

SOUTHEAST REGIONAL CO₂ UTILIZATION

SECARB-USA

and STORAGE ACCELERATION PARTNERSHIP

DE-FE0031830

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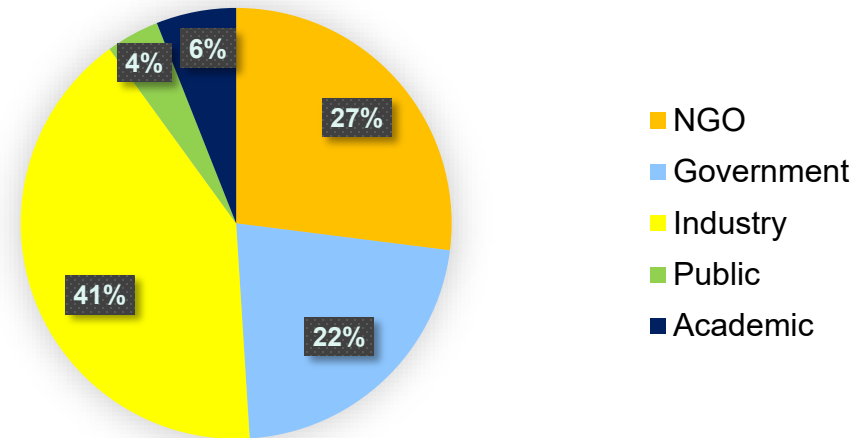
Presentation Outline

- **Technical Status, Accomplishments to Date, Lessons Learned**
 - Commercial interest upswing!
 - Cost of site characterization
 - Sub-Basin report
 - Techno-economic progress and plans
 - Non-technical challenges report
 - Outreach and cross partnership collaboration
- **Project Summary**
- **Mandatory Appendix**

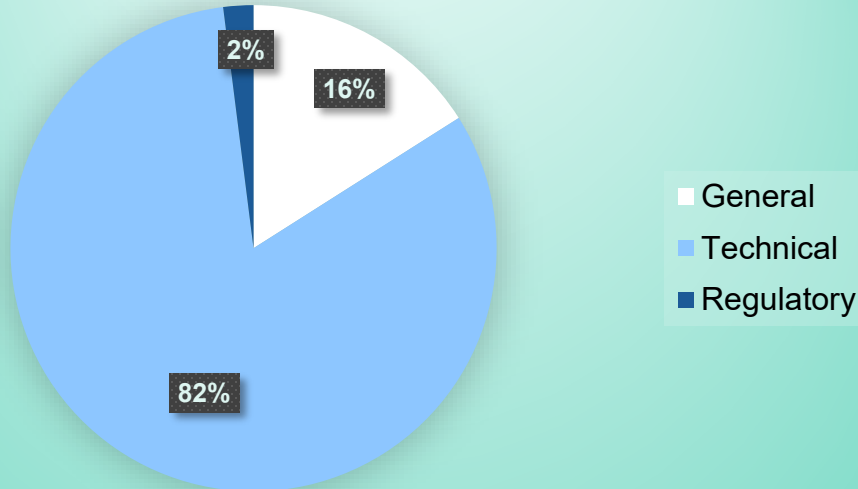
Commercial Interest Upswing

- Inquiries to SECARB-USA team during the second quarter of 2021 (N=51)

SECARB-USA Knowledge Sharing and Outreach (April-June, 2021)

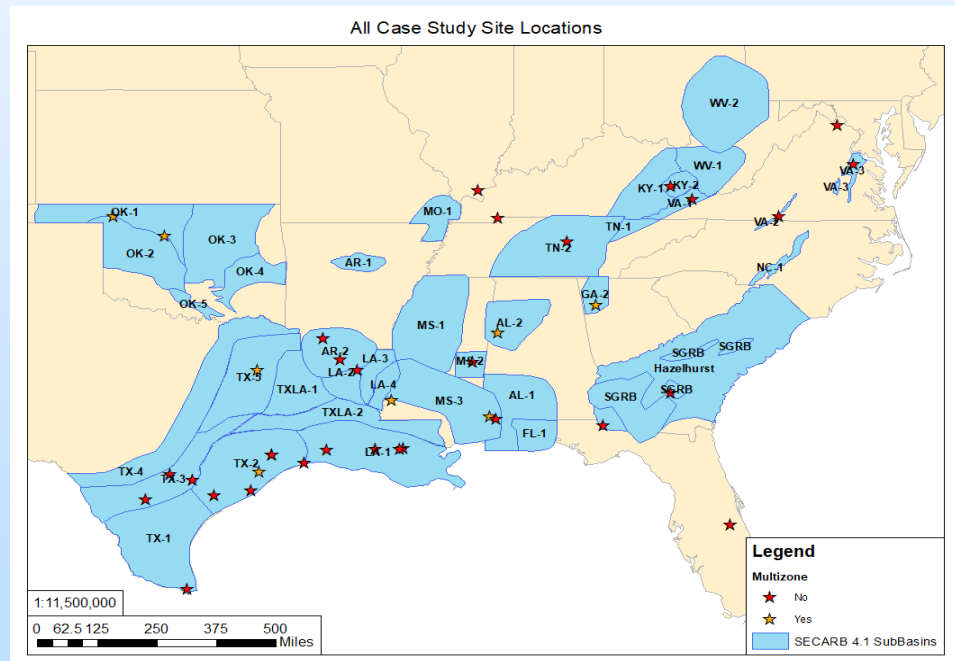


Topics Discussed

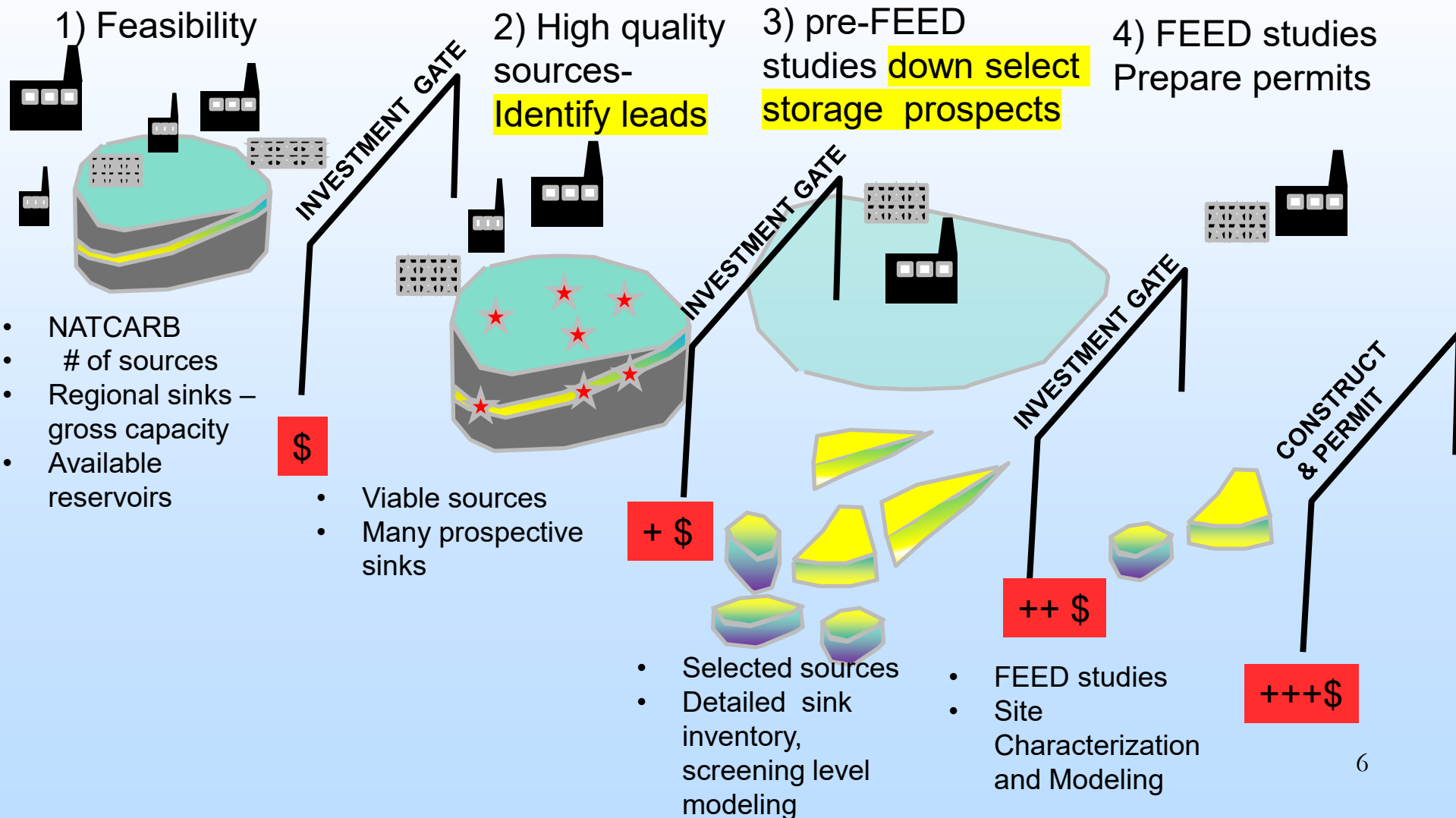


Study of Cost of Site Characterization: Motivation

- Recurrent question from industries considering CCS as part of GHG emissions reduction portfolio schedule of cost – especially cost of early stages prior to investment decision.
- Costs are modest, but experience shows that risk of project not reaching investment decision are relatively high
- Study to assess portfolio pre-permitting costs
- SECARB team effort – samples from many of the sub basins of the region.
- Sites selected to populate the spectrum of site options
- Taylor Barnhart UT Austin MS thesis work



Stages of Site Characterization



What Investment Is Needed To Cross Each Gate?

Incremental acquisition of data depends on two variables:

1. How urgent is the information?
2. How much data is already available that can be used to inform a decision?
3. We cross-plot the two inputs to rank if the data need is met at each investment gate. 6 is a passing score

Assigned Density Scores	Inverted Density Scores	=	Data Density		Data Need Score							
				4.0	0.0	2.0	4.0	6.0	8.0	10.0	12.0	
				3.5	0.0	1.8	3.5	5.3	7.0	8.8	10.5	
1.0	4.0			3.0	0.0	1.5	3.0	4.5	6.0	7.5	9.0	
1.5	3.5			2.5	0.0	1.3	2.5	3.8	5.0	6.3	7.5	
2.0	3.0			2.0	0.0	1.0	2.0	3.0	4.0	5.0	6.0	
2.5	2.5			1.5	0.0	0.8	1.5	2.3	3.0	3.8	4.5	
3.0	2.0			1.0	0.0	0.5	1.0	1.5	2.0	2.5	3.0	
3.5	1.5					0.0	0.5	1.0	1.5	2.0	2.5	3.0
4.0	1.0						Data Urgency					

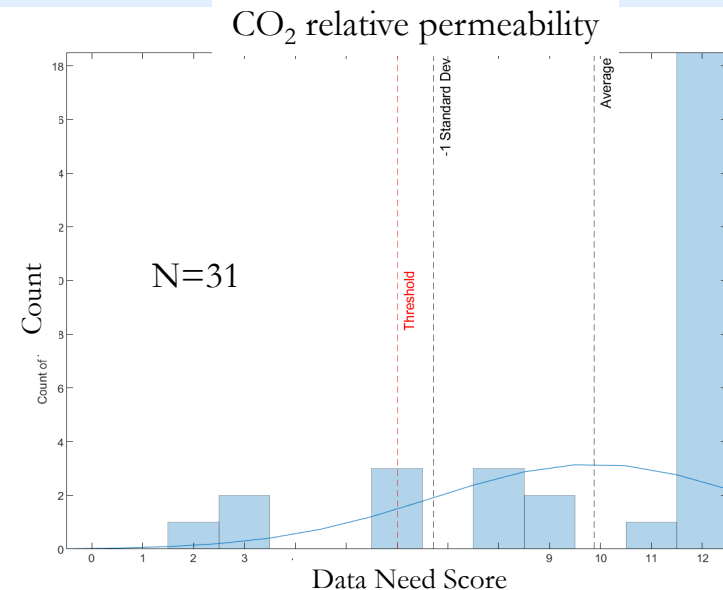
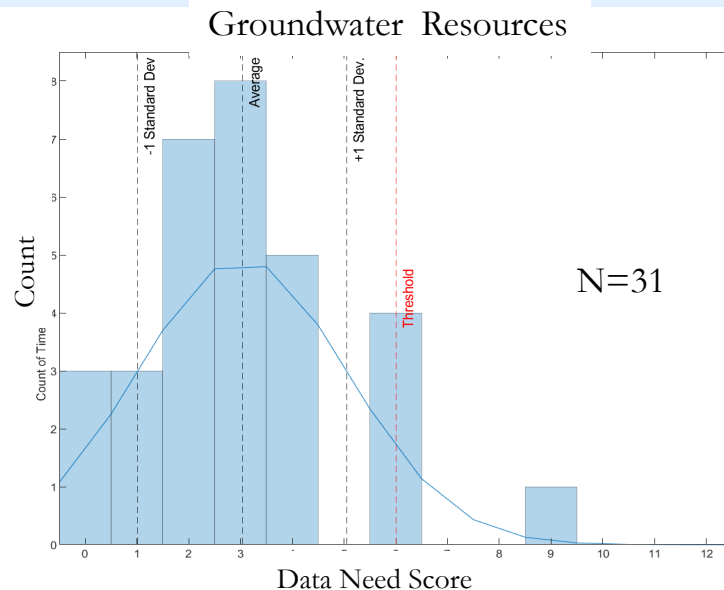
Data need score matrix

All the data EPA and States require will need to be collected to get a permit, but where the need scores well enough to pass a gate, spending can be delayed to later in the project development, and advantage.

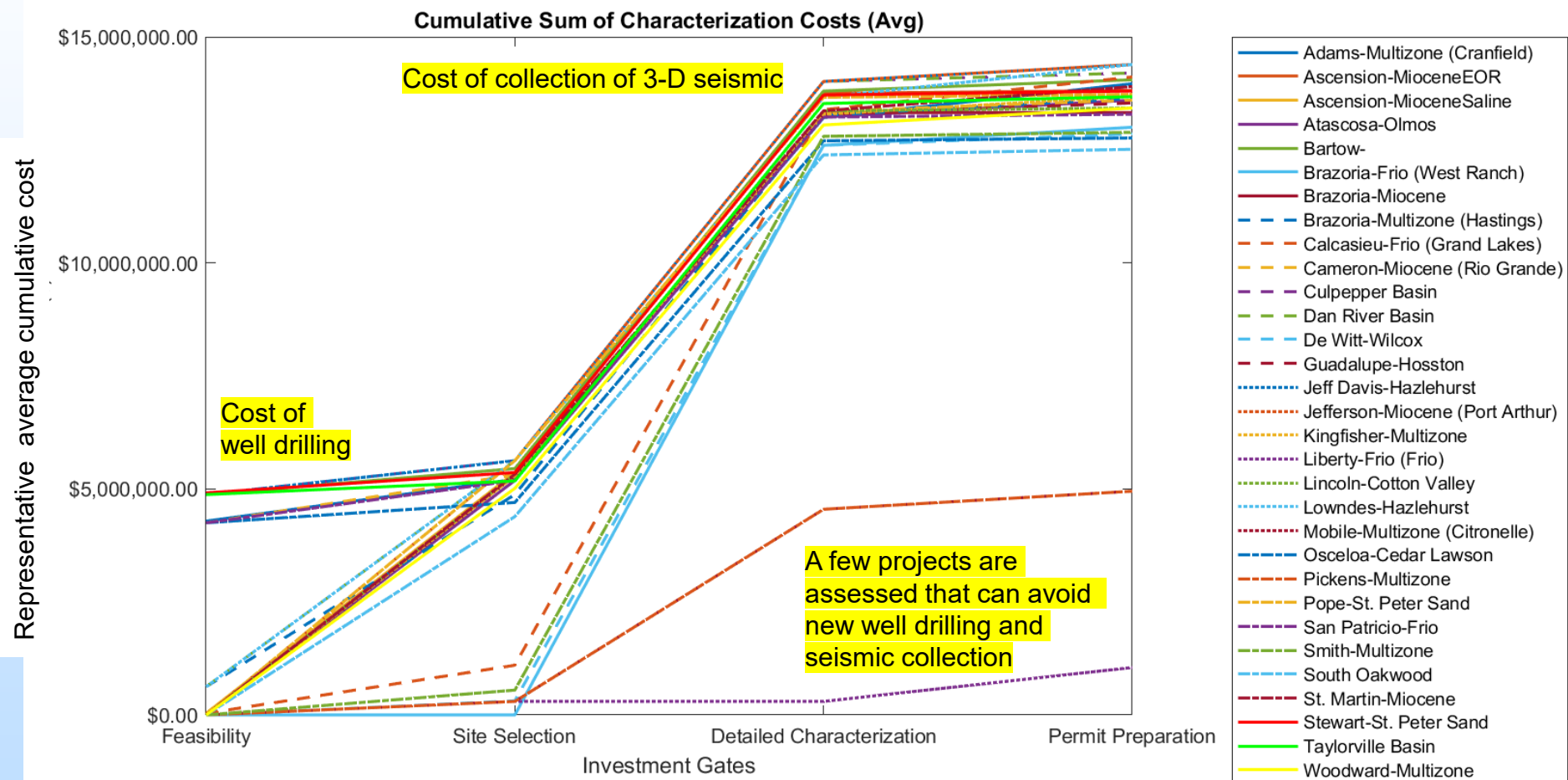


Cost of Site Characterization: Methodology

- Rubric of 42 categories for data density and urgency
- Completed by 11 SECARB team members for 31 sites
- “Beta” sites are those that are now in advanced stages of characterization, followed by prospective sites which are newly assessed
- Include multizone, saline, CBM and EOR
- Data density and urgency multiplied and evaluated.

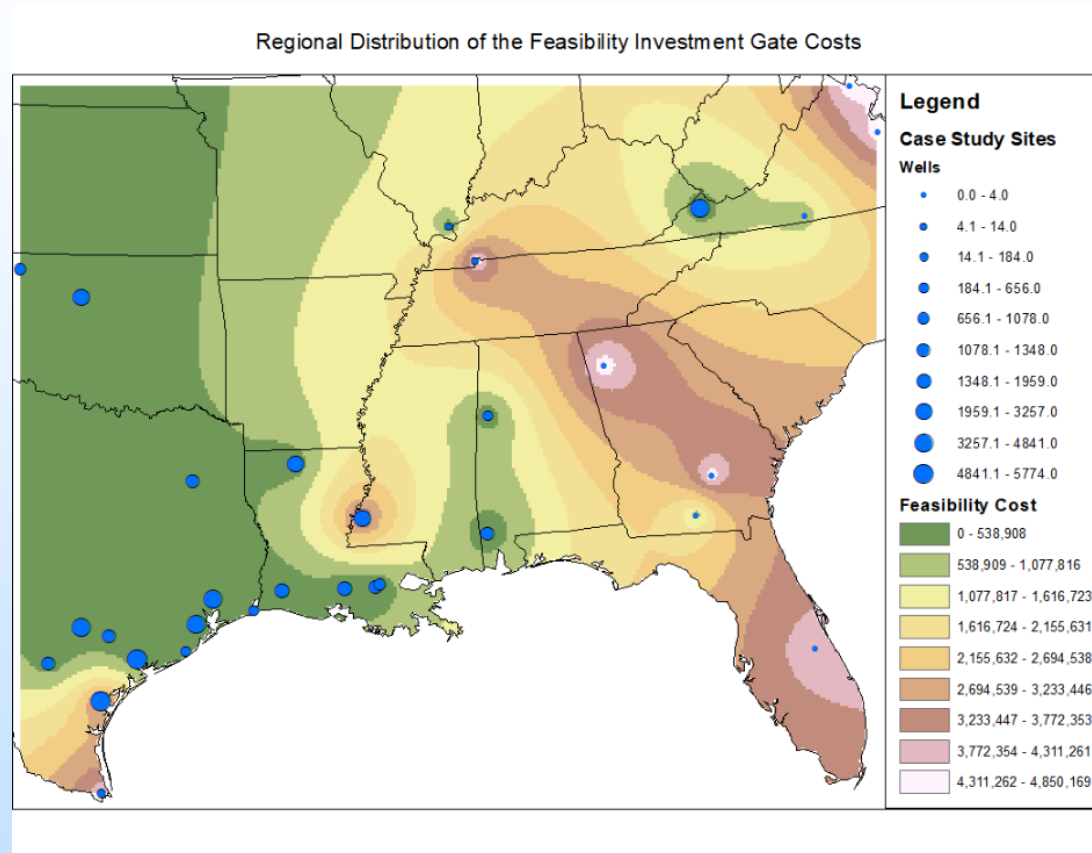


Relative Investment Costs Versus Project Stage



Relative investment costs required at each investment gate

Value of Exiting Data to Lowering Feasibility Assessment Cost



Regional distribution of the feasibility investment gate costs (green=low) with well density (IHS Markit database) within 10 miles of each site (blue dots). There is strong correlation with existence of 3-D seismic with high well density.

Industry Partners Adding to Regional Knowledge

- Industry partner Southern Company is planning stratigraphic test bores in regions with limited data density
- Southern Company-funded test bores planned for Bartow County, GA and Shelby County, AL
 - ‘CCUS Wildcat Wells’
- Working closely with SECARB-USA partners (SSEB, Advanced Resources International)
- Produced data will be added to the SECARB-USA regional knowledge base



Approximate location of Southern Company's planned stratigraphic test bores



Bartow Co. site preparation



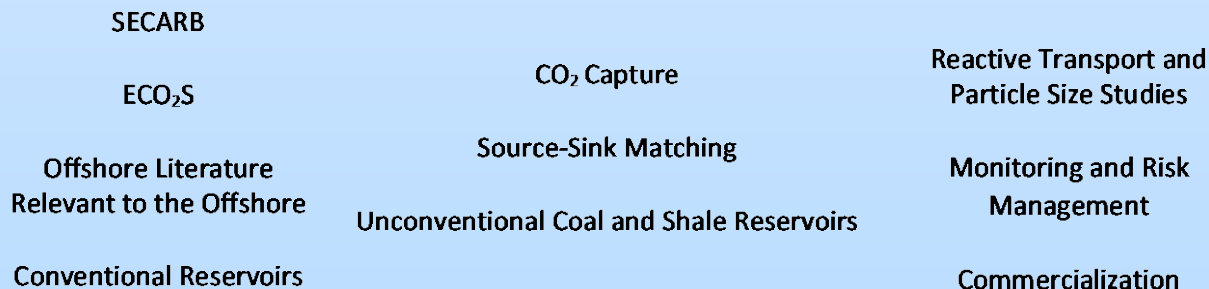
Cost of Site Characterization: Accomplishments/Lessons Learned

- Rapid increase in new commercial and other interest in CCS recently
- To provide better information to new investment in storage as part of CCS, SECARB-USA has developed and deployed a new standardized methodology for assessing investment needs to prepare data and model for permitting.
- Additional improvement and refinement upcoming
- After SECARB-USA review, the new method can be shared

Technical Status – Prospective Sub-Basins

A Sub-Basin Framework for Future CO₂ Infrastructure Development

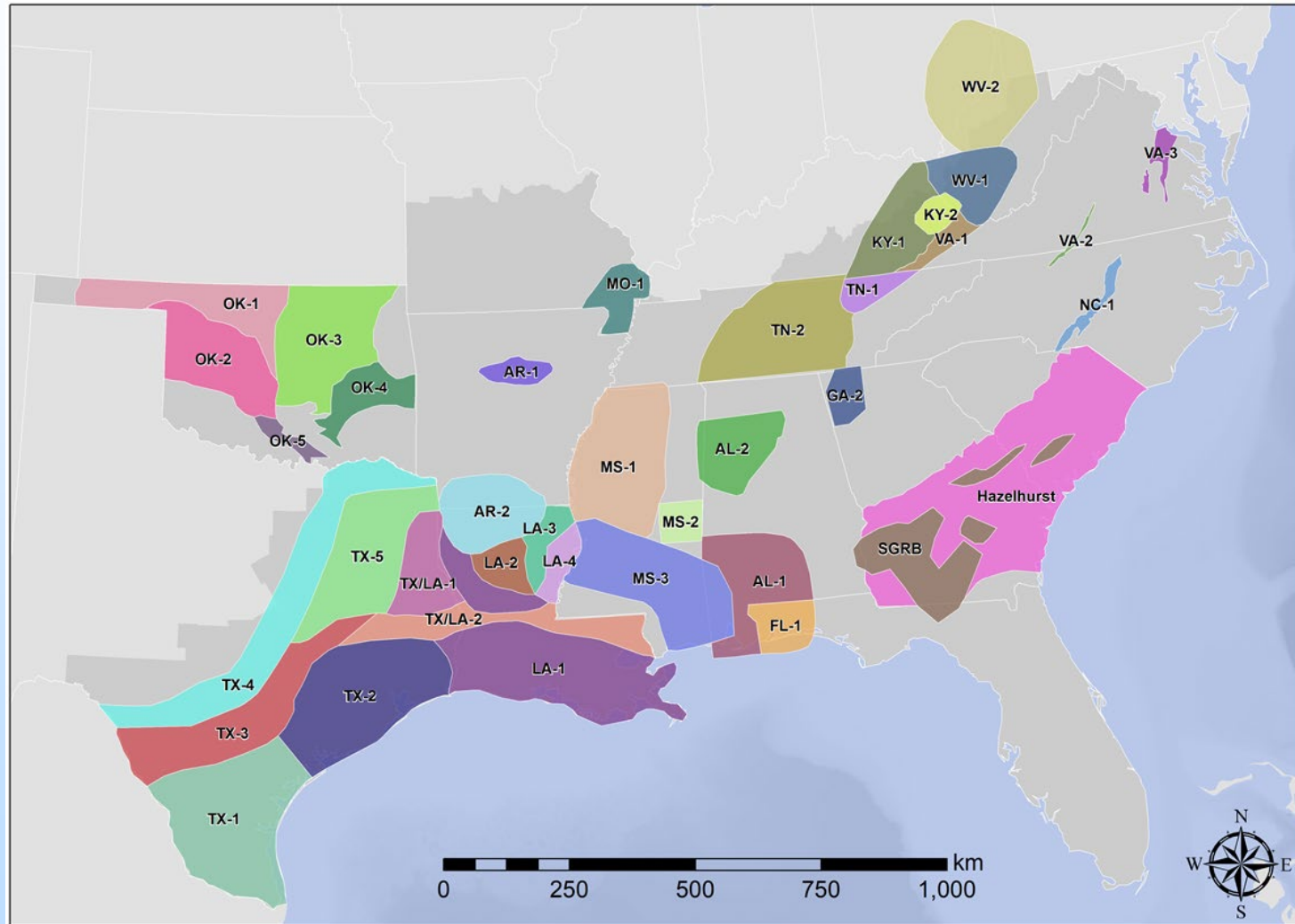
- The objective of the report, (work product 4.1.a), is to provide the framework for understanding how regional infrastructure development could occur within the Region. The sub-basin prospective areas, in conjunction with the locations of CO₂ sources and pipeline infrastructure (for source-sink matching networks) form the basis for the analysis that will be performed in the Techno-Economic Analysis of Infrastructure Buildout Scenarios
- The summaries of reports and publications (69 literature publications) are representative of the knowledge base that will enable the development of Infrastructure Buildout Scenarios for the SECARB-USA region. Specific areas of focus include:



Technical Status – Prospective Sub-Basins

- The SECARB-USA region has been one the most active areas for CCUS research, development, and demonstration in the United States.
 - From 2003 to present, the region has hosted multiple field and laboratory projects and other CCUS related studies. In addition to the research projects, the SECARB-USA region is home to commercial CCUS projects and existing CO₂ pipelines infrastructure.
 - The CCUS related research conducted by SECARB-USA project team members, as well as past studies, provides an excellent base from which the team developed the prospective sub-basins identified in the report. Each Sub-Basin was discussed in terms of:
 - Geology
 - Knowledge Gaps and Uncertainties
 - CCUS projects within the Sub-Basin

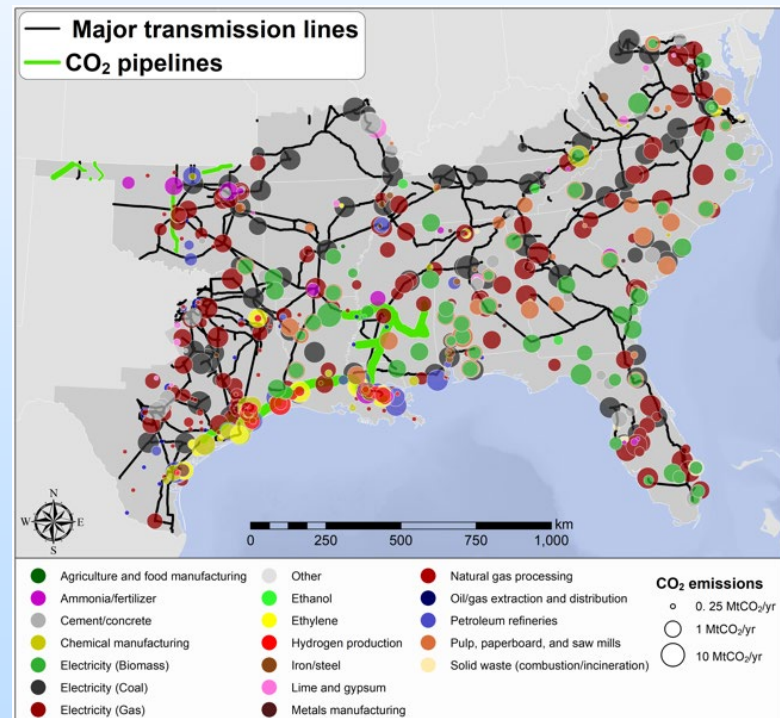
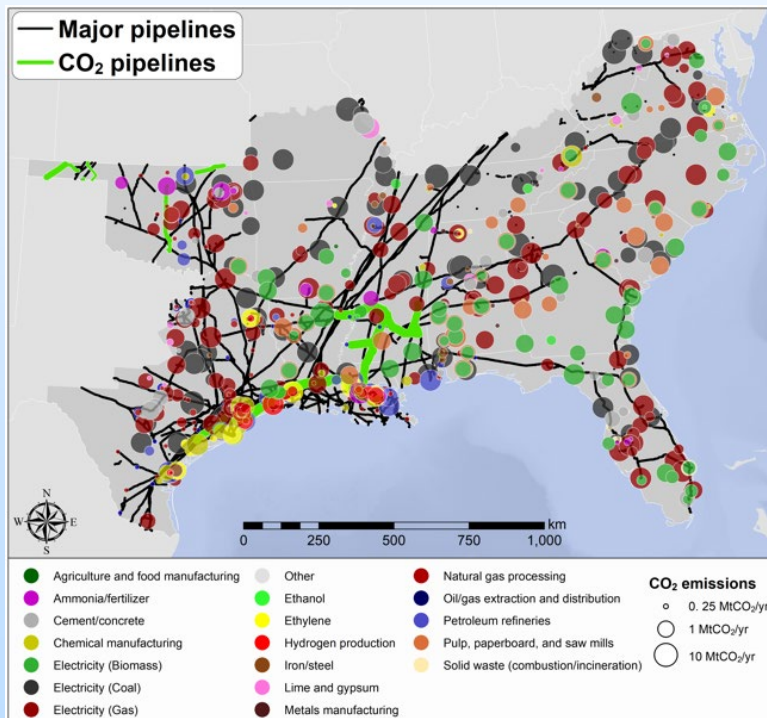
Technical Status – Geologic Sub-Basins



Prospective Sub-Basins in the SECARB-USA region

Technical Status – Regional Infrastructure

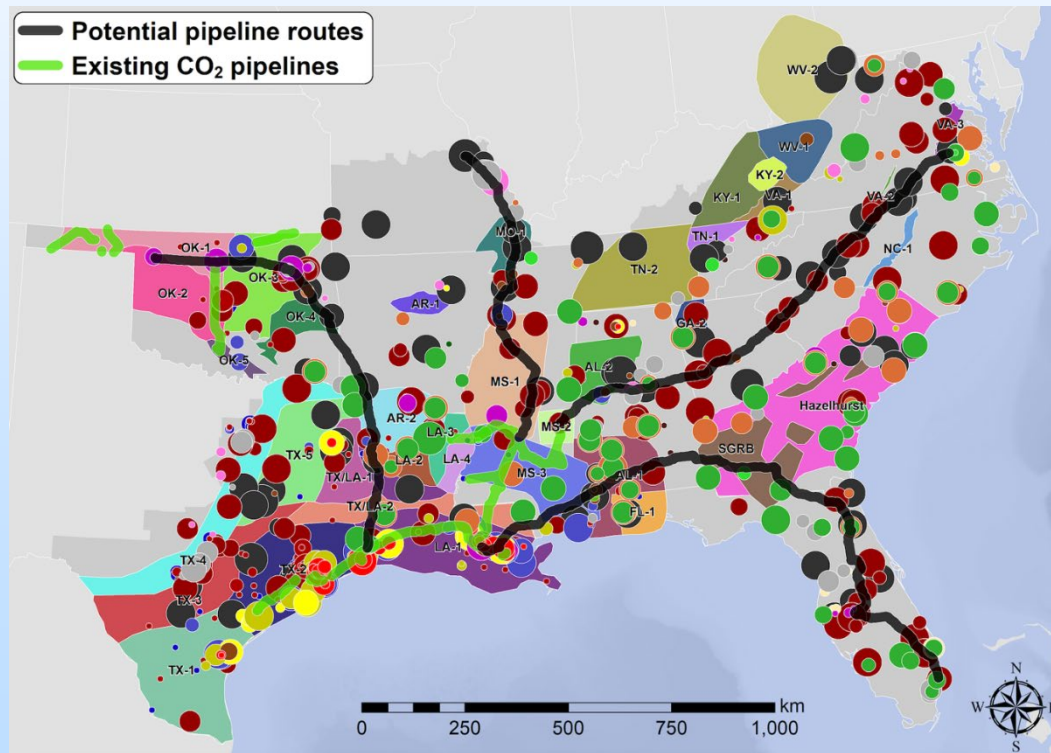
Pipeline construction is expensive, and the permitting process may take many years to finalize. A possible way to streamline the process would be to focus on building new pipelines in existing right of ways and easements. The SECARB-USA region has many existing natural gas pipelines and powerlines with existing easements.



45Q eligible sources and Major pipelines (24 inch in diameter or greater – left) and major transmission lines (345 KV and greater – Right)

Technical Status – Regional Infrastructure

- Using SimCCS^{2.0} and CostMAP, potential CO₂ pipeline routing was developed with an emphasis on using existing gas and powerline easements to connect 45Q-eligible sources with the identified Sub-Basins. This initial analysis will be used as one resource as the team develops the forthcoming Techno-Economic Analysis of Infrastructure Buildout Scenarios (Work Product 4.1.b)



Prospective Sub-Basins, existing CO₂ pipelines, proposed CO₂ pipeline routing and 45Q eligible sources

Technical Status – Non-Technical Challenges

Initial Inventory of Non-Technical Challenges to CCUS Development

- Under subtask 5.2: Non-Technical Challenges to CCUS Deployment, the Southern States Energy Board (SSEB) will define and identify An Inventory of Non-Technical Challenges to CCUS Deployment. As an initial step, SSEB organized an Industry and Non-Governmental Organization (NGO) Working Group comprised of knowledgeable market participants to assist in the development of an initial list of non-technical challenges to CCUS development.
- The Industry and NGO Working Group was comprised of individuals from the following organizations and companies:

Clean Air Task Force¹ (observer)
Environmental Defense Fund
SAS Institute Inc.

Denbury Resources Inc.
Mitsubishi Heavy Industries America
Southern Company

Technical Status – Non-Technical Challenges

- Work completed by the Industry and NGO Working Group resulted in the identification of a wide range of issues related to the Non-Technical Challenges to CCUS Development. This initial inventory provided a base of discussion for prioritizing non-technical challenges. Within each area of focus, the Industry and NGO Working Group identified Areas of focus that should be prioritized.

The Focus areas included:

- Regulatory Challenges
- CCUS Technology Transfer and Education Challenges
- Financial Challenges
- Infrastructure Challenges

Technical Status – Non-Technical Challenges

Prioritized issues related to each focus:

- **Regulatory Challenges**
 - UIC Class VI Requirements
 - Assisting states with primacy and reform of Class VI requirements
 - Facilitate other State issues
 - Pore space and surface rights access
- **CCUS Technology Transfer and Education Challenges**
 - Conduct stakeholder outreach
 - Key groups include National Association of State Energy Officials (NASEO), National Association of Regulatory Commissioners (NARUC), Public Service Commissions, industrial emitters, and energy sector employers
- **Financial Challenges**
 - Monetizing Section 45Q tax credits
- **Infrastructure Challenges**
 - Facilitating development of CO₂ transportation infrastructure and source-sink matching

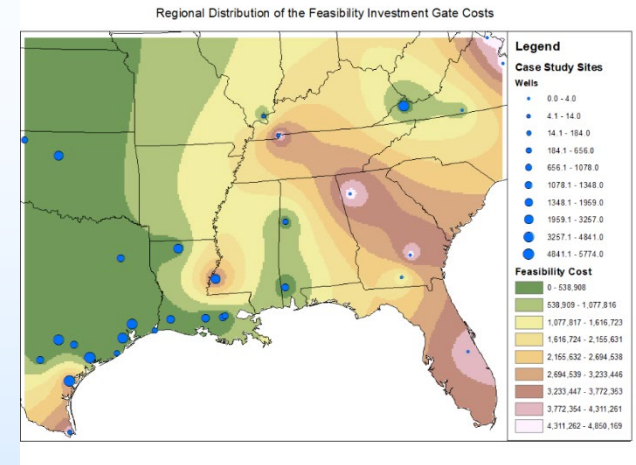
Findings used as part of other DOE-funded studies (e.g., DOE-FE0031947)

Outreach and Cross Partnership Collaboration

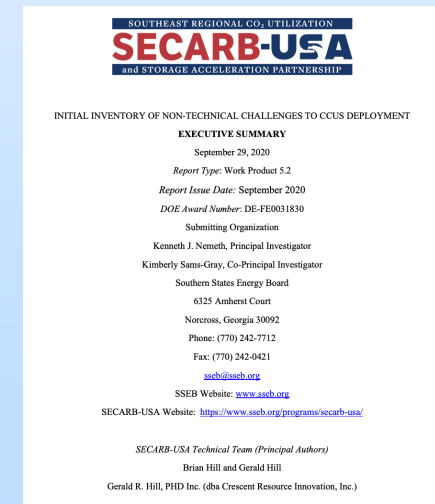
- SECARB-USA continues to coordinate with the other initiatives to identify areas of overlap and avoid duplication of effort
- Led by MRCI, the Regional Initiatives will continue to meet to discuss communication and outreach efforts
- On July 15, 2021, the Southern States Energy Board hosted a Regional Initiative Webinar to provide stakeholders with overview of regional CCUS successes and challenges. Participants included:
 - Robert Balch, Carbon Utilization and Storage Partnership (CUSP)
 - Neeraj Gupta, Midwest Regional Carbon Initiative (MRCI)
 - Ed Steadman, Plains CO₂ Reduction Partnership (PCO₂R)
 - Jason Lanclos, Director of the Louisiana State Energy Office

Accomplishments to Date

- Prepared a needs assessment framework for storage complexes
- Established a data quality methodology and identified 40 prospective sub-basins in the SECARB region (shaded regions, Figure)
- Developed a sub-basin framework for future CO₂ infrastructure development
- In coordination with the SECARB-USA industry stakeholder network, developed a list of non-technical challenges to the commercial deployment of carbon capture technologies
- The team has identified data required to advance a prospective storage complex towards permit readiness (i.e., Class VI UIC) and the general costs associated with collecting this data



Regional distribution of feasibility investment gate costs



Accomplishments to Date (continued)

- Hosted discussions with interested stakeholders and utilized SECARB-USA data to inform conversations
- SSEB Regional Initiative Webinar on July 15, 2021, to discuss the successes and challenges of the other initiatives
- Work with industry partners that are actively pursuing CCUS research in the region
- Assorted partner publications



Southern Company-funded stratigraphic test boring operations in Bartow County, GA



Register for our upcoming webinar:
Carbon Capture - Regional Initiatives Focus

July 15 | via Zoom | 11 - 12:15 p.m. EDT

Join us for our next webinar! We will explore the past, present, and future work of three regional initiatives (RIs) related to carbon capture, utilization, and storage (CCUS).

The RIs and respective project leads highlighted in this webinar are:

- The Carbon Utilization and Storage Partnership (CUSP) – New Mexico Institute of Mining and Technology with **Dr. Robert Balch**, Director of the Petroleum Recovery Research Center
- The Midwest Regional Carbon Initiative (MRCI) – Battelle Memorial Institute with **Neeraj Gupta**, Technical Director - Carbon Management in Battelle's Energy Division and **Sallie Greenberg**, Associate Director of Energy & Minerals at the Illinois State Geological Survey; and
- The Plains CO₂ Reduction Partnership (PCO₂R) – University of North Dakota's Energy & Environmental Research Center (EERC) with TBA.

This session will also feature **Jason Lanclos**, the Director of the Louisiana State Energy Office, discussing the value and effects of regional carbon capture initiatives.

Click below to register for this free event.

SSEB Regional Initiative Webinar registration landing page

Ongoing and Planned Activities

- Expand the SECARB-USA industry stakeholder network to include hard to abate industries (e.g., pulp and paper) and continue industry outreach efforts
- Continue to characterize a portfolio of prospective storage complexes with the goal of identifying costs required to advance representative complexes towards permit readiness
- Coordinate with the other Regional Initiatives where possible (e.g., outreach efforts)
- SSEB will host a SECARB-USA informational webinar for interested stakeholders
- Proposed 5/2021: Evaluate infrastructure buildout and source-sink matching scenarios and build an online dashboard to display these data
- Proposed 5/2021: Permit and drill a stratigraphic test well in northwest Georgia to further characterize the geology for a storage complex opportunity where little data currently exists
 - A \$0 federal and \$2.8 million cost-share commitment to support this effort is pending approval by DOE/NETL.

Lessons Learned

- Observed increase in industry interest in CCUS
- Identification of areas in the region that may require additional data and further investment
- Industry Partners contribution to Regional Initiative mission
- Lots to learn from the experiences of the other Regional Initiatives (outreach, etc.)

Project Summary

- Recent increase in Industrial and other interest
 - 51 separate meetings during Q2 of 2021
- Cost of site characterization
 - Data rubrics allow for the determination of investment at each decision gate
- Techno-economic progress and plans
 - Will build on the current site characterization work and regional knowledge base
- Non-technical challenges report
 - Highlights challenges to the deployment of CCUS and utilized by other DOE-funded studies.
- Outreach and cross partnership collaboration
 - Ongoing in the form of outreach and communication working groups and webinars



Research Partners



U.S. DEPARTMENT OF
ENERGY



NATIONAL
ENERGY
TECHNOLOGY
LABORATORY



Advanced Resources
International, Inc.



BUREAU OF
ECONOMIC
GEOLOGY



CRESCENTRI
RESOURCE INNOVATION



Industry Partners



CLEAN AIR
TASK FORCE



MITSUBISHI
HEAVY INDUSTRIES



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Thank You!



Benefit to the Program

- The “Southeast Regional CO₂ Utilization and Storage Acceleration Partnership” (SECARB-USA) project supports the U.S. Department of Energy (DOE) Office of Fossil Energy's (FE) mission 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.
- This 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.

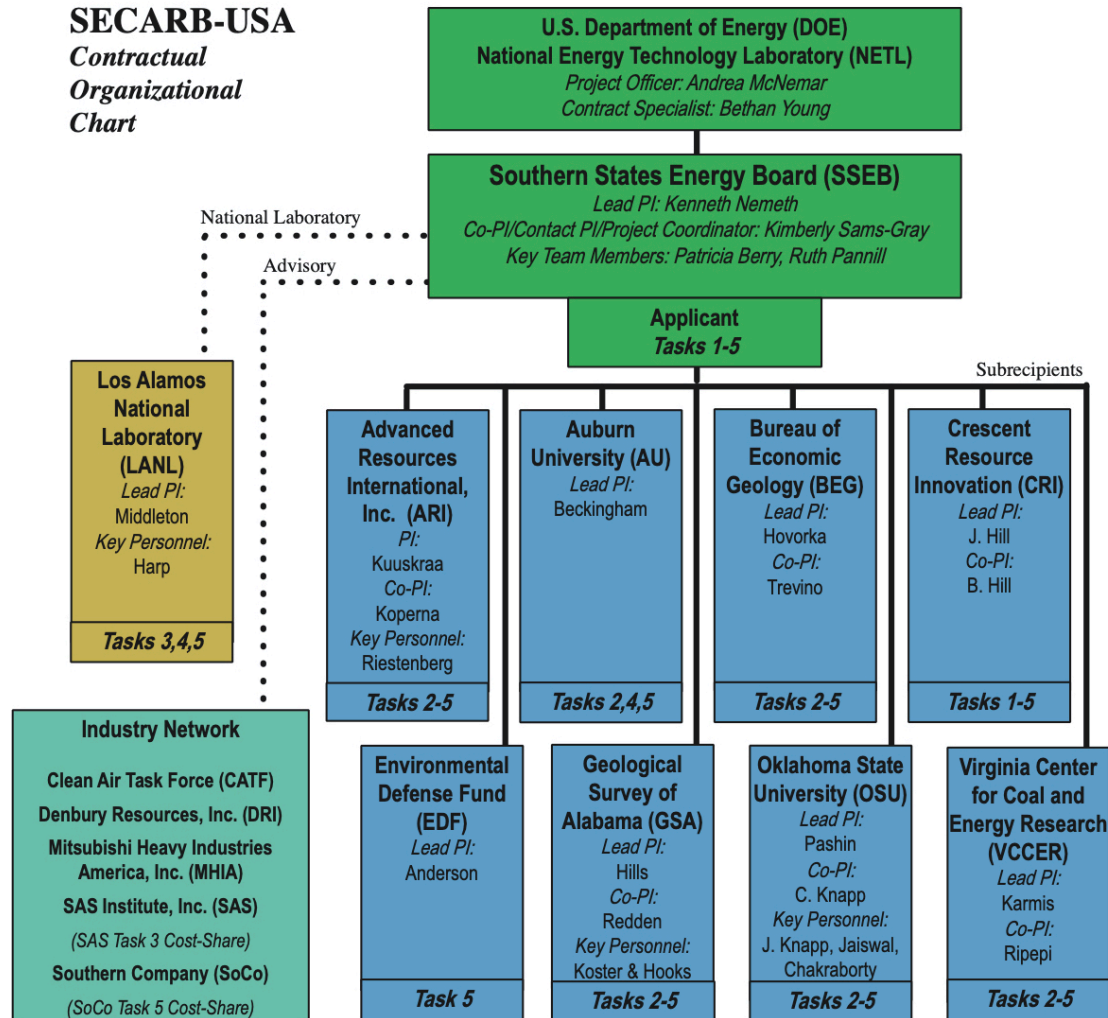
Project Overview

Goals and Objectives

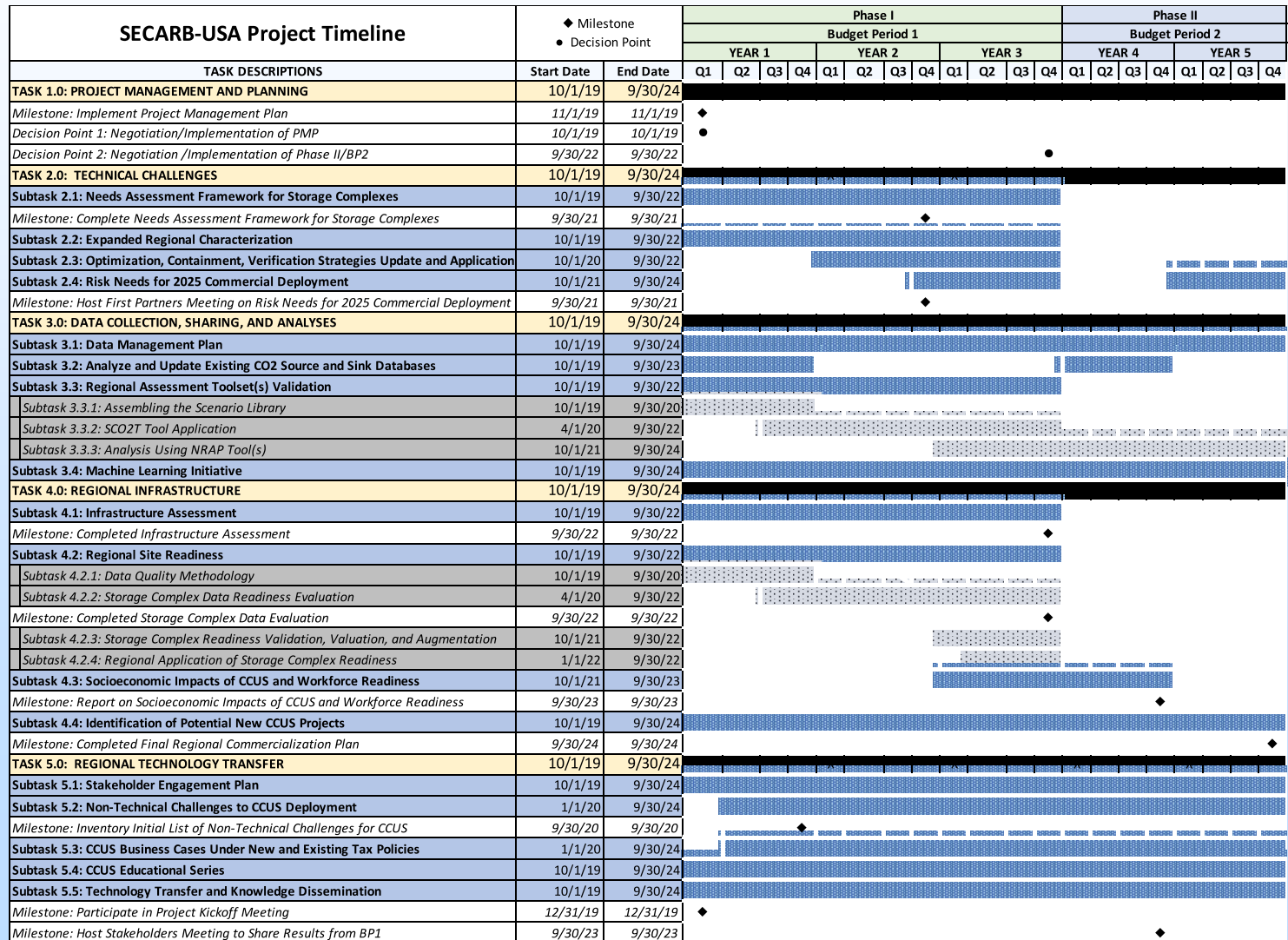
- The primary objective of the project is to identify and address regional onshore storage and transport challenges facing commercial deployment of carbon dioxide (CO₂) capture, utilization, and storage (CCUS) technologies.

Organization Chart

SECARB-USA Contractual Organizational Chart



Gantt Chart



Bibliography

- Sabo, M. S., and Beckingham, L. E., 2021, Porosity-permeability evolution during simultaneous mineral dissolution and precipitation. *Water Resources Research*, v. 57, doi: 10.1029/2020WR029072