Southeast Regional Carbon Storage Partnership: Offshore Gulf of Mexico (DE-FE0031557)

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- 16 U.S. States and Two Territories
- Each jurisdiction represented by the governor, a legislator from the House and Senate, and a governor’s alternate
- Federal Representative appointed by U.S. President
- Secretary, who serves as Executive Director

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SSEB Mission Statement
Offshore Partnership - Overview

• Establishing the knowledge base required for secure, long-term, large-scale, subseafloor storage of CO₂ with or without enhanced hydrocarbon recovery
Offshore Partnership – Student Participation

PhD
• Mohamed Abdelaal – storage capacity estimation
• Refaat Hashish – thermal monitoring and injection profiling

PhD
• Joshua Ademilola – seismic interpretation and characterization
• Rupom Bhattarjee – data analytics
• Justin Spears – mapping and seismic interpretation

PhD
• Charlie Schlosser – numerical modeling of faults

MSc
• Lars Koehn – reservoir modeling

MSc
• Kodjo Botchway – data analytics
• Xitong Hu (graduated) – data analytics
• Seyi Sholanke (graduated) – seismic interpretation
Project Timeline

Spring of 2018
- Implemented the project management plan, hosted the project kickoff meeting with partners, began assessing available information within the project area.

Spring of 2019
- Identify data gaps in the region and complete regional characterization milestone.

Fall of 2020
- Hosted offshore CO₂ storage workshop, completed report on resource characterization for the study area, completed parametric study, developed white paper explaining SAS Viya platform.

Summer of 2020
- Developed report on representative storage opportunities, white paper outlining optimum commercial strategies, hosted virtual Joint Partnership meeting with GoMCarb.

Summer of 2021
- Hosted 2022 Joint Partnership Meeting in New Orleans, hosted Regulator Workshop, developed dynamic models for representative opportunities, evaluated commercial risks.

Summer of 2022
- Hosted 2022 Joint Partnership Meeting in New Orleans, hosted Regulator Workshop, developed dynamic models for representative opportunities, evaluated commercial risks.
Offshore Partnership - Overview

1. Characterization
2. Modeling
3. Risk Identification

- Onshore pipeline inlet connections to offshore CO2 transport network.
- Estimated 239 MMmt/y CO2 inlet capacity for offshore CO2 transport pipeline network.
- For comparison, 680 MMmt/y CO2 emissions from gulf state industrial and power plants.

4. Infrastructure
5. Legal and Regulatory

CO2 Capture

SECARB: Offshore
Characterization

- Building on the foundation established by the Southeast Offshore Storage Resource Assessment (SOSRA)
- Targets are largely Miocene through Pleistocene
- Structure in the region related to either growth faulting or salt tectonics
- Static capacity estimates suggest >4 Gt contingent storage resource in depleted reservoirs, and >400 Gt in saline
**High-Level Screening**

- BOEM Sands database was curated and integrated into SAS Viya to screen for prospective storage opportunities
- Screening included pressure, temperature, porosity, and permeability
- Initial screening revealed prospective areas in the Mississippi Canyon and Green Canyon protraction areas

Reservoir pressure for sands located in central Gulf of Mexico. Sands approaching lithostatic have little headroom for CO₂. Graphic courtesy of OSU.
Reservoir Modeling - Saline

- Three sites identified as part of initial screening of Louisiana State Waters
  - Lake Pontchartrain
    - Lower Miocene shore zone, storage zone is 207 feet thick, 1.45 MMT/mile$^2$
  - South Marsh
    - Middle Miocene fluvial, storage zone is 262 feet thick, 1.73 MMT/mile$^2$
  - West Cameron
    - Lower Miocene fluvial, storage zone is 2,900 feet thick, 21 MMT/mile$^2$
Reservoir Modeling – Depleted Reservoir

• The selected geologic model for this study is a model developed for the Horn Mountain oil field (Mississippi Canyon 126) in Central Gulf of Mexico, approximately 80 miles from onshore Louisiana.

• As of the end of February 2022, over 40% of the Horn Mountain original oil in place has been produced.

• Good candidate for deep water, straight CO₂ storage.

Map illustrating the location of the Horn Mountain Field in the northeast corner of the Mississippi Canyon Protraction Area.
Reservoir Modeling – Depleted Reservoir

- Horn Mountain includes two stacked Middle Miocene sands – the M Sand and the J Sand
- M Sand is a uniform anticlinal structure with bounding faults to the north and east
- Geologic model $\Rightarrow$ reservoir model $\Rightarrow$ history matching

**Scenario:**
- Four production wells converted to injectors
- Injected 2,650 tons per day per well for 30 years

**Post Injection**
- Plume area: 11 square miles
- Dynamic storage capacity: 10.3 MMT/mile$^2$

**50 Years Post-Injection**
- Plume area: 12 square miles
- Dynamic storage capacity: 9.5 MMT/mile$^2$
Storage and Operational Risk

- Developed a risk registry that considers operation risks including (1) subsurface risks; (2) regulatory risks; (3) infrastructure risks; (4) MVA risks; (5) commercialization risks; and (6) public perception.
- MVA risks evaluated by the project team include above zone monitoring near leaky legacy well.

Above zone monitoring technique utilizing the dynamic model generated for the South Marsh Island area in the state waters of Louisiana. Here, an above zone monitoring well is located north of a leaky legacy well. Figure courtesy of Mehdi Zeidouni of LSU.

Above zone monitoring well pressure change detected from leaky legacy well to the south for three different permeability scenarios. Figure courtesy of LSU.
Evaluating Existing Infrastructure

Screening Methodology

- **Status** – identify active pipelines vs decommissioned/shut-in/removed
- **Type** – identify oil & gas pipelines vs water/service/other
- **Age** – identify pipelines constructed after 1980
- **Size** – minimum 8” diameter (roughly 1 MMmt/y capacity)
- **Operating Pressure** – minimum of 1,600 psi capability
- **Network** – continuous link from onshore inlet location

- All pipelines currently in-place
- All types
- Total Segments: 4,766
- **Total Length: 16,441 mi**
- Installed between 1948 - 2020

Lafayette
New Orleans District
Houma District
Evaluating Existing Infrastructure (cont.)

- 239 MMT CO₂ inlet capacity at 10 onshore pipeline connections
- A total of 391 MMT of CO₂ storage capacity in 31 depleted oil reservoirs
- 82 pipeline segments totaling 1,784 miles
- 125 offshore platforms; 6 scheduled for abandonment
Regulator Interactions

- Hosted May 16 Regulator Workshop in collaboration with GoMCarb
- AL, AR, and MS interested in primacy (consolidating authority)
- Lots of industry interest in LA and TX
- BOEM and BSEE developing regulations as required by the bipartisan infrastructure law
- Class VI well construction, permitting depleted oil and gas fields, and AOR definition
Other Activities

1. Legal and Regulatory
   Developing a conceptual flow diagram that includes legal and regulatory considerations for project developers

2. Infrastructure
   Developing subsea completions for CO₂ processing from natural gas fields

3. Risk
   Developing models to evaluate CO₂ pressure plume interaction with local structural features (e.g., salt diapirs)
Moving Forward

• Continue to import available seismic data, refine geologic characterization and static capacity estimates
• Refine representative models for saline storage, depleted reservoir storage
• Assess infrastructure reuse scenarios and incorporate project cost estimates
• Build out legal and regulatory framework for project developers and assist BOEM and BSEE where appropriate
Thanks!

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