Carbon Sequestration Opportunities and Science Needs in Federal Waters in the Gulf Coast

Dr. Sally M. Benson

Deputy Director For Energy and
Chief Strategist for the Energy Transition
Office of Science and Technology Policy
Executive Office of the President

Committee on Ocean Science and Assessment
National Academy of Sciences and Medicine
July 14, 2022

Congress Has Authorized the Use of The Outer Continental Shelf for Geological Sequestration of CO_2

- The Bipartisan Infrastructure Law provides the Secretary of the Interior the authority to grant a lease, easement, or right-of-way on the Outer Continental Shelf (OCS) for long-term sequestration of carbon dioxide that would otherwise go into the atmosphere and contribute to further climate change.
- Not later than 1 year after the date of enactment of this Act, the Secretary of the Interior shall promulgate regulations to carry out the amendments made by this section.
- Bureau of Ocean Energy Management (BOEM) and the Bureau of Safety and Environmental Enforcement (BSEE) are working together to draft regulations for public comment before November 2022.

Source: P.L. 117-58 (November 15, 2021). Sec. 40307, Geologic Carbon Sequestration on the Other Continental Shelf.
https://www.congress.gov/bill/117th-congress/house-bill/3684/text

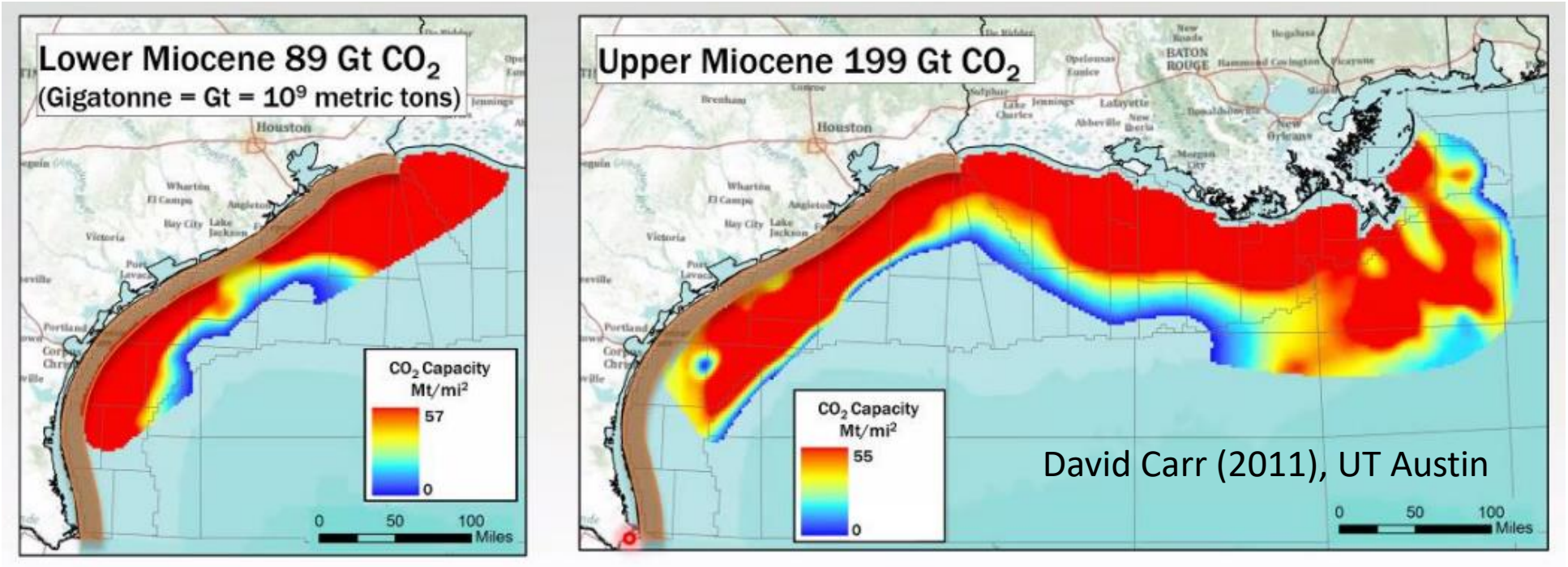
Joint BOEM and BSEE Rulemaking will address safety, environmental, and operational issues

- Financial and economic considerations
- Environmental considerations
- Pre-lease exploration/site characterization
- Leasing, Plans, and Liability
- Operations, facilities, and pipelines,
- Well qualification and offset infrastructure
- Emergency response and mitigation
- Monitoring, reporting, and decommissioning

Source: BOEM, Offshore Carbon Storage, May 19, 2022. https://www.boem.gov/sites/default/files/documents/about-boem/regulations-guidance/BOEM-5th-International-Conference.pdf

Off-Shore Gulf Sequestration Resource

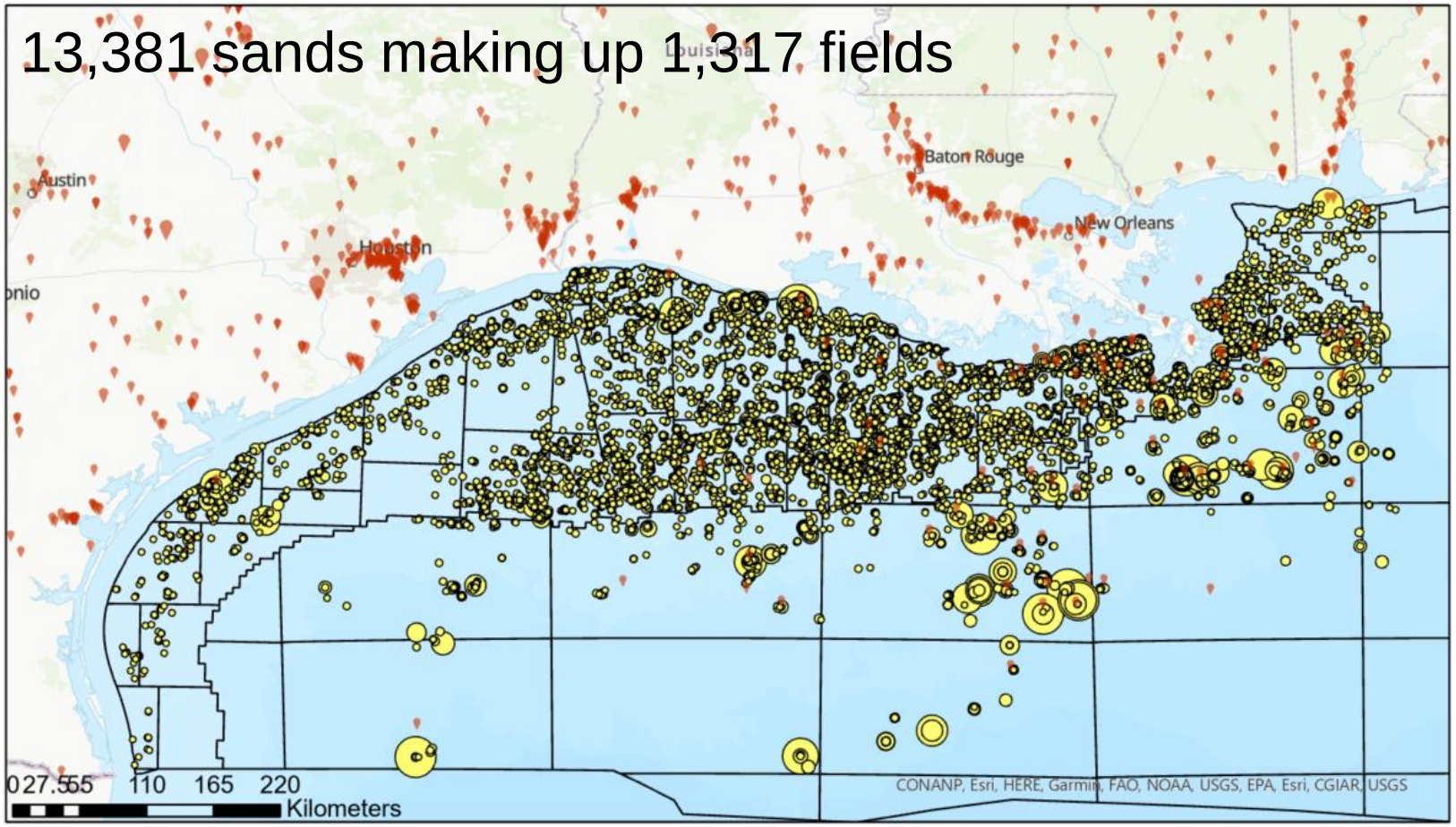
Estimated Saline Aquifer Storage Potential In Federal Waters



This resource is likely to have the capacity sufficient to sequester all the CO_2 we need between now to 2100 from point sources (CCS) and carbon dioxide removal (CDR) – based on the National Long Range Climate Strategy (~ 1 Gt/yr).

Source: https://www.beg.utexas.edu/files/gccc/research/goi/2022/5.4_IP_BOEM_Mike%20Celata_5th_International_Conf%20on%20CCUS_5_19_2022.pdf
Source: https://www.whitehouse.gov/wp-content/uploads/2021/10/US-Long-Term-Strategy.pdf

Bureau of Ocean Energy Management: A Wealth of Data



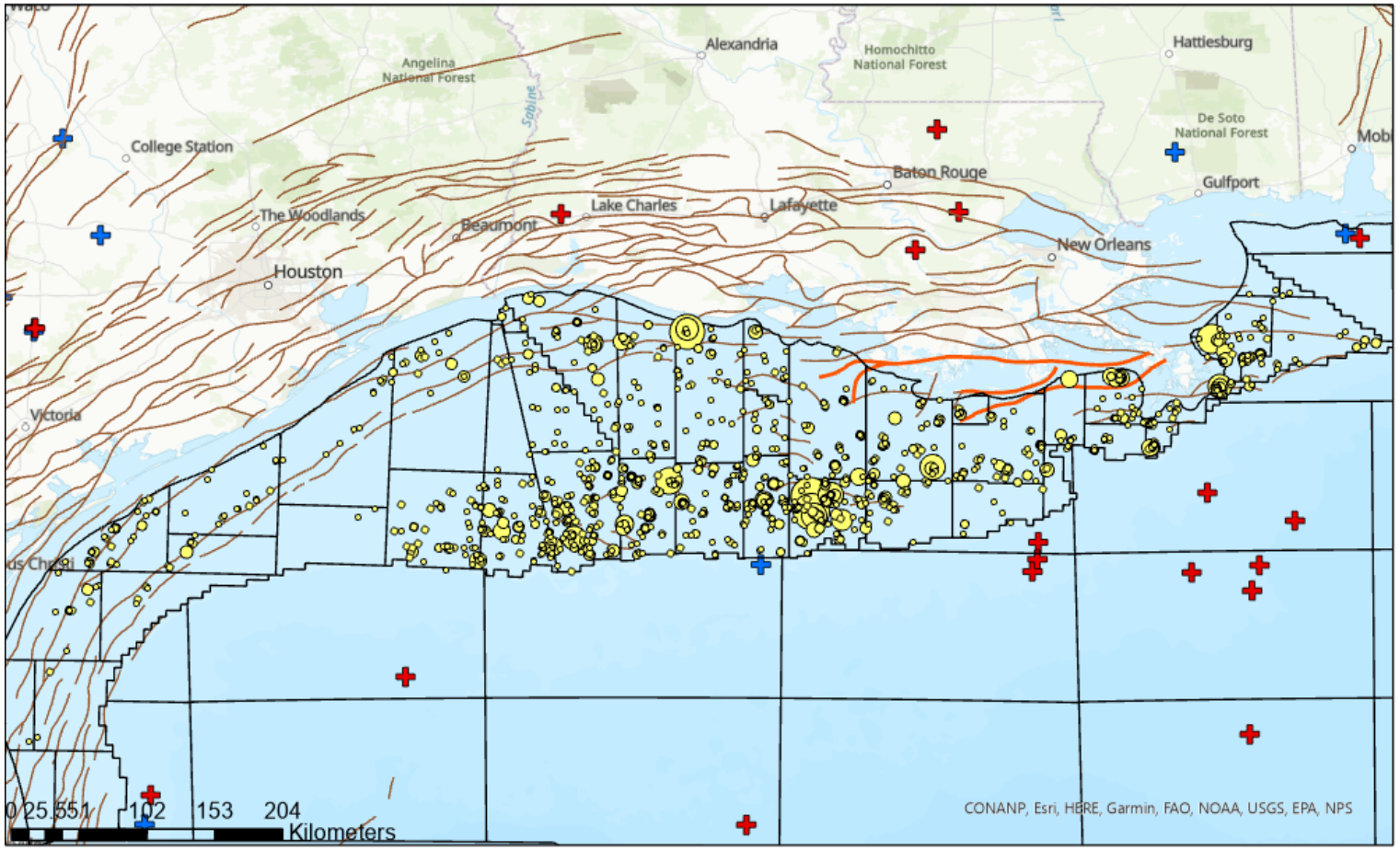
Source: Callas et al., Applied Energy, 2022.

Screening For Optimal Sites In Depleted Reservoirs

Capacity and Injection Optimization	• Finds a site that meets the necessary storage capacity and reservoir characteristics using favorable injection conditions
Retention and Geomechanical Risk Minimization	• Minimize the occurrence and potential impact of CO_2 migration and leakage from the site • Examines characteristics of top seal, potential leakage pathways such as faults in addition to other potential hazards to the storage site
Siting and Economic Constraints	• Studies the potential impact to surface and subsurface environments • Considers economic factors that might make a site less economically attractive than another

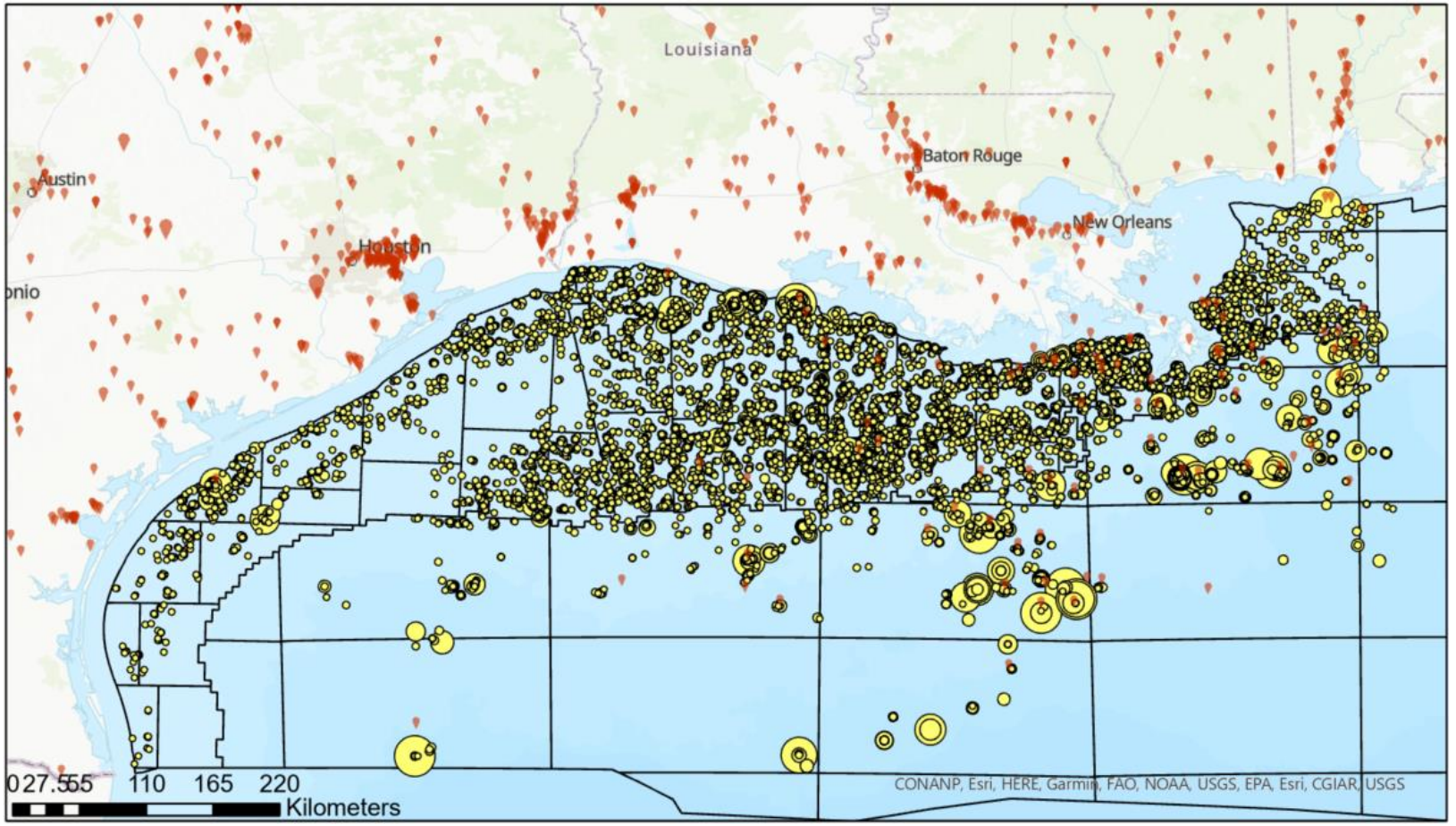
Source: Callas et al., Applied Energy, 2022.

Many Sequestration Options In Depleted Fields After Screening Sites



Source: Callas et al., Applied Energy, 2022.

In Spite of an Enormous Amount of Data, Saline Formations Remain Poorly Characterized: More Characterization Is Needed

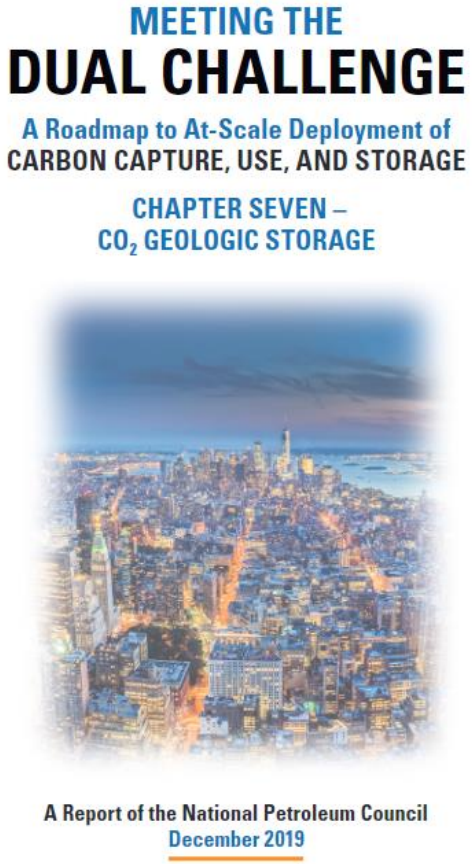


Source: Callas et al., Applied Energy, 2022.

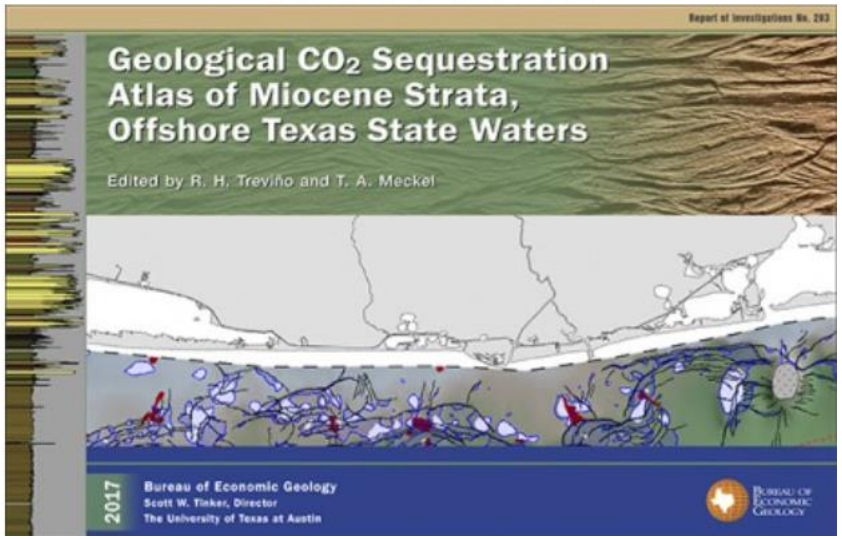
Research and Development Needs Unique To the Gulf Coast

- CO_2 plume migration and footprint in high permeability sediments
- Efficient and effective characterization for saline aquifer sequestration formations in offshore environments
- Geomechanical response to CO_2 sequestration in compartmentalized reservoirs in “soft sediments”
- Geomechanical response of highly depleted fields to pressure buildup caused CO_2 sequestration
- Risks of leakage from legacy wells in “soft sediments”
- Risks of CO_2 sequestration in overpressure formations
- Long term geochemical interactions with carbonate-rich sediments (mineralization potential and impact on seals)

Some Resources



https://dualchallenge.npc.org/files/CCUS-Chap_7-030521.pdf



https://store.beg.utexas.edu/reports-of-investigations/3415-ri0283-atlas.html

Stage 1
Site Screening
Screen many potential sites and eliminate those that do not meet qualifying criteria

Stage 2
Site Ranking
Identify and score potential sites using readily available criteria

Stage 3
Site Characterization
Selection of suitable sites using detailed characterization

Optimal depleted reservoir

Criteria and Workflow for Selecting Depleted Hydrocarbon Reservoirs for Carbon Storage, Callas et al., Applied Energy, 2022.

Main Points

- Off-shore storage has many advantages compared to onshore storage
- Gulf-Coast has a world-class CO_2 sequestration resource
  - ✓ Co-located with a large number of industrial emission sources
  - ✓ Sequestration capacity estimated to be ~ 300 Gt CO_2
- Enormous amount of BOEM and private sector data to characterize oil and gas field – and generally characterize the geology of the region
- Research and development should address unique characteristics relative to other sequestration resources, some of which are advantageous, others are challenging