



"Managing Climate Change and Securing a Future for the Midwest's Industrial Base"



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***MRCSP Site-Specific, East Bend Generating Station  
Field Demonstration Briefing, August 2006***

# Overview of the Midwest Regional Carbon Sequestration Partnership (MRCSP)

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- **Why:** Part of a national effort sponsored by the U.S. Department of Energy's National Environmental Technology Laboratory (DOE/NETL) to develop robust strategies for mitigating carbon dioxide (CO<sub>2</sub>) emissions
- **Who:** 30+ member team, led by Battelle and drawing from the research community, energy industry, non-government organizations, and government
- **What:** Demonstrate the safety and effectiveness of carbon sequestration and develop best approaches to carbon sequestration in the region
- **When:** Phase I launched, fall 2003; final report now available; Phase II commenced October 2005
- **Where:** Seven-state region of IN, KY, MD, MI, OH, PA, WV

# Carbon Dioxide ( $\text{CO}_2$ ) Emissions and Sequestration

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- The atmospheric concentration of  $\text{CO}_2$  is rising, partly attributable to the combustion of fossil fuels that power the global economy
- Research suggests that the continued build up of  $\text{CO}_2$  in the atmosphere will increase the greenhouse effect, warm our atmosphere and trigger a variety of impacts
- Efforts are underway to develop the means to reduce  $\text{CO}_2$  emissions as an element in an overall strategy to stabilize concentrations of  $\text{CO}_2$  in the atmosphere
- A variety of solutions will be needed as more fossil fuels are used around the world for industrial development

# Carbon Sequestration

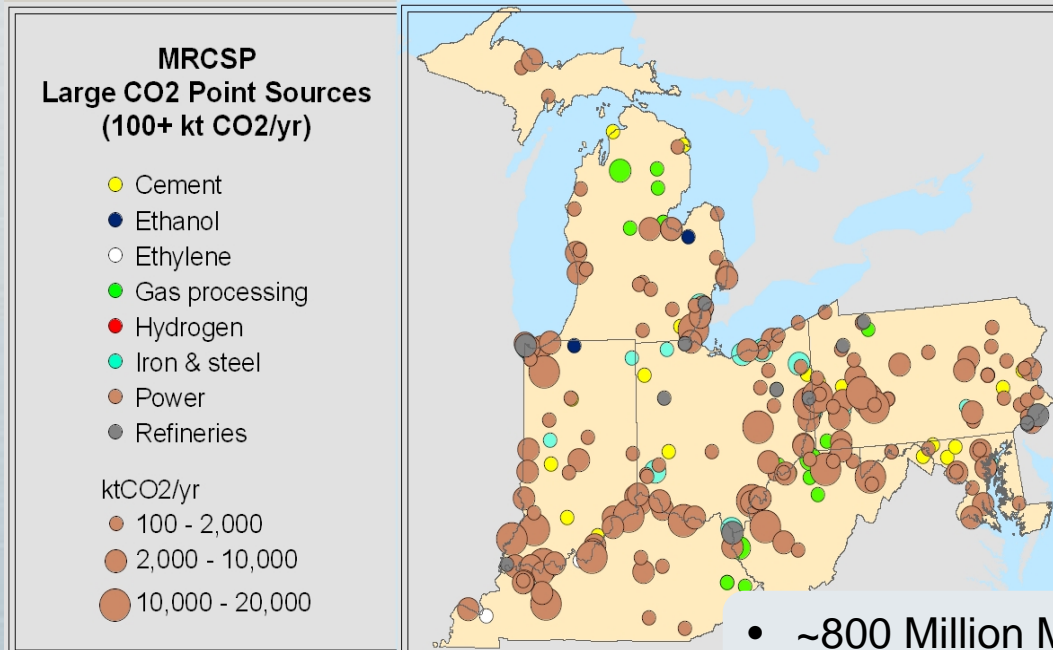
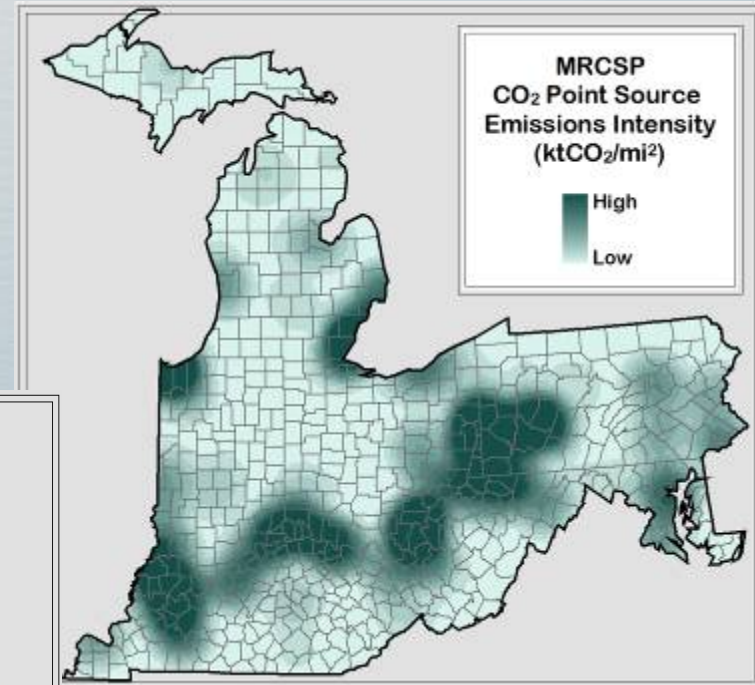
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- As part of a broad portfolio of technologies, carbon sequestration can play an important role in stabilizing atmospheric CO<sub>2</sub> concentrations
- Sequestration is the controlled, permanent storage of CO<sub>2</sub> in the earth
- Terrestrial sequestration removes CO<sub>2</sub> already in the atmosphere and takes advantage of natural processes, such as photosynthesis, to increase the amount of carbon stored in plants and soils that serve as long-term pools or “sinks”
- Geologic sequestration involves injecting CO<sub>2</sub> into formations such as depleted oil wells, unmineable coal seams and very deep saline reservoirs to permanently store CO<sub>2</sub> in the earth



# The MRCSP Region: The Nation's Engine Room

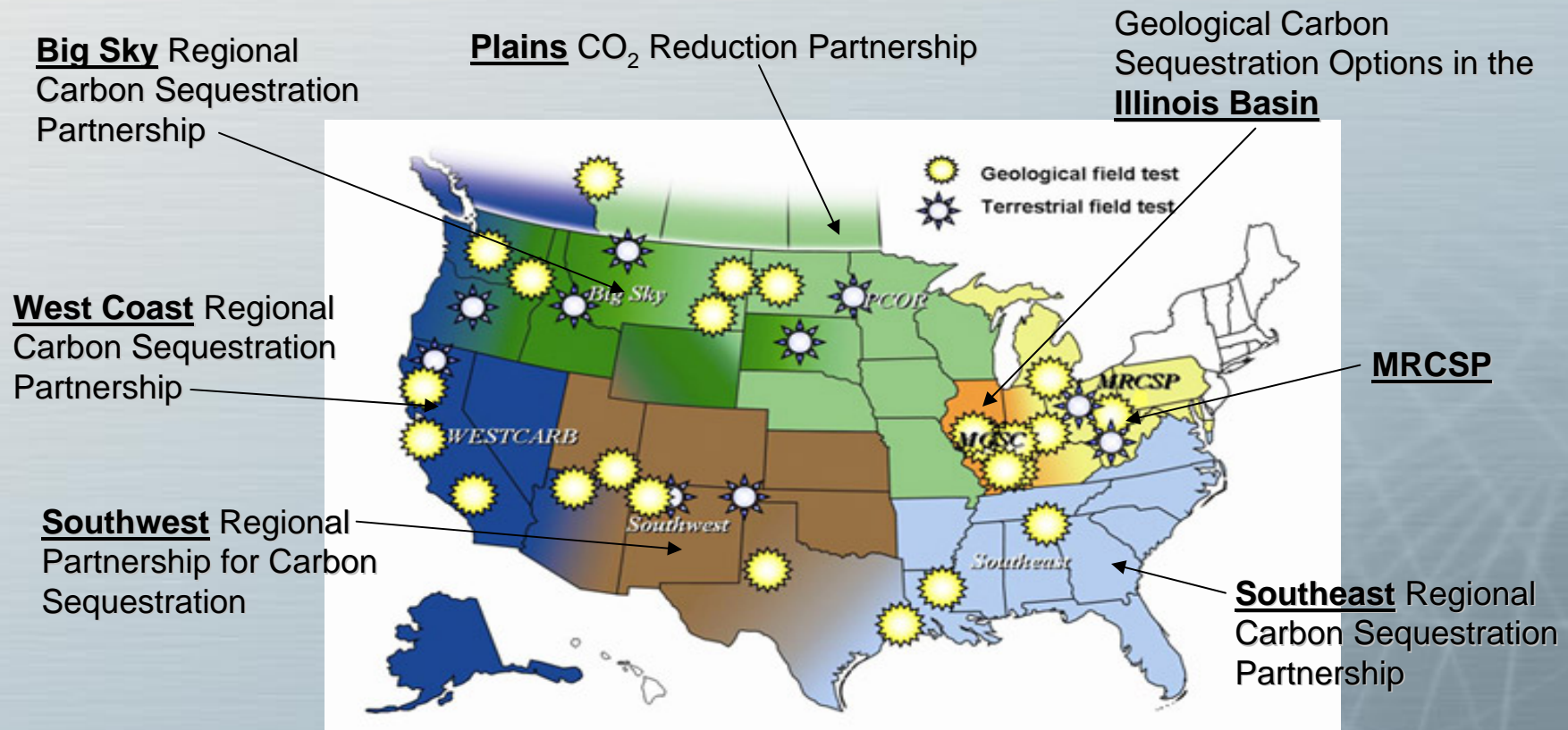
- One in six Americans
- 1/6 of U.S. Economy
- 1/5 of U.S. Electricity Generated
  - $\frac{3}{4}$  From Coal



- ~800 Million Metric Tons (MMT) CO<sub>2</sub>/year
- ~300 Large Point Sources

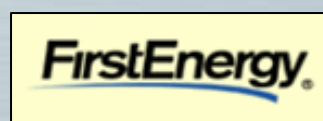
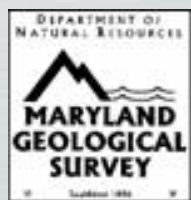
# The MRCSP is One of Seven DOE/NETL Regional Partnerships

Public/private partnerships in a nationwide effort to determine regionally-appropriate sequestration options and opportunities



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

# MRCSP Phase II Partners



U.S. Department of Energy/NETL



# MRCSP Activities in Phase I

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- Identified CO<sub>2</sub> sources in the MRCSP Region
- Assessed the technology options and cost of capturing CO<sub>2</sub> from these sources
- Identified more than 500 billion metric tons of potential storage capacity in the region's deep geologic formations, forests, agricultural and degraded land systems – enough for more than 200 years of carbon dioxide emissions from our region's large point sources
- Identified issues for technology deployment, including safety, economics, regulations and public acceptability
- Engaged the public and their elected officials to inform them about carbon sequestration and to obtain their feedback on the project
- Developed recommendations for potential small-scale validation testing during a second phase of DOE/NETL's partnership program



# Phase II Objectives

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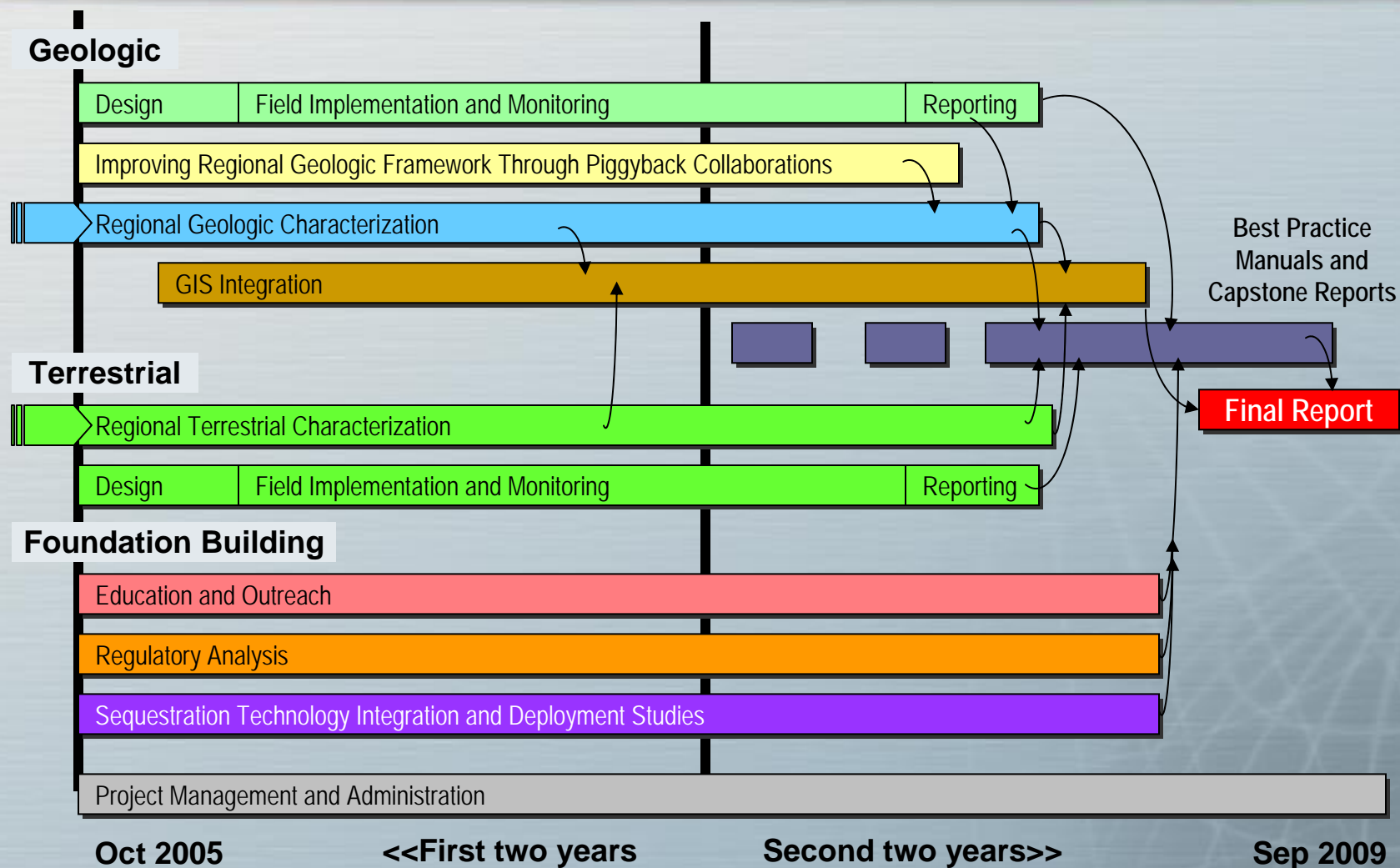
- Translate the theoretical potential for carbon sequestration defined in Phase I into tangible measures and approaches for the region
- Continue to develop the best approaches to carbon sequestration in the region by:
  - Using mapping, surveying and modeling to develop a unified conceptual framework of the region to serve as the foundation for a regional sequestration plan
  - Conducting multiple geological and terrestrial sequestration field demonstration projects in a variety of land and geology types
  - Developing innovative methods such as “piggyback” drilling to use activities already underway to generate additional geologic information about the region
  - Engaging stakeholders, including officials, industry, interest groups and ordinary citizens to inform them about the project and to obtain feedback

# Phase II Planned Activities

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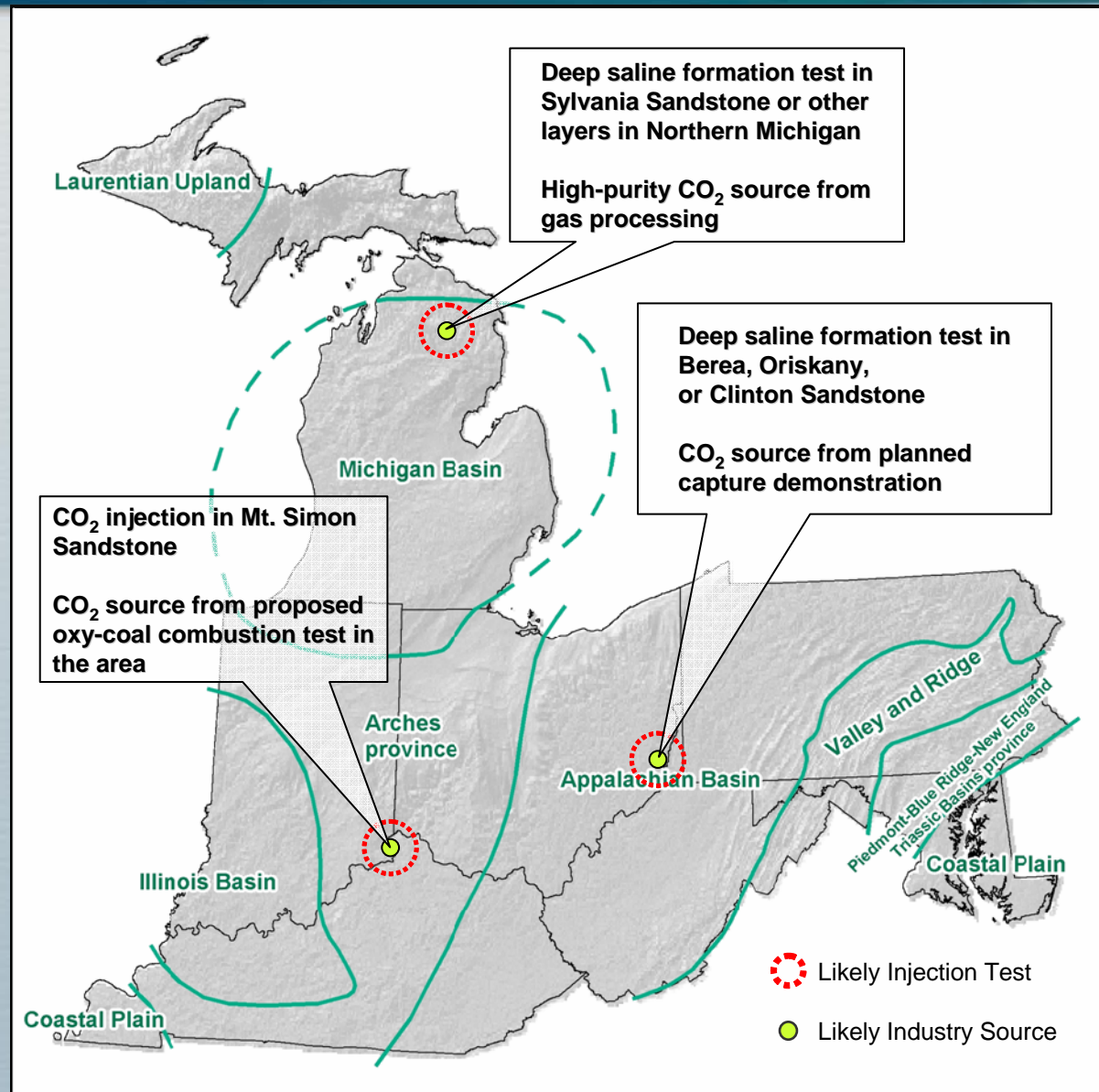
- Field validation of geologic sequestration
- Field validation of terrestrial sequestration
- Regulatory compliance
- Development of appropriate protocols for monitoring, mitigation and verification
- Refinement of regional characterization of sinks and sources
- Proactive stakeholder engagement and public outreach
- Integration of MRCSP activities with the other DOE regional partnerships

# When: Phase II Work Plan



# Phase II Candidate Geological Field Demonstrations and CO<sub>2</sub> Sources

- The primary CO<sub>2</sub> injection sites, including the East Bend site, are shown on the map
- Additional locations may be characterized for injection feasibility in saline formations, oil/gas fields, coal seams, and organic shales
- Additional possible sources of CO<sub>2</sub> include ethanol plants, gas processing, and commercial suppliers





# The East Bend Generating Station Field Demonstration

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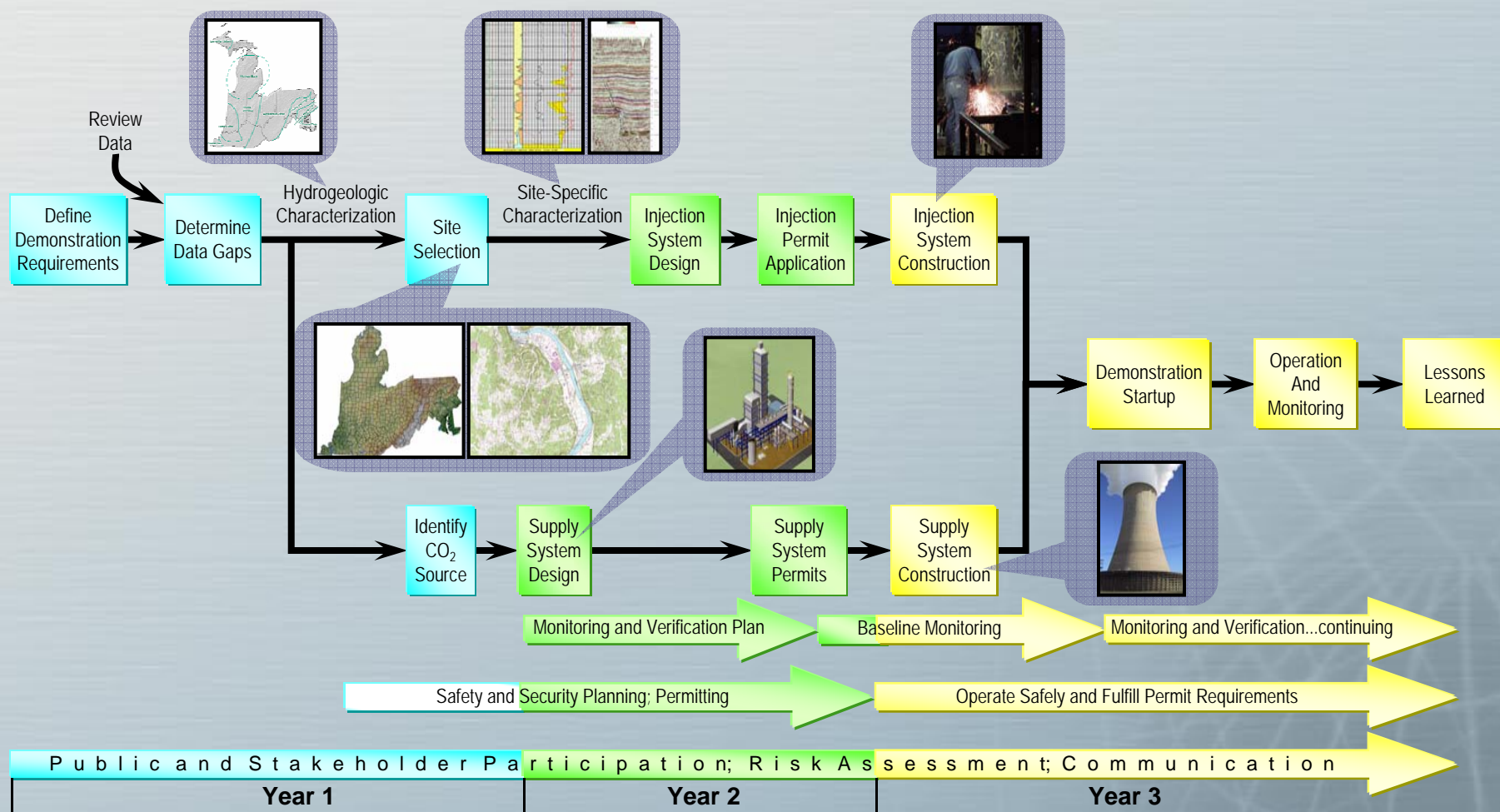
- Duke Energy's East Bend Generating Station in Rabbit Hash, Kentucky, located in the Cincinnati Arch region between the Illinois and Appalachian Basins, is one of the potential sites for geologic storage demonstration
- The site is being assessed by MRCSP to confirm its suitability and to select an optimum location
- Mount Simon Sandstone, the potential injection formation, at about 3,000 feet deep, underlies much of the Midwestern region, along with thick containment zones
- Planned tests would assess the continuity and injectivity, operational approaches and monitoring mechanisms at the site, and their applicability to the broader region

# Other Advantages of the East Bend Generating Station Site

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- Due to the presence of equipment to control plant emissions of  $\text{NO}_x$ ,  $\text{SO}_2$ , particulates and mercury, the East Bend site represents a clean coal plant with very low emissions
- The potential exists of using  $\text{CO}_2$  produced from a planned, regional demonstration of oxyfuel technology that produces a pure  $\text{CO}_2$  stream. This would allow the possibility of testing new  $\text{CO}_2$  capture technologies
- The Mount Simon Sandstone present at the site represents one of the most prominent layers in the country for  $\text{CO}_2$  storage potential

# Key Steps in Developing CO<sub>2</sub> Storage Demonstrations



# Timeline and Next Steps for the East Bend Generating Station Demonstration

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- Preliminary site screening
  - Geologic data compilation and mapping based on current information
  - Regulatory review
  - Review monitoring, measurement & verification (MMV) feasibility
  - Develop research plan and safety plan
- Permitting
  - Federal, State
  - State
  - Facility-specific issues
- Site characterization
  - Seismic survey
  - Well drilling and testing of candidate formations
  - Baseline monitoring, measurement & verification



# Timeline and Next Steps for the East Bend Generating Station Demonstration (Continued)

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- Well construction
  - Approval to begin injection
  - Continued monitoring, measurement & verification
- Injection
  - Obtain final approval to inject
  - CO<sub>2</sub> acquisition and handling
  - Well completion and injection tests
  - Continued monitoring, measurement & verification
- Post injection
  - Data analysis and review
  - Well closure or plugging
  - Post closure monitoring, measurement & verification

# Contacts

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the MRCSP see  
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