Potential in the Region\*

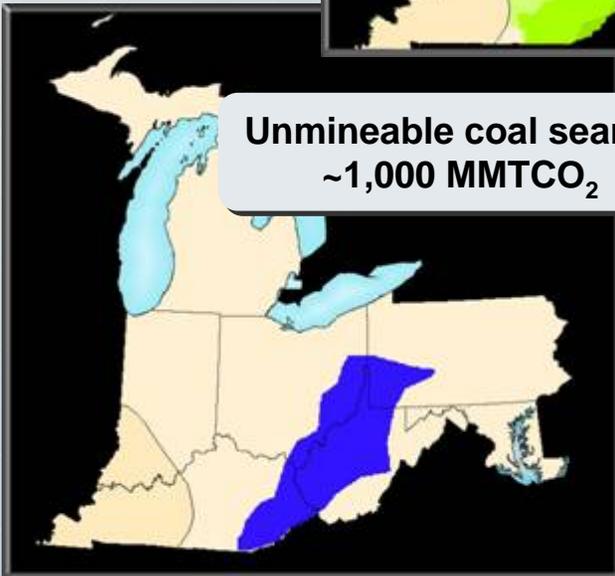
Deep saline formations:  
~160,000 MMTCO<sub>2</sub>



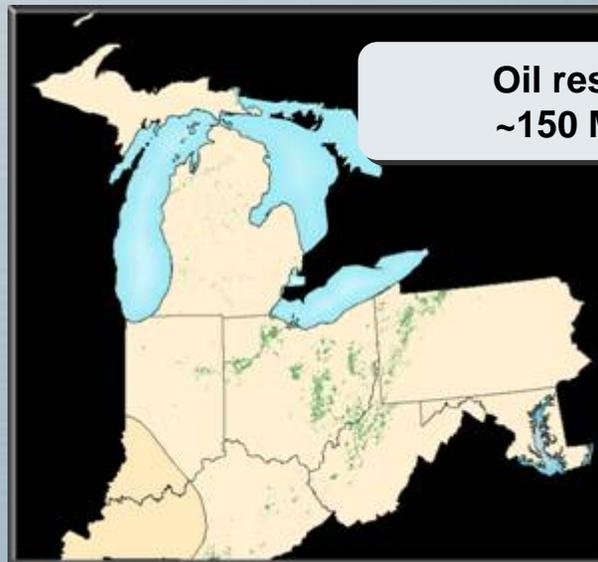
Natural gas reservoirs:  
~4,000 MMTCO<sub>2</sub>



Unmineable coal seams:  
~1,000 MMTCO<sub>2</sub>

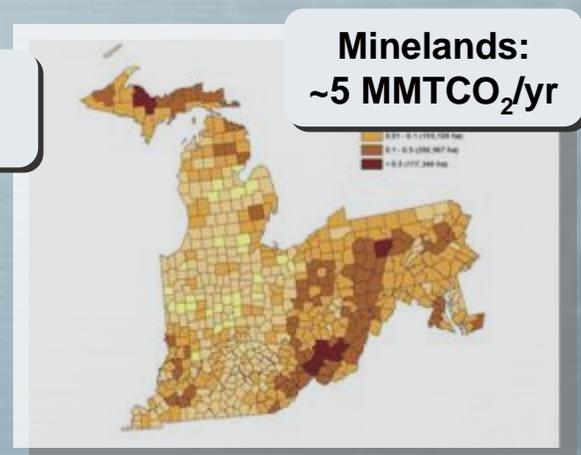
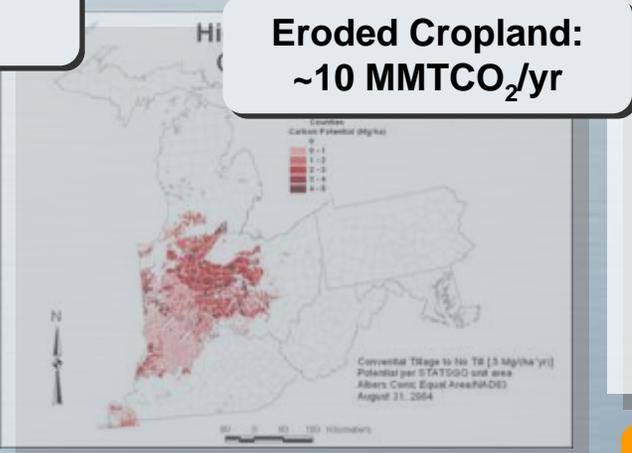
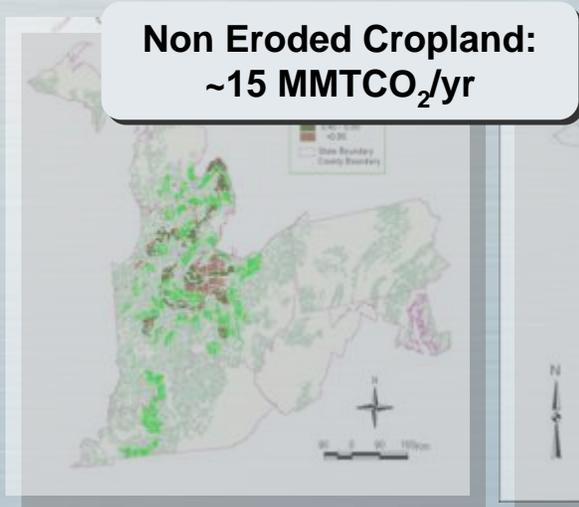
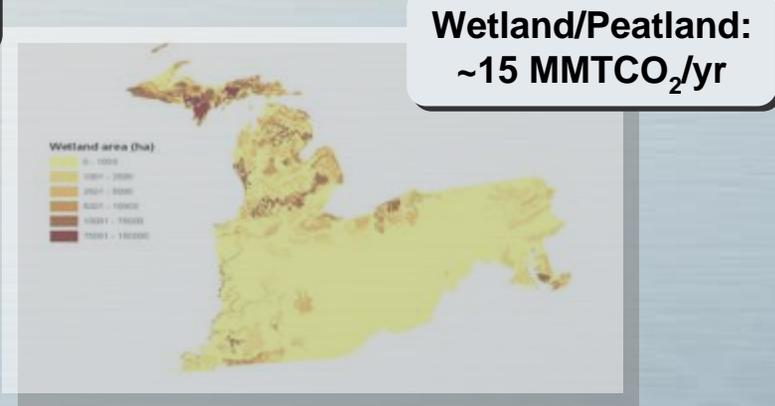
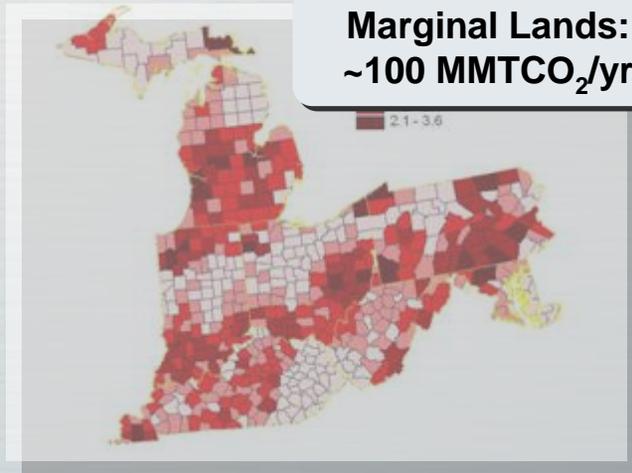


Oil reservoirs:  
~150 MMTCO<sub>2</sub>



(\* These are preliminary estimates that will be further refined by the end of Phase I

# Terrestrial Sequestration Potential in the Region\*



(\* ) These are preliminary estimates that will be further refined by the end of Phase I

# Our Data Includes Details on Individual States in the Region

## Terrestrial

State	Total Terrestrial Capacity* (MMtCO2/yr)	Emissions from Large Sources (MMtCO2/yr)	% of Emissions from Large Sources
Indiana	33	162	20%
Kentucky	21	102	20%
Maryland	6	38	16%
Michigan	23	94	25%
Ohio	28	148	19%
Pennsylvania	21	127	17%
West Virginia	11	96	12%
<b>MRCSP Total</b>	<b>143</b>	<b>767</b>	<b>19%</b>

(\*) Wetlands contribution spread evenly over the states

## Geological

State	Total Geologic Capacity (GtCO2)	No. of Large Point Source Locations	Emissions from Large Sources (MMtCO2/yr)	Years of Storage Capacity
Indiana	31	46	162	191
Kentucky	18	30	102	173
Maryland	5	17	38	133
Michigan	46	44	94	495
Ohio	36	44	148	240
Pennsylvania	16	66	127	125
West Virginia	15	27	96	157
<b>MRCSP Total</b>	<b>166</b>	<b>274</b>	<b>767</b>	<b>203</b>

# In January 2005 we Upgraded our Website ([www.mrcsp.org](http://www.mrcsp.org)) to be Interactive

Our outreach database numbers over 600 stakeholders in the region. Phone and email contacts with those stakeholders have been effective in increasing our web visits from about 400 to over 900/month since making the site interactive.

A means of delivering a coherent message on sequestration and its relevance to the Region

The image displays two screenshots of the Midwest Regional Carbon Sequestration Partnership (MRCSP) website. The left screenshot shows the 'We Want to Hear from You' page, which includes a feedback form and a list of topics for discussion. The right screenshot shows the 'Introduction to Carbon Sequestration' page, which provides an overview of carbon sequestration and lists key topics for further exploration.

**Midwest Regional Carbon Sequestration Partnership**

Home  
About Carbon Sequestration  
Climate change  
Carbon sequestration  
We want to hear from you  
About MRCSP  
The Regional Partnerships  
MRCSP  
Team List  
We want to hear from you  
Fact Sheets  
Resources & Links  
Members Area

Username:  Password:  [Login](#) [Forgot password?](#) [Register as a stakeholder](#)

## We Want to Hear from You

The MRCSP believes that public support is essential to the success of this project. Public support comes from understanding concerns and understanding the science. In order to do this, we are using the feedback. We plan to use the feedback to ask for targeted feedback, comments, questions and responses into a summary report to be presented to the MRCSP.

**Topic 1**  
What are your thoughts on the MRCSP?  
Please click [here](#) to see the results.

**Topic 2**  
In your opinion, how important is carbon sequestration in your region? What additional concerns about terrestrial sequestration do you have?  
Please click [here](#) to see the results.

**Topic 3**  
In your opinion, how important is carbon sequestration in your region? What additional information do you need about geologic sequestration?  
Please click [here](#) to see the results.

**Topic 4**  
What specific concerns do you have about the techniques being developed for carbon sequestration?  
Please click [here](#) to see the results.

**Topic 5**  
A cursory survey of the opportunity to use geologic sequestration in your region?  
Please click [here](#) to see the results.

Click [here](#) to contact a stakeholder.  
Click [here](#) to obtain the results.

**Midwest Regional Carbon Sequestration Partnership**

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## Introduction to Carbon Sequestration

Printable Version

1. Carbon sequestration
2. Geologic sequestration
3. The regional partnership program
4. Additional information

**1.** Carbon sequestration is the term used to describe a broad class of technologies for capturing and permanently sequestering, or storing, carbon dioxide (CO<sub>2</sub>). Affordable and environmentally safe sequestration approaches could offer a way to help stabilize atmospheric levels of carbon dioxide at "a level that would prevent dangerous anthropogenic interference with the climate system," a goal toward which 188 nations have pledged to work.

Ways to securely store CO<sub>2</sub> in biological materials **terrestrial sequestration** or in deep underground formations **geologic sequestration** currently are being studied in the US and around the world. Terrestrial sequestration involves carbon storage in soils, including degraded soils (soils that have declined in quality), and in forests and agricultural land.



An expert in Bolivia from the Food and Agriculture Organization of the United Nations (FAO) measures grass that has been planted as pasture for cattle. With care, land use of this type can sequester a lot of carbon -- and support animals at the same time (FAO/20889.1/3.3/paul).  
<http://www.fao.org/news/2002/020305-e.htm>

**2.** Geologic sequestration involves capturing and permanently storing CO<sub>2</sub> in deep underground formations such as saline (saltwater) reservoirs, depleted oil and gas fields, or unmineable coal seams.

Scientists currently are testing these approaches on a small scale to determine how sequestration can provide a safe, effective and efficient means of slowing the increase of, and eventually stabilizing, atmospheric concentrations of CO<sub>2</sub> over the course of this century. But before these technologies can be deployed on a wide scale, we need to answer a number of questions including:

- How much CO<sub>2</sub> can be stored and for how long?
- Can it be done cost-effectively?
- How should it be regulated?
- How would we measure, monitor and verify the safety and efficacy of carbon sequestration?

While obtaining feedback from stakeholders on issues and questions posed on the site.

# Regulatory Analysis

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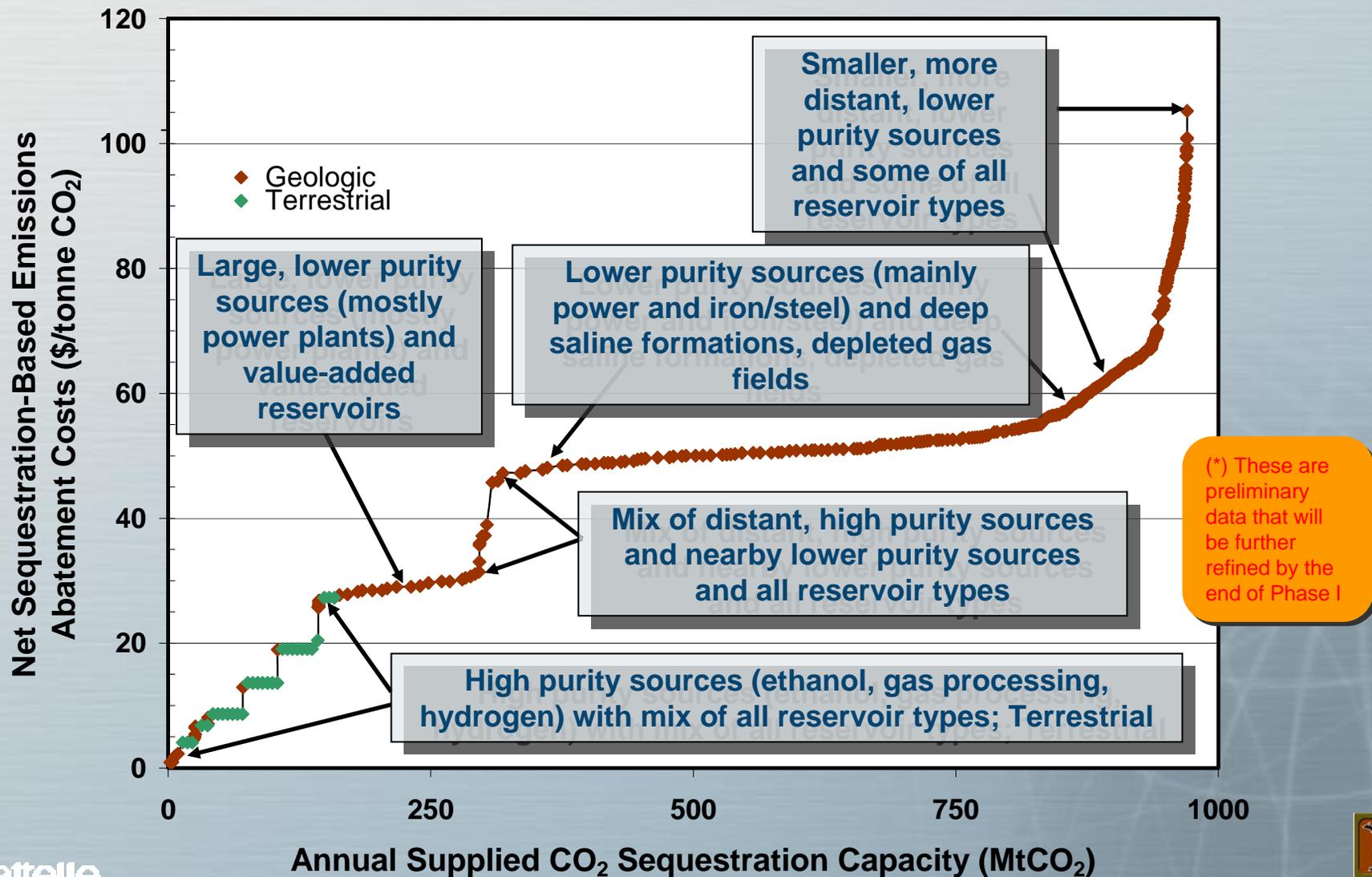
## What are we Doing?

- Acquire, review, and catalogue existing state regulations
- Conduct workshops with state officials (Ohio, West Virginia and Indiana completed thus far)
- Outline a regulatory framework for geologic sequestration (in progress)

## What have we Learned (a sample)?

- The current regulatory regime for Underground Injection Control system (40 CFR 144.6) is being reviewed for applicability to geologic CO<sub>2</sub> sequestration
- Four states in the region have primacy: Indiana, Maryland, Ohio, and West Virginia
- Four states have experience with CO<sub>2</sub> injection for enhanced oil or gas recovery: Kentucky, Michigan, Pennsylvania, and West Virginia
- No applications for CO<sub>2</sub> injection into deep saline formations

# Understanding the Costs of Exploiting Sequestration\*



# Our Proposed Phase II Program

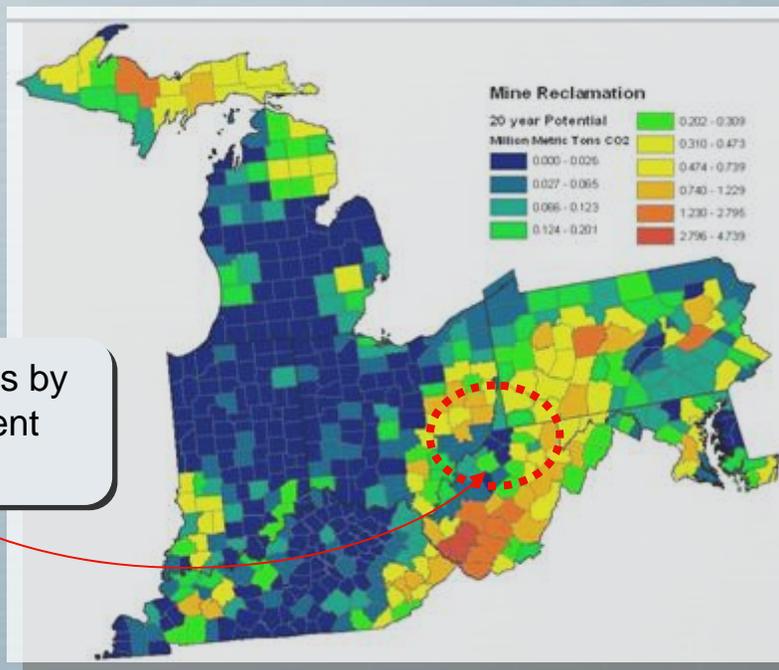
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- We have proposed to carry out multiple small-scale field demonstrations throughout a broad area of our region
  - Both geologic and terrestrial projects
- In our proposal we are fortunate to have strong support from a number of our industry partners
  - Both financial support and willingness to host demos
- We also propose a robust research effort to refine and expand on our characterization of our region
- We propose an outreach effort that will build upon our Phase I contacts and web based interactions to also include supporting our host partners' site-specific outreach efforts around our demo sites.

# Phase II Terrestrial Field Validation Tests

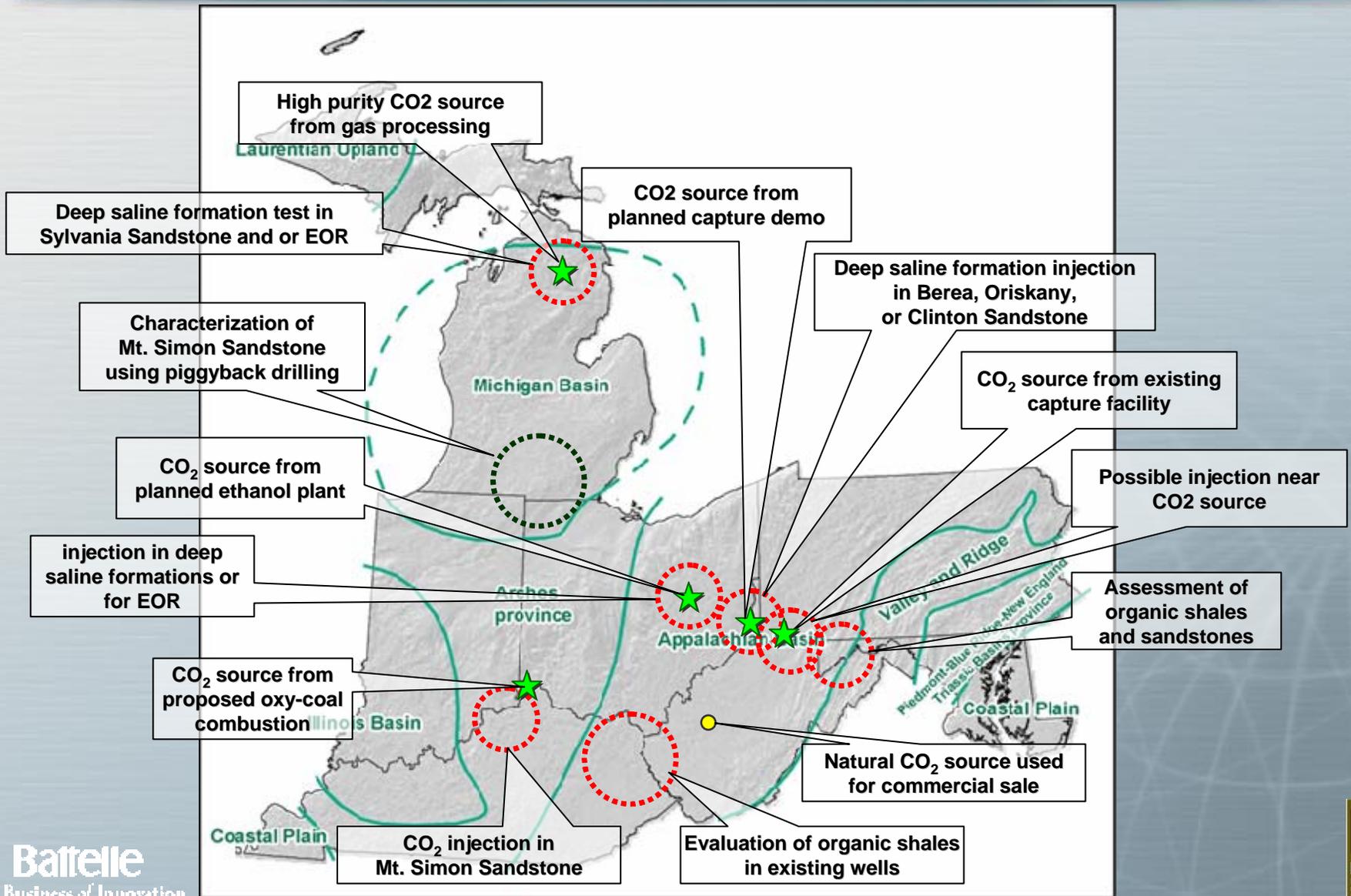


Measure sequestration on croplands under different conditions.



Characterize sequestration for minelands by comparing carbon uptake under different reclamation practices.

# Phase II Geologic Field Validation Tests



# We Also Plan More “Piggyback Drilling” Projects Such as These Around Ohio

## Collaboration with Oil and Gas Industry to Build Geologic Framework

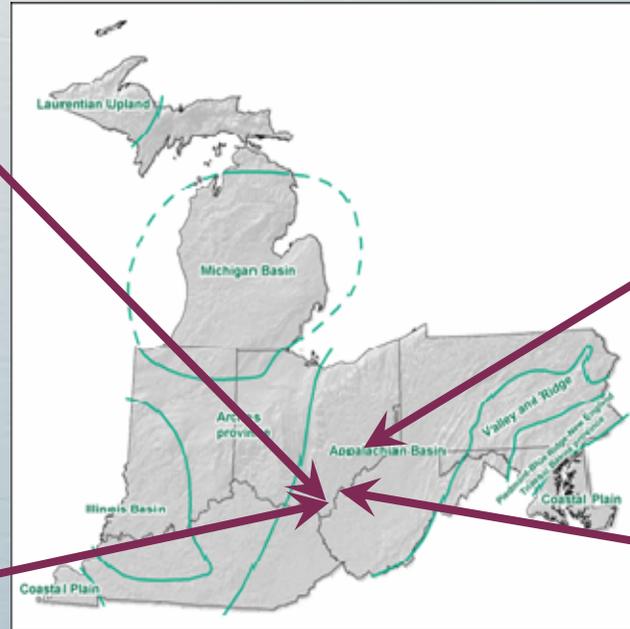
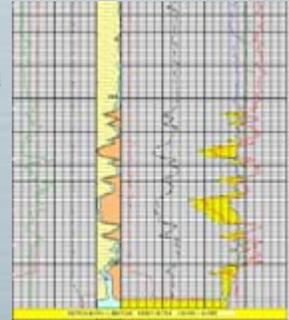
### Gallia County, Ohio

- Drill, log, and core borehole to risk assessment
- Collaborative project with Japanese electric power institute



### Noble County, Ohio

- Collect wireline data
- Collect rock core samples



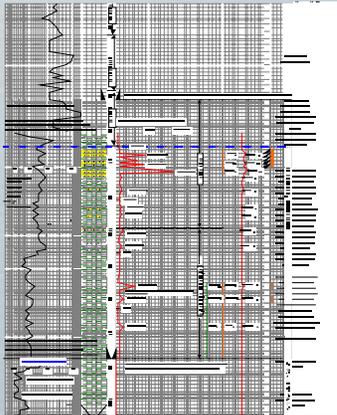
### Mountaineer Plant

- Drill 9200 ft. test well
- Collect wireline data
- Collect brine and rock core samples
- Prepare plans for injection phase



### Gallia County, Ohio

- Extend borehole depth
- Collect wireline data
- Collect rock cores
- Establish regional continuity



**Battelle**

The Business of Innovation



**MRCSP:** A diverse group including many of the region's major energy companies, agricultural entities, research organizations, government agencies, and NGOs.



U.S. Department of Energy/NETL

# Summary:

## *Our Goal is to Deliver Robust Carbon Management Strategies*

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- Define the real world potential for carbon sequestration
- Help the region take a first step towards implementation
- Position the Region as a leader in developing robust carbon management solutions

*Sequestration technologies are needed to protect core economic assets in the region in a greenhouse gas constrained world*

