Mid-Atlantic U.S. Offshore Carbon Storage Resource Assessment

Project Developments and Status Update

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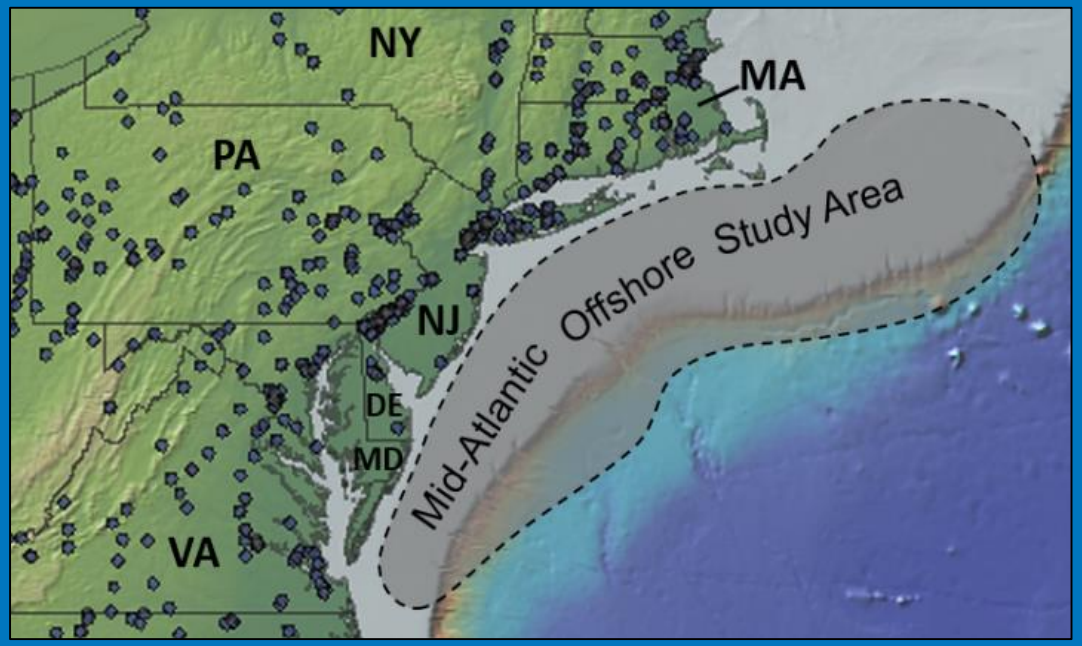

2nd International Workshop on Offshore CO_2 Geological Storage

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MID-ATLANTIC U.S. OFFSHORE CARBON STORAGE RESOURCE ASSESSMENT PROJECT

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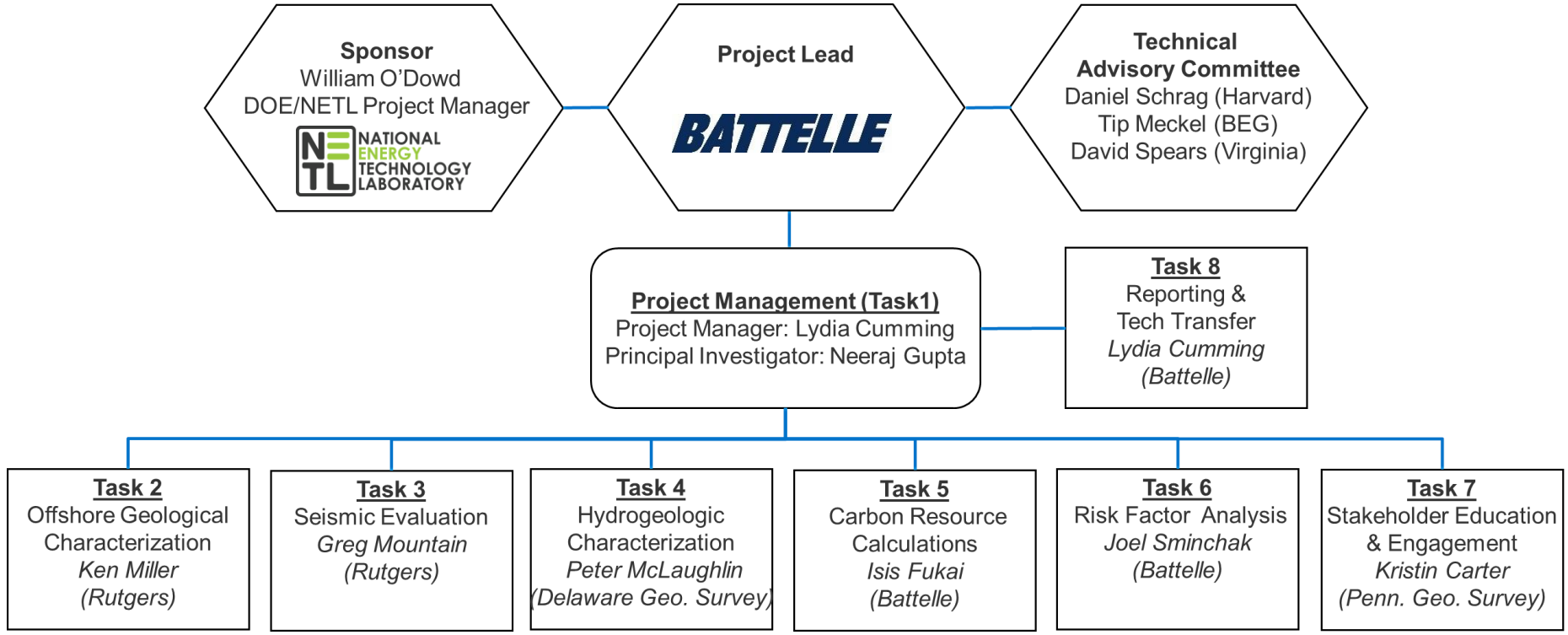
Project Background

Objective: Conduct a regional assessment of geologic CO_2 storage resources in the Mid-Atlantic U.S. offshore area



The Offshore Carbon Storage Resource Assessment consists of 8 tasks, with a diverse team of experts responsible for project implementation

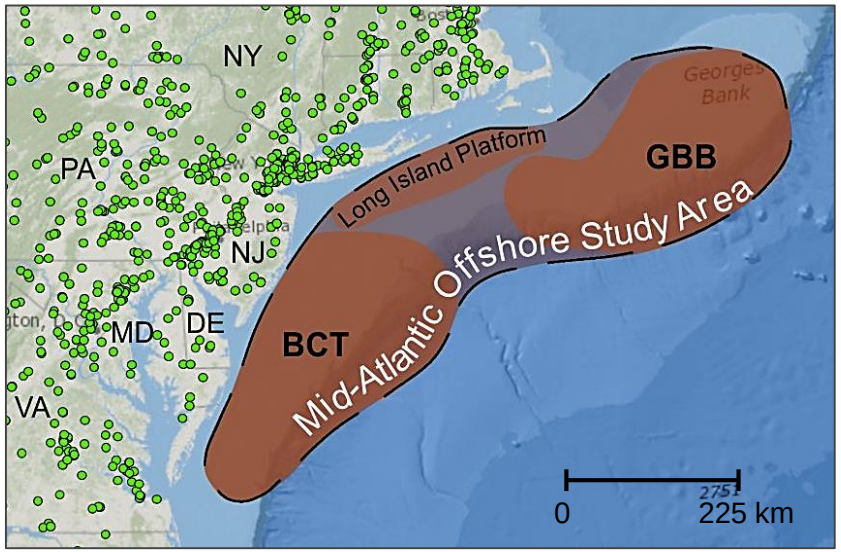
Offshore Study Area and Geology

Study Area

- ~171,000 km^2
- Within 100-200 mi from shore (within 200 m isobath)
- Three sub-regions

Formations: Mesozoic sandstones, shales, carbonates

- Previous work[a] suggests storage potential in porous/permeable Cretaceous sands
- Sands interbedded with and confined by shales



BCT Baltimore Canyon Trough **GBB** Georges Bank Basin

Stationary Sources of CO_2 (U.S. DOE-NETL NATCARB v. 1502)

Age	Seal or Reservoir	Formation Name[b]
Upper Cretaceous	Seal	Dawson Canyon
Lower Cretaceous	Reservoir	Logan Canyon
	Seal	Naskapi
	Reservoir	Missisauga
Upper Jurassic	Seal	Mic Mac
	Reservoir	Mohawk
	Base/Seal	Mohican / Iroquois

a. E.g. Smith et al., 1976; Amato and Bebout, 1980; Slater, 2010; MRCSP, 2011
b. Based on Libby-French (1984)

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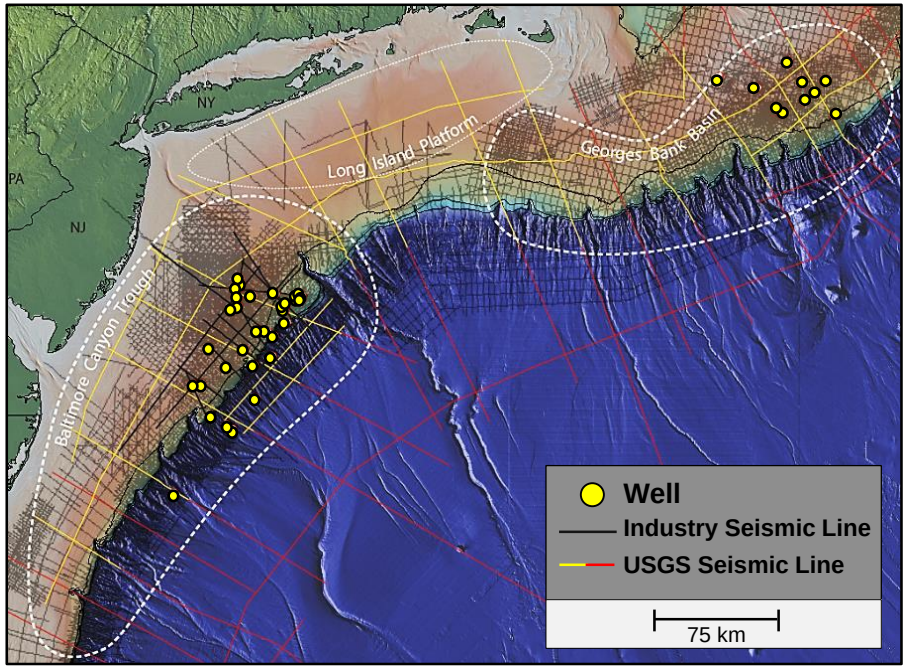
Data Compilation and Inventory

A large coordinated group effort was undertaken to categorize and preserve offshore samples and data

For 44 wells in the study area:



- Sample Inventory
  - ~2,300 core samples
  - ~5,000 thin-sections
  - ~97,000 drill cuttings
- Data Compilation
  - ~2,500 log files
  - Over 1,000,000 ft. of log data digitized
  - 5,973 porosity & 5,729 permeability core data points[a] from 184 existing reports and publications

a. Includes all raw and derived entries reported at all depths for 41 wells in the study area

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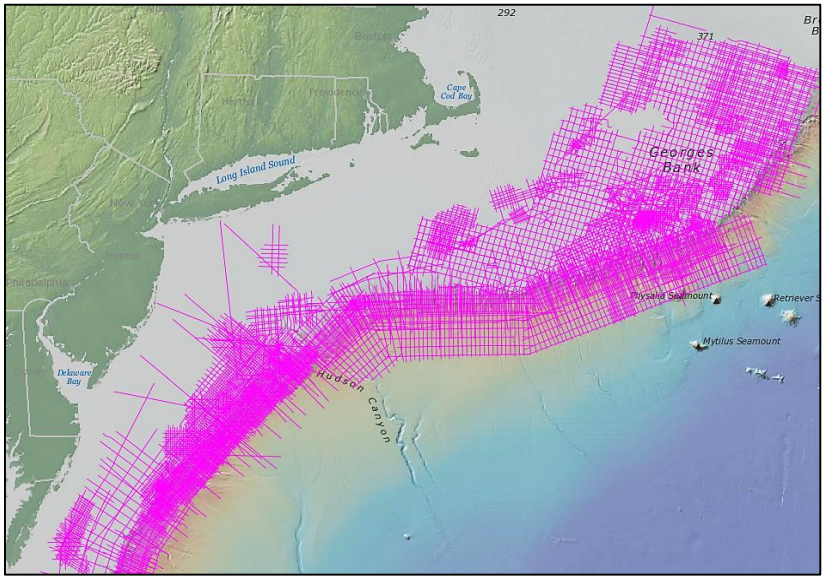
Seismic Integration and Reprocessing

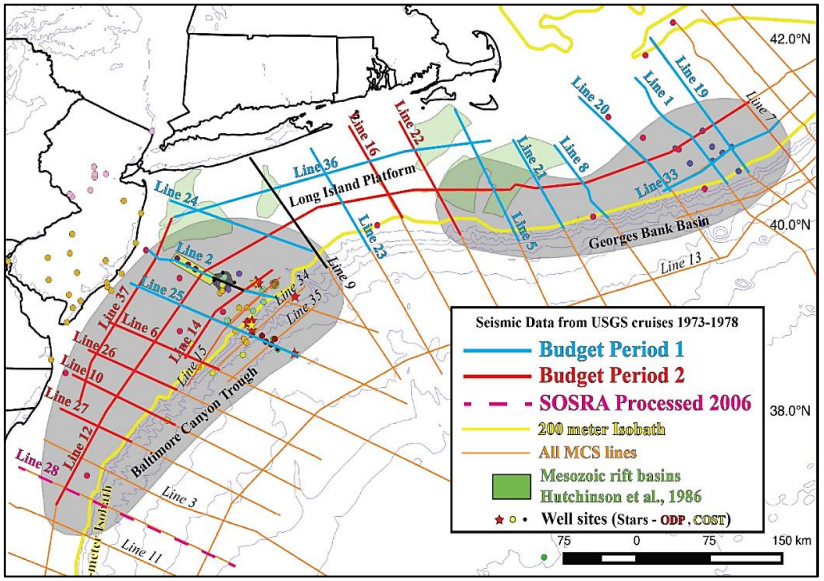
Seismic data is being used to constrain formation geometry, continuity, and geologic structures

Dense grid of existing USGS lines & newly released lines by BOEM



Grid of available seismic lines (pink) in the study area (from walrus.wr.usgs.gov/namss/search/)

Reprocessing 4,000 km of seismic with modern techniques to enhance resolution



Map showing the reprocessing plan for seismic lines in the study area. Approximately 2,000 km have been reprocessed to-date.

Time-to-depth conversions are being established via integration of seismic with sonic logs, density logs, velocity & checkshot data from 28 wells

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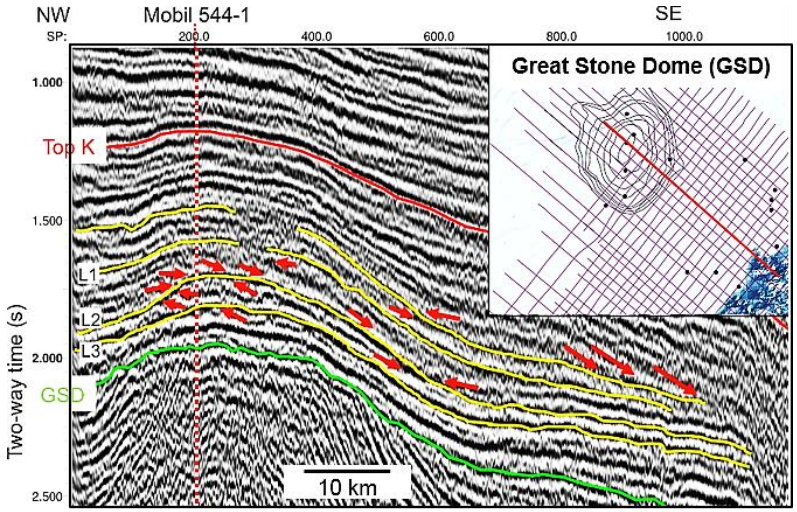
Geologic Characterization

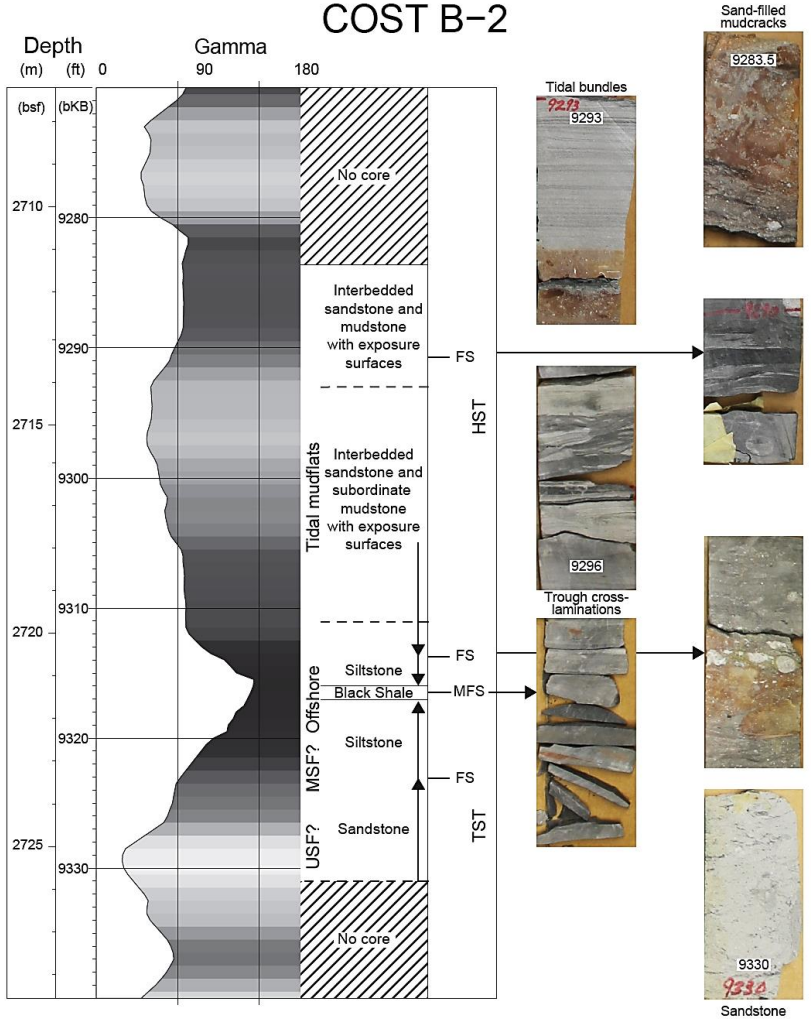
Subtidal, supratidal, & deltaic deposition of Cretaceous sequences corroborated by core, log, and seismic data

Chronostratigraphic surfaces are traceable for 67 km in GBB and ~80 km in BCT

Four sequence boundaries identified in mid-Cretaceous sediments in northern BCT; **thick (≥10 m) sand units well-defined & predictable**



Interpreted seismic profile through the Great Stone Dome in the northern BCT showing terminations (red arrows) and sequence boundaries (yellow lines). Inset location map shows profile as red line.



Sequence stratigraphic interpretation based on correlation of gamma ray log signatures with core facies (Miller et al., submitted).

FS: flooding surface; TS: transgressive surface; MFS:Maximum Flooding Surface; TST: Transgressive Systems Tract; HST: Highstand Systems Tract

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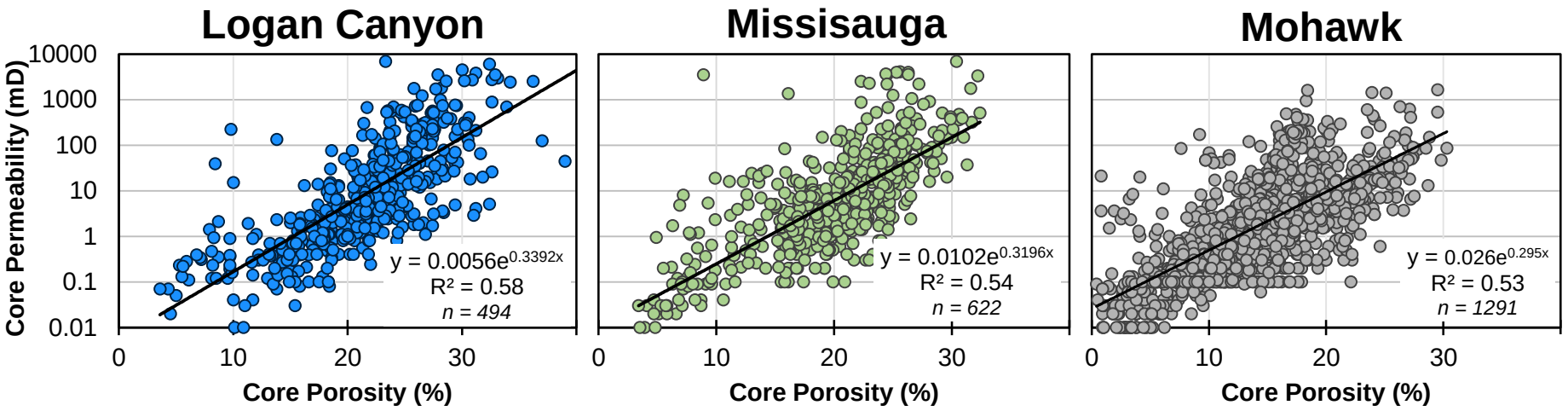
Geologic Characterization

Core & log data indicate deep saline formations have reservoir potential & occur at depths suitable for storage



	Logan Canyon	Missisauga	Mohawk
Depth[a]:	2,208 - 9,561 ft.	3,583 - 10,639 ft.	4,924 - 15,082 ft.
Thickness[a]:	174 - 2,227 ft.	553 - 4,542 ft.	5274 - 7,742 ft.

Seal Characteristics[a]

Depths: 996 – 13,591 ft.

Thicknesses: 50 – 4,116 ft.

a. Based on lithostratigraphic tops from 41 wells in the study area

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Future Work

- Risk Factor Analysis
  - **Perform initial assessment of CO_2 storage risk factors in study area:** faults, slope stability, environmental/ecological zones, existing use & infrastructure
- Storage Resource Calculations
  - **Calculate & map Prospective CO_2 Storage Resource** of deep saline formations in sub-regions (e.g. BCT; GBB)
  - **Refine calculations at select locales** regional observations & data density to guide site selection (e.g. GSD)
  - **Use DOE-NETL CO_2-SCREEN tool** for stochastic, grid-based calculation

Storage Efficiency Input				
Efficiency Parameter	Auto-populated		User Specified	
	P_{10}	P_{90}	P_{10}	P_{90}
Net-to-Total Area	0.20	0.80	0	0
Net-to-Gross Thickness	0.21	0.76	0	0
Effective-to-Total Porosity	0.62	0.78	0	0
Volumetric Displacement	0.18	0.63	0	0
Microscopic Displacement	0.39	0.82	0	0

Physical Parameter Input					
Grid Cell #	Area (km^2)	Gross Thickness (m)		Total Porosity (%)	
	Mean	Mean	Std Dev	Mean	Std Dev
1	203	29	0	5.8	0
2	203	38	0	5.8	0
3	203	47	0	5.2	0
4	115	40	0	3.2	0
5	203	26	0	5.4	0
6	203	28	0	5.8	0
7	203	51	0	3.5	0
8	203	71	0	3.4	0
9	203	50	0	2.2	0
10	203	37	0	0.7	0

GCO_2 Results (Mt)			
Grid Cell #	P10	P50	P90
1	2.1	8.4	25.0
2	2.8	10.9	32.4
3	3.1	12.2	36.2
4	0.9	3.6	10.6
5	1.7	6.9	20.4
6	2.1	8.2	24.2
7	2.2	8.8	26.0
8	3.0	11.7	34.6
9	1.4	5.5	16.4
10	0.3	1.4	4.0
Summed CO_2 Total (Mt)	P10	P50	P90
	564	1873	4517

Screenshot of DOE/NETL CO_2-SCREEN tool, available at https://edx.netl.doe.gov/ (Sanguinito et al., 2016)

Important Outcomes

Provide technical information on CO_2 storage capacity and best practices to support policy and business decisions

- Characterization of regional geology
- Development of a Mid-Atlantic offshore database/data repository
- Establish Prospective Storage Resource estimates for study area
- Assessment of offshore storage risks

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It can be done

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