



# **Southeast Regional Carbon Utilization and Storage Acceleration (SECARB-USA) Initiative: An Overview**

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Southern States Energy Board

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## MISSION STATEMENT

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.



# Executive Committee

The Southern States Energy Board (SSEB) is a nonprofit interstate compact organization established in 1960. Our membership is composed of 16 states and two territories.

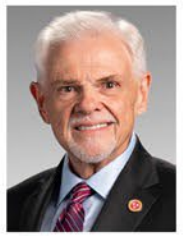
The Executive Committee of SSEB is responsible for the overall management and direction of the organization. The Committee meets regularly to review and approve the organization's budget, programs, and policies. They also oversee the work of the various committees and task forces established by SSEB to address specific energy issues and promote cooperation among member states.



**Chair**  
Gov. Bill Lee  
*Tennessee*



**Vice Chair**  
Rep. Bill Sandifer  
*South Carolina*



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Sen. Ken Yager  
*Tennessee*



Gov. Henry McMaster  
*South Carolina*



Gov. Kay Ivey  
*Alabama*



Rep. John Ragan  
*Tennessee*



Rep. Lynn Smith  
*Georgia*



Sen. Brandon Smith  
*Kentucky*



Sen. Bryan Hughes  
*Texas*



Hon. Jim Powell  
*Federal Representative*



Kenneth Nemeth  
*Secretary*



*Transcending Boundaries*



# Legislative Membership

Alabama

Arkansas

Florida

Georgia

Kentucky

Louisiana

Maryland

Mississippi

Missouri

North Carolina

Oklahoma

Puerto Rico

South Carolina

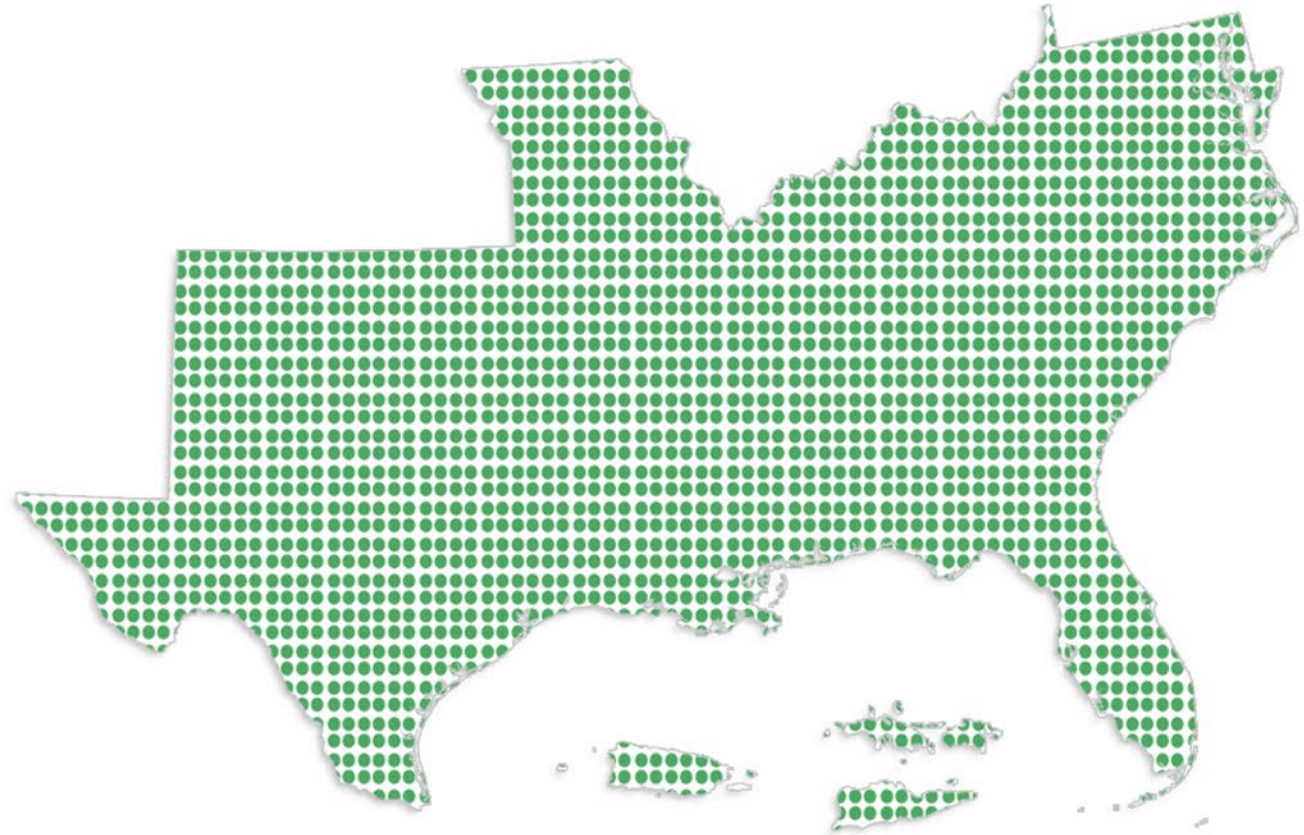
Tennessee

Texas

U.S. Virgin Islands

Virginia

West Virginia



# Associate Membership

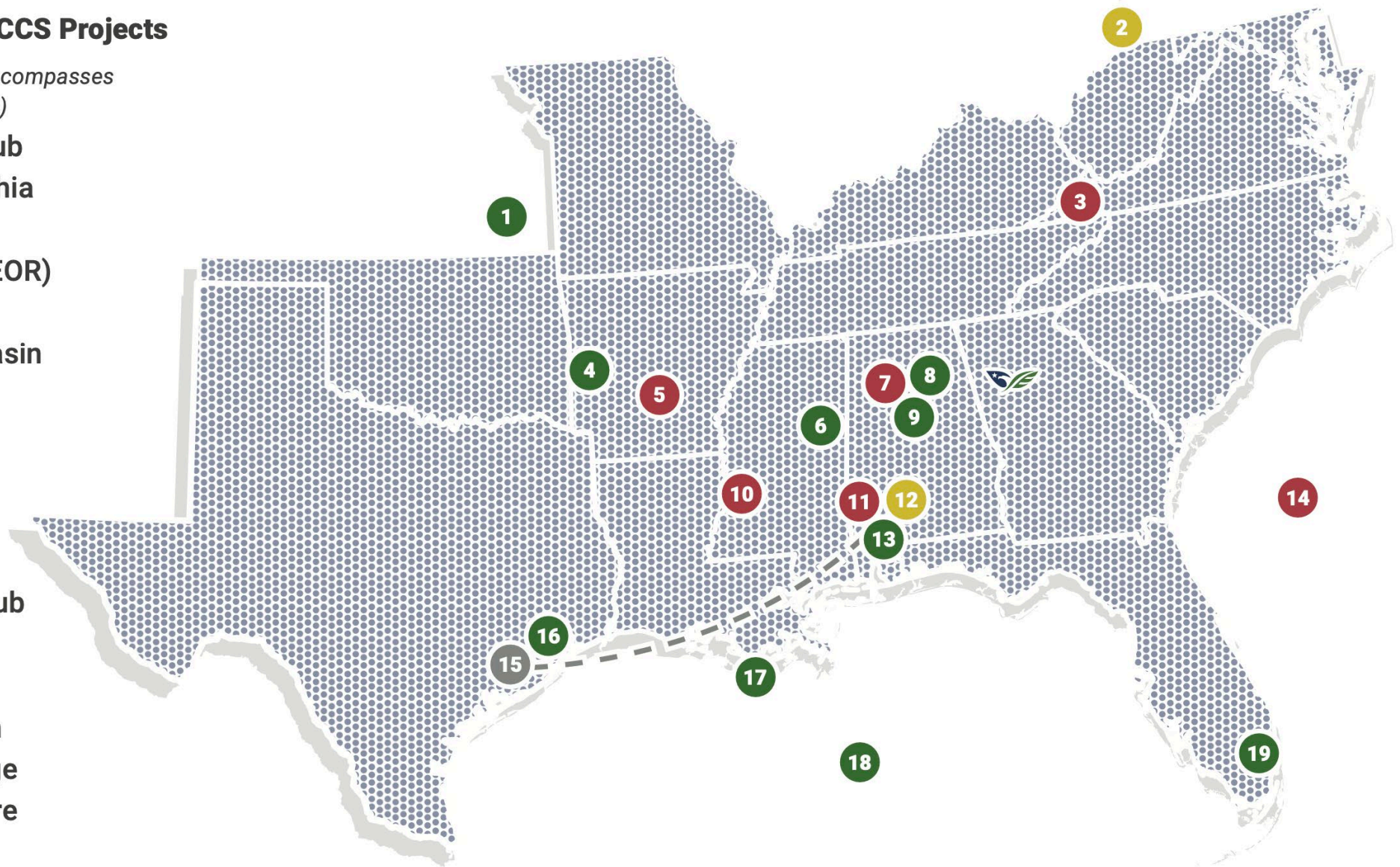




## Current and Former CCS Projects

1. SECARB-USA (*encompasses majority of our region*)
2. Tri-State CCS Hub
3. Central Appalachia
4. Foreman FEED
5. Arkansas (CO<sub>2</sub>-EOR)
6. Kemper County
7. Black Warrior Basin
8. Project OASIS
9. NCCC (DAC)
10. Cranfield
11. Citronelle
12. SEDAC Hub
13. Longleaf CCS Hub
14. SOSRA
15. Petra Nova
16. Univ. of Houston
17. Project Lochridge
18. SECARB Offshore
19. Project ACCESS

- Open Project   ● Under Negotiation  
● Closed Project   ● Technology Transfer



# SECARB-USA Partners





# Student Activity



## Graduate

- Chidera Iloejesi
- Jamie Newsome
- Nora Lopez Rivera
- Otis Williams

## Post Doc

- Zhuofan Shi

## Graduate

- Edna Rodriguez Calzado
- Yushan Li
- Angela Luciano
- Maria Madariaga
- Chinemerem Okezie

## Intern

- Ethan Cavasos

## Graduate

- Victor Fakeye
- Silas Samuel
- Sreejesh Sreedhar
- Megan Garrett
- Jaren Schuette
- Kusuma Lanka
- Suresh Marreddy

## Graduate

- Lars Koehn
- Uzezi Orivri

## Undergraduate

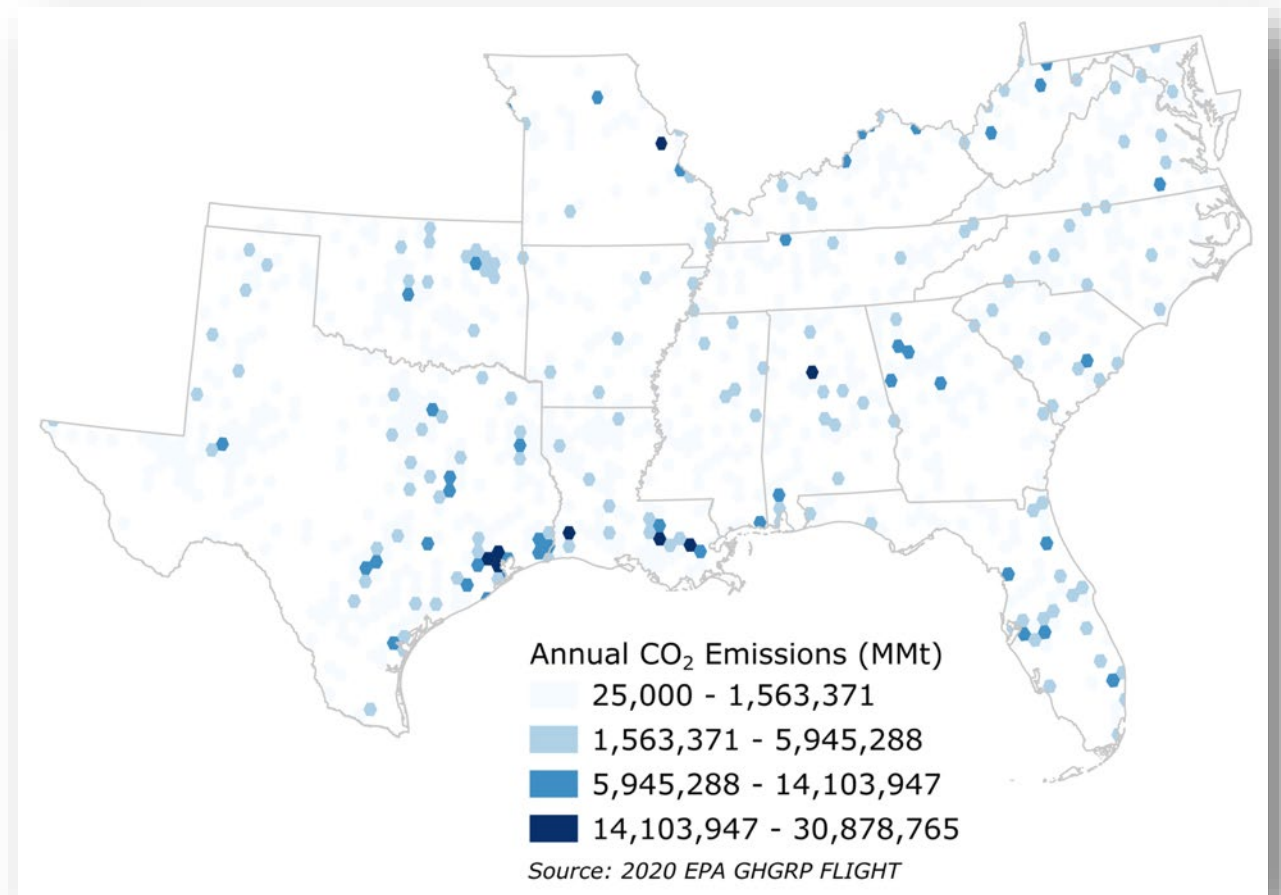
- Kristen Claye
- Nick Fowler
- Wes Godbey
- Liz Johnson
- Thea Torrisi
- Mary Verne



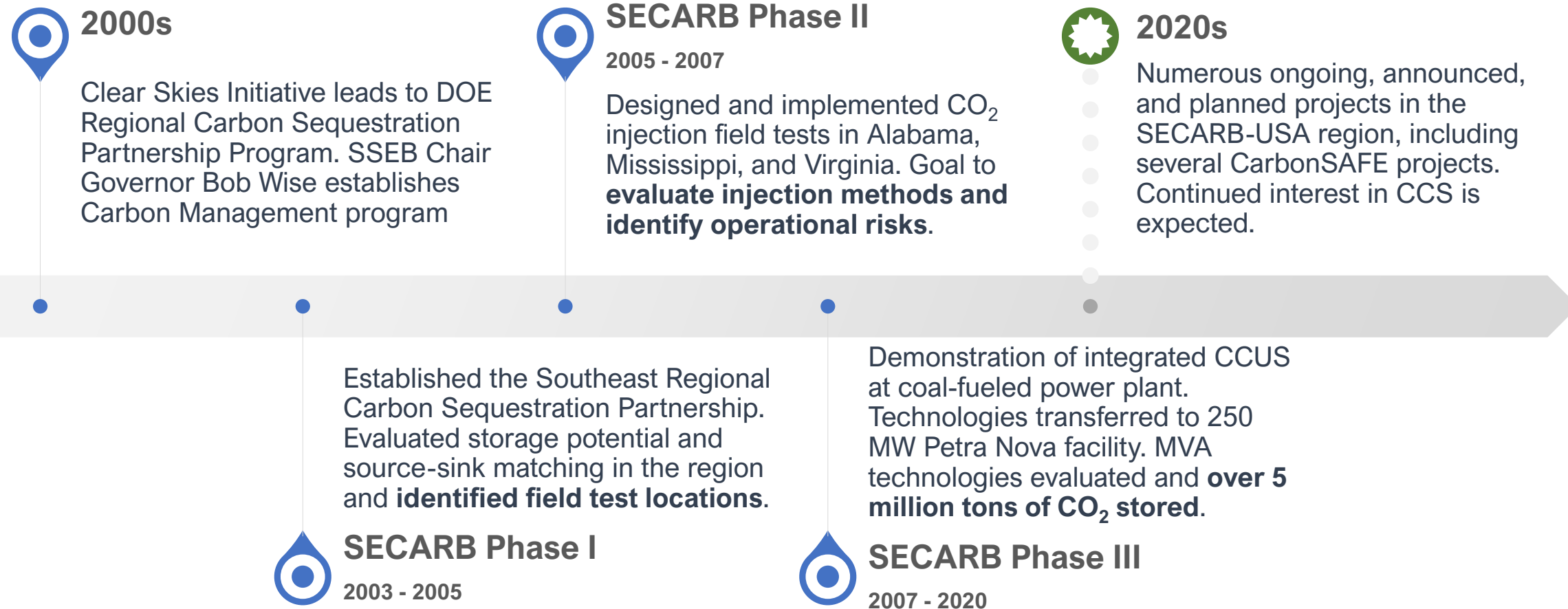
# CCS - Motivation

- Region accounts for over 1.2 billion metric tons of annual CO<sub>2</sub> emissions, or ~ 30% of U.S. annual emissions
  - Utility-scale electric generation
  - Industrial activities
  - Regional importance (jobs, energy security)
- Opportunity for CO<sub>2</sub>-focused economy
- Broad industry interest in decarbonizing, and expertise

Spatial Density of CO<sub>2</sub> Emissions in the Southeast



# CCS – Southeastern Timeline





# State Activities

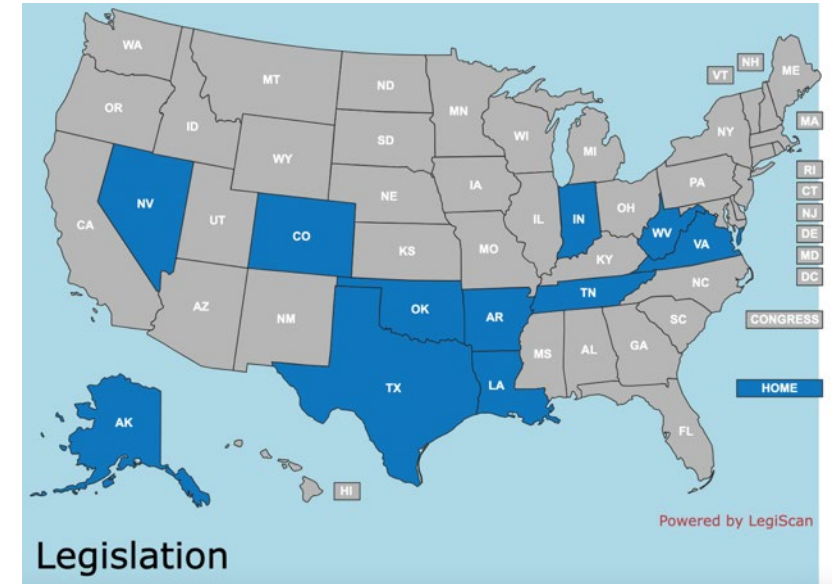
## State Legislation

- 2022 was a busy year for CCS
  - AL, AR, MS clarified regulatory oversight of CO<sub>2</sub>
- In 2023, 11 states introduced 25 CCS-related measures
  - LA SR 179 – assess impacts of CCS
  - WV SR 162 – DNR lease pore space
- In 2024, 28 states introduced CCS-related measures
  - AL 320 – clarifies amalgamation procedures
  - LA HB 73 – parish tax on CCS projects
  - WV HB 5045 – relating to primacy

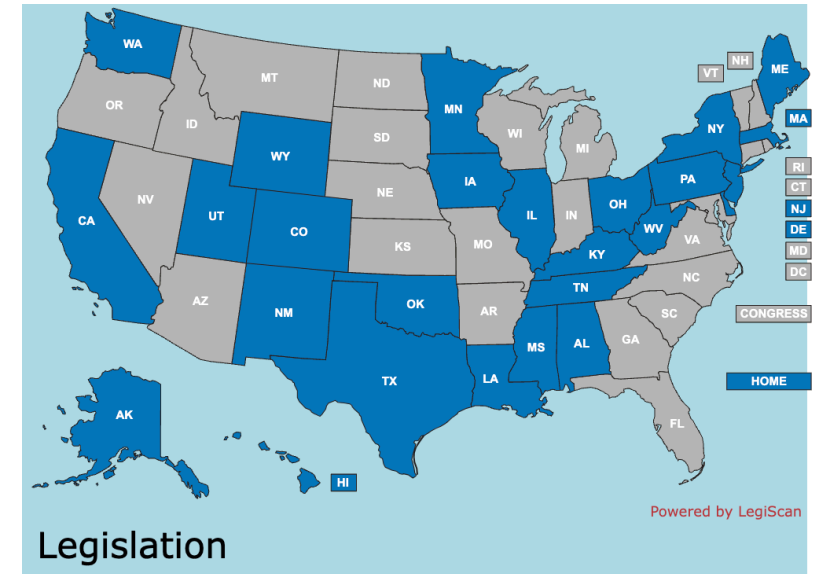
## Regulatory

- Louisiana primacy granted
  - Alabama is likely next in line – draft rules out in December of 2023
  - TX GLO continues to lease state waters

## 2023 Carbon Management Legislation by State



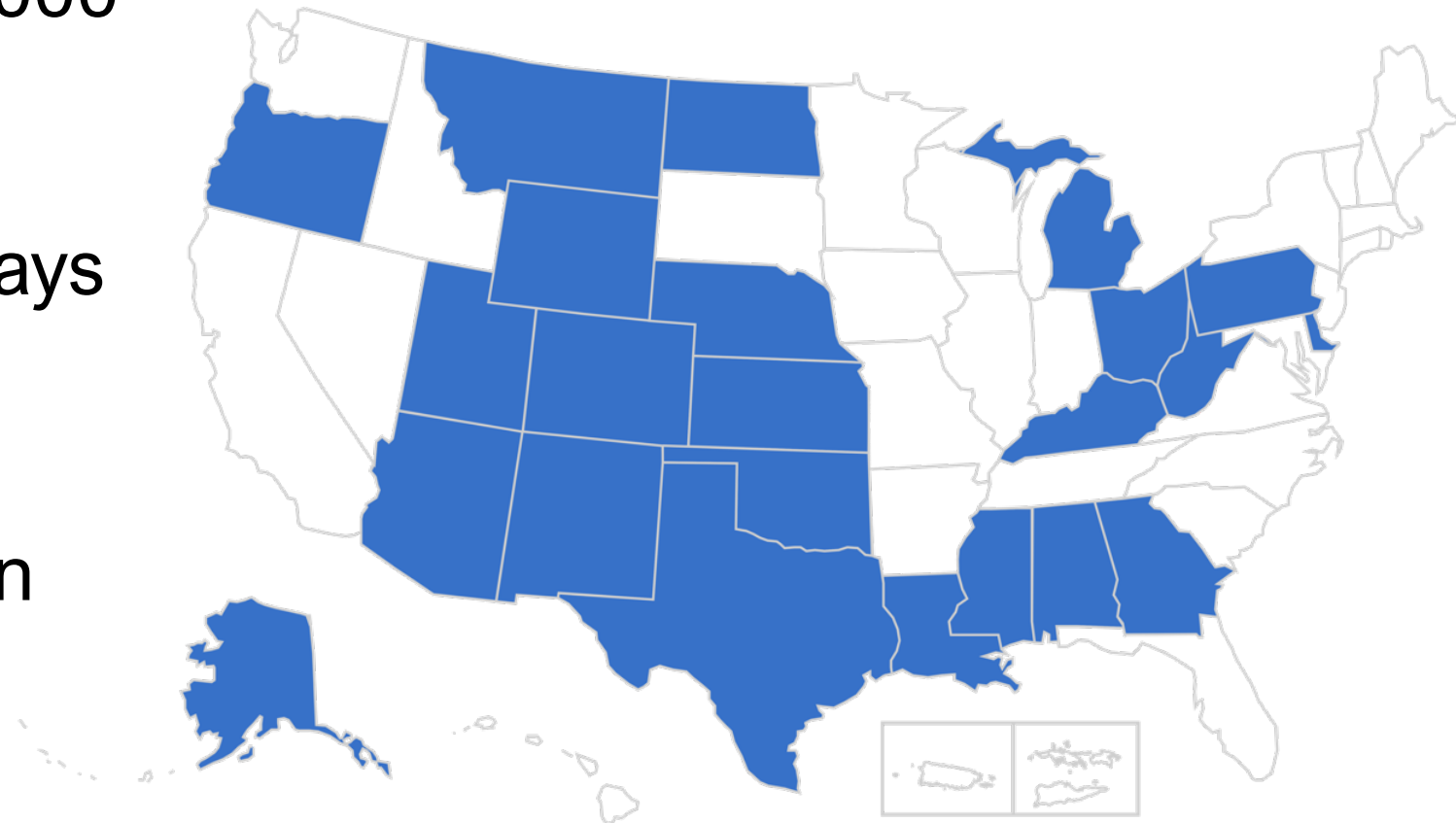
## 2024 Carbon Management Legislation by State



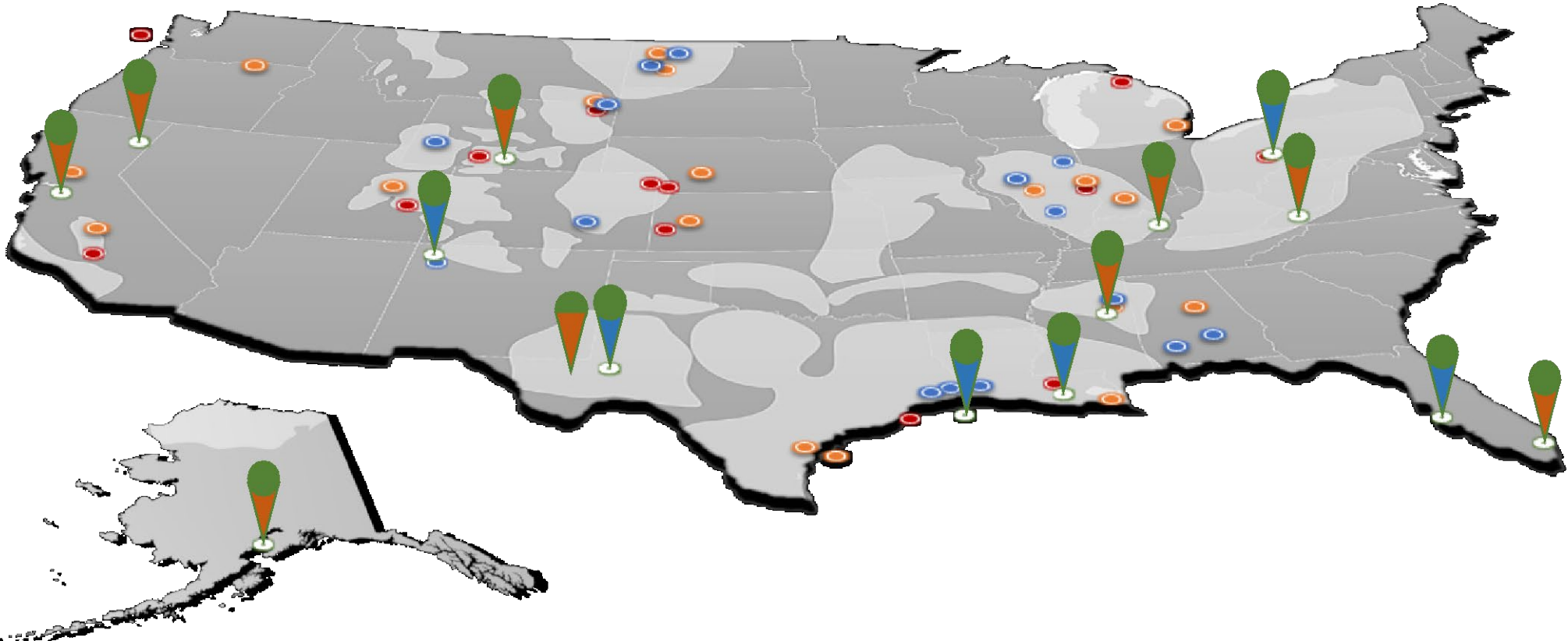
# Class VI Grants Program

- BIL appropriated \$48,250,000 in funds made available to states, tribes, or territories
- Funds to be used in two ways
  - Primacy or program revisions
  - Program implementation
- 23 states and 2 tribes received funds

States Receiving Grants to Support UIC Programs

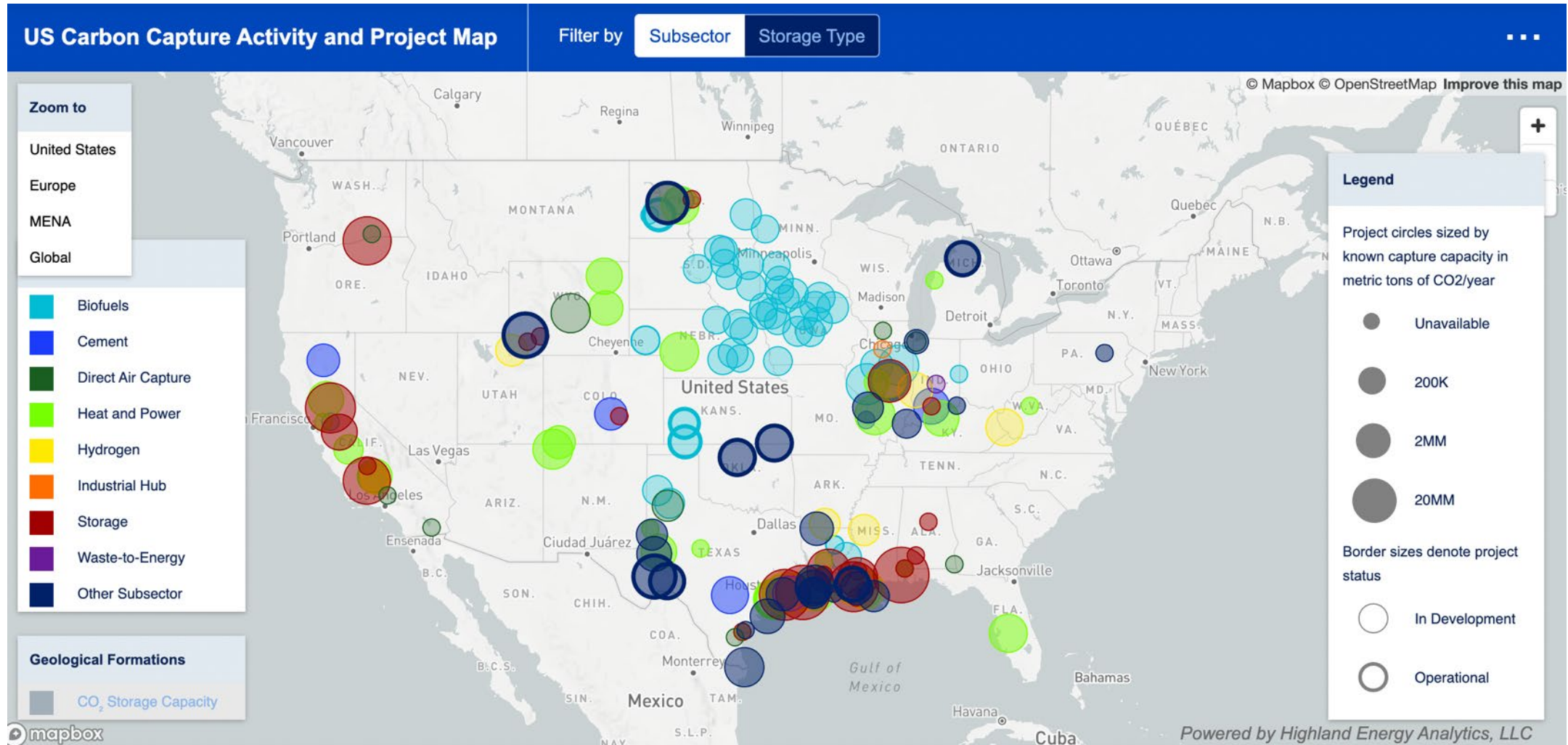


# CarbonSAFE Locations





# Deployment



# SECARB-USA: Past Activities

- One of four DOE Regional Initiatives tasked with identifying and removing barriers to the commercial deployment of CCUS
- Developed a needs assessment framework for prospective storage complexes in the region based on Class VI requirements
- Preliminary evaluation of regional storage potential and costs using NRAP and SCO<sub>2</sub>T
- Identified prospective sub-basins in the region for CO<sub>2</sub> storage
- Developed an inventory of non-technical challenges to the commercial deployment of CCS
- Completed stratigraphic test wells in Alabama, Georgia, and Virginia
- Acquired seismic data in under explored regions
- Supported project development with regional industry

**Southeast Regional CO<sub>2</sub> Utilization & Storage Acceleration Partnership**  
**SECARB-USA**

The Southern States Energy Board (SSEB) is leading a coalition of technical experts to identify and address regional onshore storage and transport challenges facing commercial deployment of carbon dioxide (CO<sub>2</sub>) capture, utilization and storage (CCUS) technologies.

The goal of the "Southeast Regional CO<sub>2</sub> Utilization and Storage Acceleration Partnership" (SECARB-USA) project is to help the United States meet its need for secure, affordable, and environmentally sound fossil energy supplies by utilizing the advancements made by the Regional Carbon Sequestration Partnership (RCSP) Initiative to continue to identify and address knowledge gaps.

SSEB and a select network of experienced CCUS project developers and operators will coordinate their capabilities to accelerate CCUS deployment and achieve four primary research objectives: 1) address key technical challenges; 2) facilitate data collection, sharing and analysis; 3) assess transportation and distribution infrastructure; and 4) promote regional technology transfer and dissemination of knowledge.

The SECARB-USA regional initiative encompasses the States of Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and portions of Kentucky, Missouri, Oklahoma, Texas, and West Virginia. The Southern States Energy Board is the award recipient.

To date, the project team has made significant strides towards de-risking commercial investment in CCUS technologies. For example, a regional assessment of prospective storage complex subsurface data availability revealed data gaps throughout the region. It was observed that data availability is strongly correlated with historical oil and gas exploration and production. Consequently, less information is available to decision makers in and around the Appalachian fold-thrust belt, the Rome Trough, and the coastal plain of Georgia, South Carolina, North Carolina, Virginia, and Maryland. These observations supported Southern Company's stratigraphic test well drilling in the Valley and Ridge province of north-central Alabama and northwest Georgia. Broadly, the information obtained through field activities will be incorporated into the SECARB-USA knowledge base and may provide potential sinks for emitters in the area.

In addition to the technical activities highlighted above, the project team is actively engaged with industry, regulators (state and federal), legislators, and the public more broadly. In total, 186 separate engagements were documented by the project team over a one-year period (Q4 2021 through Q2 2022). Additionally, the program has supported numerous undergraduate and graduate students at the Auburn University, Oklahoma State University, the University of Texas at Austin, and Virginia Tech.

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Principal Investigator  
Kenneth J. Nemeth  
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nemeth@sseb.org

**Field Test Partners**  
Primary Sponsors  
» US DOE  
» NETL  
» SSEB

**Partners**  
» Advanced Resources International, Inc.  
» Auburn University  
» Bureau of Economic Geology at the University of Texas at Austin  
» Crescent Resource Innovation (Gerald R Hill PhD)  
» Environmental Defense Fund  
» Geological Survey of Alabama  
» Los Alamos National Laboratory  
» Oklahoma State University  
» SAS Institute, Inc.  
» Virginia Center for Coal and Energy Research at the Virginia Polytechnic Institute and State University

**Industry Network**  
» Clean Air Task Force  
» Denbury Resources, Inc.  
» Mitsubishi Heavy Industries America, Inc.  
» Reppol  
» SAS Institute, Inc.  
» Southern Company

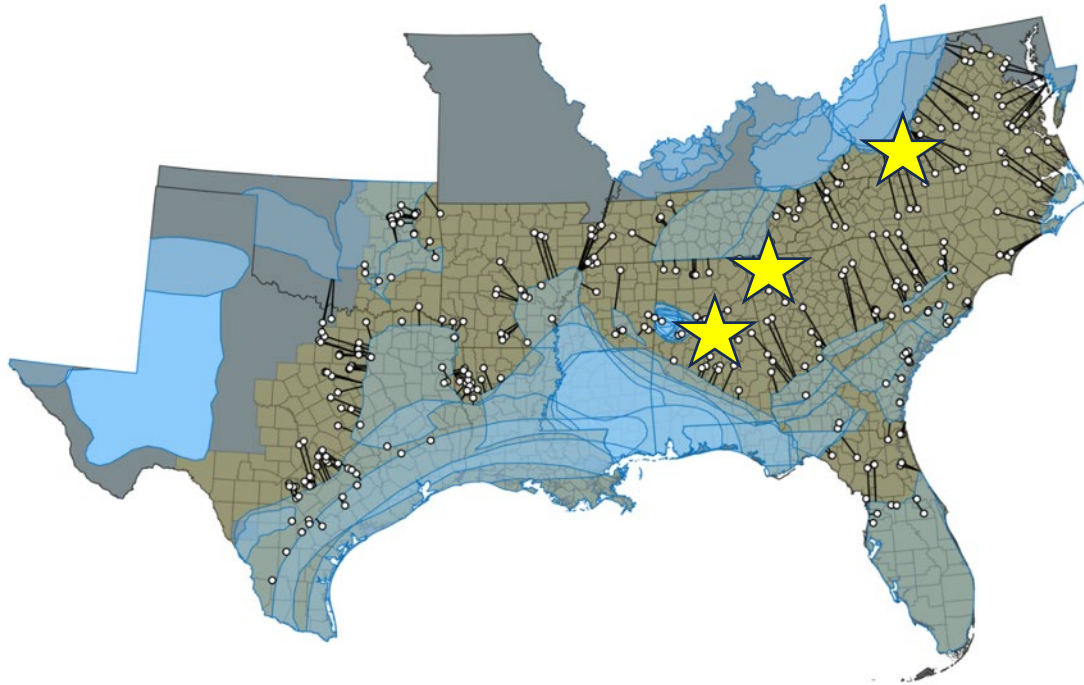
**CARBON STORAGE MAP**  
SOURCE: NETL (2019)

**Legend:**  
SOUTHERN STATES ENERGY BOARD  
BATTELLE MEMORIAL INSTITUTE  
UNIVERSITY OF NORTH DAKOTA  
NEW MEXICO INSTITUTE OF MINING AND TECHNOLOGY

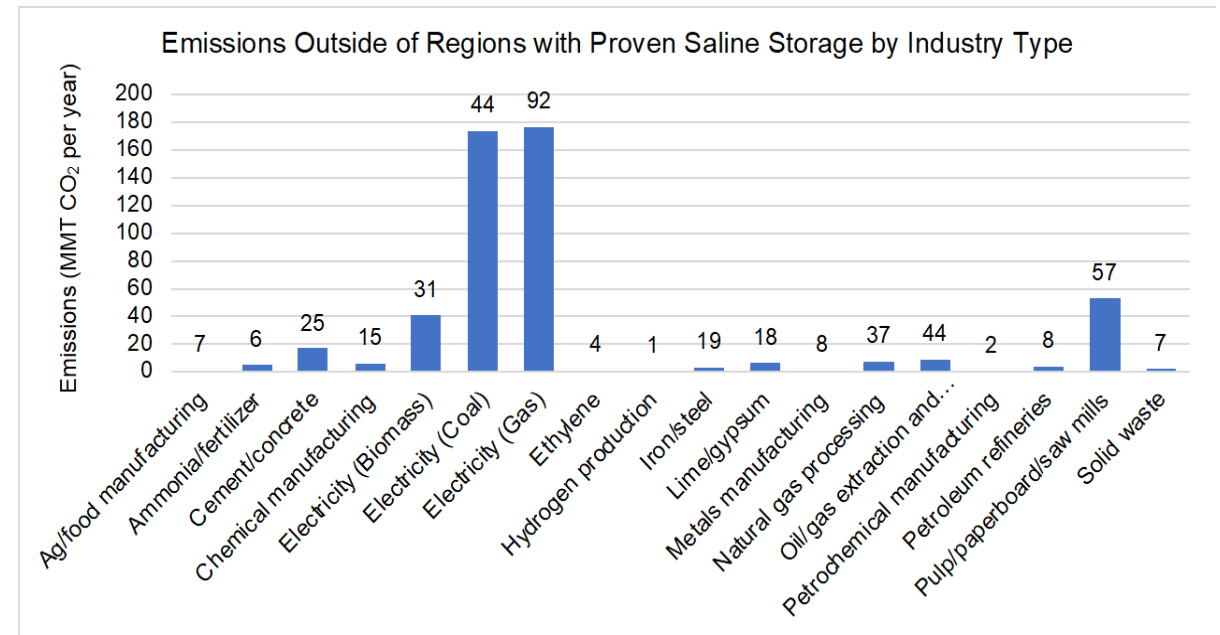
SECARB-USA 2022 Fact Sheet

# SECARB-USA: Stranded Emissions

- In total, 425 facilities fall outside of areas with proven saline storage, representing annual emissions of nearly 509 million metric tons of CO<sub>2</sub>
- Lengthy infrastructure required, or investment in proximal exploration



Location of SECARB-USA regional facilities (white dots) located outside of proven saline storage areas (blue polygons). Also shown is least distance path to from each facility to saline polygons as a proxy for required pipeline length. Facility data is from the EPA GHGRP while saline polygons are from the US DOE NATCARB Atlas.

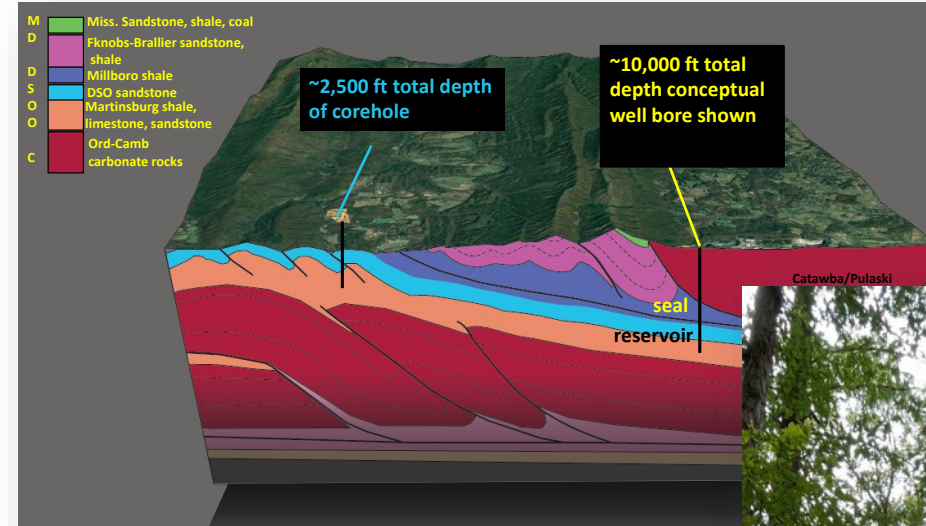


Distribution of facilities outside of areas with proven saline storage in the SECARB-USA region by industry type, number, and annual CO<sub>2</sub> emissions.



# SECARB-USA: Central Appalachia

- Coordinating with Titan America to evaluate subsurface storage opportunities near their Roanoke Cement Plant
- Preliminary **geologic characterization** and **reservoir modeling** shows promise as an enduring sink
- Continuous **core drilling to 2,500 feet total depth**
  - Targeting Ordovician-Silurian sandstone and limestone formations
  - Confining interval is the Millboro Shale



Subsurface model for the Valley and Ridge province of southwest Virginia. Figure Courtesy of Virginia Tech.



Photograph of field activities in southwest Virginia. The mineral rig is being utilized to test the subsurface for CO<sub>2</sub> storage suitability in an up-dip section from the Roanoke Cement facility. Image courtesy of Nino Ripepi, Virginia Tech.

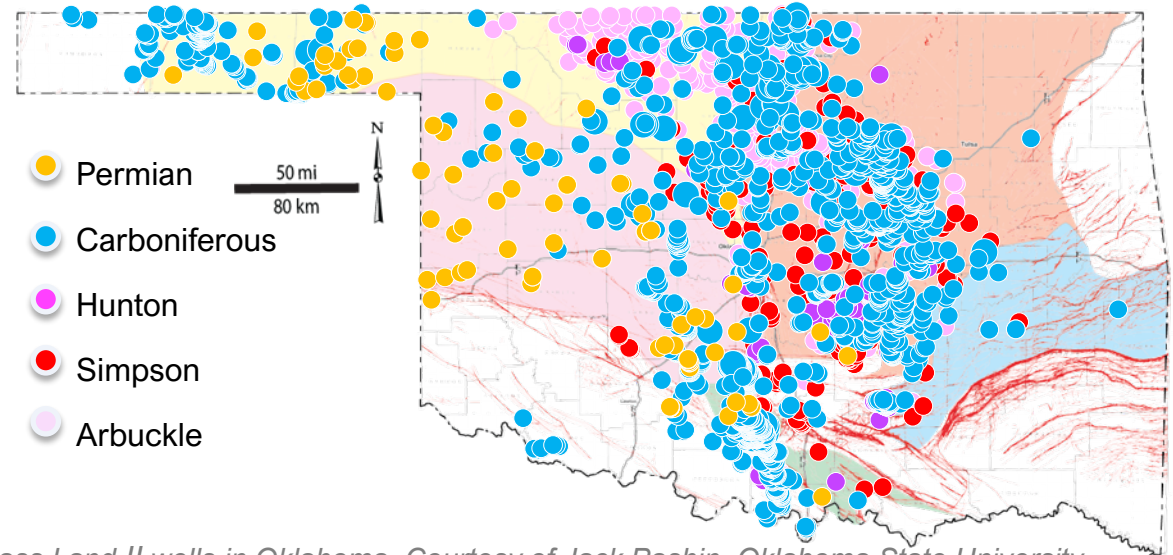
# SECARB-USA: Ongoing Activities



## • Oklahoma

- Numerous Class I and II injection zones in state
- Large database of injection volume, wellhead pressure, and water chemistry data
- Storage potential in Ordovician-Permian section; numerous thick reservoir seals distributed throughout section
- Work communicated to the Secretary of Energy and Environment

## Active injection zones

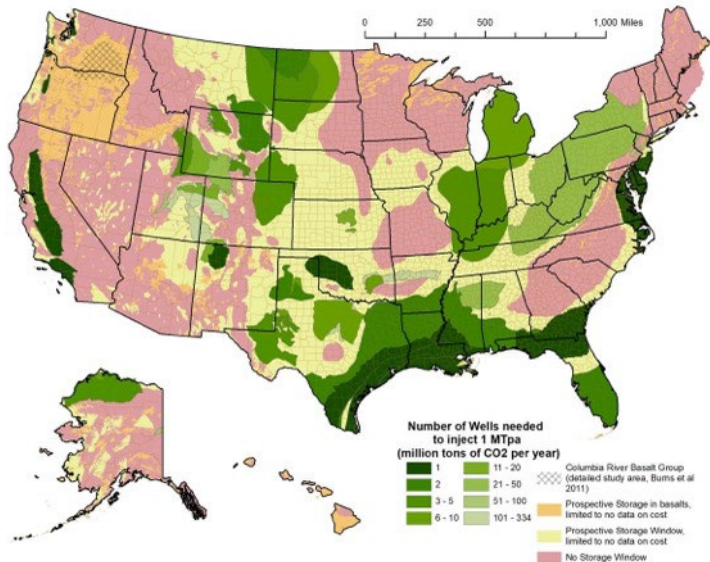


Class I and II wells in Oklahoma. Courtesy of Jack Pashin, Oklahoma State University.

## • National

- Updates to storage window thickness and injectivity at the national level
- Lots of injectivity in the Gulf South
  - 1 or 2 injection wells required to inject 1 million metric tonnes of CO<sub>2</sub> annually

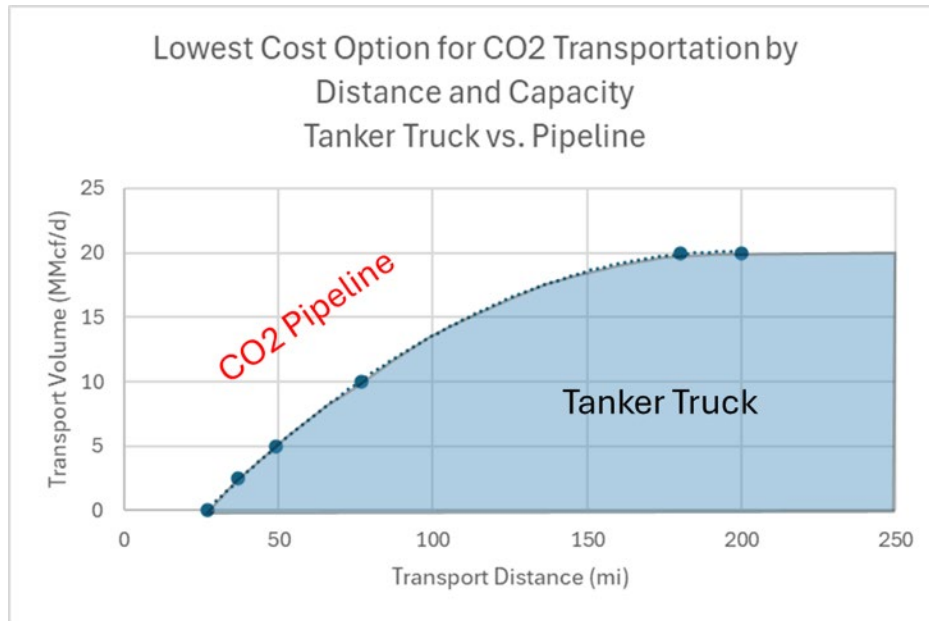
National injectivity map based on existing storage window thickness. Figure courtesy of UT Bureau of Economic Geology and Lawrence Livermore National Lab.



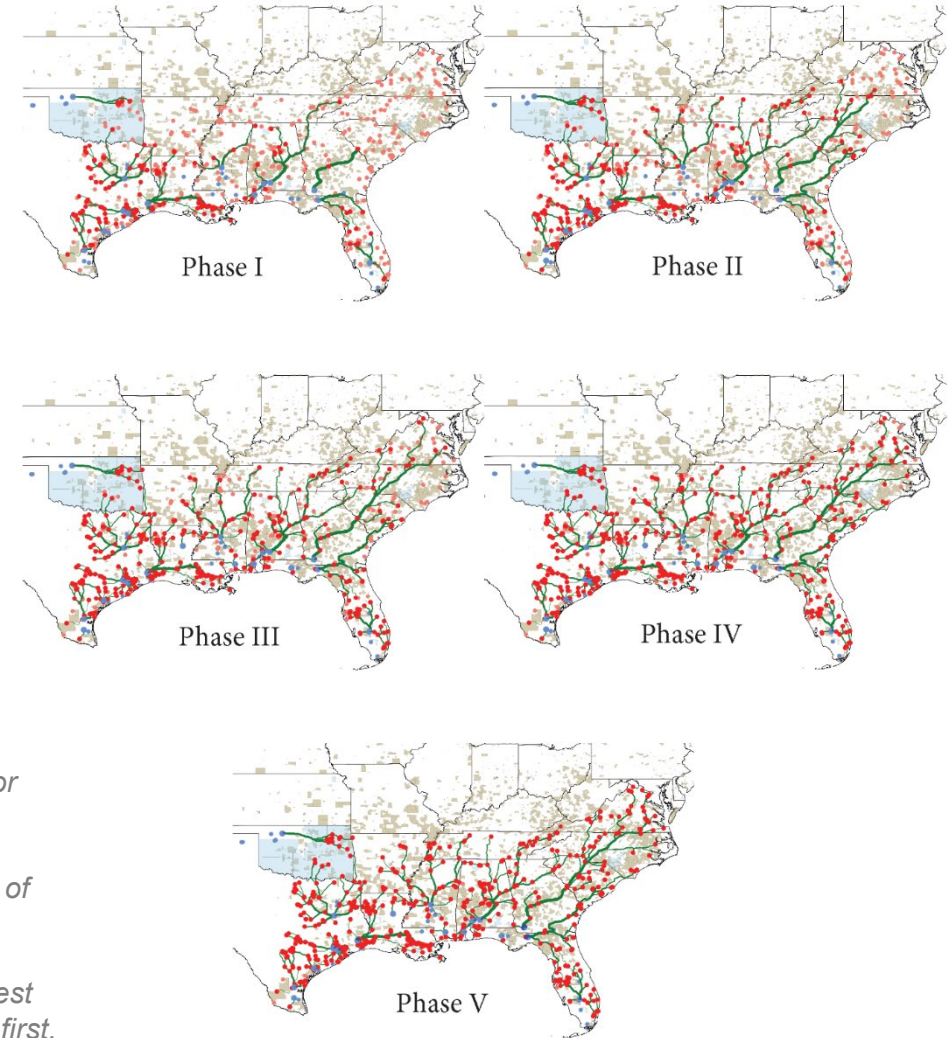


# SECARB-USA: Ongoing Activities

- Evaluating regional infrastructure buildout scenarios
- **IRA modified 45Q rules, there are 956 Mmt capturable emissions**
- Marginal cost increase when considering EJ community avoidance



Left: Cost curve for CO<sub>2</sub> emitting facilities and pipeline or tanker truck transportation methods. Figure courtesy of ARI.  
Right: SimCCS model for eligible facilities in the SECARB-USA region considering the location of environmental justice communities. Staged buildout focuses on lowest cost to capture facilities first. Figure courtesy of LANL.





# SECARB-USA: Ongoing Activities

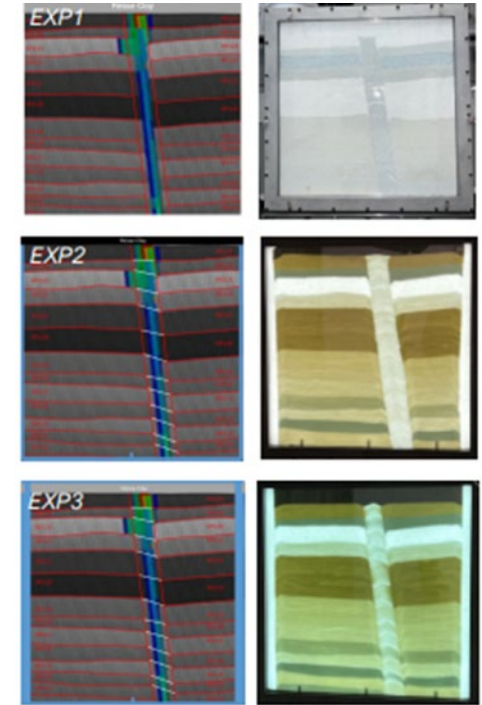
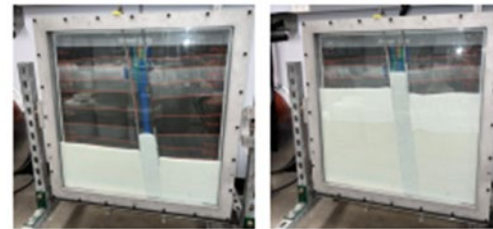


- Ongoing experimental and modeling efforts
- UT-BEG utilizing tank experiments to replicate field patterns in a lab environment
  - Increase confidence in models
- Auburn is utilizing samples from regional reservoirs and confining units to understand CO<sub>2</sub>-brine-rock reactions
  - Important to understanding impacts on geology

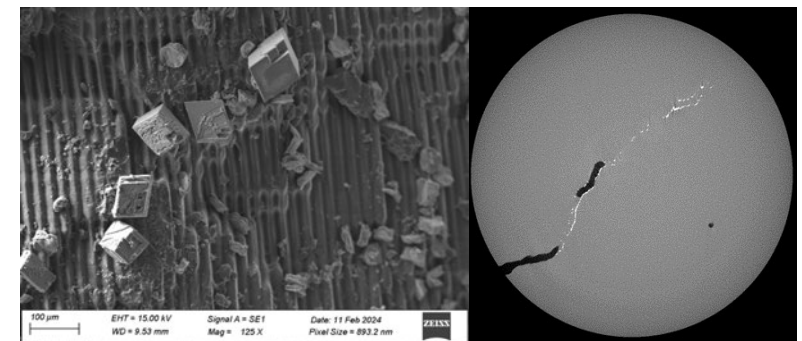
To replicate the field geologic pattern in the lab setting, we mixed different grain sizes of glass beads so that their capillary entry pressure ratios are equivalent to the permeability ratios measured for the various layers.

We then manually packed the sand tank domain according to a 2D cross-section from the field-scale simulation domain shrunk to the size of the tank.

*Below: Photos of the sand tank packing procedure. Right: 2D cross-section images and the completed dry bead pack photos for the three experiments.*



*Top: Sand tank experiments. Courtesy of UT-BEG. Right: SEM micrographs courtesy of Auburn.*



# SECARB-USA: Industry Outreach Activities

- **Regional knowledge source for industry partners – basis for many new projects (> 15 new projects)**
- **Frequent discussions with regional legislators and regulators**
  - June 2024 meeting with Oklahoma Secretary of Energy and Environment
  - Sharing project insights and utilizing activities to plan future events
- **Supporting regional efforts such as Georgia Tech's Equitable DAC symposium**



*Promotional material for the GT Advancing DAC for Community Benefit and Decarbonization Workshop. Keynote speaker, Dr. Simone Stewart, shown in the bottom right.*

*DAC in the Context of Environmental Justice in the Southeast panel. From left to right: Jay Bassett, Gary Harris, Dr. Yomi Noibi, Janelle Wright, and Dr. Erica Holloman-Hill.*



# Challenges to CCUS Deployment - Perception

- Despite investments and various incentives, public perception challenges will present strong headwinds to CCUS project developers
- Without regulatory mandates, public opposition may heavily influence decision makers
- General lack of data surrounding public sentiment to inform early engagement
- **Opportunity to proactively identify public concerns and develop messaging priorities utilizing text analytics and large language models**

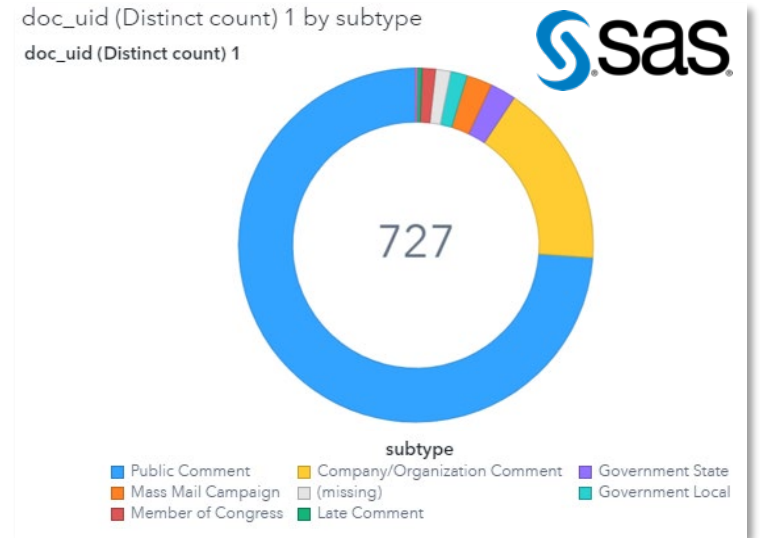
MAD CCS, or the Mutually Assured Destruction of the CCS Industry



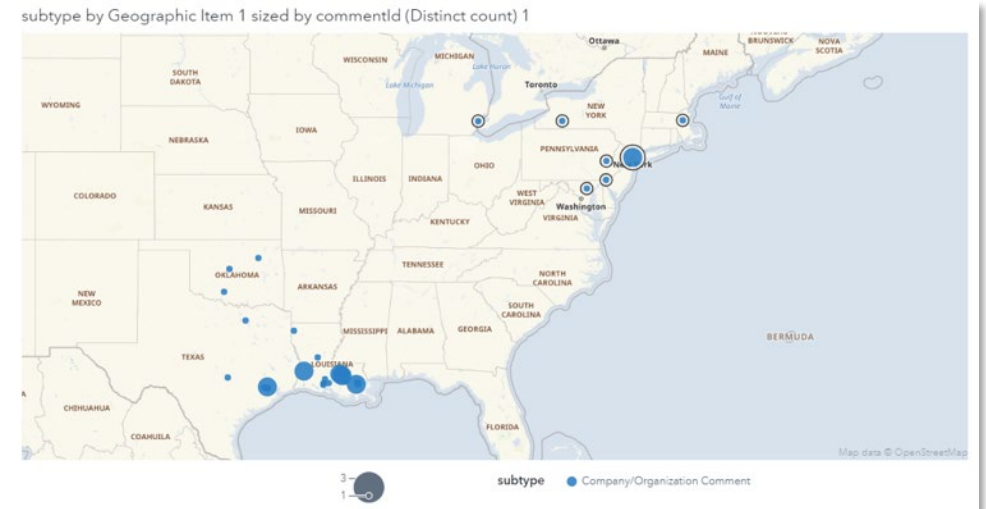


# Using Text Data for Insights

- Analysis of Louisiana Primacy Application Public Comments
- May prove valuable to others in the region considering primacy
- Over 40k comments, around 727 are unique
- Majority private citizens, followed by companies/organizations
- Location data available for some
- **More importantly, sentiment can be extracted**



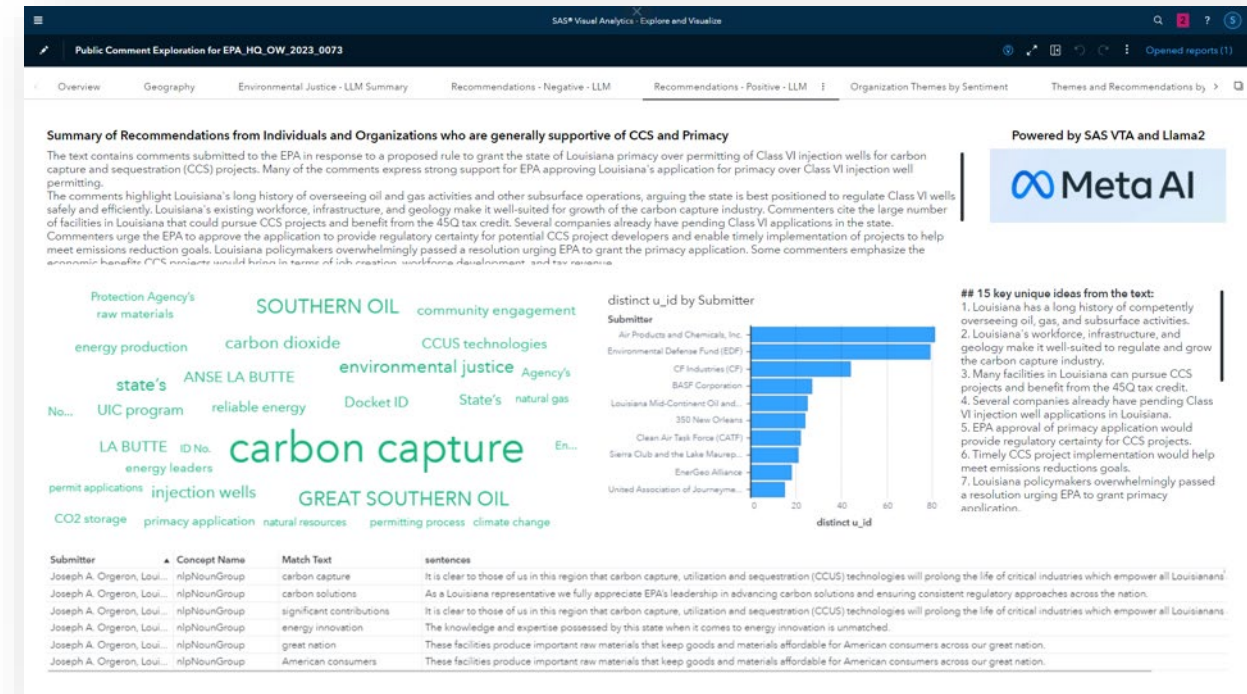
*Proportion of comments by type (e.g., company, government official, private citizen). Figure courtesy of SAS.*



*Geographic distribution of public comments. Figure courtesy of SAS.*

# Using Text Data for Insights

- 727 public comments contain approximately 12,000 unique statements
- Capture unique ideas and extract themes and subthemes
- Sentiment analysis to identify high-priority topic or alternately, rants
- Large Language Models to summarize key public comment patterns



Text analytics dashboard example.

# Summary of Louisiana Class VI Primacy Comments

## 40,000

comments received

# of comments for prior primacy authority

ND 15 WY 7

## Mass Mailers



75%  
negative



25%  
positive

683 unique remarks analyzed\*

## Unique Comment Sentiment



## Major Themes

### Positive

- 1) Louisiana's long history of competently overseeing oil, gas, and subsurface activities.
- 2) The state's workforce, infrastructure, and geology make it well-suited to regulate and grow the carbon capture industry.
- 3) Many facilities can pursue CCS projects and benefit from the 45Q tax credit.
- 4) Several companies have pending Class VI injection well applications.
- 5) EPA approval of primacy would provide regulatory certainty for CCS projects.

### Negative

- 1) Carbon dioxide leakage and related concerns.
- 2) Lack of adequate plans to consider environmental justice.
- 3) EPA preferred for a higher level of oversight vs. the state's Dept. of Natural Resources.
- 4) Groundwater and drinking water contamination concerns.
- 5) The state's willingness to properly administer the program.

## Key Terms

### Positive

Oil & gas industry | Community support  
Support primacy | Energy jobs |  
Environmental protection

### Negative

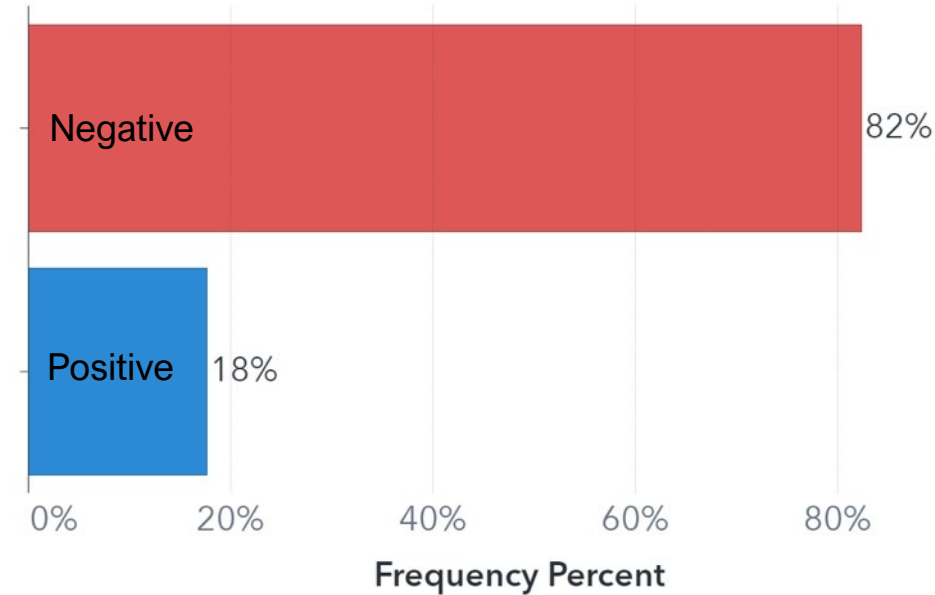
CO<sub>2</sub> | Environmental justice | Reject primacy |  
Water contamination | Well abandonment



# Analysis of News Media



- **How is CCUS discussed in media?**
- Opportunity to further understand messaging priorities
- 11 Class VI permits accounting for 50 wells in California (40% of permits in review with EPA)
- California articles from 2021 to 2023 were assessed
  - 463 articles analyzed, of which 82% were largely negative in sentiment



# Summary of Text Analytics Work

- More data available to understand messaging priorities and **inform initial engagement efforts**
- Opposition campaigns are highly effective at amplifying their message
  - Project specific actions can be identified when filtering out mass mailers
- Likely that **stakeholders see negative messaging *before* we have an opportunity to engage**

# Next Steps for Text Analytics Work

## Next Steps

- Expand assessment of news media in areas where CCS activity is expected
  - AL, LA, MS, OK
- Validate text analytics and LLM workflows by comparing results from like datasets within team
  - UT-BEG is exploring workflows using NLTK
- Identify overlap or nuance across geographies
  - Opportunity to evaluate how CCS is discussed within a region
- Utilize information to inform messaging strategies, identify strategic engagement opportunities

## Database Structure

ALABAMA\_INPUT ▾ Columns: 9 Rows: 849 Size: 294 KB ⚡

Details Sample data

Filter

#	↑	Name	Label	Data Type	Raw Length
1		State	--	varchar	7
2		County	--	varchar	10
3		City	--	varchar	10
4		Newspaper ...	--	varchar	25
5		Date	--	double	8
6		Heading	--	varchar	68
7		Sentences	--	varchar	547
8		s_id	--	double	8

*Example database structure for news articles from Alabama. Figure courtesy of Kusuma Lanaka at OSU.*



# SECARB-USA: Moving Forward

- Collaborate with industry partners to evaluate CO<sub>2</sub> storage feasibility near existing assets and to assist in the development of business plans, many of which involve multiple companies (hub concept) - **ongoing**
- Evaluate how CCS is described in media to inform messaging strategies- **ongoing**
- Develop an interactive dashboard for educational purposes that includes infrastructure scenarios, costs, risks, societal considerations and impacts (energy and environmental justice; and diversity, equity, inclusion and accessibility), and workforce readiness and development – **ongoing**
- Continue field efforts in collaboration with industry in Alabama, Georgia, Oklahoma, and Virginia – ongoing
- **Host a series of state-specific workshops to discuss considerations for CCS with legislators, regulators, and industry partners - ongoing**

SECARB-USA Project Timeline	◆ Milestone ● Decision Point	Phase I												Phase II								
		Budget Period 1												Budget Period 2								
		YEAR 1				YEAR 2				YEAR 3				YEAR 4				YEAR 5				
TASK DESCRIPTIONS	Start Date	End Date	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
<b>TASK 1.0: PROJECT MANAGEMENT AND PLANNING</b>	10/1/19	9/30/24																				
Milestone: Implement Project Management Plan	11/1/19	11/1/19																				
Decision Point 1: Negotiation/Implementation of PMP	10/1/19	10/1/19																				
Decision Point 2: Negotiation /Implementation of Phase II/BP2	9/30/22	9/30/22																				
<b>TASK 2.0: TECHNICAL CHALLENGES</b>	10/1/19	9/30/24																				
<b>Subtask 2.1: Needs Assessment Framework for Storage Complexes</b>	10/1/19	9/30/22																				
Milestone: Complete Needs Assessment Framework for Storage Complexes	9/30/21	9/30/21																				
<b>Subtask 2.2: Expanded Regional Characterization</b>	10/1/19	9/30/22																				
<b>Subtask 2.3: Optimization, Containment, Verification Strategies Update and Application</b>	10/1/20	9/30/22																				
<b>Subtask 2.4: Risk Needs for 2025 Commercial Deployment</b>	10/1/21	9/30/24																				
Milestone: Host First Partners Meeting on Risk Needs for 2025 Commercial Deployment	9/30/21	9/30/21																				
<b>TASK 3.0: DATA COLLECTION, SHARING, AND ANALYSES</b>	10/1/19	9/30/24																				
<b>Subtask 3.1: Data Management Plan</b>	10/1/19	9/30/24																				
<b>Subtask 3.2: Analyze and Update Existing CO2 Source and Sink Databases</b>	10/1/19	9/30/23																				
<b>Subtask 3.3: Regional Assessment Toolset(s) Validation</b>	10/1/19	9/30/22																				
Subtask 3.3.1: Assembling the Scenario Library	10/1/19	9/30/20																				
Subtask 3.3.2: SCO2T Tool Application	4/1/20	9/30/22																				
Subtask 3.3.3: Analysis Using NRAP Tool(s)	10/1/21	9/30/24																				
<b>Subtask 3.4: Machine Learning Initiative</b>	10/1/19	9/30/24																				
<b>TASK 4.0: REGIONAL INFRASTRUCTURE</b>	10/1/19	9/30/24																				
<b>Subtask 4.1: Infrastructure Assessment</b>	10/1/19	9/30/22																				
Milestone: Completed Infrastructure Assessment	9/30/22	9/30/22																				
<b>Subtask 4.2: Regional Site Readiness</b>	10/1/19	9/30/22																				
Subtask 4.2.1: Data Quality Methodology	10/1/19	9/30/20																				
Subtask 4.2.2: Storage Complex Data Readiness Evaluation	4/1/20	9/30/22																				
Milestone: Completed Storage Complex Data Evaluation	9/30/22	9/30/22																				
Subtask 4.2.3: Storage Complex Readiness Validation, Valuation, and Augmentation	10/1/21	9/30/22																				
Subtask 4.2.4: Regional Application of Storage Complex Readiness	1/1/22	9/30/22																				
<b>Subtask 4.3: Socioeconomic Impacts of CCUS and Workforce Readiness</b>	10/1/21	9/30/23																				
Milestone: Report on Socioeconomic Impacts of CCUS and Workforce Readiness	9/30/23	9/30/23																				
<b>Subtask 4.4: Identification of Potential New CCUS Projects</b>	10/1/19	9/30/24																				
Milestone: Completed Final Regional Commercialization Plan	9/30/24	9/30/24																				
<b>TASK 5.0: REGIONAL TECHNOLOGY TRANSFER</b>	10/1/19	9/30/24																				
<b>Subtask 5.1: Stakeholder Engagement Plan</b>	10/1/19	9/30/24																				
<b>Subtask 5.2: Non-Technical Challenges to CCUS Deployment</b>	1/1/20	9/30/24																				
Milestone: Inventory Initial List of Non-Technical Challenges for CCUS	9/30/20	9/30/20																				
<b>Subtask 5.3: CCUS Business Cases Under New and Existing Tax Policies</b>	1/1/20	9/30/24																				
<b>Subtask 5.4: CCUS Educational Series</b>	10/1/19	9/30/24																				
<b>Subtask 5.5: Technology Transfer and Knowledge Dissemination</b>	10/1/19	9/30/24																				
Milestone: Participate in Project Kickoff Meeting	12/31/19	12/31/19																				
Milestone: Host Stakeholders Meeting to Share Results from BP1	9/30/23	9/30/23																				



# Connect with SSEB ([wernette@sseb.org](mailto:wernette@sseb.org))



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