Midwest Regional Carbon Sequestration Partnership

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

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The Midwest Regional Carbon Sequestration Partnership

The Midwest Regional Carbon Sequestration Partnership will be the premier resource in the region for identifying the technical, economic, and social considerations associated with and creating viable pathways for the deployment of CO_2 sequestration.

The Midwest Regional Carbon Sequestration Partnership - Goals

Assess the technical and economic potential of carbon sequestration:

- Identify CO_2 sources in the Region
- Assess the cost of capturing CO_2 from these sources
- Assess the Region's deep geologic formations, forests, agricultural and degraded land systems for their potential to sequester CO_2

Sequestration must also be socially acceptable:

- Engage the public and elected officials to communicate the potential value of geologic and terrestrial sequestration
- Examine barriers that would hinder cost-effective and timely deployment
- Identify strategies for overcoming these barriers via Phase II field demonstrations

Translate this theoretical knowledge into practical implementation strategies to assist the industries that rely on the region's abundant, reliable, and inexpensive energy sources.

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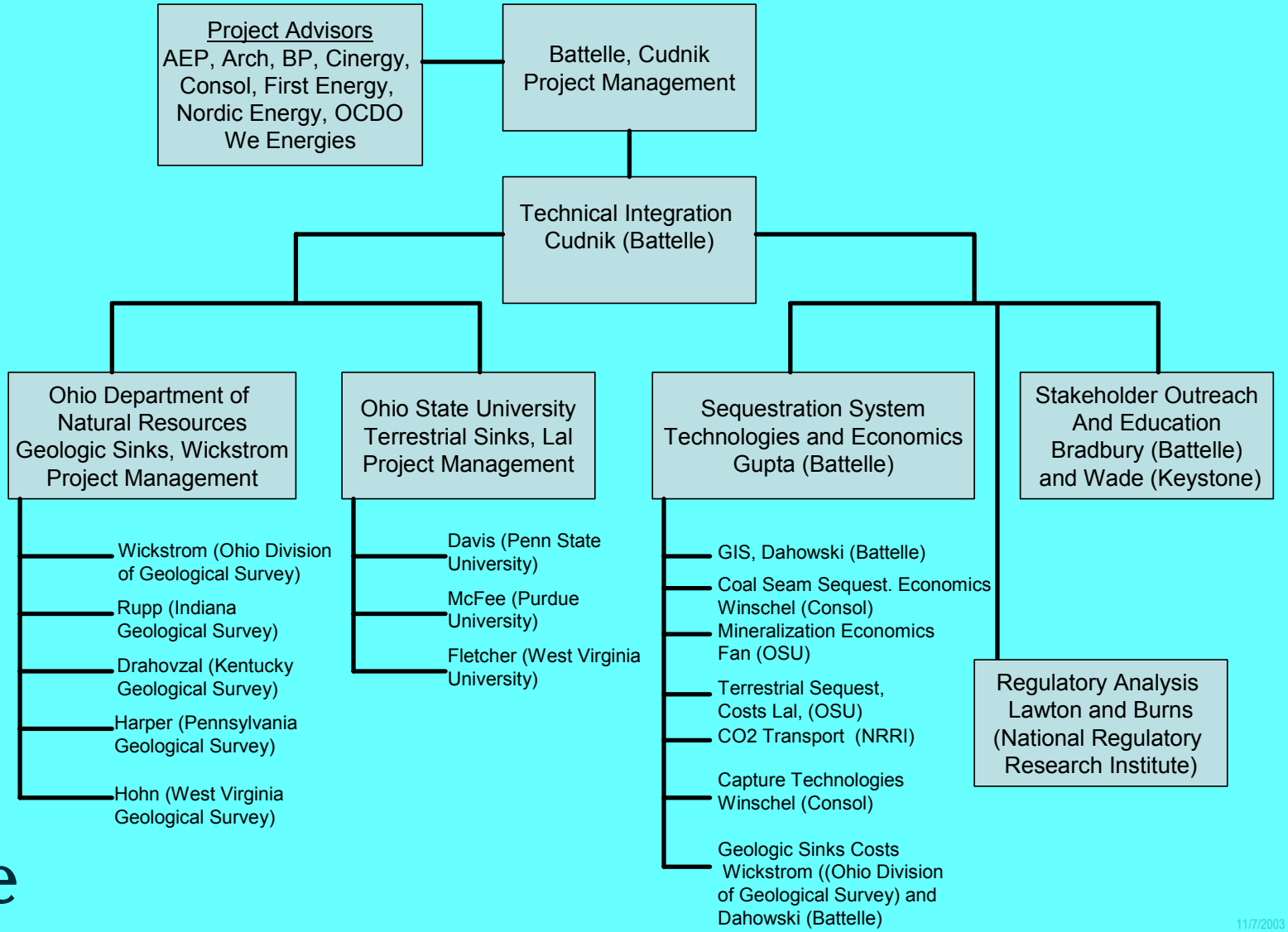
Battelle, OSU, and ODNR
Providing Intellectual Leadership



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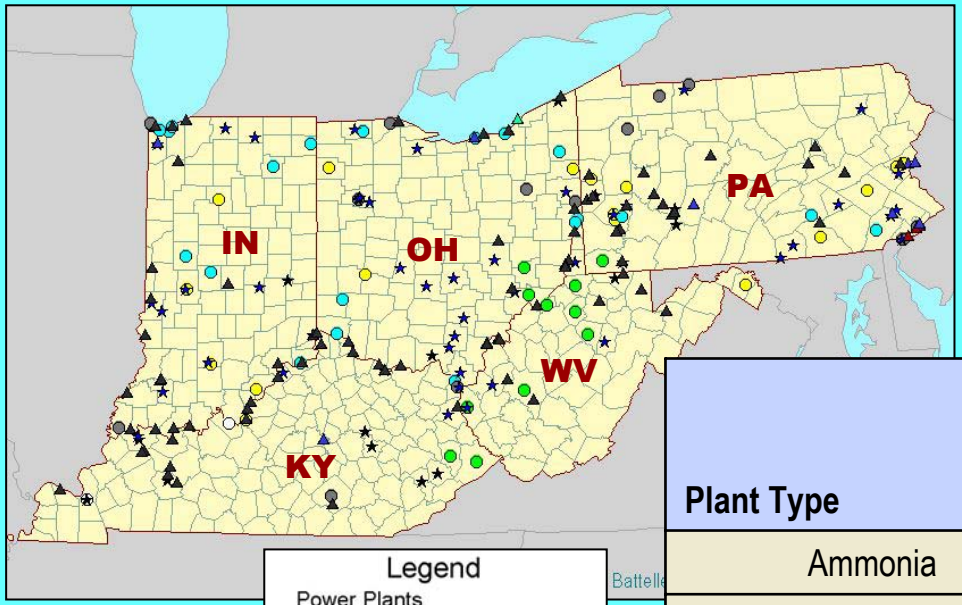
Large CO_2 Point Sources in the Region
Preliminary Estimate



Plant Type	Midwest Region (IN, OH, KY, WV, and PA)	
	Known Regional CO_2 Point Sources	Annual CO_2 Emissions
Ammonia	1	21,000
Cement	20	9,885,000
Ethylene/Ethylene Oxide	4	977,000
Gas Processing	18	9,039,000
Hydrogen	9	448,000
Iron & Steel	57	53,987,000
Power	287	575,445,000
Refineries	16	19,069,000
Total	**412**	**668,899,000**

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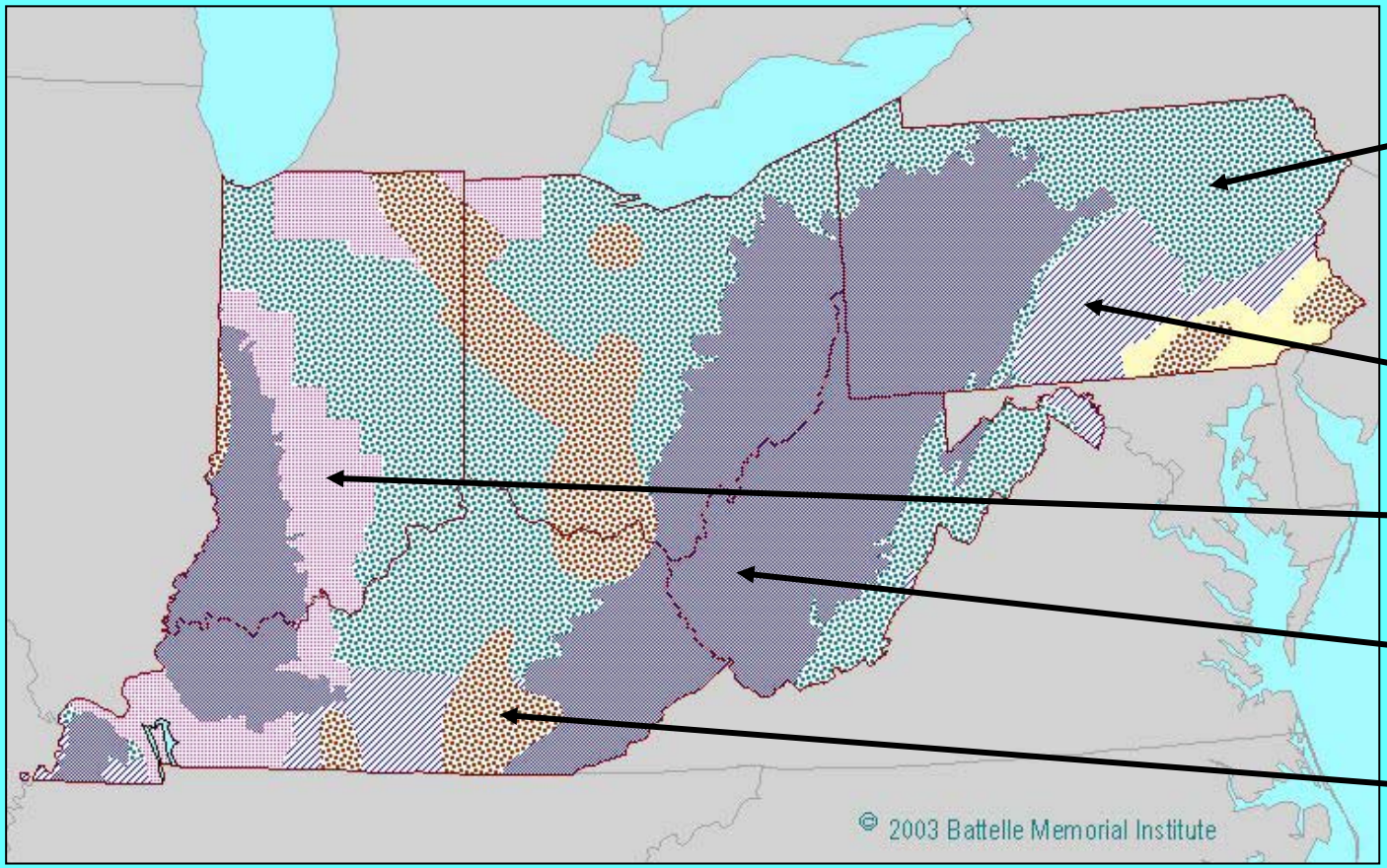
Potential Geologic CO_2 Sequestration Sites
Preliminary Compilation



- Geologic Sequestration
  - Deep Brine-Filled Sedimentary Formations
  - Depleted Gas Fields
  - Depleted Oil Fields
  - Deep Coal Seams
  - Basalt Formations

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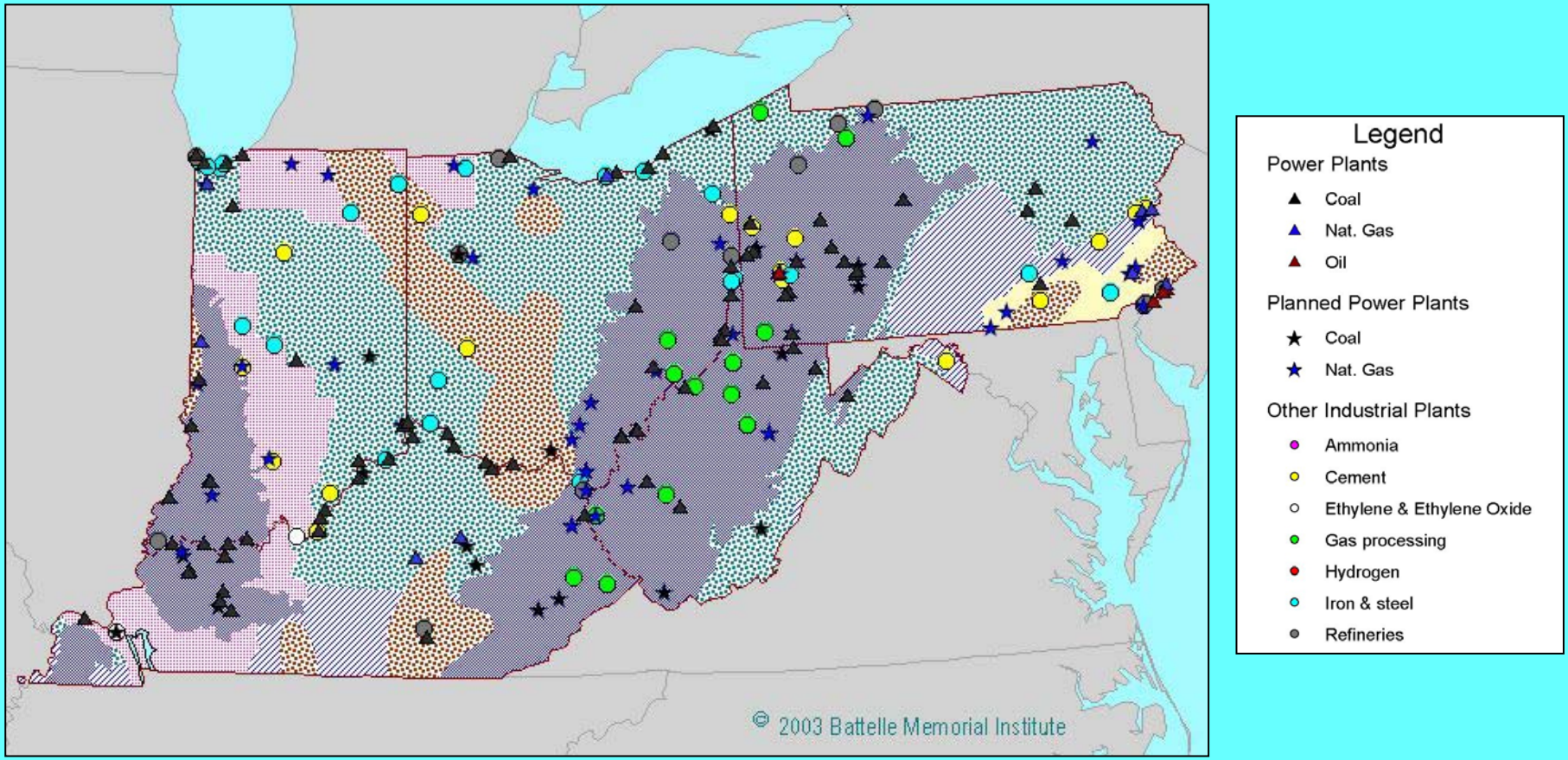
Good Match Between Point Sources and Geologic Sinks



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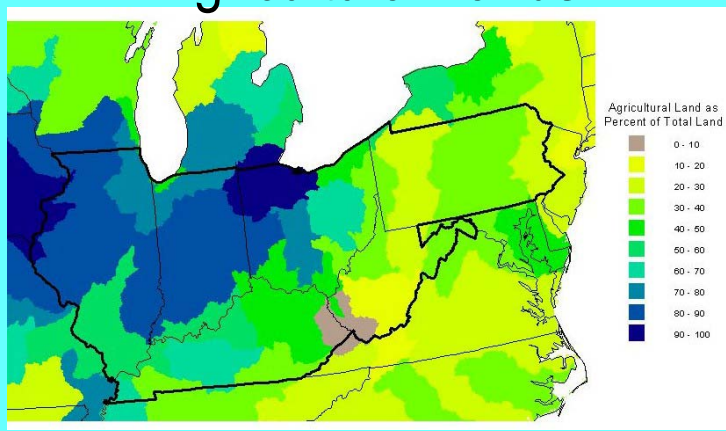
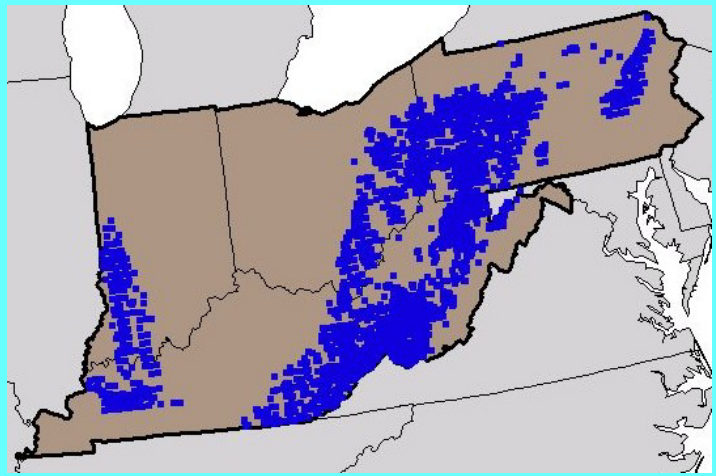
Potential Terrestrial Sequestration Options
Preliminary Compilation

- **Major terrestrial sequestration options to be studied by the Partnership:**
  - **Agricultural Lands**
  - **Degraded / Eroded Lands**
  - **Abandoned Mine Lands**
  - **Forests**

Agricultural Lands



Abandoned Mine Lands



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Develop a Broad Understanding of How Sequestration Systems will Deploy in the Region

- Fact Finding:
  - Identify and address issues for technology deployment, including safety, economics, regulations, public perceptions, environmental impacts, monitoring, and verification
  - Develop public involvement and educational methodologies and supporting materials in order to raise public awareness of Regional sequestration needs and opportunities, and provide stakeholders with information regarding technology development efforts

- Laying the Foundation for a successful Phase II
  - Identify promising options for CO_2 capture, transport, and sequestration on the basis of technical feasibility, safety, estimated cost, perceived public acceptability, CO_2 reduction potential, and environmental efficacy
  - Prepare action plans for involving and educating the public regarding sequestration opportunities and for informing interested stakeholders about the planned technology development efforts
  - Prepare action plans for implementing and validating small-scale field tests of sequestration options in the Midwest Region in Phase II.

Develop a Cost Methodology that Works for Both Terrestrial and Geologic Sequestration

- Develop methodology for estimating costs of sequestration options
  - Terrestrial options
  - Deep saline formations
  - Coal seams
  - Depleted Oil and Gas Fields
  - Enhanced oil recovery
  - CO_2 mineralization
  - CO_2 capture from a number of industrial processes
- Implement methodology using data collected and organized with respect to potential sequestration reservoirs
- Ultimately create a cost based listing of Region's sequestration options

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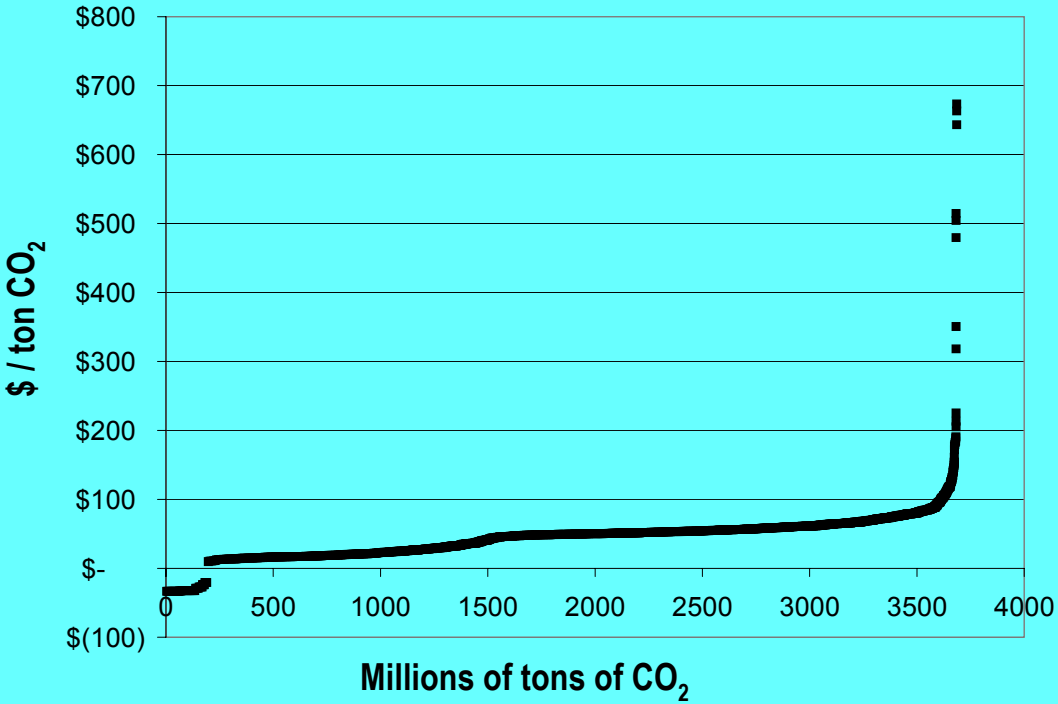
Cost Methodology Will Help Answer Many Pressing Questions About Sequestration



- How many million tons of CO_2 sequestration are available at a given price?
- Is there "enough" sequestration capacity in the Region?
- When (and at what prices) does the region import or export carbon permits?

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But Cost Will Not Be the Only Criterion for Deploying Sequestration within the Region

- Therefore we must collaboratively develop the Phase II Plan with all sponsors and stakeholders
  - The project team will develop a full listing of Region's sequestration options
  - We will prepare a draft multi-criteria methodology that will be used to define a focused set of Regional priority projects
    - Cost per ton
    - Ability to utilize existing infrastructure
    - Strong industrial / DOE support
    - Relevance for the Region's future
    - Broad stakeholder input
    - Ability to develop knowledge needed for science-based sequestration regulations
  - Hold a workshop with sponsors and stakeholders to confirm and apply methodology
  - We will document the results of the workshop and develop the Phase II Plan

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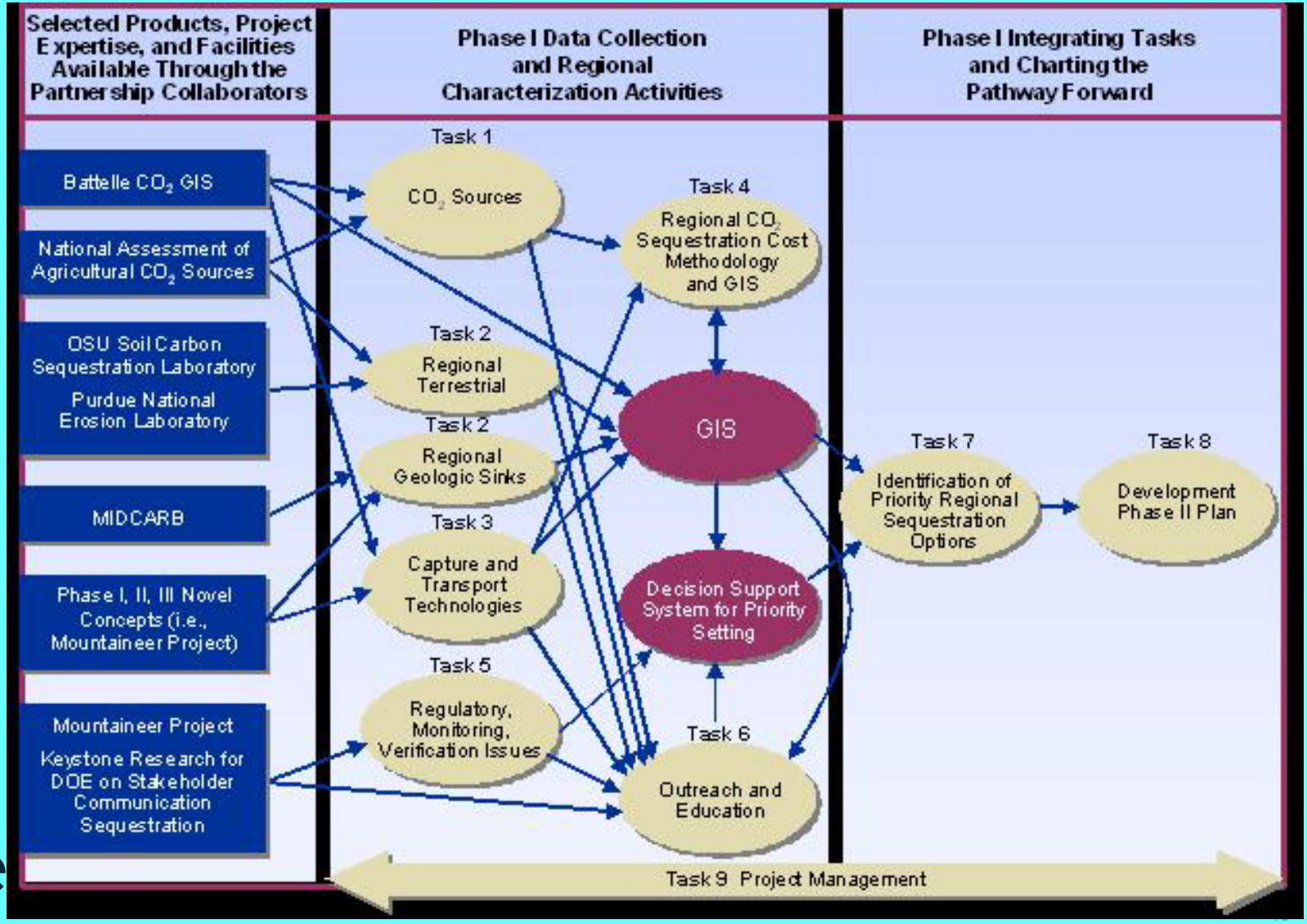
A Quick Start and Higher Value-Added Deliverables, Because Partnership Team Members Are Conducting Highly Relevant Research Right Now



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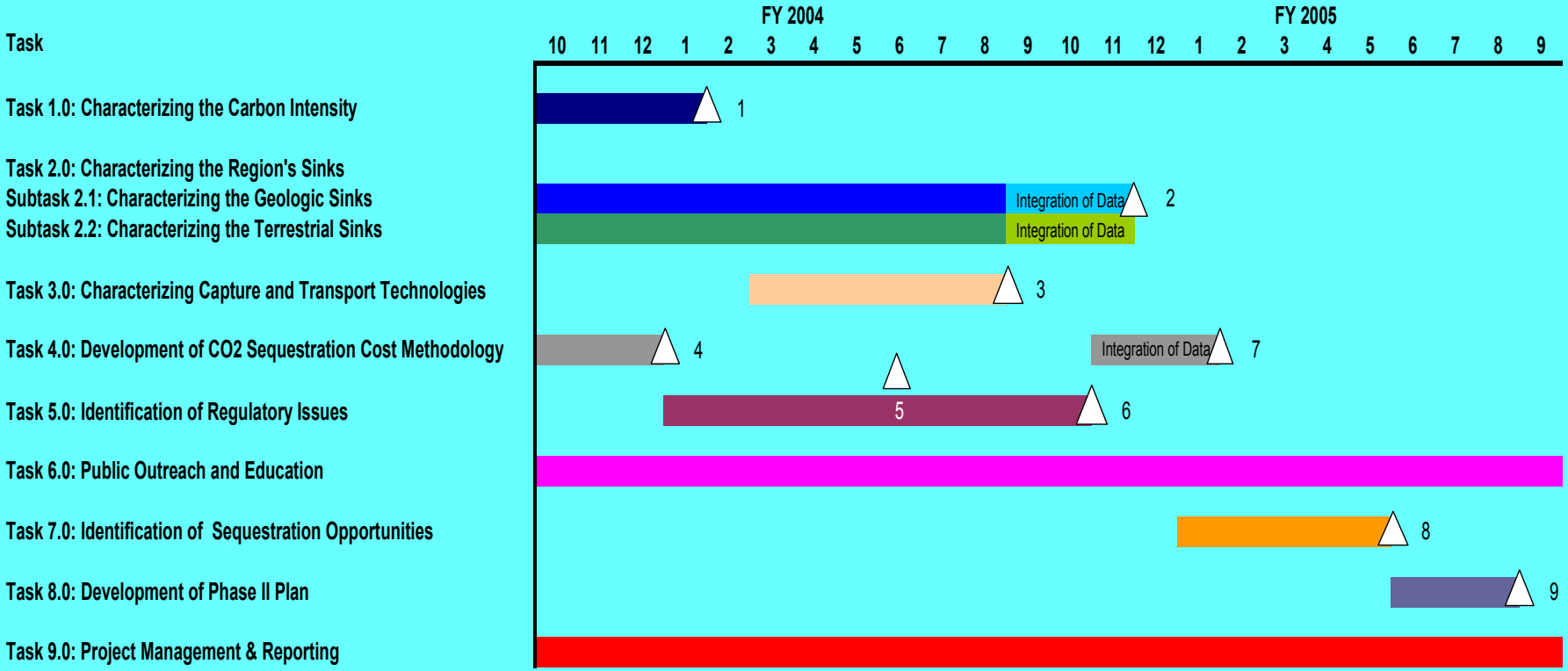
Proposed Schedule



1 Carbon Intensity of the Region Characterized
2 Assessment of Geologic and Terrestrial Sequestration Reservoirs Potential and Associated Issues Documented; GIS-Compatible Sequestration Data
3 Capture and Transport Technologies Characterized
4 Sequestration Cost Methodologies Developed
5 Current Regional Regulatory Issues Identified
6 Framework for Future Regulatory System
7 GIS Functional
8 Regional Sequestration Opportunities Identified
9 Phase II Plan Developed

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The Partnership: Delivering Solutions

- The Partnership will define the real world potential and what it will take to realize this potential for carbon sequestration in the Region.
- These sequestration technologies are needed to protect core economic assets in the Region in a greenhouse gas constrained world.
- The Partnership brings together internationally recognized research leaders to help define real world carbon management solutions.
- The Partnership's research will help its customers take a first step towards the avoidance of a potential multi-hundred million if not multi-billion dollar future problem.
- The Partnership's work will allow its sponsors to position themselves as leaders in developing robust carbon management solutions.