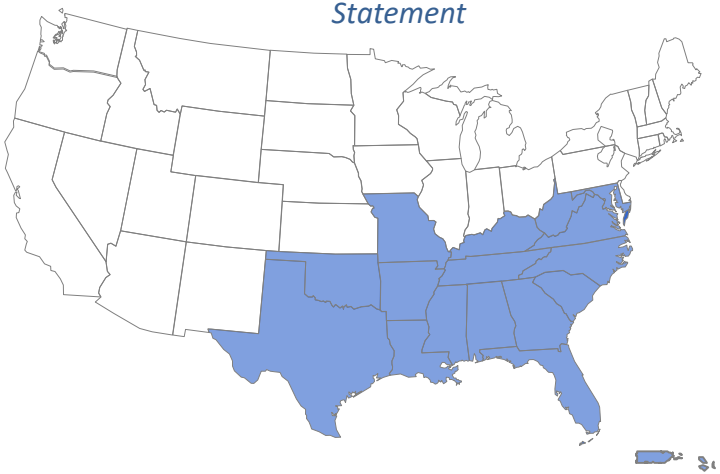
SOUTHERN STATES ENERGY BOARD

Transcending Boundaries

CCUS Projects in the Southeast with a Focus on Policy and Resources

November 20, 2019

"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*



- Interstate Compact Organization, created by state law and consented to by Congress
- Established as Southern Interstate Nuclear Board in 1960
- Mission expanded in 1978 to include full spectrum of energy & environmental issues (Southern States Energy Board)
- 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

2019-2020 Executive Committee

Maryland's Board Members

Gov. Larry Hogan

Sen. Brian Feldman

Sen. Stephen Hershey
(Alternate)

Del. Dereck Davis

Dr. Mary Beth Tung
(Governor's Alternate)

SSEB's Focus for "All-of-the-Above" Energy Portfolio

- Cybersecurity
- Hardening critical energy infrastructure
- Modernization and enhancement of the electric grid
- Advanced and emerging technologies
  - Energy storage
  - Electric vehicles
  - **CO_2 capture, utilization, and storage (CCUS)**
  - Water-energy nexus
- Workforce development and training
- Education and outreach

CLEAN
EFFICIENT
RELIABLE
RESILIENT
SECURE
SUSTAINABLE
AFFORDABLE
ELECTRICITY

2019 Adopted Resolution on CCUS *(9/24/19)*

7.2019 - Accelerating Commercial Investments in Carbon Dioxide (CO_2) Capture, Utilization, and Storage at Conventional Power Plants

Sen. Yager (TN), Rep. Sandifer (SC), Sen. Stubblefield (AR)

"…urges Treasury to use all necessary resources available to finalize its review of comments received from Notice 2019-32 and issue final regulations associated with carbon capture, storage and utilization under 45Q."

"…requests that Congress consider amending and extending, for a minimum of two years, the construction commence date of January 1, 2024, in Section 45Q of the Internal Revenue Code regulations as amended by The Bipartisan Budget Act of 2018 to account for the delay in Final Regulations being issued by Treasury."

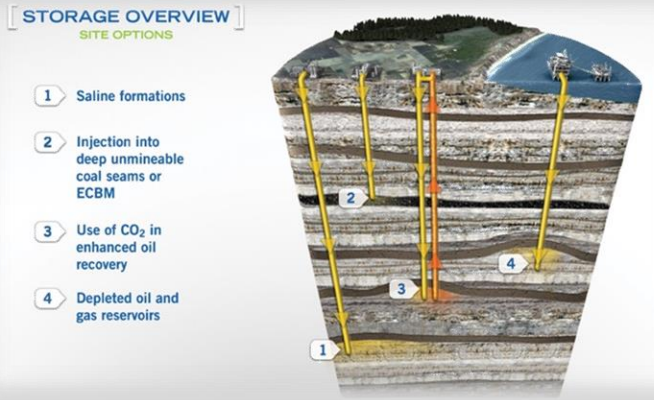
"…encourages Congress to support deployment of conventional generating technology to maintain fuel diversity and ensure energy security by enacting technical modifications to Section 48A of the Internal Revenue Code that are needed to incentivize investment of CO_2 capture on new and existing conventional power generating units."

Carbon Management Program

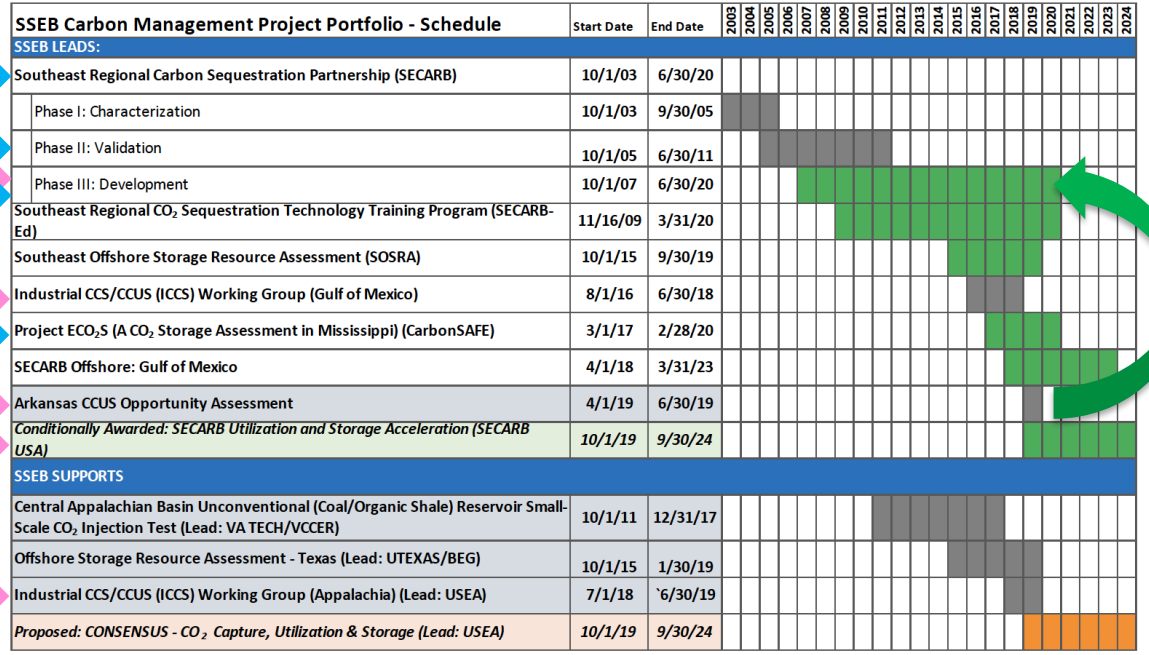
2003 Chairman's Initiative

Carbon Capture, Utilization, and Storage (CCUS) Research and Development

Knowledge Sharing through Partnerships
&
Workforce Development



SSEB Carbon Management Project Portfolio - Schedule	Start Date	End Date
SSEB LEADS:		
Southeast Regional Carbon Sequestration Partnership (SECARB)	10/1/03	6/30/20
Phase I: Characterization	10/1/03	9/30/05
Phase II: Validation	10/1/05	6/30/11
Phase III: Development	10/1/07	6/30/20
Southeast Regional CO_2 Sequestration Technology Training Program (SECARB-Ed)	11/16/09	3/31/20
Southeast Offshore Storage Resource Assessment (SOSRA)	10/1/15	9/30/19
Industrial CCS/CCUS (ICCS) Working Group (Gulf of Mexico)	8/1/16	6/30/18
Project ECO_2S (A CO_2 Storage Assessment in Mississippi) (CarbonSAFE)	3/1/17	2/28/20
SECARB Offshore: Gulf of Mexico	4/1/18	3/31/23
Arkansas CCUS Opportunity Assessment	4/1/19	6/30/19
Conditionally Awarded: SECARB Utilization and Storage Acceleration (SECARB USA)	*10/1/19*	*9/30/24*
SSEB SUPPORTS		
Central Appalachian Basin Unconventional (Coal/Organic Shale) Reservoir Small-Scale CO_2 Injection Test (Lead: VA TECH/VCCER)	10/1/11	12/31/17
Offshore Storage Resource Assessment - Texas (Lead: UTEXAS/BEG)	10/1/15	1/30/19
Industrial CCS/CCUS (ICCS) Working Group (Appalachia) (Lead: USEA)	7/1/18	`6/30/19
Proposed: CONSENSUS - CO_2 Capture, Utilization & Storage (Lead: USEA)	*10/1/19*	*9/30/24*



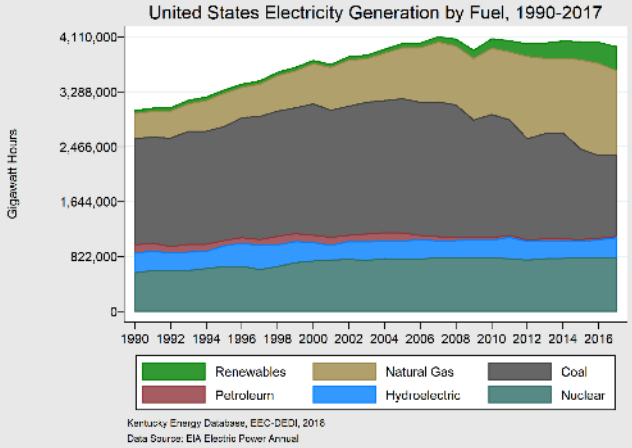
Active Projects
Proposed Projects
Closed/Completed Projects

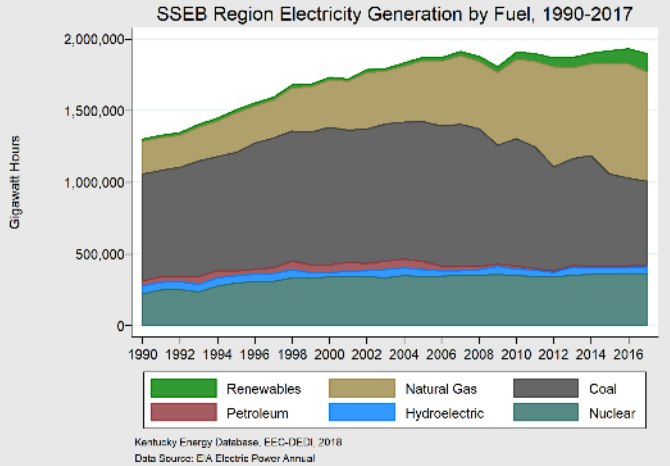
Kim Gray, SSEB

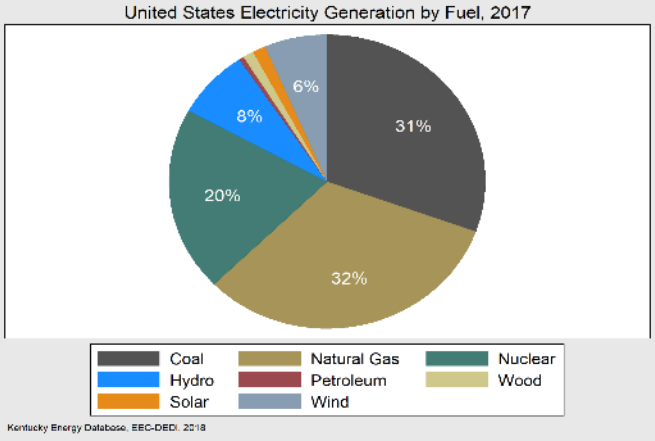
Dave Riestenberg, ARI

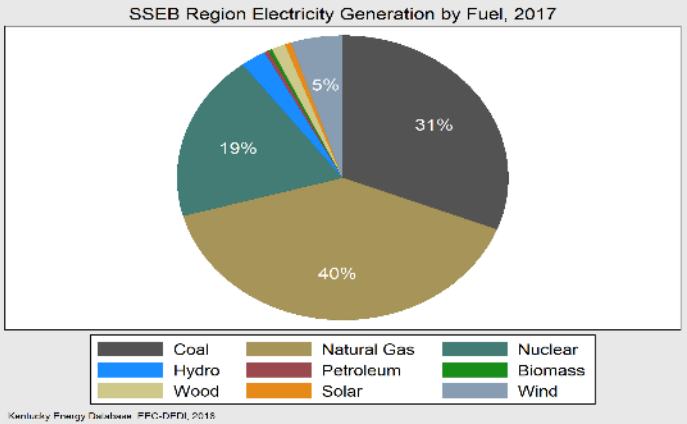
Energy Landscape in the South

- The SSEB states dominate fuel consumption for electricity generation
- New natural gas-fueled electric power capacity and opportunities for retrofit of existing coal-fueled plants reside in the region
- New large industrial sources of CO_2 are emerging in the Southeast (e.g., rapidly growing installation of LNG plants on the Gulf Coast)

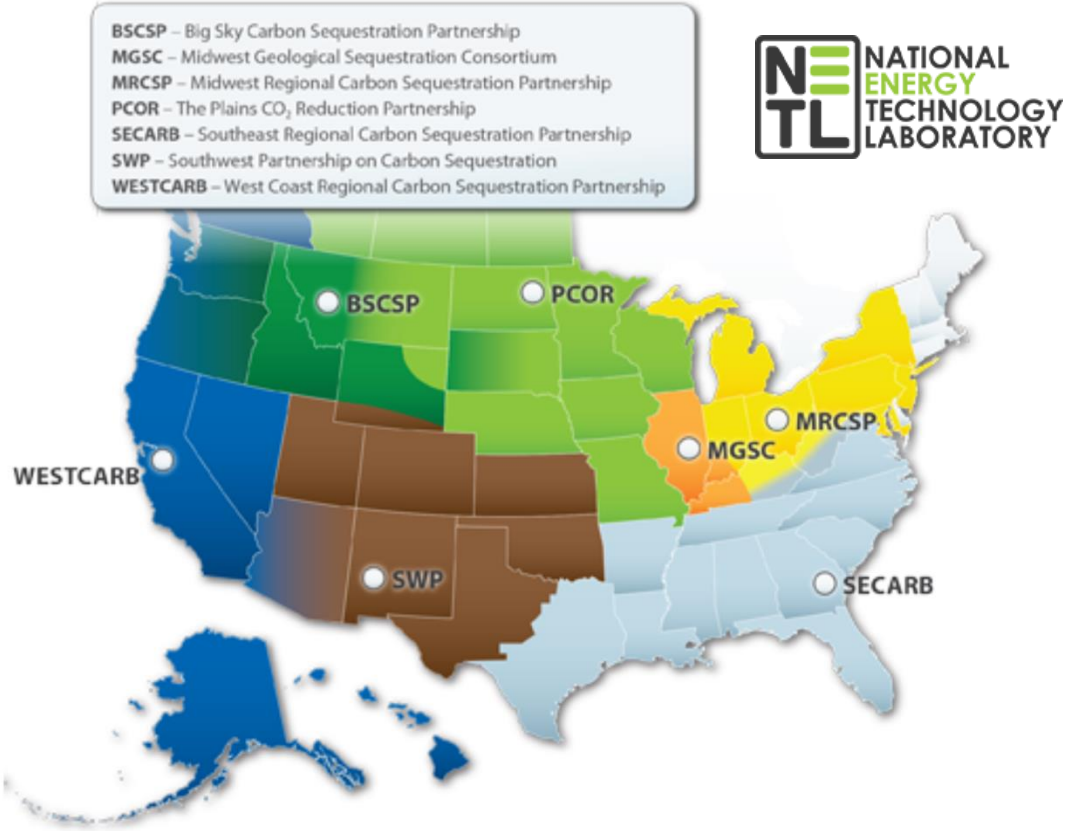








Regional Carbon Sequestration Partnerships (RCSPs)



SECARB Phase II

Coal Seam Project
Host Company: CNX Gas
Russell County, Virginia

1,000 metric tons of Commercial CO_2

Coal Seam Project
Host Company: El Paso Exploration and Production Company
near Tuscaloosa, Alabama

~1,000 metric tons of CO_2
Natural CO_2 from Jackson Dome, MS

Stacked Storage Project
Cranfield Test Site
Host Company: Denbury Resources, Inc.
Southwest Mississippi

250-500K metric tons CO_2
Natural CO_2 from Jackson Dome, MS

Mississippi Test Site
Mississippi Powers Plant Daniel
near Escatawpa, Mississippi

3,027 metric tons of CO_2
Natural CO_2 from Jackson Dome, MS

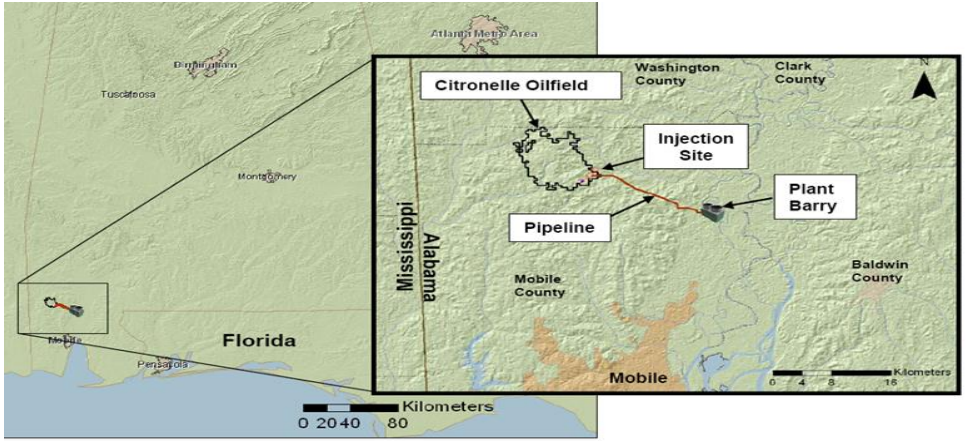
SECARB Phase III

Early Test
Cranfield, MS

Anthropogenic Test
Citronelle, AL

SECARB Phase III Anthropogenic Test

- Carbon capture from Plant Barry, 25MWe
- 12-mile CO_2 pipeline constructed by Denbury Resources
- CO_2 injection into ~9.400 ft. deep saline formation (Paluxy), Class V Experimental UIC Permit
- 114,000 metric tons injected
- Monitoring CO_2 during injection




Power Plant


Capture


Transport


Storage

Petra Nova - Emergence of CCUS in South

SECARB 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 CO_2/day or 90% of CO_2
- Pipeline to Petra Nova West Ranch Oil Field (81 miles)
- EOR 300 bbls/day to 15,000 bbls/day (peak)!
- 60 million bbls Recoverable Reserves

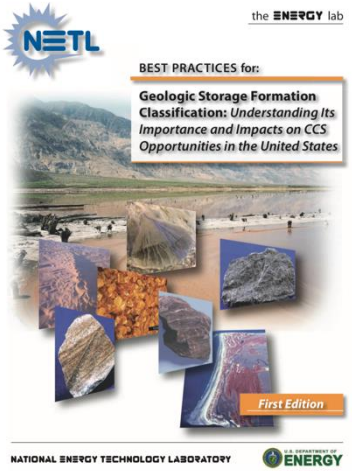
RCSP Best Practices Manuals

DOE Best Practice Manuals	
DOE Best Practice Manual	**Description**
Monitoring, Verification, and Accounting (MVA) for Geologic Storage Projects	Discusses development of MVA plans for geologic storage projects and provides recent research results on existing and emerging MVA techniques. The focus is on the experience gained through the RCSP Initiative, but MVA plans and a few key monitoring techniques applied at international large-scale field projects are also described. The best practices result from successful application of techniques during field application and are documented through lessons learned. This BPM provides an extensive discussion of existing and evolving monitoring tools, the information that each tool can provide, the tool's R&D status, and insights into how some of these tools can be used to meet regulatory requirements.
Public Outreach and Education for Geologic Storage Projects	Provides guidelines for conducting outreach and education for geologic storage projects across a variety of geologic and cultural settings. These best practices are intended to address recurring issues related to: (1) insufficient knowledge of how CO_2 storage works due to the "out of sight" nature of the technology; (2) a lack of familiarity with similar storage functions already occurring in nature; and (3) the difficulty of communicating effectively when implementing complex projects.
Site Screening, Site Selection, and Site Characterization for Geologic Storage Projects	Provides guidelines for locating and developing a geologic storage project from the initial stages of regional exploration at the basin scale, to the point where a site is considered qualified for commercial storage. This BPM will also inform the public about activities involved in screening, selecting, and characterizing potential geologic storage sites. Examples and lessons learned are provided as case studies from the RCSP Large-Scale Development Phase field projects.
Risk Management and Simulation for Geologic Storage Projects	Presents the concepts and steps involved in developing a qualitative and quantitative evaluation of the impact project risks could pose to human health, safety, the environment, and operational aspects of a storage project. This BPM summarizes tools that have recently become available for performing risk analysis and discusses the potential major pathways for migration of CO_2 out of the storage reservoir and approaches to mitigate, remediate, and control such migration. It also presents a framework of best practices for developing and using numeric simulation to model the specific subsurface processes (thermal and hydrologic, chemical, mechanical, and biological) at a geologic storage site that are necessary for predicting the behavior of injected CO_2 for risk management and other purposes.

https://www.netl.doe.gov/coal/carbon-storage/strategic-program-support/best-practices-manuals

RCSP Best Practices Manuals

Operations for Geologic Storage Projects	Encompasses all facets of field operations related to planning, designing, implementing, and executing a carbon storage project—from project development to post-injection monitoring. Site development planning, permitting, well drilling and completion operations, injection operations, and post-injection operations are discussed, with emphasis on detailing the components necessary to initiate and operate a large-scale carbon storage project.
Geologic Formation Storage Classification	Discusses the basis for categorizing different groups, or "classes," of depositional environments as having potential for CO_2 storage. Describes how physical and chemical conditions and processes at the time the sediments were deposited might affect flow of CO_2 and other fluids in potential storage complexes. Depositional environments are defined in terms of geomorphic units, or landforms, examples of which can be readily found at present.
Terrestrial Sequestration of CO_2	Based on the field experience of the RCSPs' field projects and covers land types and management methods that can maximize carbon storage in vegetation and soil. Covers the analytical techniques necessary to monitor, verify, and account for terrestrially stored carbon and how these technologies were applied in the various field projects.



STANDARDS BY ISO/TC 265

Carbon dioxide capture, transportation, and geological storage

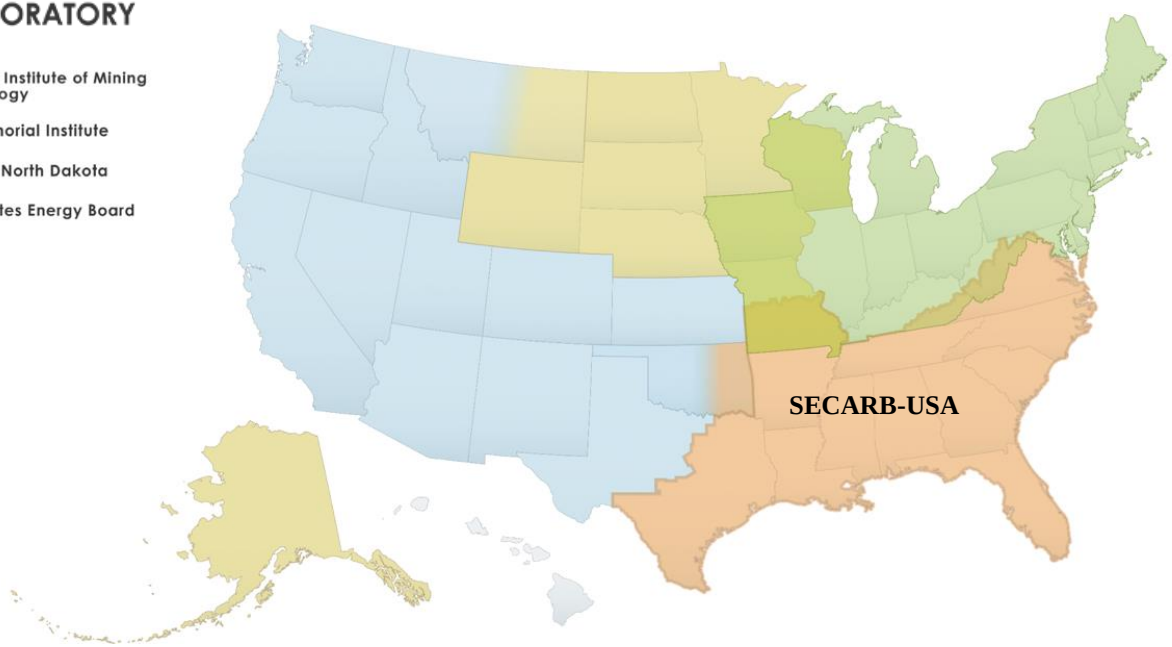
STANDARD AND/OR PROJECT UNDER THE DIRECT RESPONSIBILITY OF ISO/TC 265 SECRETARIAT (8)	STAGE	ICS
ISO/TR 27912:2016 Carbon dioxide capture — Carbon dioxide capture systems, technologies and processes	60.60	13.020.40
ISO 27913:2016 Carbon dioxide capture, transportation and geological storage — Pipeline transportation systems	60.60	13.020.40
ISO 27914:2017 Carbon dioxide capture, transportation and geological storage — Geological storage	60.60	13.020.40
ISO/TR 27915:2017 Carbon dioxide capture, transportation and geological storage — Quantification and verification	60.60	13.020.40
ISO 27916:2019 Carbon dioxide capture, transportation and geological storage — Carbon dioxide storage using enhanced oil recovery (CO2-EOR)	60.60	13.020.40
ISO 27917:2017 Carbon dioxide capture, transportation and geological storage — Vocabulary — Cross cutting terms	60.60	01.040.13 13.020.40
ISO/TR 27918:2018 Lifecycle risk management for integrated CCS projects	60.60	13.020.40
ISO 27919-1:2018 Carbon dioxide capture — Part 1: Performance evaluation methods for post-combustion CO2 capture integrated with a power plant	60.60	13.020.40

https://www.iso.org/committee/648607/x/catalogue/p/1/u/0/w/0/d/0

Regional Initiative to Accelerate CCUS Deployment

NATIONAL ENERGY TECHNOLOGY LABORATORY

- New Mexico Institute of Mining and Technology
- Battelle Memorial Institute
- University of North Dakota
- Southern States Energy Board



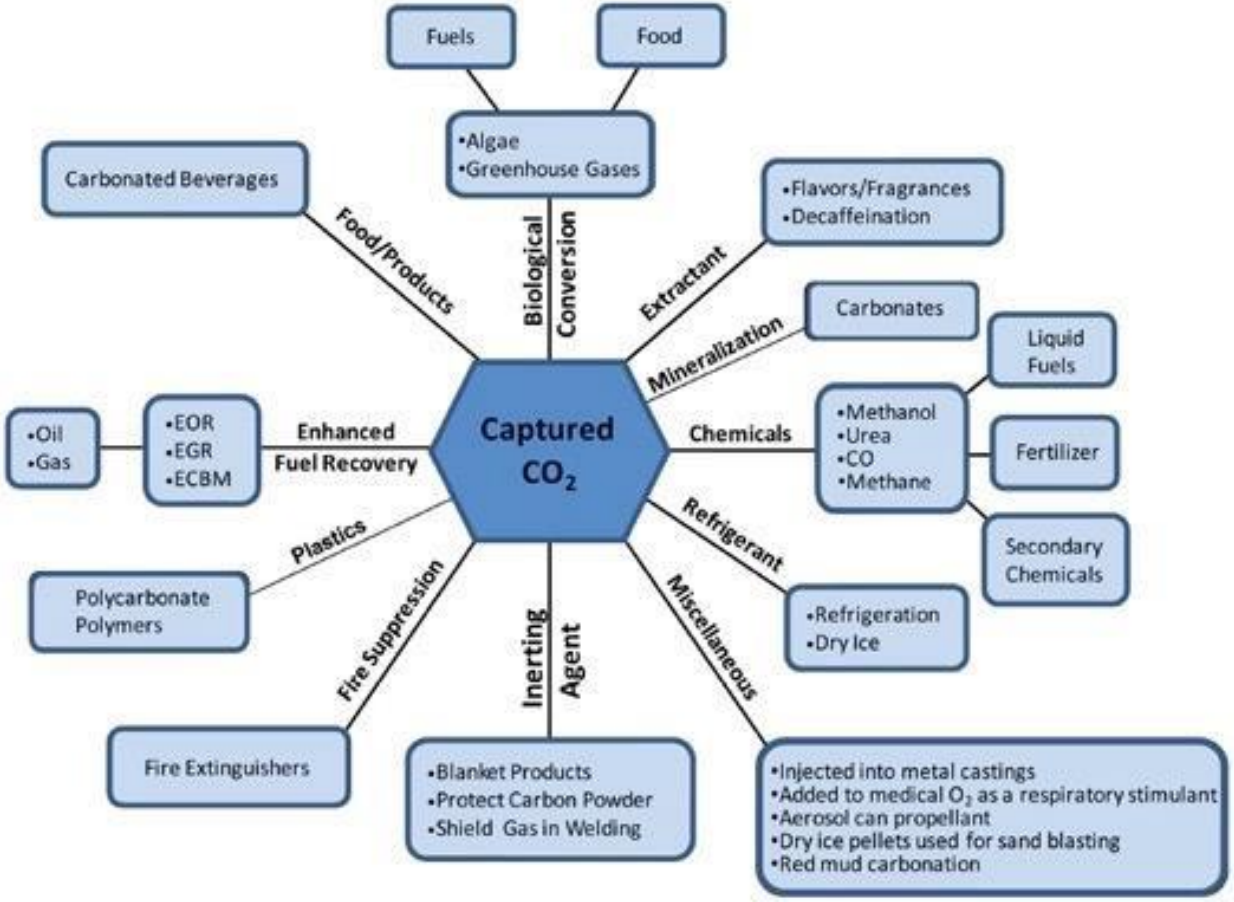
Acceleration

- 5 years (2019-2024)
- 4 Partnerships
- $20M DOE and cost share

Scope of Work

- Address key technical challenges
- Facilitate data collection, sharing, and analysis
- Assess transportation and distribution infrastructure
- Promote regional technology transfer and dissemination

Industrial and Commercial CO_2 Utilization Applications

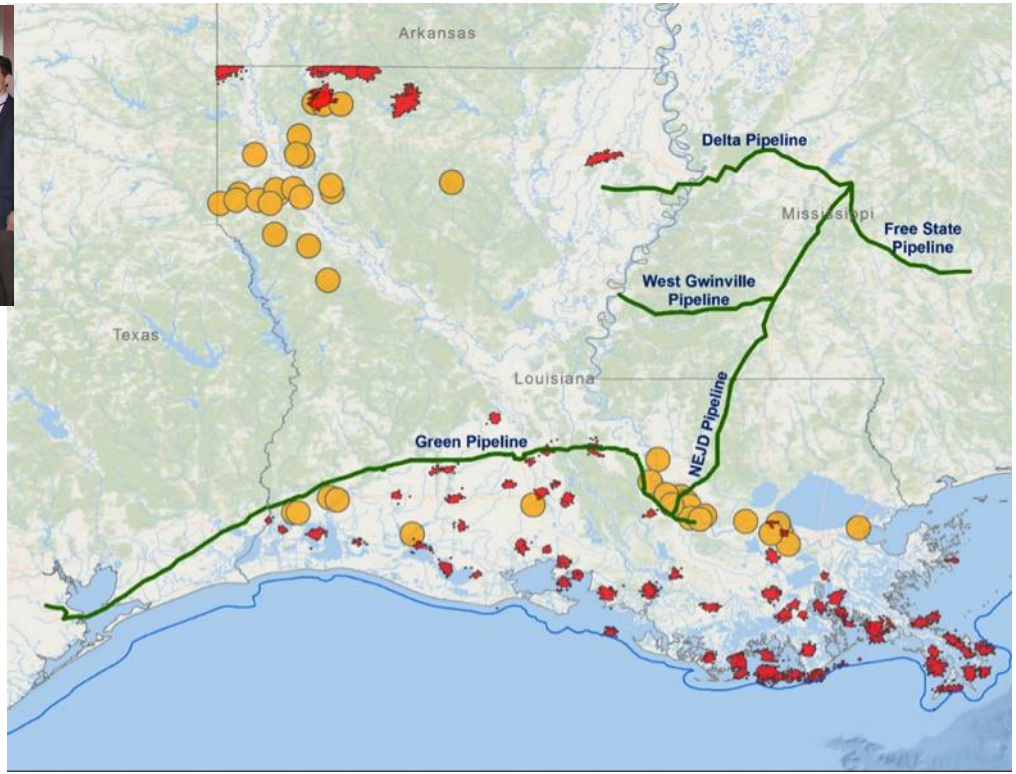


Louisiana CCUS Workshop – November 2016

- Louisiana chemical/industrial corridor along Mississippi River is uniquely situated to benefit from integrated CCUS system
- Industrial sources produce large amount of CO_2
- Green pipeline runs across southern Louisiana
- Many existing oilfields could benefit from Enhanced Oil Recovery (EOR)

U.S. DEPARTMENT OF ENERGY

Orange = Industries Red = Oil Fields



CO_2 Emission Clusters, Pipeline Infrastructure, and Oil Fields

Source: Louisiana State University, Center for Energy Studies, 2016

Louisiana CCUS Summit: July 2019

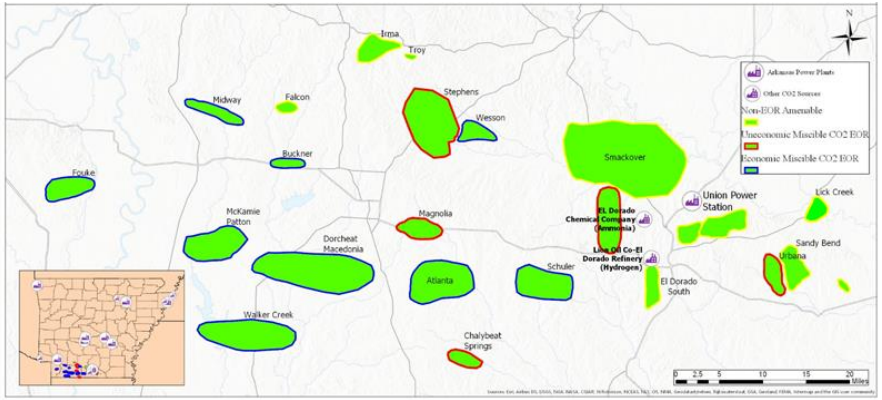
- "Management of the industrial emissions of CO_2 is a critical policy initiative for the State of Louisiana."
- Investment opportunities for CO_2 management in Louisiana
- Hosted by:
  - Governor Edwards
  - Louisiana Department of Natural Resources – State Energy Office
  - Louisiana Economic Development
  - OGCI Climate Investments, LLP

Arkansas CO_2 Capture, Utilization, and Storage Opportunities

- Preliminary scoping study
- Funded by Arkansas Economic Development Commission (AEDC)
- Briefing on January 28 and Findings Presented July 10
- Determining economic viability for CCUS

ARKANSAS INC

Advanced Resources International, Inc.



Arkansas CCUS Meeting with Governor Asa Hutchinson (AR), Legislative Leaders from Southwest Arkansas, and AEDC

Little Rock, Arkansas | January 28, 2019

Appalachian Region

What is needed to promote Industrial CCUS (ICCUS)?

- Engage stakeholders
- Identify and interview CO_2 producers and potential users
- 3 Sub-regional Workshops
  - Hosts
  - Off-takers
  - Transportation links
  - Commercial, financial, regulatory, technological, and environmental risks
  - Financial modeling to analyze recommended ICCUS projects
- 1 Regional Workshop
  - Commonalities
  - Knowledge gaps
  - Issues/Resolutions?

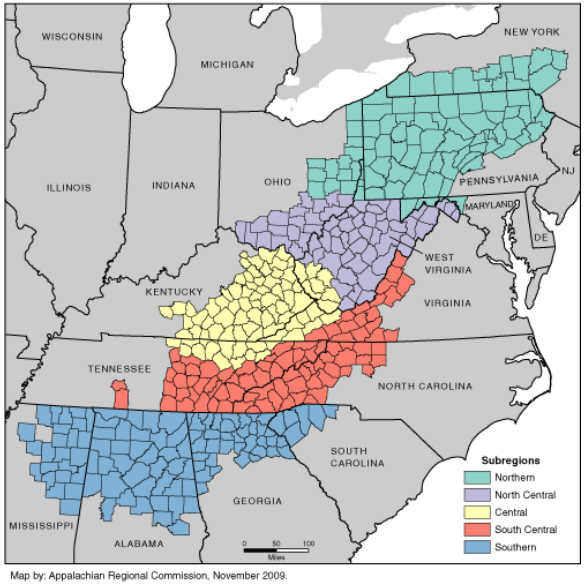


Figure 1. Appalachian Regional Commission's sub-regions, November 2009

U.S. DEPARTMENT OF ENERGY

USEA United States Energy Association

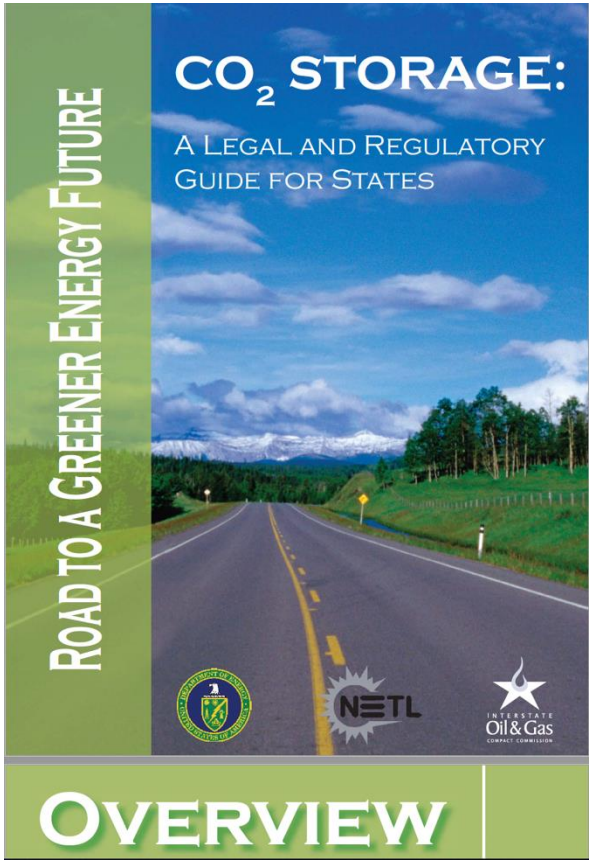
CCUS: The Role of States

- Reduce uncertainty to encourage investment
  - Education
  - Policy
  - Regulatory
  - Primacy over Underground Injection Control well classes
- Education and outreach to industry regarding state and federal incentives
  - Federal: U.S. Internal Revenue Code Title 26, Sections 45Q and 48A
  - 45Q U.S. Treasury guidance (SSEB Resolution 7.2019)
- Workforce development






Model Legislation for CCUS (2007)



- Download the full report
  - Published under leadership of Governor (now U.S. Senator) John Hoeven, North Dakota
  - http://iogcc.publishpath.com/Websites/iogcc/PDFS/2008-CO2-Storage-Legal-and-Regulatory-Guide-for-States-Full-Report.pdf
- Model CO_2 storage statute
- Set of model rules and regulations governing geological CO_2 storage (with explanations)
- Report addressing the ownership and right of injection of CO_2 into the subsurface

Legislation: Popular CCUS-Related Topics

- Pore space and CO_2 ownership
- Long-term liability
- Tax incentives (severance tax, ad valorem, sales tax, franchise tax)
- Eminent domain and easements
- State organizational jurisdiction over CO_2 injection wells, pipeline transport, and similar issues

State Laws/Incentives *(Selected)*

Reducing uncertainty/risk/costs

- Pore space and CO_2 ownership: IL, LA, MS, MT, ND, OK, TX, WV, and WY
- Long-term liability: IL, KS, KY, LA, MS, MT, TX, WV, and WY
- Tax incentives: AL, FL, LA, MS, OK, TX, and VA (e.g., severance tax, ad valorem, sales tax, franchise tax), plus a few outside the SSEB region
- Eminent domain: AL, KY, LA, MS, and TN
- CCUS and enhanced oil recovery laws are in place in a number of states that specify state organizational jurisdiction over CO_2 injection wells, pipeline transport of CO_2, and similar issues (ID, IL, LA, MI, MT, and TX)

State Legislation: First Movers in Southeast

Texas – The Advanced Clean Energy Project Grant and Loan Program (2007) and additional laws promoting CCS and EOR (2009)

- Sales tax exemption: equipment purchases for projects that capture at least 50% of their CO_2 emissions
- Franchise tax credit: $100 million per-project to the first three projects that can achieve a 70% carbon capture rate qualification
- Severance tax exemption: 75%, 30-year exemption for oil recovered using CO_2 captured from anthropogenic, or manmade, emission sources
- Offshore carbon repository program: creates a network of CO_2 pipelines throughout Texas
- Grant program: new emissions-reducing technologies, including clean coal technologies and CCS projects (2009 Appropriations Act)
- Regulatory framework: authorizes Railroad Commission jurisdiction over the injection of CO_2 into wells for oil and gas production

State Legislation: First Movers in Southeast

Louisiana Geologic Sequestration of Carbon Dioxide Act (2009)

- Liability: releases storage operators from any and all liability associated with or related to that storage facility which arises after the issuance of the certificate of completion of injection operations
- Caps on civil liability cases: non-economic damages may not exceed $1 million
- Eminent domain rights: any carbon storage operator who obtains a state permit or certificate of public convenience and necessity
- Severance tax incentives: oil and gas recovered through EOR

Mississippi Geologic Sequestration of Carbon Dioxide Act (2011)

- Regulatory framework: pore space and CO_2 ownership
- Liability: liability for the owners of the CO_2
- Severance tax incentives: oil and gas recovered through EOR
- Ad valorem tax exemptions: equipment used for EOR

SECARB-Ed *(Workforce Development)*

- Workforce development to support CO_2 storage advanced research and future commercial deployment
- Develop/provide short courses on CCUS technologies
- Issue professional development hours and continuing education units

Next Steps?

- Project Management
- Stakeholder Engagement
- Risks
- Legal and Regulatory Frameworks
- Continued Collaboration with RCSPs
  - Knowledge sharing and technical transfer
  - Identification of knowledge gaps
- Education, Networking, and Communication

Upcoming Events

December 11-12, 2019	Joint Meeting of SSEB's Radioactive Materials Transportation Committee and Transuranic Waste Transportation Working Group	Miami, Florida
February 7-10, 2020	National Governors Association Winter Meeting	Washington, DC
February 2020	SSEB Associate Members Winter Meeting (held in conjunction with the National Governor's Association Winter Meeting)	Washington, DC
March 2020	Southeast Regional Carbon Storage Partnership: Offshore Gulf of Mexico, Stakeholders Briefing	New Orleans, Louisiana
March 2020	Southeast Regional Carbon Storage Partnership: Offshore Gulf of Mexico, Joint Meeting with GoMCarb	New Orleans, Louisiana
May 2020	SSEB Committee on Clean Coal Energy Policies and Technologies (held in conjunction with the Virginia Coal and Energy Alliance's Annual Meeting)	Kingsport, Tennessee
August 1, 2020	SSEB Annual Energy Briefing to Southern Legislative Leaders	Winston-Salem, North Carolina
Fall 2020	SSEB 60th Annual Meeting, Hosted by Oklahoma Governor J. Kevin Stitt	Oklahoma

https://www.sseb.org/news-and-events/

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Want more information? Email us at **sseb@sseb.org**

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Transcending Boundaries

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