SSEB Overview and Current Projects

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“Through innovations in energy and environmental policies, programs and technologies, the Southern States Energy Board enhances economic development and the quality of life in the South.”

- SSEB Mission Statement

- Established 1960 and expanded in 1978
- 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
Key Issues for states

- Appalachian Storage Hub
- 45Q (CCUS tax credits)
- Hydropower relicensing
- Hurricane support to states
- Workforce development & training
Key Issues in the Shifting Energy Game Board

- Impact of hurricanes on major energy resources
- Regional fuel waivers during major natural disasters or supply disruptions
- Appalachian energy/storage hub
- SECARB / Petra Nova emergence of CO$_2$-EOR in region
- Industrial CCUS in the South
- Project ECO$_2$S and Regional CO$_2$ Storage Complex
- Nuclear faces cold reality in the South
- Recent rulings on Atlantic Coast and Mountain Valley pipelines
- DOE – Grid Reliability and Resiliency Markets
- Subsidies to meet state GHG goals and retain baseload power plants
- Rollback of Clean Power Plan and implications for SSEB states
- Fracking infrastructure impacts – land use, water, transport
- Infrastructure Funding – what it might mean in the South
• $10 + Billion infrastructure project
• Creates opportunity for chemical and downstream sectors to grow, creating economic revitalization of Appalachia
• Shale gas revolution has delivered low cost energy & feedstock
• Downstream chemical investments have increased 50%
• Shell’s ethane cracker is multi-billion dollar investment
• Storage hub necessary to support development of full regional systems
• Support for the project includes recent U.S. Chamber of Commerce letter to Energy Secretary Perry
• Senator Capito (WV) introduced Appalachian Energy & Manufacturing Infrastructure Revitalization Act of 2017 in June, 2017 (S.1340)
SECARB CCUS Demo

- SSEB’s SECARB Demo at Plant Barry (Bucks, AL)
- 25 MW post-combustion slip-stream carbon capture
- 12 mile pipeline to Citronelle, AL for storage
- Potential for EOR
SSEB Demo Goes Commercial!

- NRG Energy (Houston, TX)
- Interest in Plant Barry Demonstration
- Plant scale-up to 240 MW
- Post-combustion slip-stream
- Captures 5,200 tons CO₂/day or 90% of CO₂
- Pipeline to Petra Nova West Ranch Oil Field (81 miles)
- EOR 300 bbls/day to 15,000 bbls/day!
- 60 million bbls Recoverable Reserves
Project ECO₂S: Pursue key advances in CO₂ storage knowledge & technology, including optimizing CO₂ storage efficiency, modeling the fate of injected CO₂, and establishing residual CO₂ saturations. Project ECO₂S will involve “real-life” experiences, issues, and challenges of scaling-up from its regional, pre-feasibility assessment of CO₂ storage to establish a site-specific, commercial-scale CO₂ storage facility, including capturing “lessons learned”

- **CarbonSAFE Program Goals**: Develop a commercial-scale integrated CCS storage complex
- **CarbonSAFE Program Phases**:
  - Phase 1. Integrated CCS Pre-Feasibility Study
  - **Phase 2. Storage Complex Feasibility Study**
  - Phase 3. Site Characterization
  - Phase 4. Permitting & Construction
- Advanced Resources International, Inc.
- Auburn University
- Battelle Memorial Institute
- Geological Survey of Alabama
- Gerald R Hill PHD, Inc.
- GHG Underground
- Lawrence Berkeley National Laboratory
- Los Alamos National Laboratory
- Loudon Technical Services, LLC
- Mississippi Power Company
- Mississippi State University
- Oklahoma State University
- Pashin Geoscience, LLC
- Southern Company
- Trimeric Corporation
- University of Alabama at Birmingham
- University of Wyoming
- Virginia Polytechnic Institute and State University, Virginia Center for Coal and Energy Research
• Characterize offshore CO₂ storage opportunities and conduct a volumetric analysis
• Model offshore CO₂ storage to identify well and reservoir configurations that are capable of meeting the goal of 30 megatonnes or greater storage in key focus areas
• Develop best practices to advance the state of knowledge while reducing the cost of storage operations
• 3 Planning Areas: Mid-Atlantic, South Atlantic, and Eastern Gulf of Mexico
SECARB Offshore

- Expands membership of the Southern States Energy Board’s (SSEB) existing Gulf of Mexico (GOM) government-industry partnership to focus on assembling the knowledge base required for secure, long-term, large-scale carbon dioxide (CO$_2$) subsea storage, with or without enhanced hydrocarbon recovery.

- Supports DOE’s long-term objective to ensure a comprehensive assessment of the potential to implement offshore CO$_2$ subsea storage in all of the U.S. Department of Interior’s Bureau of Ocean Energy Management (BOEM) Outer Continental Shelf (OCS) Oil and Gas Leasing Program Planning areas in the GOM.

  - **Objective 1:** Combine the capabilities and experience of industry, academia, and government to develop and validate key technologies and best practices to ensure safe, long-term, economically-viable CO$_2$ storage in offshore environments.

  - **Objective 2:** Facilitate the subsequent development of technology-focused permitting processes needed by industry and regulators (i.e., Department of Interior and BOEM).

  - **Objective 3:** Collaborate with Federal and State agency programs to improve the confidence in containment of CO$_2$ in the subsea offshore environment in storage reservoirs over both short and long timeframes.

  - **Objective 4:** Provide a comprehensive assessment of the potential to implement offshore CO$_2$ storage in the defined GOM Study Area.
Table: SECARB Offshore

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<thead>
<tr>
<th>Study Area</th>
<th>Oil and Gas</th>
<th>Study Area</th>
<th>Saline Aquifers</th>
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<td>Western Planning Area</td>
<td>Depleted Oil &amp; Gas Fields, and Potentially Associated CO₂-EOR</td>
<td>Deep Saline</td>
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<td>Central Planning Area</td>
<td>Study Area is East of Houma District’s Western Boundary (includes Houma District)</td>
<td>Study Area is East of New Orleans District’s Western Boundary (excludes Houma District)</td>
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<td><strong>STATE WATERS</strong></td>
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<tr>
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<td>Alabama</td>
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<tr>
<td>Florida (West Coast)</td>
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Industrial and Commercial CO₂ Utilization Applications

- Calculated Beverages
  - Oil
  - Gas
  - EOR
  - EGR
  - ECBM
- Enhanced Fuel Recovery
  - Polycarbonate Polymers
- Fire Extinguishers
  - Blanket Products
  - Protect Carbon Powder
  - Shield Gas in Welding
- Biological Conversion
  - Algae
  - Greenhouse Gases
- Extractant
  - Flavors/Fragrances
  - Decaffeination
- Mineralization
  - Carbonates
  - Methanol
  - Urea
  - CO
  - Methane
- Refrigeration
  - Dry Ice
- Inerting Agent
  - Refrigeration
  - Dry Ice
- Miscellaneous
  - Injected into metal castings
  - Added to medical O₂ as a respiratory stimulant
  - Aerosol can propellant
  - Dry ice pellets used for sand blasting
  - Red mud carbonation
- CO₂ Utilization and Storage Acceleration (CO₂ USA) - Gulf Coast used a market-driven approach to identify opportunities to accelerate CCUS commercialization within the industrial sector.
- SSEB and DOE-FE developing roadmap and toolkit.
- Central Gulf Coast Region is prime area for Industrial-CCUS.
- Louisiana and industrial corridor along Mississippi uniquely situated to benefit from integrated CCUS System:
  - Industrial sources produce large amount of CO₂.
  - Green pipeline runs across southern Louisiana.
  - Many existing oilfields could benefit from Enhanced Oil Recovery (EOR).

*Orange = Industries  Red = Oil Fields

Source: Louisiana State University, Center for Energy Studies, 2016
• Closely related to CO₂ USA - Gulf Coast and designed to educate and inform interested parties about possible beneficial uses of CO₂ across Appalachia
• Project is comprised of three regions within Appalachia (Northern, Central and Southern).
• Within each region, specific opportunities may exist that could lead to viable business opportunities to capture and utilize existing CO₂ emissions
• Regional workshops have been held in each region to explore potential business opportunities and solicit feedback on perceived barriers to advancing these potential business opportunities
• Feedback may be used to identify additional research that could reduce existing data gaps and assist market participants in advancing potential CO₂ focused business opportunities.