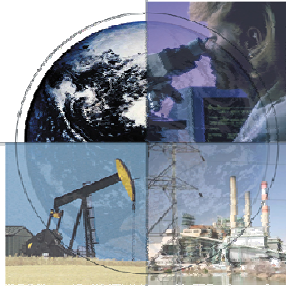


Summary of DOE Regional Carbon Sequestration Partnerships



WESTCARB Annual Meeting

11/08/06

Dawn Marie Deel

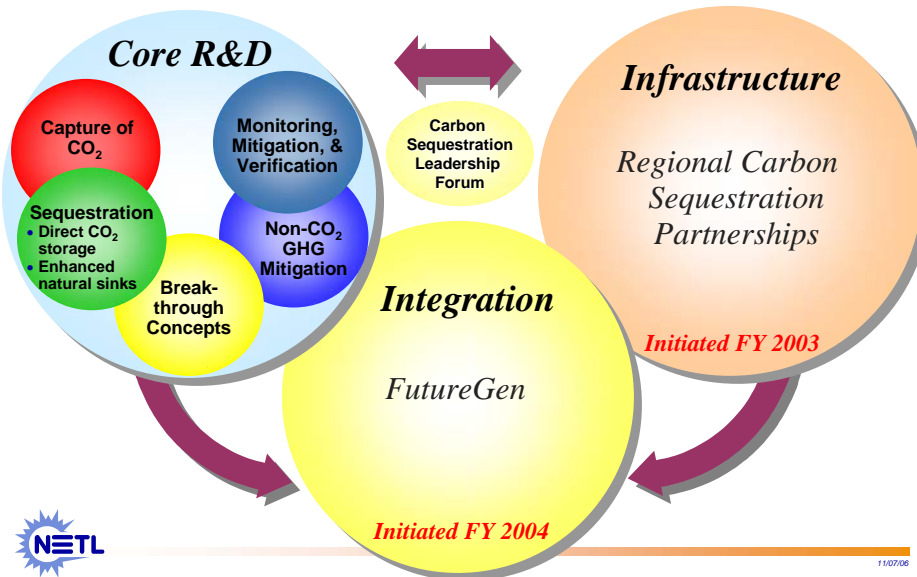
National Energy Technology Laboratory



Office of Fossil Energy



Carbon Sequestration Program Structure



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Regional Carbon Sequestration Partnerships “Developing the Infrastructure for Wide Scale Deployment”

Characterization Phase

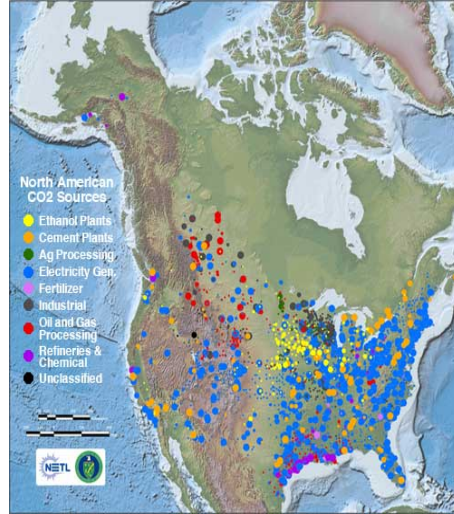
- 24 months (2003-2005)
- 7 Partnerships (40 states)
- \$16M DOE funds

Validation Phase

- 4 years (2005 - 2009)
- Field validation tests
 - 25 Geologic
 - 10 Terrestrial
- \$100M DOE funds







Deployment Phase

- 10 years (2007-2016)
- Several large volume injection tests
- \$450M DOE funds



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Regional Carbon Sequestration Partnerships

	California Energy Commission http://www.westcarb.org/
	New Mexico Institute of Mining and Technology http://www.southwestcarbonpartnership.org/
	Montana State University http://www.bigskycarbon2.org/
	University of North Dakota, Energy & Environmental Research Center http://www.undeerc.org/pcor/
	University of Illinois, Illinois State Geological Survey http://www.sequestration.org/
	Battelle Memorial Institute http://www.mrcsp.org/
	Southern States Energy Board http://www.secarbon.org/



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Characterization Phase Accomplishments

- **Characterized opportunities for capture and storage of carbon dioxide in North America**
- **Developed National Carbon Sequestration Atlas and Geographic Information System (NATCARB)**
- **Completed regulatory analysis and published recommendations for states – IOGCC Report 2005**
- **Public outreach accomplishments**
 - Documentary of Carbon Sequestration
 - Focus groups used to gauge public opinion
 - Outreach materials - websites and fact sheets
- **Developed regional action plans for regulatory permitting, MMV, outreach, and project implementation**
- **Identified promising opportunities for Validation Phase**

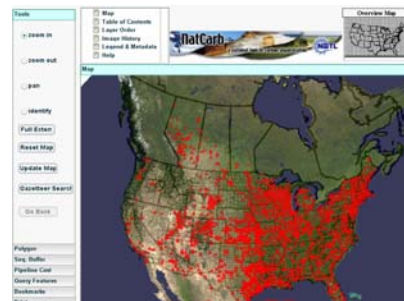


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National Carbon Sequestration Database and Geographical Information System (NATCARB)

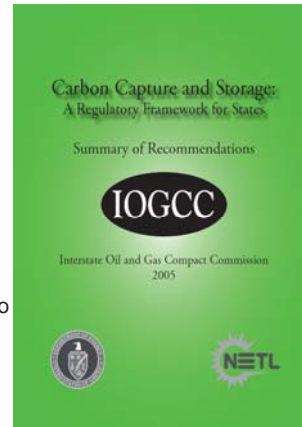
- **Integrate data across Partnerships**
- **National perspective of sequestration potential**
 - Identifies CO₂ sources
 - Identifies sequestration opportunities
 - Incorporates more than 130 layers, 25 services, and 15 servers
- **Decision support tools**
 - Polygons for source data
 - Capacity buffers
 - Pipeline tool
- **Improve access to Partnership data**
 - Display and integration of metadata
 - Access and visualization tools
- **Outreach tool**
 - Web-site gets 200-400 unique visitors every month



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Carbon Capture and Storage Regulatory Analysis *Interstate Oil and Gas Compact Commission*

- **Capture**
 - Existing permitting structure under federal/state versions of Clean Air Act
 - Measurement and accounting standards required
- **Transportation**
 - Existing regulation throughout North America for transport of CO₂
 - Industry and professional organizations have developed standards for CO₂ pipeline construction
- **Injection**
 - Class II permitting framework exist under the EPA and States' Underground Injection Control (UIC) programs for oil and gas
 - Class V has been used to permit several small tests
 - Existing permitting structure needs to be amended to address risk, MMV, and reservoir interactions related to CO₂
- **Post Injection**
 - Framework needed to address the site abandonment, long-term liability, and monitoring requirements
 - Can be developed from the existing UIC program



2007 - Model Statutes and Regulations to be developed for states

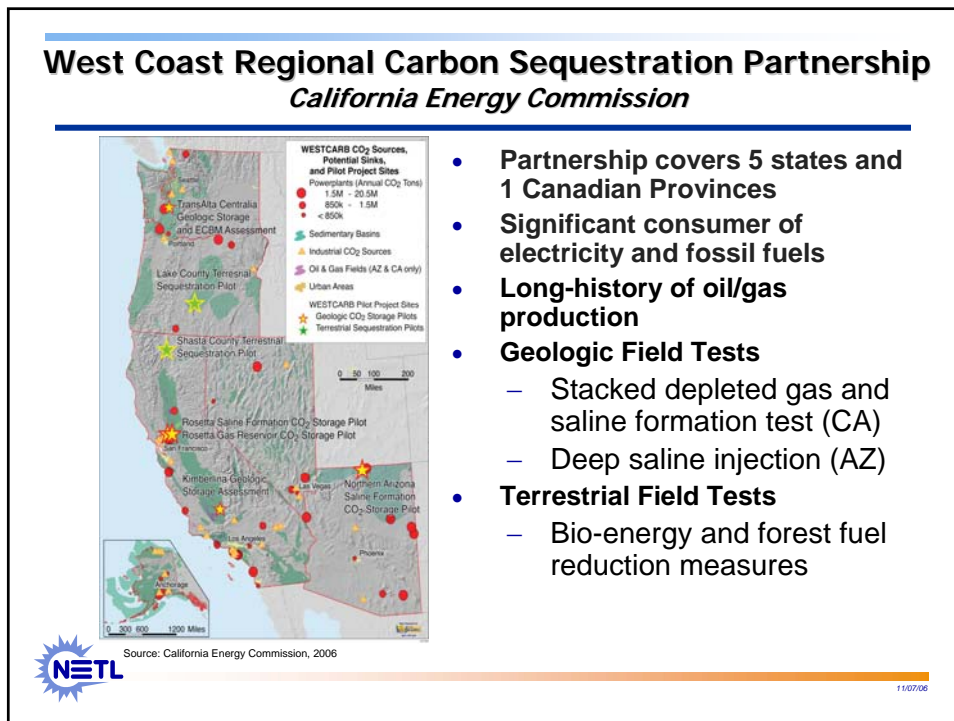
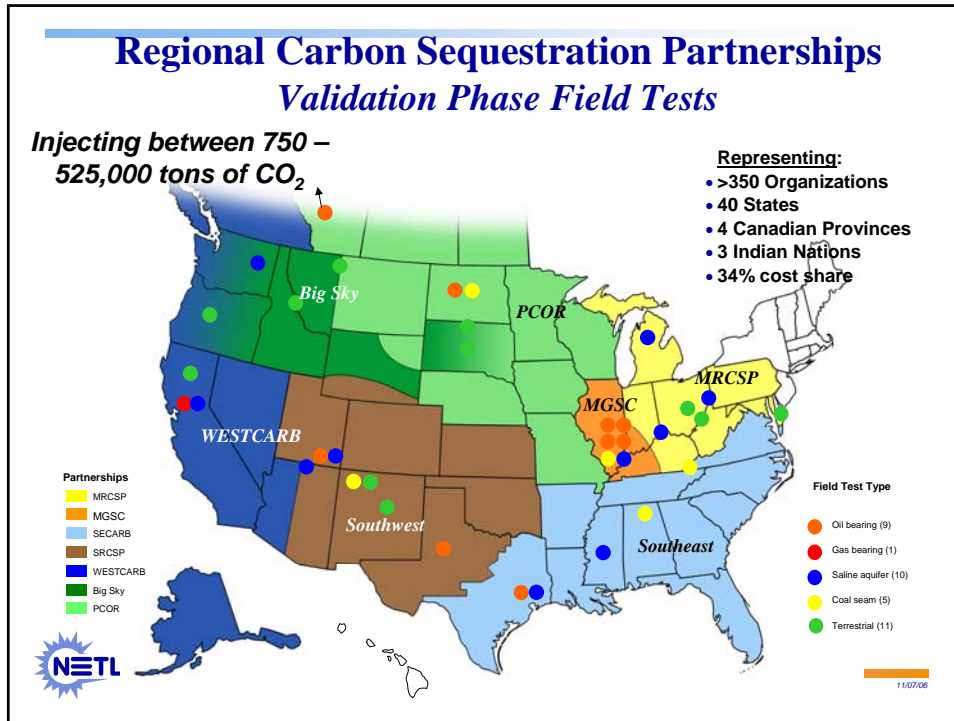
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Validation Phase Goals

1. Perform regional technology validation tests for 2012 technology assessment
2. Refine and implement monitoring, mitigation, and verification protocols
3. Continue regional characterization
4. Perform regulatory compliance activities
5. Implement public outreach and education
6. Identify commercially available sequestration technologies ready for large scale deployment

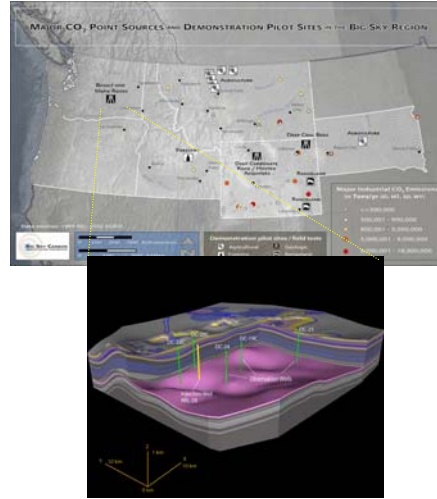


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Big Sky Regional Carbon Sequestration Partnership *Montana State University, Bozeman*

- **Partnership covers 6 states**
 - Over 25 partners including several CSLF countries
- **Extensive Reactive Carbonate and Basalt Formations**
- **Geologic Sequestration Tests**
 - Basalt formations in the Grande Ronde Basalt
 - Reactive Carbonates in the Madison Formation
- **Several Terrestrial field tests planned**
 - No-till agriculture
 - Reforestation
 - Rangeland restoration



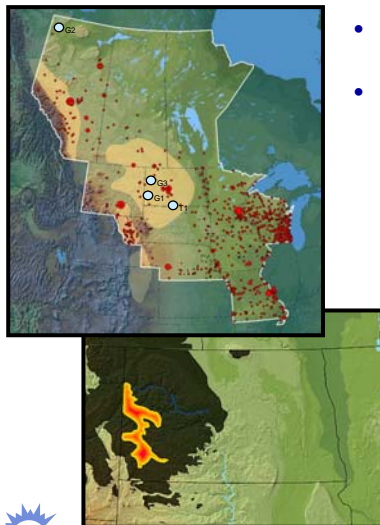
Source: PNNL, 2005

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Plains CO2 Reduction Partnership *UND, Energy and Environmental Research Center*

- **Partnership covers 9 states and 3 Canadian Provinces with over 40 partners**
- **Geologic Demonstrations**
 - G1 – Beaver Lodge, North Dakota. CO2 injection site for CO2 sequestration and EOR
 - G2 – Zama, Alberta. Acid gas Injection site for CO2 sequestration and EOR
 - G3 – Lignite coal in North Dakota. CO2 injected into an unminable lignite coal seam for CO2 sequestration and possible ECBM production
- **Terrestrial Demonstration**
 - T1 – Restoration of Wetlands to tests MMV and accounting protocols



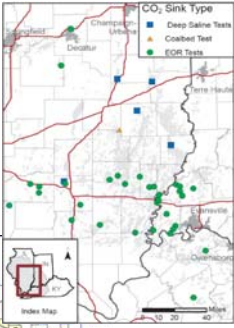
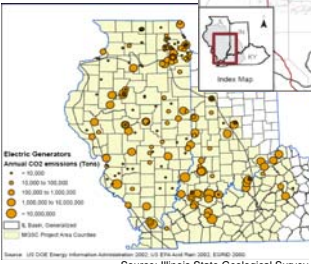
Source: UND, EERC 2005

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Midwest Geological Sequestration Consortium *Illinois State Geological Survey*

- **Covers Illinois Basin, IL, KY, and IN**
- **Value added products**
- **Six field tests proposed from portfolio of 34**
 - 4 sites being selected
 - 11 oil operators involved
 - Coal seam site selected
 - Saline site
- **Conducting structural characterization using seismic**

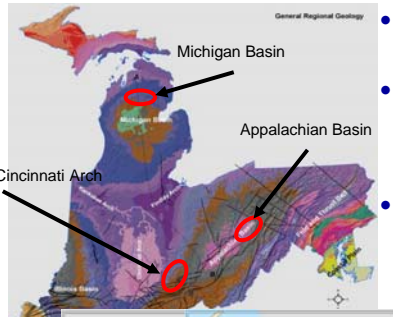
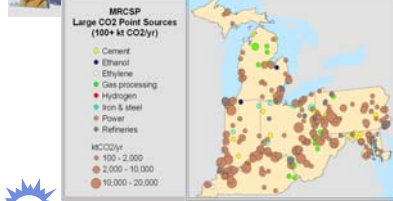



Source: Illinois State Geological Survey




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Midwest Regional Carbon Sequestration Partnership *Battelle Laboratories*

- **Covers most of the Midwest and Mid Atlantic Region of the United States**
- **Nations Engine Room**
 - 21% of U.S. electricity production
 - 75% from coal
- **Geologic Demonstrations**
 - Appalachian Basin
 - Cincinnati Arch
 - Michigan Basin
- **Terrestrial Demonstrations**
 - No-till agriculture
 - Mine land restoration
 - Wetland restoration

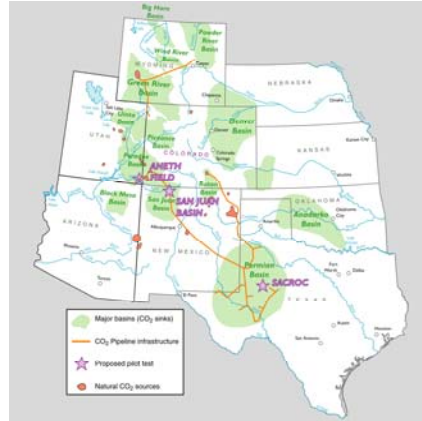
Source: Battelle, 2006



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Southwest Partnership on Carbon Sequestration
New Mexico Institute of Mining and Technology

- Partnership covers 8 states
- 30 year history of CO₂ EOR and CO₂ transportation
- **Geologic Sequestration Tests**
 - 2 CO₂ Sequestration and EOR Recovery Tests
 - 1 Coal bed sequestration and methane recovery test
 - 1 Saline formation test
- **Terrestrial Sequestration**
 - Riparian restoration and regional assessment



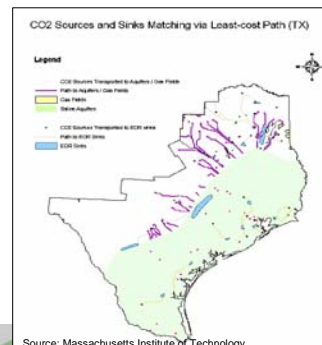
Source: Colorado Geological Survey



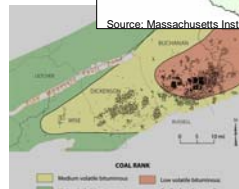
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Southeast Regional Carbon Sequestration Partnership
Southern States Energy Board

- Partnership covers entire Southeast and Gulf Coast Region of the US
- Nearly 30% of national CO₂ emissions from the region
- **Geologic Sequestration Tests**
 - Two coal bed storage tests in Alabama and Appalachia
 - Stacked storage test along gulf coast – EOR/Saline
 - Deep saline test



Source: Massachusetts Institute of Technology



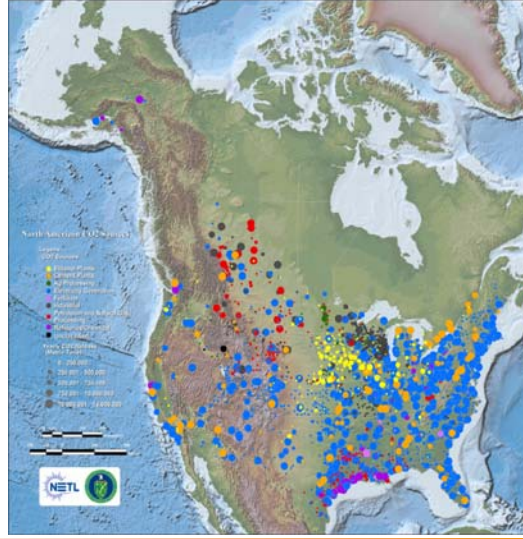
Source: Virginia Center for Coal and Energy Research, Virginia Tech



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Validation Phase *Sources Identified*

CO ₂ Sources Documented in NatCarb		
	Quantity (Million Tonnes)	Number of Facilities
PCOOR	401	1037
Illinois basin	343	212
Midwest	1,319	496
Southeast	1,021	981
WestCarb	132	62
Southwest	336	432
Big Sky	112	158
Northeast (from USGS)	144	987
TOTAL	3,809	4365



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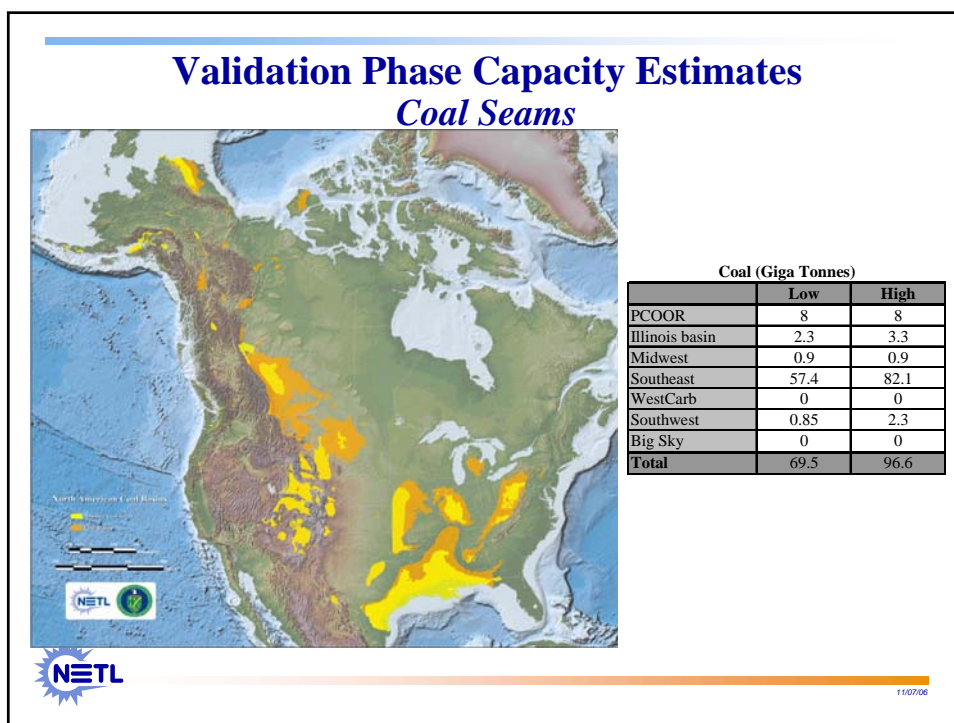
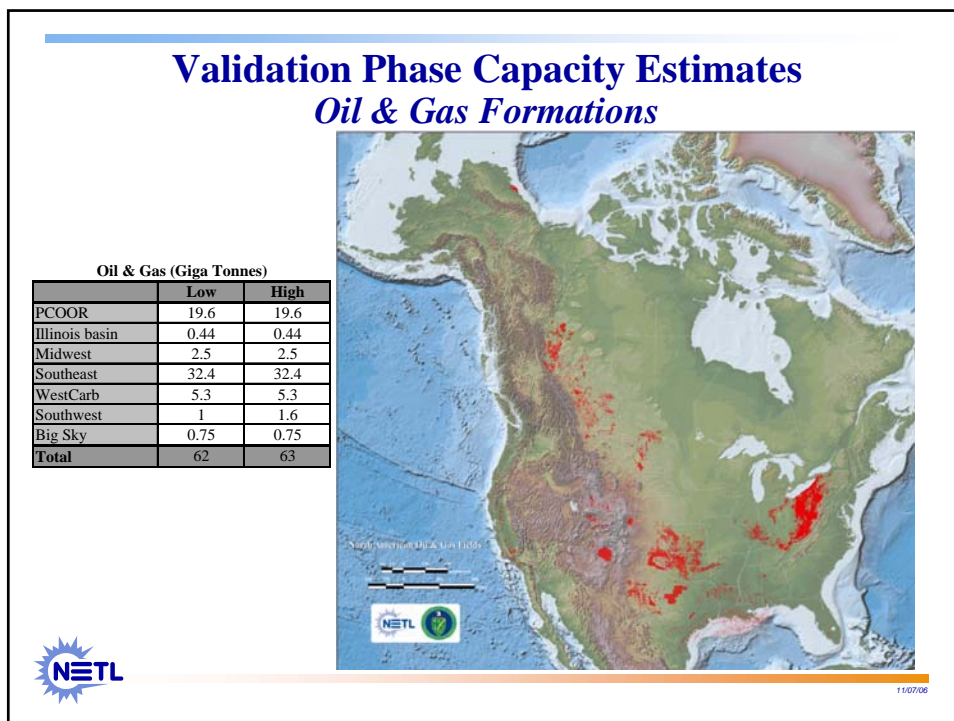
Validation Phase Capacity Estimates *Saline Formations*



Saline Formations (Giga Tonnes)		
	Low	High
PCOOR	97	97
Illinois basin	29	115
Midwest	118	118
Southeast	360	1,440
WestCarb	76	304
Southwest	18	64
Big Sky	-	-
Total	698	2,138



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Working Groups

- **Geologic and Infrastructure**
- **Capture and Transportation**
- **GIS and Database**
- **Public Outreach**
- **Regulatory Working Group**
 - IOGCC
- **Economics and Markets**

- **Benefits:**
 - Developing standards
 - Sharing information
 - Developing common messages



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Benefits of the RCSP Initiative

- **Better understanding of regional opportunities**
- **Match sources and sinks**
 - Define scenarios for implementation
- **Test and refine geologic models**
- **Measure fate of CO₂ and compare technologies**
 - Both physical and chemical
- **Best management practices to address site selection, well design, operations, monitoring, and closeout**
- **Engagement of regional stakeholders**



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Questions ?



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