

SOUTHEAST REGIONAL CO₂ UTILIZATION

SECARB-USA

and STORAGE ACCELERATION PARTNERSHIP

DE-FE0031830

Led by Southern States Energy Board

Ken Nemeth, Kimberly Sams-Gray, Patricia Berry

Susan D. Hovorka

Gulf Coast Carbon Center

Bureau of Economic Geology

Jackson School of Geoscience

The University of Texas at Austin

Brian Hill

Crescent Resource Innovation

U.S. Department of Energy

National Energy Technology Laboratory

Carbon Storage Project Review Meeting

Sept 8-11 2020

Disclaimer

This presentation is based upon work supported by the Department of Energy and was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

Program Goal, Objective, and Research Areas

The **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 current Regional Carbon Sequestration Partnership (RCSP) Initiative to continue to identify and address knowledge gaps**.

Identify and address regional onshore storage and transport challenges facing commercial deployment of carbon dioxide (CO₂) capture, utilization, and storage (CCUS) technologies.

Primary Research Areas:

- 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.

Research Partners



U.S. DEPARTMENT OF
ENERGY



NATIONAL
ENERGY
TECHNOLOGY
LABORATORY



Advanced Resources
International, Inc.



BUREAU OF
ECONOMIC
GEOLOGY



Industry Partners



CLEAN AIR
TASK FORCE



SECARB-USA

SECARB-USA at a glance...

Basics

- 5-year project, start date 10/1/2019
 - Conditional award
- 2 phases (P) and 2 budget periods (BP)
 - PI/BP1 (3 years): 10/1/19-9/30/22
 - PII/BP2 (2 years): 10/1/22-9/30/24
- Federal \$5,000,000 (\$5 million/RI appropriated and currently under negotiation with NETL for scope enhancement)
- Non-Federal \$1,335,136 (21%)
- 8 Subrecipients
- 1 National Laboratory
- 5 Industry Network Organizations – advisory capacity
- Existing Public-Private Partnership

Primary Tasks

- T1: Project Management & Planning
- T2: Technical Challenges
- T3: Data Collection, Sharing, and Analyses
- T4: Regional Infrastructure
- T5: Regional Technology Transfer

Project-Specific Meetings

- Annual Partners Meetings
- Annual Stakeholders' Briefing
- Project Review Meetings and Kickoff and Final Briefings

Outline

- Initial Inventory of Non-Technical Challenges to CCUS Deployment - Brian Hill, Crescent Resources Innovation
- Preliminary assessment of regional storage using SCO_2T - Richard Middleton, Los Alamos National Lab
- SAS Viya Decision Support System - Oklahoma State
- Oklahoma Storage Objectives – Jack Pashin, Camelia Knapp, James Knapp
- S. Arkansas/ N. Louisiana CO_2 Storage – Dave Riestenberg, Advanced Resources International
- Virginia update – Michael Karmis, Nino Ripepi Virginia Center for Coal and Energy Research, Virginia Tech
- Geochemical characterization: Mineral trapping and changes in formation properties Water –Rock interaction in subsurface energy systems - Lauren Beckingham – Auburn University
- Developing storage leads and concept of fetch and trap – Texas Louisiana – Susan Hovorka and Vanessa Nuñez-Lopez, Gulf Coast Carbon Center
- Working with SECARB USA for Safe and Smart CCUS Deployment – Scott Anderson, Environmental Defense Fund

Initial Inventory of Non-Technical Challenges to CCUS Deployment*

- Subtask 5.2: Non-Technical Challenges to CCUS Deployment – Define and identify 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 including:
 - Clean Air Task Force
 - Environmental Defense Fund
 - SAS Institute
 - Denbury Resources
 - Mitsubishi Heavy Industries America
 - The Southern Company
- The Industry and NGO Working Group (Working Group) held three of four conference calls to identify and discuss potential Non-Technical Challenges to CCUS Deployment.
- Initial areas of discussion and interest identified by the Working Group included
 - The need to consider issues surrounding regional hubs
 - The need to assist states in obtaining Class VI primacy
 - Storage was identified as one of the most significant components to moving capture/storage forward
 - The location of sources relative to storage/utilization options was identified as a factor in holding back capture unit buildout
 - Understanding financial incentives for CCUS and guiding the implementation of financial incentives to match commercial deployment needs

*Preliminary, Working Group may make additional changes prior to September 30, 2020

Brian Hill CRI

Initial Inventory of Non-Technical Challenges to CCUS Deployment*

- Over the course of several months, the Working Group developed an initial List of Non-Technical Challenges to CCUS Deployment. The challenges identified were then grouped into one of several categories
 - Regulatory Challenges
 - CCUS Technology Transfer and Education Challenges
 - Financial Challenges
 - Infrastructure Challenges
- The Working Group determined that it should prioritize non-technical challenges and that the focus of SECARB-USA should be on (1) making sure actions are relevant to the Southeast; and (2) “how to implement” actions in the Southeast. The five prioritized challenges for SECARB-USA are identified as follows:
 - Class VI UIC Requirements
 - Facilitating Other State Challenges
 - Stakeholder Dialogue on CCUS
 - Focus on Incentives
 - CO2 Infrastructure and Source-Sink Matching
- Within each prioritized challenge, the Working Group was able to identify some initial actions that could be applied through work within SECARB-USA to begin addressing each challenge. Possible actions include:
 - Assessment and Reporting
 - Workshops
 - Briefings
 - Stakeholder Engagement
 - External Communications

*Preliminary, Working Group may make additional changes prior to September 30, 2020

Brian Hill CRI

LANL: Progress & Future Plans

TASK 3.3 – REGIONAL STORAGE

- DELIVERABLE: Preliminary assessment of regional storage using *SCO₂T* (9/30/20).
- PROGRESS: *SCO₂T* tool has been enhanced & applied to calculate regional storage (figure).
- DEVELOPMENT: *SCO₂T* tool recently published - <https://www.sciencedirect.com/science/article/pii/S2590197420300173> & second paper in review.

FUTURE

- STORAGE: Update input geology data to enhance *SCO₂T* calculations.
- INFRASTRUCTURE: Apply *SimCCS* framework (<https://simccs.com/>) to Southern Company gas power plants → calculate integrated capture, transport, & storage.

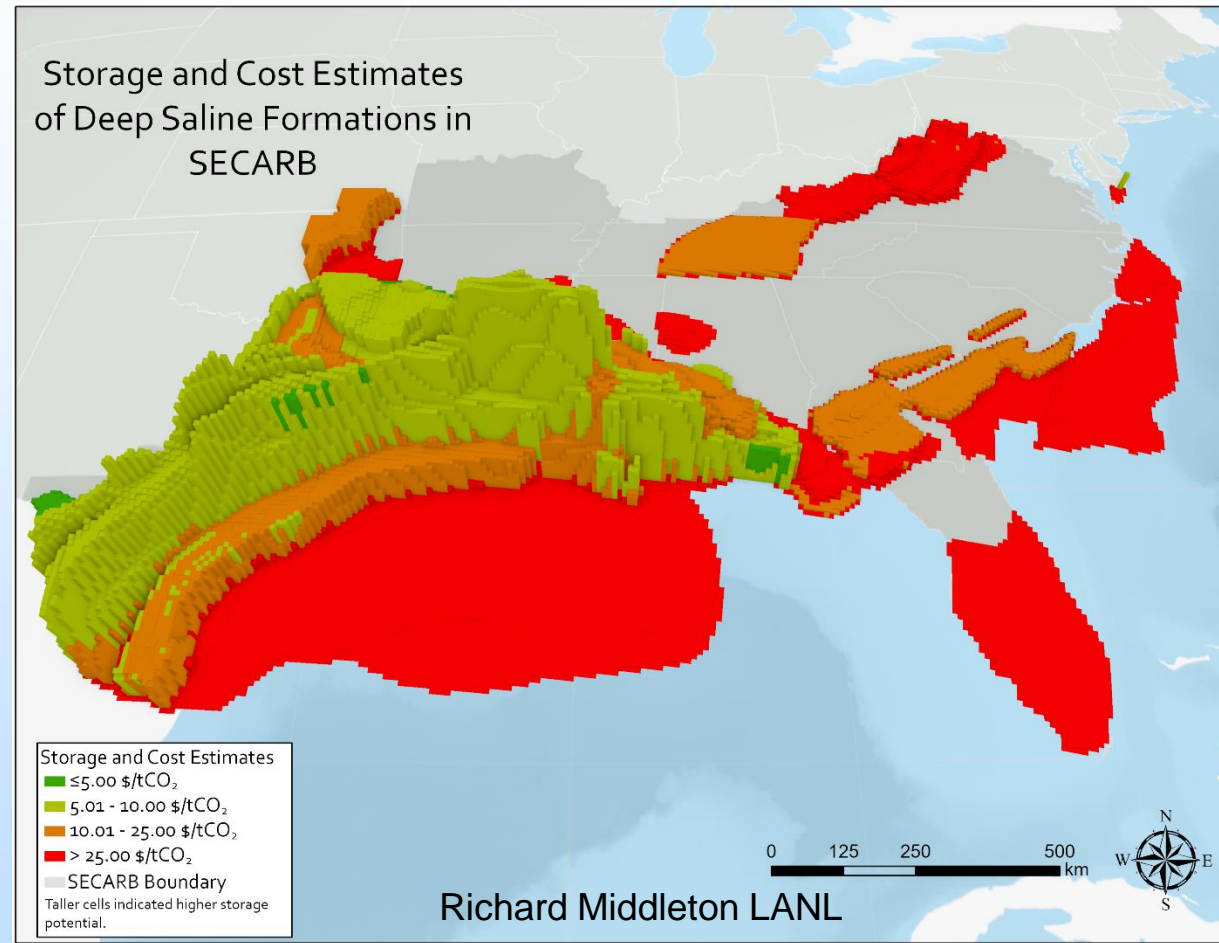


FIGURE: Saline storage capacity and costs for the SECARB region based on the *SCO₂T* tool. Each 10x10 km grid cell includes capacity (bar height) and weighted-average costs (color) across stacked storage options. Missing geologic data in NATCARB results in low/absent storage capacities (e.g., offshore).

SAS VIYA DECISION SUPPORT SYSTEM

- ✓ Data Mining
- ✓ Advanced analytics
- ✓ Machine learning
- ✓ Decision support
 - Site characterization
 - Multivariate site ranking and selection
 - Risk assessment



What are your objectives?

Saline formation storage
Depleted reservoir storage
Enhanced oil recovery
Pressure maintenance

Considerations

Quantified factors
Categorical factors
Ranked factors
Infrastructure
Fluid transport options

Geologic Information

Reservoir location, dimensions
Rock type
Depth
Reservoir thickness
Structural and depositional geometry
Trap type

Reservoir properties

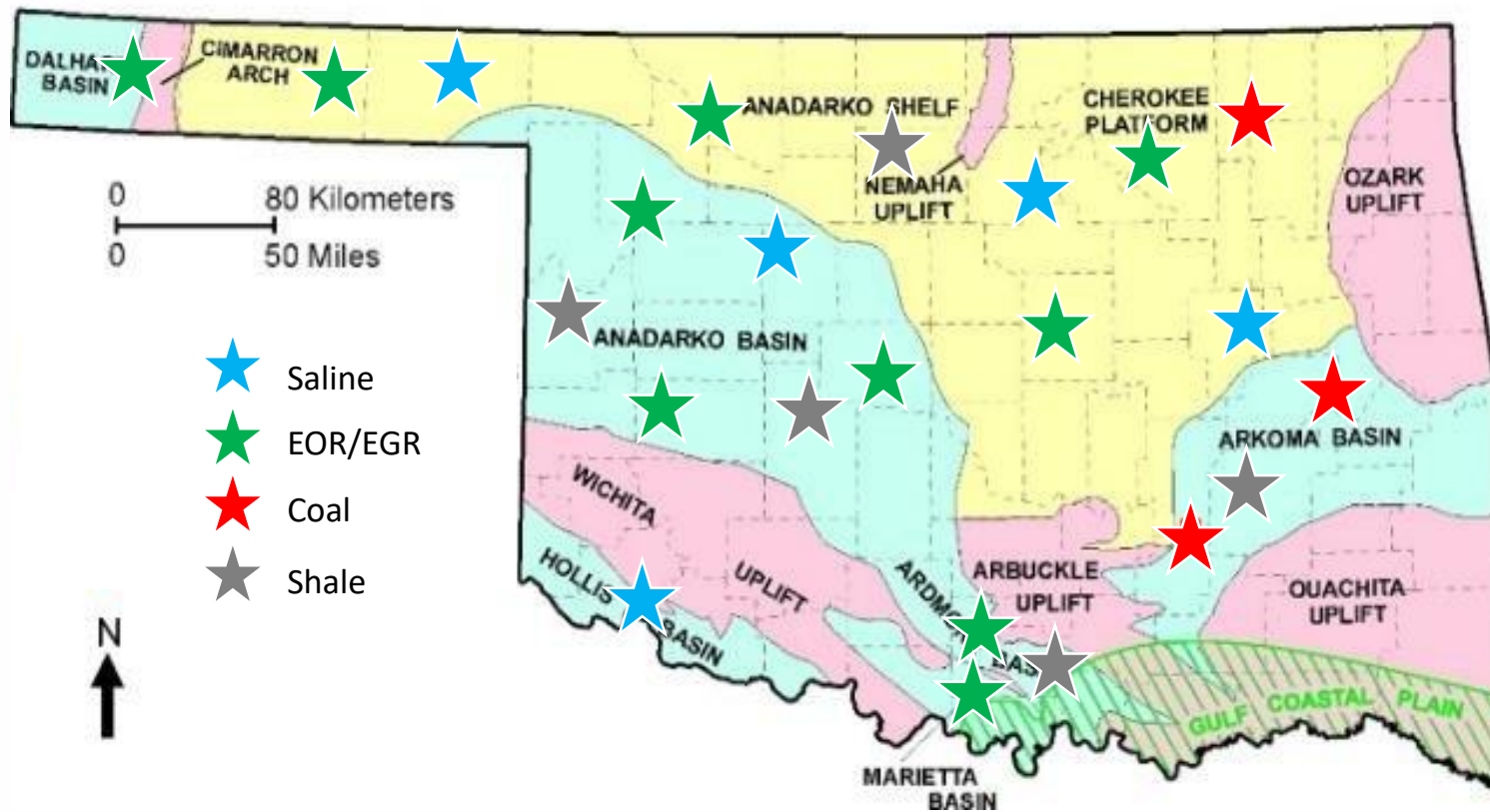
Porosity
Permeability
Fluid composition and properties
Pressure
Storage resource

EOR/EGR information

API gravity
Gas-oil ratio
Resource/reserve volumes
Production volumes
Production history
Drive type
Production systems

Pashin, Oklahoma State

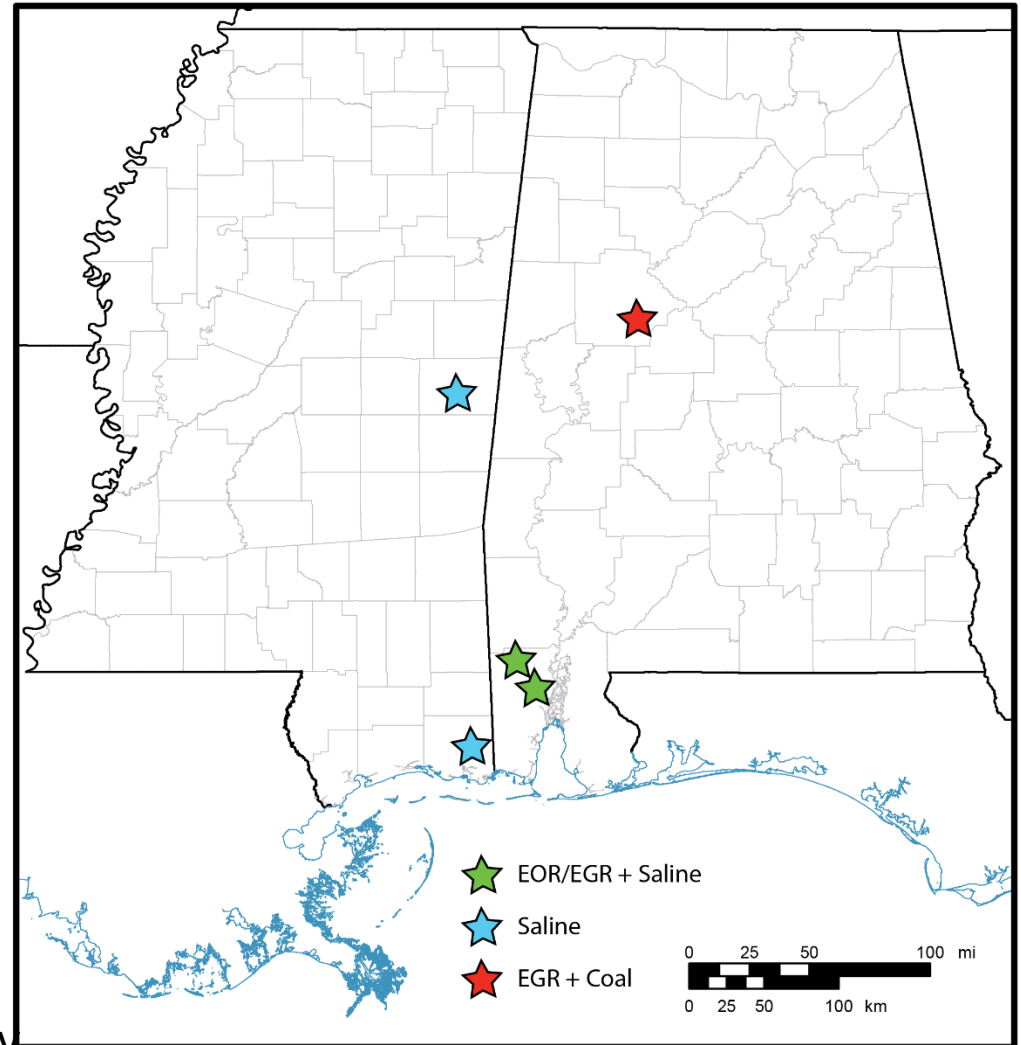
OKLAHOMA STORAGE OBJECTIVES



Pashin, Oklahoma State

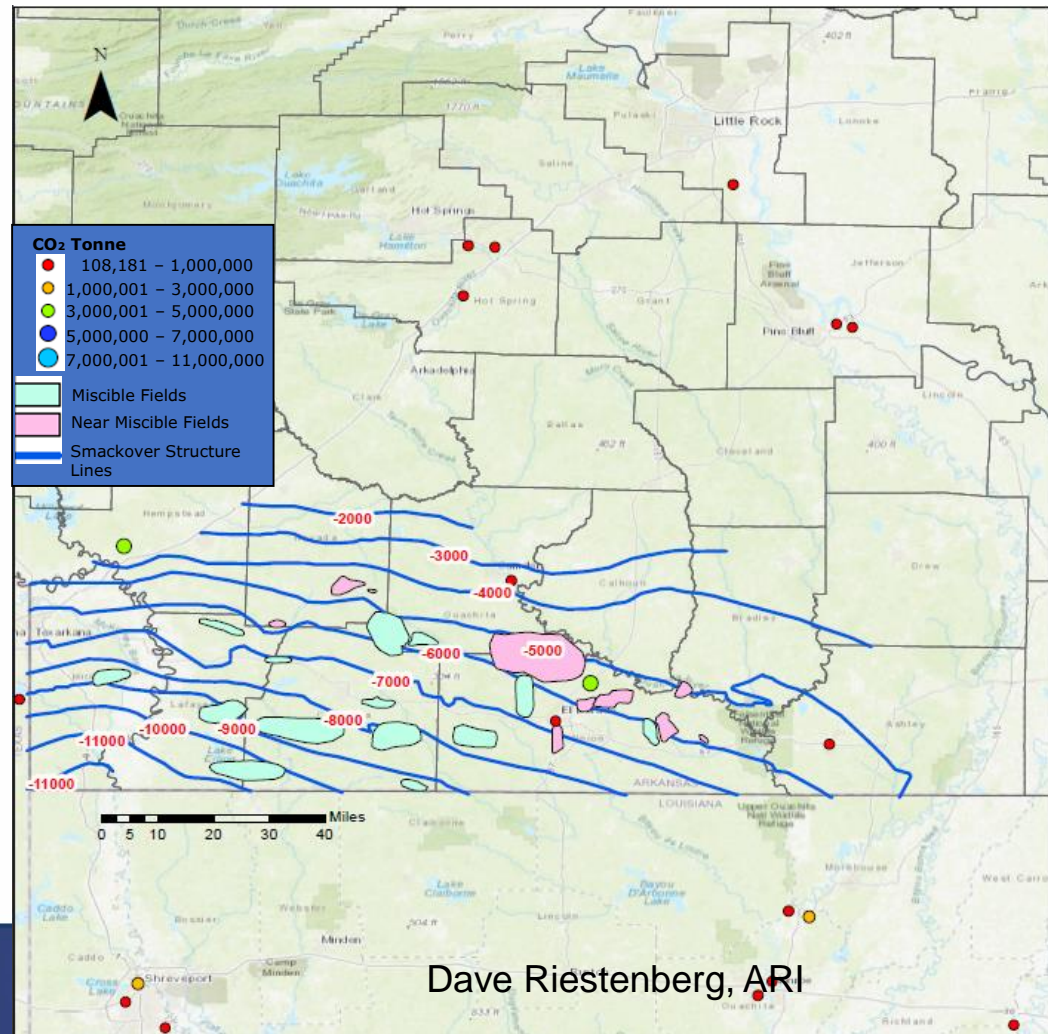
Geological Survey of Alabama – Current Status

- a. Targets:
 - a. Saline formations
 - b. Depleted reservoir storage
 - c. EOR/EGR
- b. Current status:
 - a. Database analysis and update for region well underway
 - b. Evaluating subregions, particularly for stacked storage potential



S. Arkansas/ N. Louisiana CO₂ Storage

- 9 fields are amenable for EOR (in green)
- 19 Depleted gas fields (EUR > 100 Bcf)
- 13 geologic formations in southern Arkansas have potential for CO₂ storage in saline formations *including Smackover (blue structure contours)*
- Multiple CO₂ sources

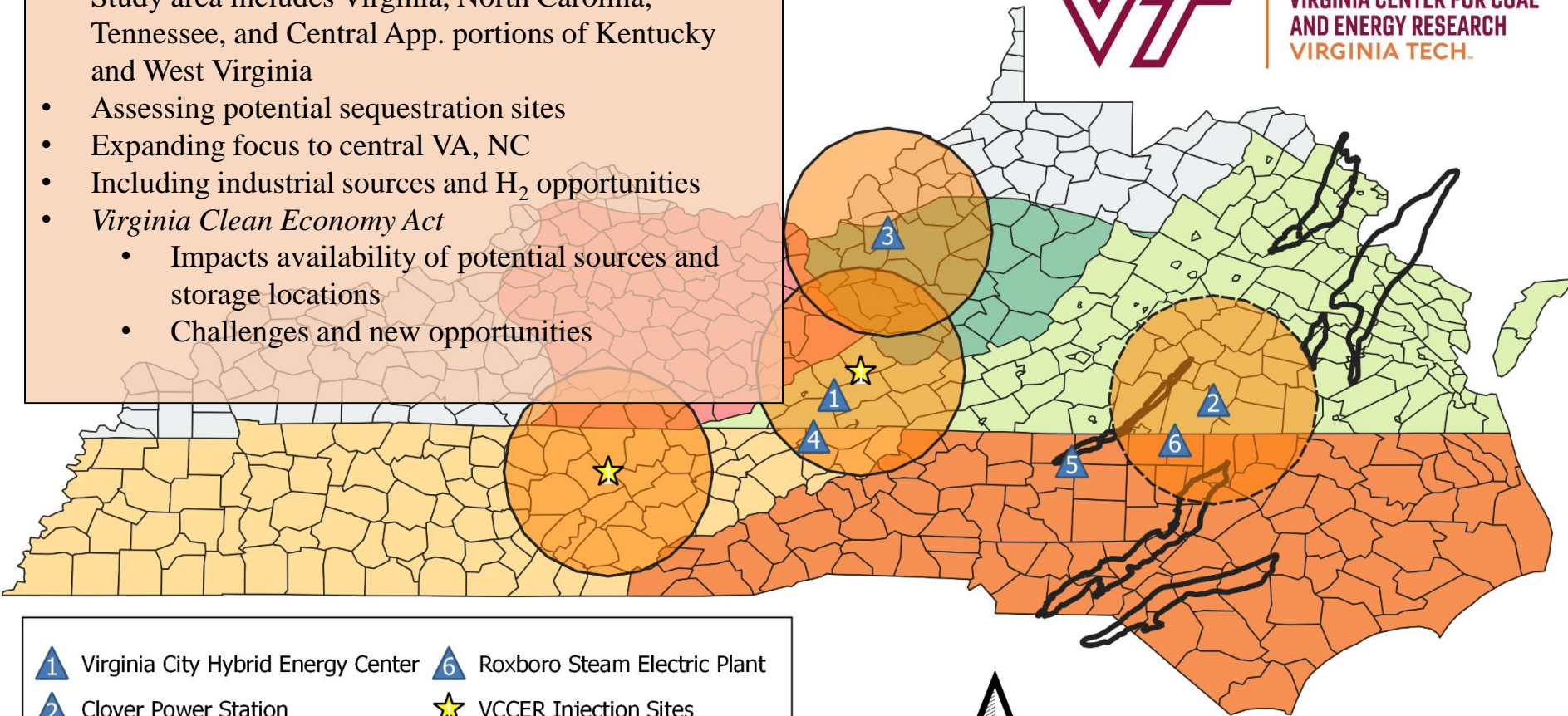


SECARB USA - VCCER

- Study area includes Virginia, North Carolina, Tennessee, and Central App. portions of Kentucky and West Virginia
- Assessing potential sequestration sites
- Expanding focus to central VA, NC
- Including industrial sources and H₂ opportunities
- *Virginia Clean Economy Act*
 - Impacts availability of potential sources and storage locations
 - Challenges and new opportunities



VIRGINIA CENTER FOR COAL
AND ENERGY RESEARCH
VIRGINIA TECH.



- | | |
|--------------------------------------|--------------------------------|
| 1 Virginia City Hybrid Energy Center | 6 Roxboro Steam Electric Plant |
| 2 Clover Power Station | ★ VCCER Injection Sites |
| 3 John E Amos Power Plant | ○ VCCER Study Area |
| 4 Eastman Chemical Company | ○ VCCER Prospective Study Area |
| 5 Belews Creek Steam Station | □ Prospective Basins |

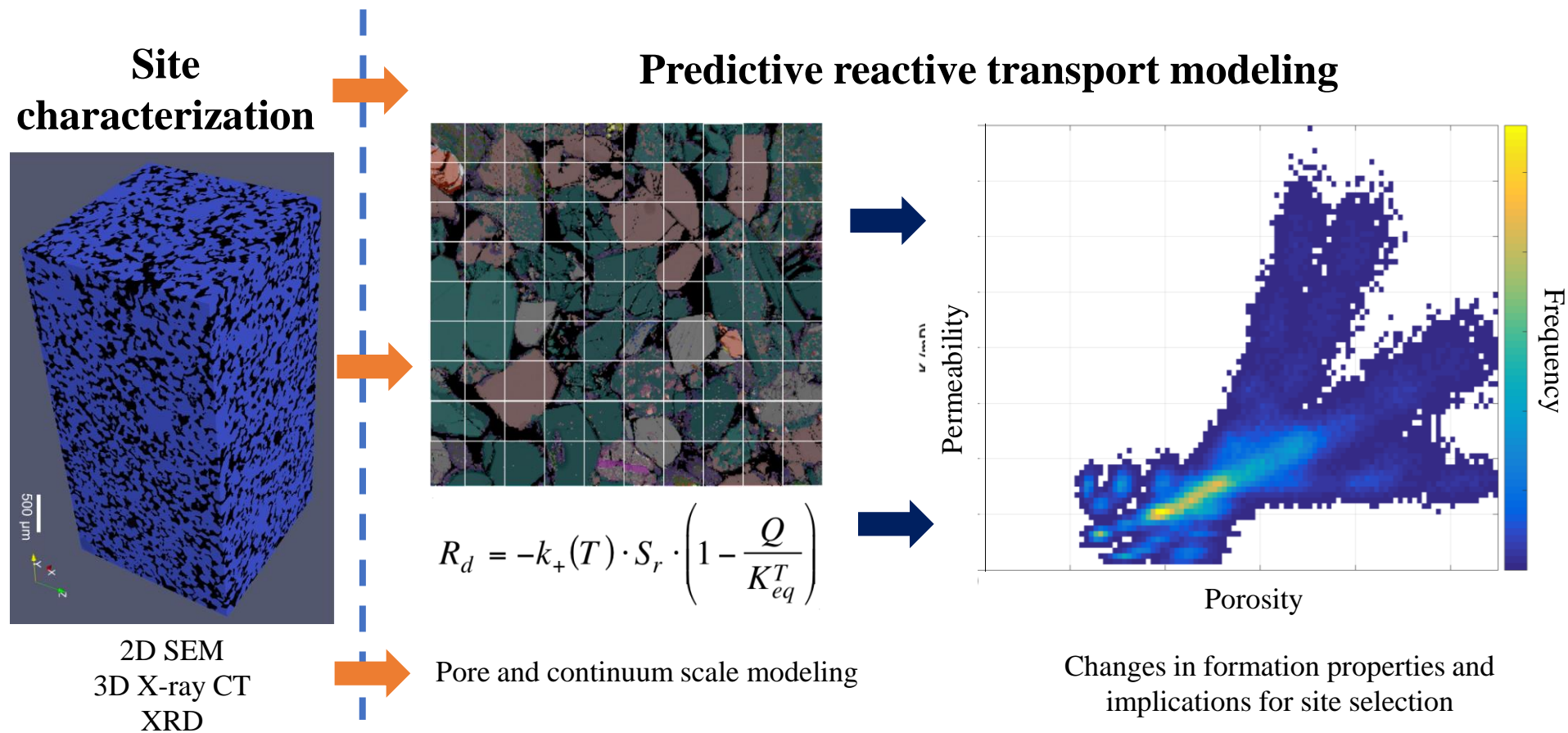


Karmis and Ripepi Virginia Tech

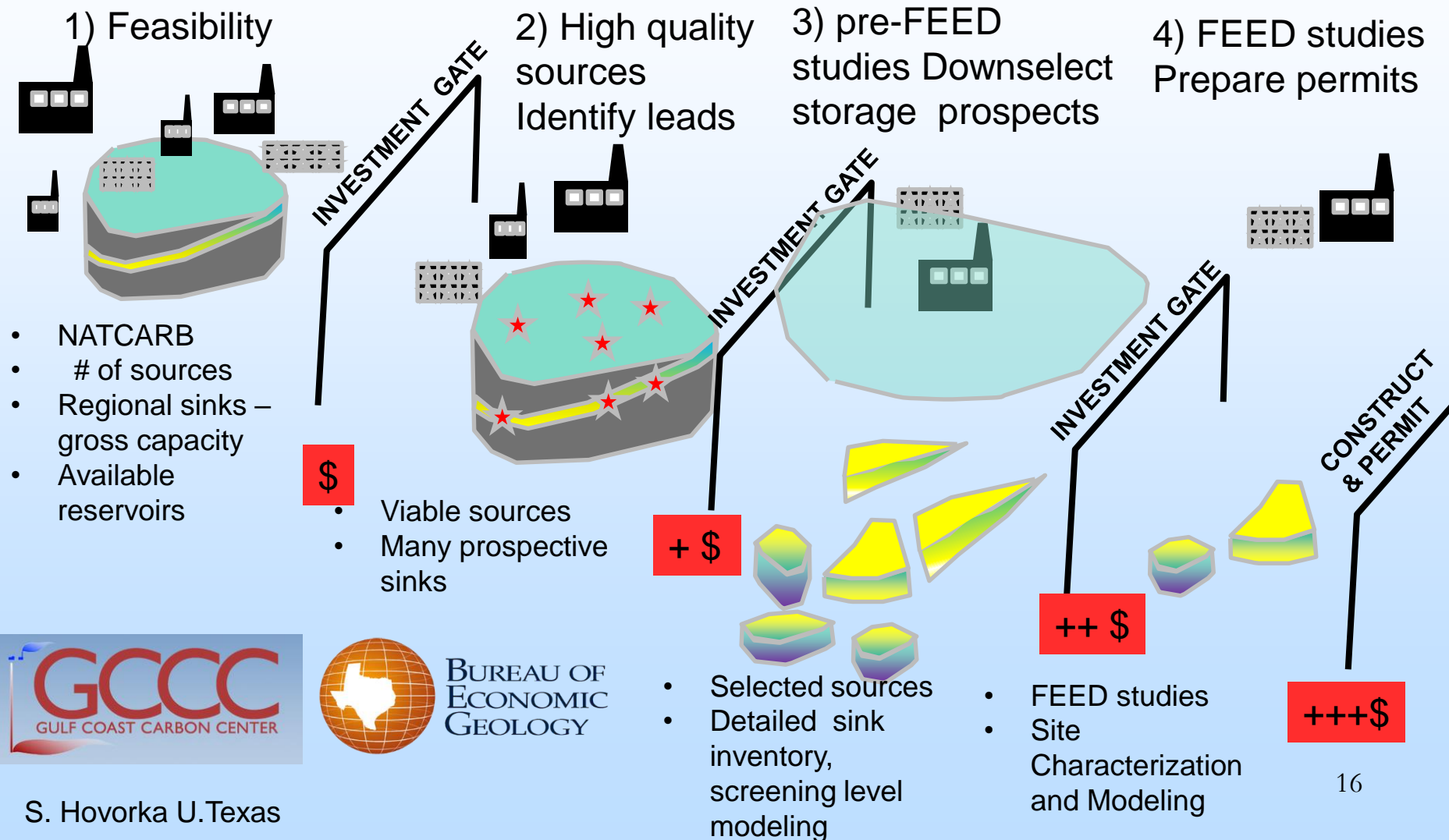




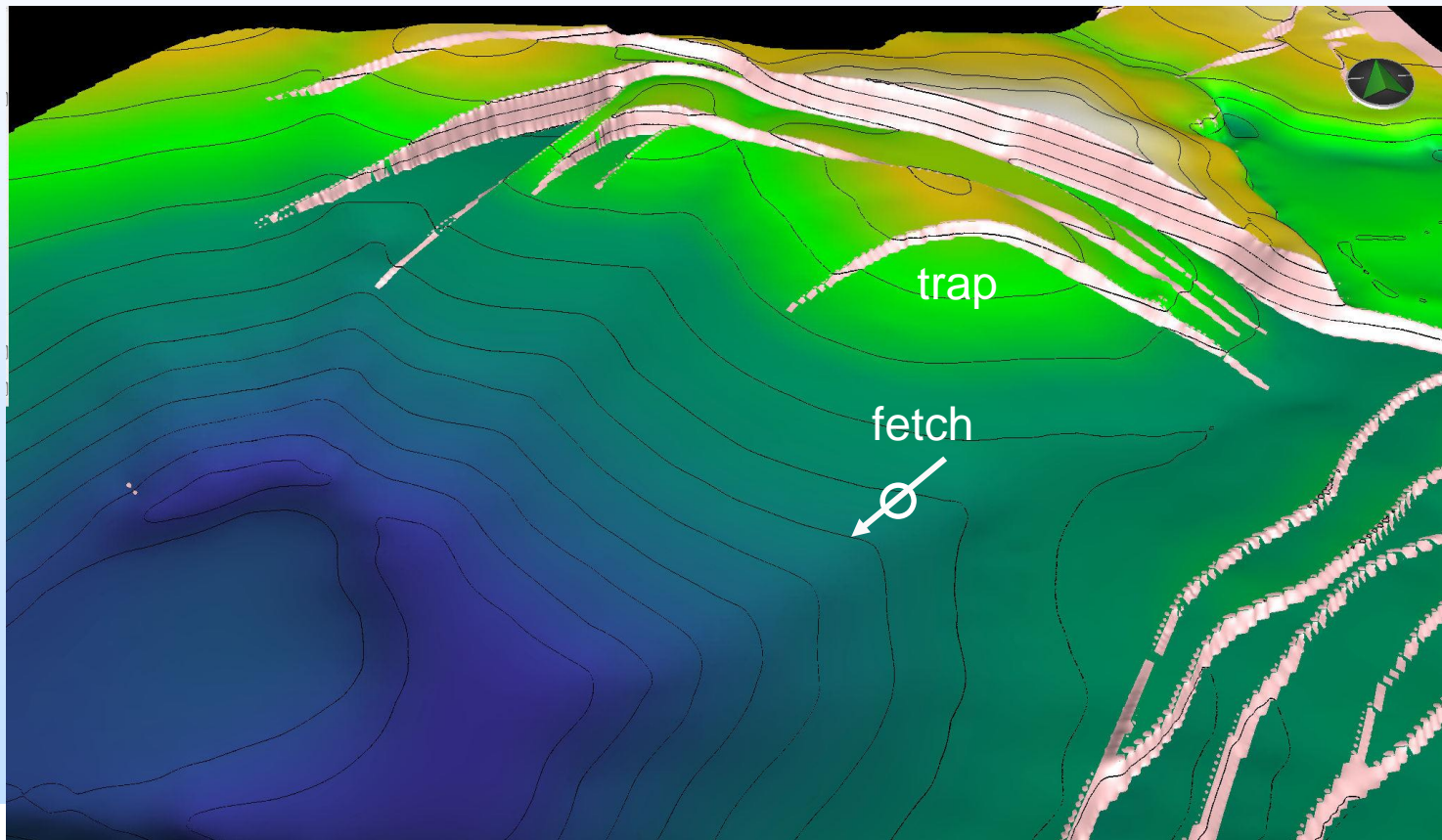
Geochemical characterization: Mineral trapping and changes in formation properties



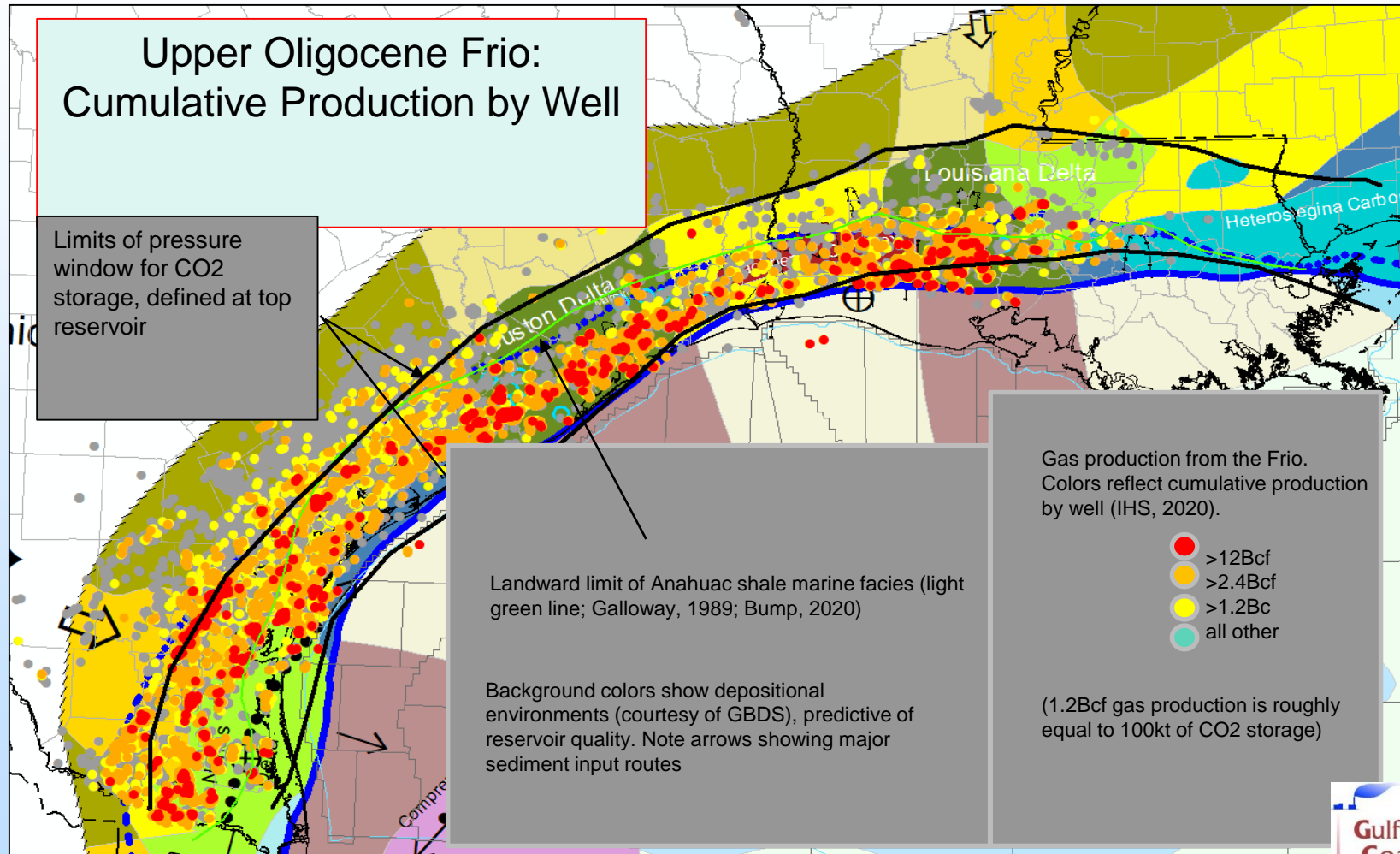
Storage Complex -- Cost of Characterization



Fetch & Trap, SW Louisiana



Regional Trends in Production Overlaid on Depositional Framework Defines Storage Fairways



Depositional elements map courtesy of GBDS (2019) Analysis A. Bump GCCC UTexas

EDF: Working with SECARB USA for Safe and Smart CCUS Deployment

- a. EDF: one of the worlds largest ENGOs
 - 2.5 million members and activists
 - 700 scientists, economists and policy analysts on staff
 - Offices in 8 states in the US and 4 countries
- b. CCUS play a critical role in achieving carbon neutral economy
 - Potentially 9% of all climate mitigation by 2050
- c. EDF joined SECARB USA to help assure that projects are done with environmental integrity and overcome key policy and other non-technology challenges facing CCUS deployment
 - Improving regulatory oversight
 - Coming up with practical ways to address non-regulatory issues
 - Expanding smart incentives for deployment
 - Working with stakeholders at all levels
 - Encourage commercialization through sink-source mapping and infrastructure support

Summary

SECARB represents a diverse region in terms of both sources and sinks

Sources Include

- Several large clusters of industrial Co₂ emitters

- Coal and natural gas generation across the region

Sinks Include

- Large saline structures

- Depleted oil and gas wells

- EOR opportunities

Representation of research across the region

Commercial interest in CCS is expanding rapidly in this region

An aerial photograph showing a vast, dense forest canopy. The trees are tightly packed, creating a textured, green surface. Above the forest, a clear blue sky is visible. The perspective is from directly above, looking down on the forest.

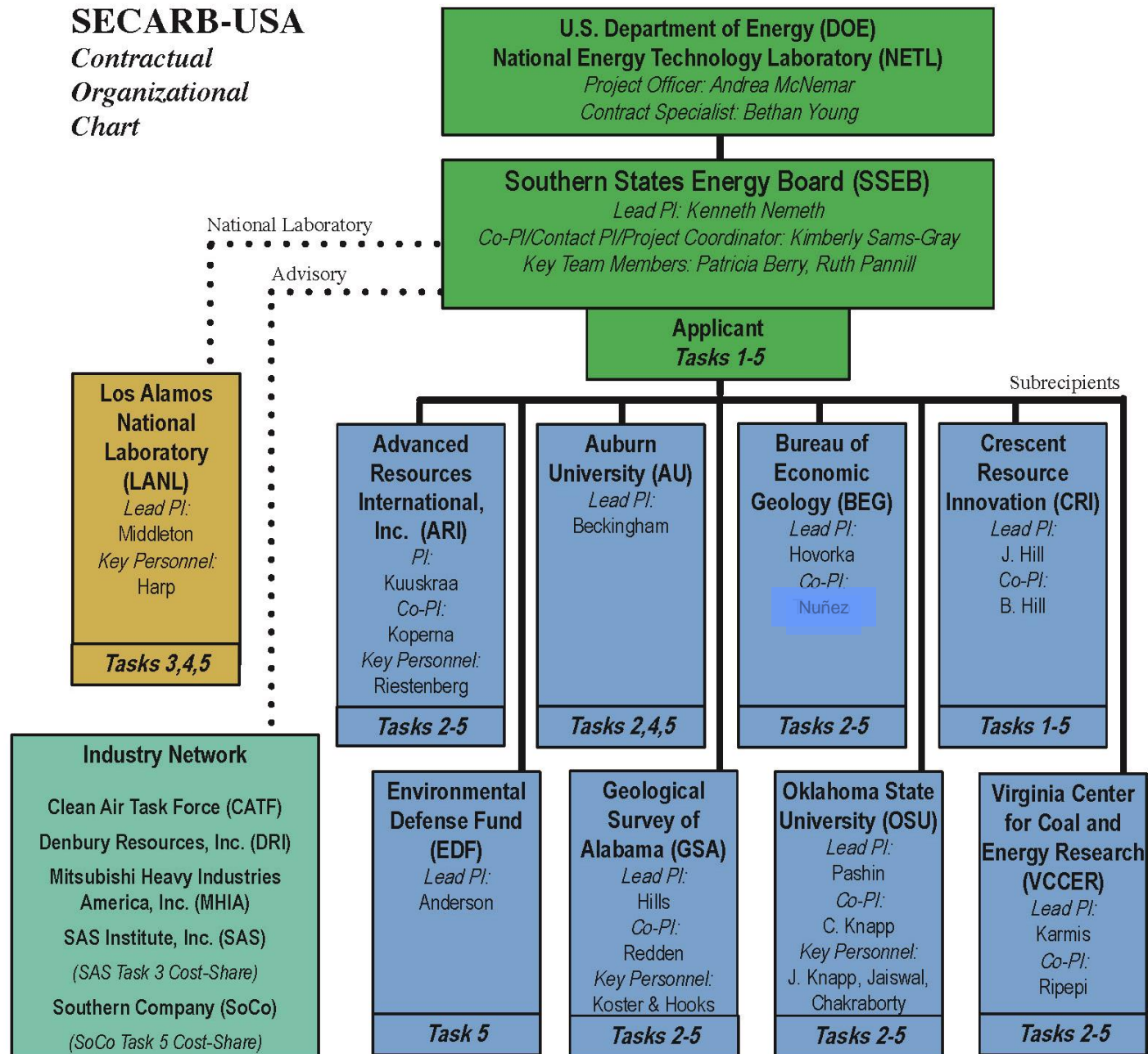
Thank you

Appendix

- These slides will not be discussed during the presentation, **but are mandatory.**

SECARB-USA

Contractual Organizational Chart



Gantt Chart

