"GoMCarb” Partnership”
Offshore Gulf of Mexico Partnership for Carbon Storage Resources and Technology Development
Cooperative Agreement: DE-FE0031558

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U.S. Department of Energy
National Energy Technology Laboratory
Addressing the Nation’s Energy Needs Through Technology Innovation – 2019 Carbon Capture, Utilization, Storage, and Oil and Gas Technologies Integrated Review Meeting
August 26-30, 2019
Presentation Outline

• Offshore storage portfolio
• Partners and collaborators
• Storage resource status
• Risk assessment - blowouts
• Monitoring
• Knowledge sharing – stakeholder surveys
Global and US Offshore storage portfolio
Global and US Offshore storage Status

Studies
Project Plans
Injection under way
Partners and collaborators

1.0 Management
GCCC Univ of Texas

Task 2.1 characterization
GCCC -UTIG- GDBS
–LA GS –

Task 2.2 Data Gap Assessment
Fugero
TDI-Brooks

Task 2.3 Offshore and reservoir storage EOR potential
BEG- Nunez
USGS

Task 3.1 Risk
LBNL –LLNL -

Task 3.2 Geologic Modeling
GCCC - UT
Petroleum Geosystems Engineering

Task 3.3 Risk
LBNL –LLNL -

Task 4. MVA
GCCC Lamar University – LBNL – Rice U
FUGRO GERG

Task 4. MVA
GCCC Lamar University – LBNL – Rice U
FUGRO GERG

Task 5.1 CO₂ Transport and delivery
Trimeric AKER

Task 5.2 Scenario Optimization
GCCC

Task 5.3 Communication
GCCC

Task 6.1 Stakeholder Outreach
UT Comm Dept

Task 6.2 Technical Outreach
GCCCTrimeric – Source outreach

Task 6.3 Advisory Panel
IEA GHG UK
BOEM US
Exxon Mobil
Shell UK
IEA Paris
Carbon Net Au
Guangzhou China
Edinburgh UK
RITE Japan
SENER – Mexico
PEMEX Mexico
CATF Env NGO
Sandia NL
Finley
South Africa
NOK- UK

State or University Participant
Federal participant
Commercial participant

Partners and collaborators
Dense data

GDBS seismic lines

GDBS Well data
Dense data

3-D surveys loaded

Gulf of Mexico

Texas

Louisiana
Paleogeography and principal depositional systems of the Middle Miocene depositional episode

Stacked reservoirs separated by mudrocks
Focused near current coast
Arealy extensive

Galloway et al., 2005
Collaboration with Dr Robert Finley
Storage Resource Assessment status

High Island analog studies

200 Miles
320 Kilometers
Initial look at newest survey – TX OBS (mid-Texas Coast)

Seismic data owned by SEI, Inc. Interpretation is that of the Bureau of Economic Geology.
Chandeleur Sound, LA
Gulf Basin Depositional Synthesis, UTIG

Seismic data owned by SEI, Inc. Interpretation is that of the Bureau of Economic Geology
High Island Analog studies

Explanation
- Transparent yellow: closures (max column 50m)
- White lines: fetch area boundary for each closure
- Brown: state fields
High Island Prospect Evaluation
Analogs
High Island prospect studies: Three-D models
High Island Fault Studies
Risk Assessment – Faults

Josh White, LLNL
Reprocessing High Resolution

Ye Feng BEG
Risk Assessment of Offshore CO$_2$ Wells and Pipelines

Curtis M. Oldenburg, Lehua Pan, Yingqi Zhang, and Quanlin Zhou (LBNL)

- Offshore GCS needs sub-sea risk assessment
- For the GoMCarb project, we are coupling three existing models to understand consequences of offshore CO$_2$ leaks and blowouts
  - T2Well for reservoir-well flow
  - TAMOC for jet and buoyant plume flow in the water column
  - NRAP MSLR for atmospheric dispersion
To understand effects of water column (depth), we simulated a large CO$_2$ blowout (~35 kg/s) for two cases

Case I (50 m depth)  
- Preliminary results show
  - Median bubble size is ~0.5 mm
  - 99% of the CO$_2$ is dissolved in the seawater for a blowout at 50 m depth (v. little surface emission)
  - 94% of the CO$_2$ is emitted at the sea surface for a blowout at 10 m depth (v. little dissolution)
  - The CO$_2$ concentration in air reduces by a factor of 100 within 0.5 km of the emission site in the 10 m case under light wind (1 m/s at 10 m elevation).

Case II (10 m depth)  
- CO$_2$ transitions from jet to buoyant plume and mostly dissolves during rise in 50 m case  
- CO$_2$ mostly jet-like in 10 m case with very little dissolution
Offshore Monitoring

• Adaption of global experience to GoM Conditions
  – STEMM CCS, Northern Lights, Tomakomai

• Pipelines – Daniel Chen. Lamar Univ.

• High resolution seismic
  – Improved skills from Tomakomai

• DAS in this setting – Jonathan Ajo Franklin (Rice University)
Infrastructure

Darshan Sachde, Ray Mc Kaskle, Katherine Drombrowski, Trimeric

• 10-L Existing well analysis – 33 wells
  – Diameters 5.5” to 10.8”
  – Depth 5,800 to 14,000 ft
  – Key risk, any value?

• Two existing pipelines in 10-L
  – Assess suitability for retrofit

• Future Aker Solutions
  – Options for new well completions
Knowledge Sharing

American Beach and Shore Preservation Association

Events hosted at Lamar University, Beaumont: Joint project meetings, Community interactions

Cheniere LNG plant
600,000 -1,000,000 MMT CO$_2$
Low CCS awareness. Around 10% among people in the U.S (Boyd et al., 2017); 67% knew very little about CCS (Kahlor et al. 2017)

Climate change. Perceive as an environmental risk, seriousness → higher support (Selma et al. 2014)

Trust. Trust varied by different information source (e.g., lower trust government and oil & gas industry, higher trust university scientists) (Kahlor et al. 2017)

Benefits and risks perception. Impacts CCS support/opposition (Huijtes et al. 2007; Tokushige et al. 2007; Wallquist et al. 2012)

Misconception. Based on past experiences (e.g., similar industries, capture processes, etc.), and inaccurate info (Ashworth et al., 2015)
How to create messages that resonate with stakeholders in Coastal Areas

- Data collection in Port Arthur area July, 2019
- Early messages
- Jobs/clean industry
- Hurricanes/flood

U.S Fish and Wildlife
Lamar University
Big Thicket Association
Texas Point Nat’l Wildlife Refuge
McFadden Nat’l Wildlife Refuge
Coastal Fisheries (TPWD)

Sea Rim State Park
Community In-Power and Development Ass. Inc.
International Seafarers Ass.
Realtors, lawyers
Accomplishments to Date

– Mapping analog sites at level of detail needed to advance toward real projects.
– Broaden coverage in basin
– Begin assessments of fault risk
– Complete initial blowout risk assessment
– Begin knowledge sharing
– Begin stakeholder engagement work
Lessons Learned

– Dense data requires strategic approach to support rapid progress: use detailed “analog” sites to probe deeply into data needs.

– Infrastructure evaluation remains challenging – data are incomplete and scattered

– Shallow water near-shore setting is different from deeper offshore settings – e.g. blowout response
Synergy Opportunities

– Strong global opportunities to leverage US efforts

– Possibility for US leadership in future.

– Collaboration with SECARB offshore and groups working offshore Atlantic and Pacific
Next Steps

– Project in full swing
– Continued characterization of regions followed by analog sites
– Modeling efforts –esp. fluid flow and geomechanics will be a next step
– Shallow-Gulf specific risks, monitoring, and infrastructure.
Appendix
Benefit to the Program

- Determining the CO$_2$ storage resource potential of offshore oil, gas, and saline bearing formations.
- Improving carbon storage efficiency and security by advancing new and early-stage monitoring tools and models.
- Improving capabilities to evaluate and manage environmental risks and uncertainty through integrated risk-based strategic monitoring and mitigation protocols.
- Disseminating findings and lessons learned to the broader CCS community and key stakeholders.
Project Overview:
Goals and Objectives

• The primary objective of this FOA is to develop an Offshore Carbon Storage Partnership that is similar in structure to the existing RCSPs Characterization Phase, but is focused on sub-seafloor saline or hydrocarbon reservoir-associated geologic storage.
• Assemble the knowledge base required for secure, long-term, large-scale CO₂ storage, with or without enhanced hydrocarbon recovery.
• Identify and address knowledge gaps, regulatory issues, infrastructure requirements, and technical challenges associated with offshore CO₂ storage.
GoMCarb Organizational Chart
# Gantt Chart

## Partnership for Offshore Carbon Storage Resources and Technology Development in the Gulf of Mexico

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G = Quarterly Report; A = Annual Report; M = Milestone; DP = Decision Point; D = Deliverable; G-NG = Go/no-go decision point; FI = Final Report