CO_2 Transport and Storage - Status and Opportunities

Reducing Data Center Carbon Footprint through CCS Workshop, co-hosted by the U.S. Department of Energy (DOE) and Electric Power Research Institute (EPRI)

Richard A. Esposito, Ph.D., P.G.
R&D Program Manager – Carbon Transport & Storage
Net Zero Technologies / National Carbon Capture Center
Southern Company

Southern Company

Research, Environment & Sustainability

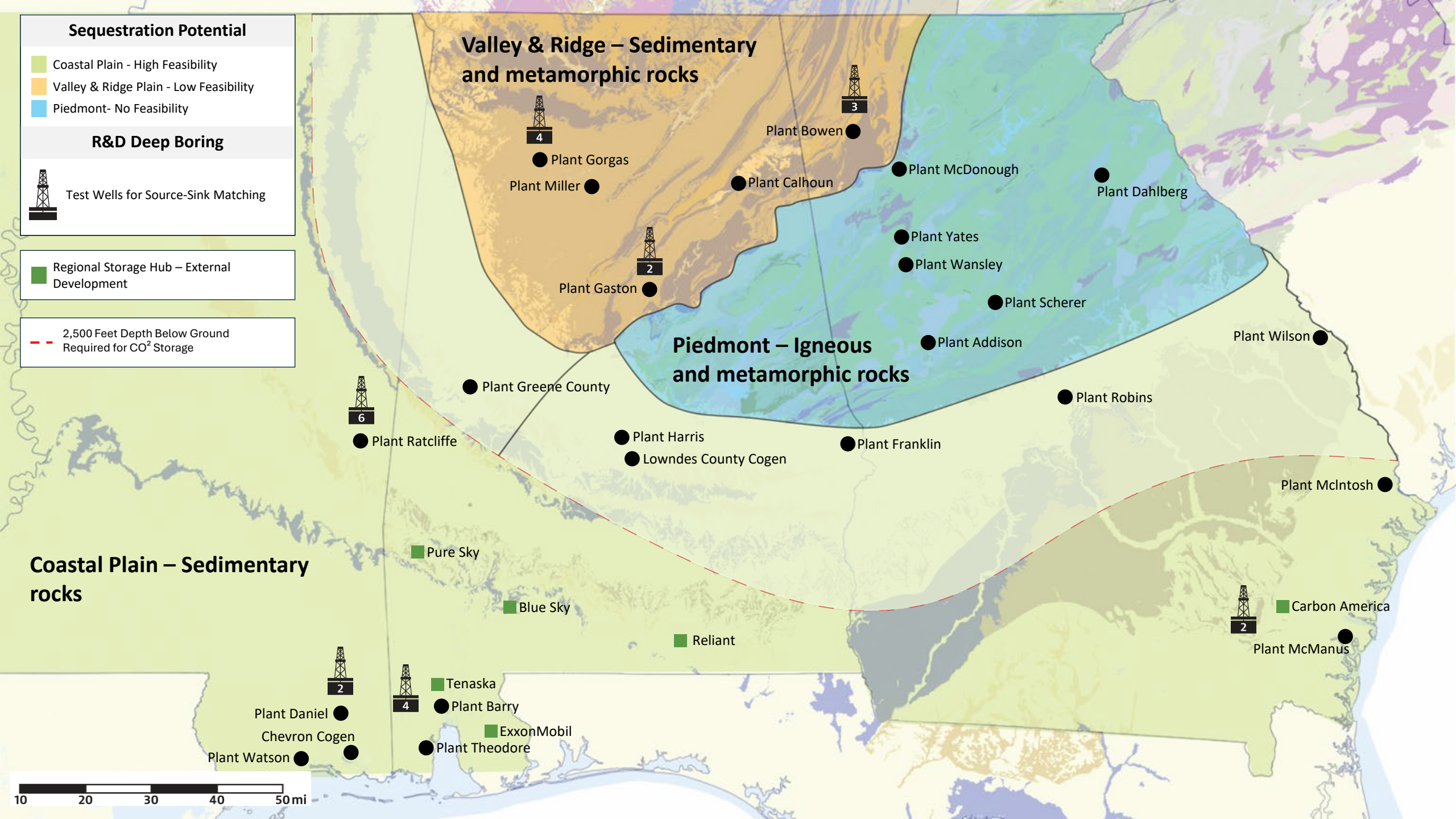
Utility perspective - Low CI Power with CCS for Data Centers

- **Everyone - educating data center developers/investors on CCS**
  - CCS projects are complex; costs, timeframes, siting, multiple participants
  - Location, location, location; capture sites with proximity to geology have potential for moving faster
  - Linear infrastructure can be hard; co-locating CO_2 pipelines with existing corridors offer pros and cons

- **Owner - understanding source to sink relationships with capture to storage**
  - Regional Carbon Sequestration Partnerships/CarbonSAFE
  - Utility self-funded characterization (whether driven by 111D or IRP or R&D)

- **Owner - welcoming third party (T&S) development to the table**
  - Early site permitting
  - Cost basis/reality with transport
  - Engagement with large landowners

- **Everyone - externalities**
  - State driven regulatory/legislative action to de-risk (or not) storage development
  - Participation in outreach & stakeholder acceptance


Sequestration Potential
Coastal Plain - High Feasibility
Valley & Ridge Plain - Low Feasibility
Piedmont- No Feasibility
R&D Deep Boring
Test Wells for Source-Sink Matching
Regional Storage Hub – External Development
2,500 Feet Depth Below Ground Required for CO2 Storage
Valley & Ridge – Sedimentary and metamorphic rocks
Piedmont – Igneous and metamorphic rocks
Coastal Plain – Sedimentary rocks
Plant Gorgas
Plant Miller
Plant Bowen
Plant Calhoun
Plant McDonough
Plant Dahlberg
Plant Yates
Plant Wansley
Plant Gaston
Plant Scherer
Plant Addison
Plant Wilson
Plant Greene County
Plant Robins
Plant Ratcliffe
Plant Harris
Lowndes County Cogen
Plant Franklin
Plant McIntosh
Pure Sky
Blue Sky
Reliant
Carbon America
Plant McManus
Tenaska
Plant Barry
Plant Daniel
ExxonMobil
Chevron Cogen
Plant Theodore
Plant Watson
10 20 30 40 50 mi

CO_2 Pipeline Installation Plant Barry CCS Demonstration

DOT 29 CFR 195 4-inch carbon steel, liquid pipeline; buried 5 feet with surface vegetation maintenance

Directional drilled 18 sections of the pipeline under roads, utilities, railroad tracks, and wetlands (some up to 3,000 ft long and 60 ft deep)

Injection operations have a small footprint, but subsurface pore space requirements do not!

Mainline valve station along pipeline

Meter station & building at Plant Barry

Horizontal CO_2 booster pump at D-9-7 #2 wellsite

D-9-7 #2 injection well

Some States are De-Risking Commercial CCS Activities

State Action

1 Clarify Oversight and Primacy

Several states have clarified regulatory oversight of CO_2 storage which is a critical step in pursuing state primacy over Class VI wells. Example: AL SB 36.

2 Pore Space Statutes

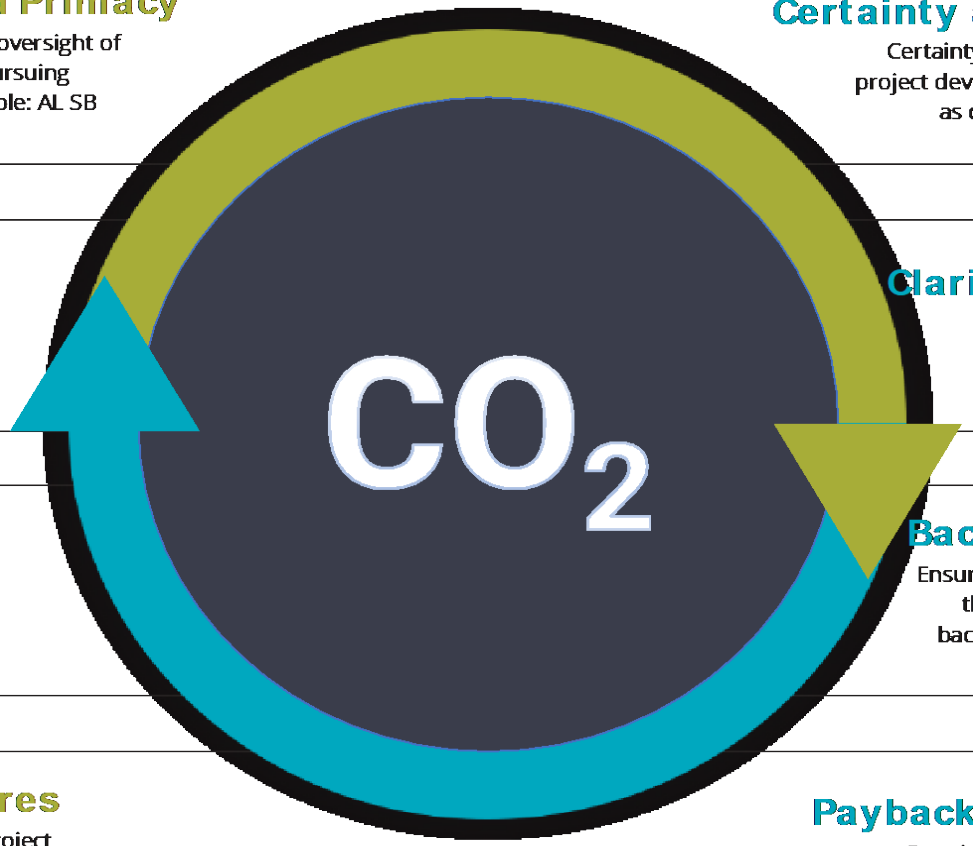
Clarify pore space ownership and establish amalgamation thresholds and procedures. Examples: AL SB 230, ND SB 2095.

3 Establish Trust Funds

Provide a mechanism to support state agencies and provide funds to support remediation if needed. Examples: LA HB 571.

4 Tax Incentive Structures

Provide a means to further incentivize project development by providing tax credits, direct support, or excluding CO_2 from sales taxes. Examples: CA LCFS, MS HB 1459, TX HB 3732.



Impact

1 Certainty and Expedited Review

Certainty around regulatory oversight is critical to project developers. In addition, state primacy is seen as critical to expediting permit review times..

2 Clarity Around Pore Space

Codified thresholds for amalgamation thresholds and procedures simplifies land negotiations and associated risks.

3 Backstop and Perception

Ensures that personnel are in place to oversee these activities and provides an important backstop for long-term stewardship which is important to perception.

4 Payback, Create Marketplace

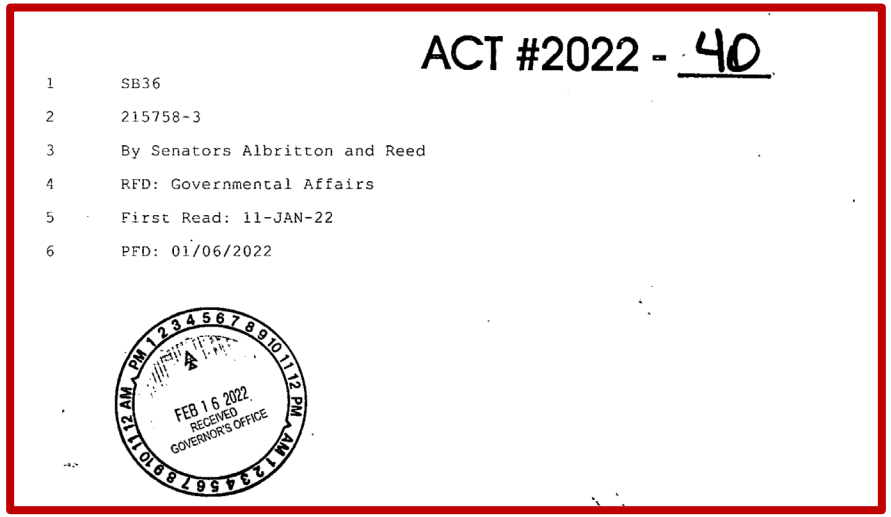
Creating incentives to deploy capital is critically important, as are mechanisms that support the creation of a CO_2 marketplace..

Slide Courtesy of SSEB

Regulatory Development for CO_2 Storage in Alabama

- **Act 2022-40 amended OGB's natural gas storage statute to include "…carbon oxides, ammonia, hydrogen, nitrogen, noble gases…" and stated that this "… is in the public interest and welfare of this state and is for a public purpose."**

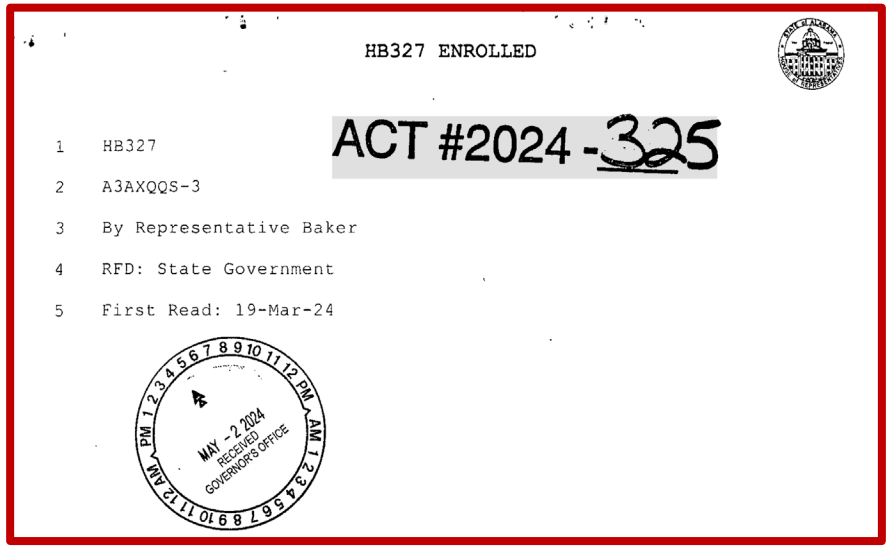
- **Act 2024-325 enabled OGB's regulatory authority and provided clarity to encourage development of a geologic storage industry in the State of Alabama.**
  - Established two administrative funds:
    - For use during active operations
    - For long-term care
  - Provided parameters for ultimate closure of a storage facility.
  - Defined legal ownership of pore space-storage rights
  - Provided for the "amalgamation" of storage rights-analogous to unitization for O&G
  - Allowed the State to lease state owned lands for storage



ACT #2022 - 40

SB36
215758-3
By Senators Albritton and Reed
RFD: Governmental Affairs
First Read: 11-JAN-22
PFD: 01/06/2022

FEB 16 2022
RECEIVED
GOVERNOR'S OFFICE



HB327 ENROLLED

ACT #2024 -325

HB327
A3AXQQS-3
By Representative Baker
RFD: State Government
First Read: 19-Mar-24

MAY -2 2024
RECEIVED
GOVERNOR'S OFFICE

Slide Courtesy of Nick Tew, Alabama State Geologist

Understanding Business Model Options/Commercial Terms

Four primary business models are available to an electricity company and its electricity generation units (EGUs).

Section 45Q and data center development are evolving traditional business models.

1. Vertically Integrated Business Model – “Doing it all by yourself”
2. Third-Party Business Model – “Let someone else do it all”
3. Joint Venture Offtake Business Model – “Let’s do it together” (particularly with a 3rd party transportation and storage developer/owner/operator)
4. Single source – sink matching or hub-and-spoke regional storage networks

Esposito, R. A., L. S. Monroe, and J. S. Friedman, "Deployment Models for Commercialized Carbon Capture and Storage," Environmental Science & Technology, 2011, 45 (1), 139-146.

Thank you for the opportunity today!

Richard A. Esposito, Ph.D., P.G.
raesposi@southernco.com
205.567.0186

Southern Company

NATIONAL CARBON CAPTURE CENTER