26th Annual CO₂ Conference Presented Both Live and Virtually

Presented at the 26th Annual CO₂ Conference Tuesday - Thursday Dec 8th-10th, 2020

> Bush Convention Center Midland, Texas





Transcending Boundaries

Carbon Management Workshop

Midland CO₂ Conference Presentation by Kenneth J. Nemeth Virtual Meeting | December 8, 2020 "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 (PL 87-563, PL 92-440)
- 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
- Secretary, who serves as Executive Director

2020-2021 Executive Committee







Chair Gov. Kevin Stitt Oklahoma

Vice Chair Rep. Lynn Smith Georgia









Gov. Asa Hutchinson Arkansas

Gov. John Bel Edwards Louisiana











Rep. Howard Sanderford Alabama

Sen. Brandon Smith Kentucky











SLC E&E Chair Rep. Jim Gooch, Jr. Kentucky

Federal Representative Honorable Eddie Joe Williams

Secretary Kenneth Nemeth

SSEB Chairman's Priorities

"Affordable, clean, domestic energy is the most basic building block of a healthy, growing economy. It's what sets the United States apart from the world."

"My hope as Chairman is that America's southern states will continue to embrace, adopt, and be a leader in new technologies that will drive growth, create jobs, and deliver reliable, affordable energy for the generations to come."

> Honorable J. Kevin Stitt Governor of Oklahoma SSEB Chairman, 2019-2021





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
 - <u>CO₂ capture, utilization, and storage</u> (CCUS)
 - Water-energy nexus
- Workforce development and training
- Education and outreach



Governor Stitt (top), Board and Associate Members, and Staff SSEB's 60th Annual Business Meeting | Virtual | September 29, 2020

2020 Adopted Resolutions

- 1.2020 Broadband for Grid Modernization | Rep. Rocky Miller, Missouri*
- 2.2020 Commitment to Abundant and Reliable Low-Cost Energy | Sen. Ed Emery, Missouri*
- **3.2020** Impact of Energy Costs on Covid-19 Recovery | Mary Beth Tung, Ph.D., Maryland Energy Administration, Governor's Alternate*
- **4.2020** Continuing Support for Carbon Dioxide Capture, Utilization, and Storage | Mary Beth Tung, Ph.D., Maryland Energy Administration, Governor's Alternate*
- 5.2020 Supporting Inclusive Energy Source Options for Consumers & Balanced Energy Solutions | Sen. Mark Allen, Oklahoma*, Sen. Ken Yager, Tennessee, and Rep. Jim Gooch, Jr., Kentucky
- 6.2020 Accelerating the Hydrogen Economy with Future Research and Development | Rep. Mark McBride, Oklahoma*
- 7.2020 Supporting Balanced Energy Solutions and Revenue Sharing for States by Ensuring Gulf of Mexico Access | Rep. Brent Powell, Mississippi*
- 8.2020 Commending the Collaborative Efforts of Congress, the U.S. Department of Energy and Its National Labs, and Electric Utilities and their Supplier Community to Develop and Deploy New Reactors and Other Innovative Carbon-Free Nuclear Technologies | Rep. John Ragan, Tennessee*, Sen. Ken Yager, Tennessee, and Comm. David Salyers, Governor's Alternate
- **9.2020** Investments in Reliable, Resilient and Lower Carbon Emission Electricity | Rep. Jim Gooch, Kentucky*



Representative William E. "Bill" Sandifer, South Carolina SSEB's Resolutions Committee Chair SSEB's 60th Annual Business Meeting | Virtual Event September 29, 2020

Visit <u>https://www.sseb.org/publications/resolutions/</u> to download recently adopted resolutions.



New Publications





https://www.sseb.org/publications/

Analysis of E&E Laws Enacted in 2020



State budgeting, rural broadband access, emergency notifications and shelters, and studying/banning polyfluoroalkyl substances (PFAS)

SSEB's Carbon Management Program



S	EB Carbon Management Project Portfolio - Schedule	Start Date	End Date	2003	2004 2005	2006	2007	2009	2010	2012	2013	2015	2016	2018	2019	2020 2021	2022	2023 2024 2025
Sc	Southeast Regional Carbon Sequestration Partnership (SECARB)		6/30/20															
	Phase I: Characterization	10/1/03	9/30/05			Π												
	Phase II: Validation	10/1/05	6/30/11	Π	Т													
	Phase III: Development	10/1/07	6/30/20			Π												
SE	CARB Utilization and Storage Acceleration (SECARB USA)	10/1/19	9/30/24															
υ.	5. Clean Coal & Power Systems Technology Transfer	1975	9/30/25															
	Southeast Regional CO2 Sequestration Technology Training Program (SECARB-Ed)	11/16/09	9/30/25	Π														
Sc	Southeast Offshore Storage Resource Assessment (SOSRA)		9/30/19					Π		Π							Π	
In	lustrial CCS/CCUS (ICCS) Working Group (Gulf of Mexico)	8/1/16	6/30/18															
Pr	Project ECO ₂ S (A CO ₂ Storage Assessment in Mississippi) (CarbonSAFE) Phase II		9/30/20															
Pr	Project ECO ₂ S (A CO ₂ Storage Assessment in Mississippi) (CarbonSAFE) Phase III		8/31/23															
SE	CARB Offshore: Gulf of Mexico	4/1/18	3/31/23															
Cc (D	nditionally Awarded: Direct Air Capture Recovery of Energy for CCUS Partnership AC RECO2UP)	10/1/20	9/30/23															
Ar	cansas CCUS Opportunity Assessment	4/1/19	6/30/19													Projec to SEC	t Trar ARB F	sferred hase III
ss	SSEB SUPPORTS																	
Ce Sc	ntral Appalachian Basin Unconventional (Coal/Organic Shale) Reservoir Small- ale CO ₂ Injection Test (Lead: VA TECH/VCCER)	10/1/11	12/31/17															
о	shore Storage Resource Assessment - Texas (Lead: UTEXAS/BEG)	10/1/15	1/30/19															
In	lustrial CCS/CCUS (ICCS) Working Group (Appalachia) (Lead: USEA)	7/1/18	`6/30/19															
Pr	pposed: CONSENSUS - CO 2 Capture, Utilization & Storage (Lead: USEA)	10/1/19	9/30/24															
					Activ	2				Nego	tiati	ng		Clos	sed/0	Comp	leter	

Public-Private Partnerships





Public-Private Partnerships





Transcending Boundaries

Southeast Regional Carbon Sequestration Partnership (SECARB)

Regional Carbon Sequestration Partnerships (RCSPs)

VS/E

SECARB Phase II & Phase III Project Sites

Name/Description Location

SECARB Phase III Early Test

Location

- 15 miles east of Natchez, MS
- Oilfield discovered in 1940s and abandoned in 1960s
- Currently owned/operated by Denbury Onshore LLC
- CO₂-EOR injection since 2008, Natural CO₂, Jackson Dome

Geology

• Target Injection Zone: Lower Tuscaloosa Formation – saline reservoir at depth of >10,000 feet

epth (ft)	Stratigraphic Unit	Hydrologic function
	Pleistocene-Holocene alluval sediments and loess	Vadose - unconfined
1000_	Miocene - Oligocene undivided	Fresh water aquifer system- confined
000		Confining system
	Cockfeild Fm. Cook Mountain Formation	
	Sparta Formation	
5000	Wilcox Group	Gas producer- pressure sink
6000		
/000	Garren and a second	
3000	Midway- Navarro - Taylor	Confining system
	Selma-Austin chalks	Buffering system
	Eutaw-upper Tuscalloosa	Monitoring zone
0000	Middle Tuscaloosa Fm.	Injection zone confining system
0000		ANY TRUCKS ANY TRUCKS AND ANY TRUCKS AND ANY TRUCKS AND ANY TRUCKS AND
	Lower Tuscaloosa Fm.	injection zone

SECARB Phase III Anthropogenic Test

- Carbon capture from Plant Barry, 25MWe
- 12-mile CO₂ pipeline constructed by Denbury Resources
- CO₂ injection into ~9.400 ft. deep saline formation (Paluxy), Class V Experimental UIC Permit
- 114,000 metric tons injected
- Monitoring CO₂ during injection

From SECARB to Petra Nova

SSEB Demo Goes Commercial!

- NRG Energy (Houston, TX)
- Plant scale-up to 240 MW
- Post-combustion slip-stream
- Captures 5,200 tons CO₂/day or 90% of CO₂
- Pipeline to Petra Nova West Ranch Oil Field (81 miles)
- EOR 300 bbls/day to 15,000 bbls/day!
- 60 million bbls Recoverable Reserves

Southeast Regional CO₂ Utilization and Storage Acceleration Partnership (SECARB-USA)

Regional Initiative to Accelerate CCUS Deployment

SECARB-USA

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 (CO_2) capture, utilization, and storage (CCUS) technologies.

Primary Research Areas:

- address key technical challenges;
- facilitate data collection, sharing and analysis;
- assess transportation and distribution infrastructure; and
- promote regional technology transfer and dissemination of knowledge.

SECARB Offshore Partnership: Gulf of Mexico

Offshore GOM Study Areas

FEDERAL WATERS								
	Depleted Oil & Gas Fields, and Potentially Associated CO ₂ -EOR	Deep Saline						
Western Planning Area	No	No						
Central Planning Area	Study Area is East of Houma District's Western Boundary (includes Houma District)	Study Area is East of New Orleans District's Western Boundary (excludes Houma District)						
Eastern Planning Area	All	All						
STATE WATERS								
	Depleted Oil & Gas Fields, and Potentially Associated CO ₂ -EOR	Deep Saline						
Texas	No	No						
Louisiana	Partial, Includes State Waters East of Houma District Boundary Extension	Partial, Excludes Chandeleur Sound/Islands						
Mississippi	Yes	Yes						
Alabama	Yes	Yes						
Florida (West Coast)	Yes	Yes						

SECARB Offshore GOM Study Areas (Oil, Gas, and Saline)

- Offshore Storage Resource Characterization
- Risk Assessment, Simulation, and Modeling
- Monitoring, Verification, and Accounting
- Infrastructure, Operations, and Permitting

NATIONAL

COUTHERN STATE

Industrial CCUS

Louisiana

- Louisiana chemical/industrial corridor along Mississippi River is uniquely situated to benefit from integrated CCUS system
- CCUS Workshop, November 2016
- CCUS Summit on July 2, 2019 (investment)

CO₂ Emission Clusters, Pipeline Infrastructure, and Oil Fields

Source: Louisiana State University Center for Energy Studies, 2016 ***Orange = Industries Red = Oil Fields**

Arkansas

- Funded by Arkansas Economic Development Commission (AEDC) Preliminary Findings Presented July 10, 2019 Continued characterization via SECARB Phase III
- agreement through June 2021
- •
- Determining economically viability for CCUS Viable miscible and immiscible CO₂-EOR, including quantity of CO₂ purchase needed and sources of CO_2
 - Storage resources
 - State and federal regulatory framework and financial/investment incentives

Arkansas CCUS Meeting with Governor Asa Hutchinson (AR), Legislative Leaders from Southwest Arkansas, and AEDC Little Rock, Arkansas | January 28, 2019

Maryland

- Governor Hogan's Clean and Renewable Energy Standard (CARES) strategy
 - 100% clean electricity by 2040
 - All-of-the-above approach
- The Future of Carbon Capture in Maryland, November 19-20, 2019
 - Pilot project possibilities
 - CO₂ sources, with emphasis on industrial sector
 - CO₂ utilization options
 - CO₂ storage (moratorium on fracking)
 - Hosted by:
 - Maryland Energy Administration
 - Maryland Department of Environment

Appalachian Region

What is needed to promote Industrial CCUS (ICCUS)?

- Engage stakeholders ٠
- Identify and interview CO₂ 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 ٠
 - Commonalities
 - Knowledge gaps
 - Issues/Resolutions?

Transcending Boundaries

Project ECO₂S (CarbonSAFE Phases II & III)

Phase II

- Established a 30,000-acre area of interest which contains gigatonne CO₂ storage potential
- Drilled 3 characterization wells (MPC 10-4, MPC 26-5, MPC 34-1)
- Identification and characterization of three storage reservoirs (Massive Sand/Dantzler, Washita-Fredericksburg, and Paluxy)

CO ₂ Storage Reservoir	P ₁₀ Capacity (MMmt)	P ₅₀ Capacity (MMmt)	P ₉₀ Capacity (MMmt)				
Massive/Dantzler	85	160	280				
WashFred.	350	660	1,130				
Paluxy	200	380	650				
TOTAL	635	1,200	2,060				

Phase III

- Accelerate wide-scale deployment of CCUS by assessing and verifying safe and cost-effective commercial-scale storage sites for CO₂ emissions, and assessing the technical and economic viability of carbon capture and/or purification technologies for sources that will supply CO₂ to storage sites.
- Four key activities
 - Site Characterization of a Commercial-scale CO₂
 Storage Site
 - UIC Class VI Permit to Construct
 - CO₂ Capture Assessment
 - NEPA

PROJECT

ECOS

Sustain a Regional Effort to Support Clean Coal and Carbon Management Policies and Technologies

Clean Coal Energy Policies and Technologies

"Provide a regional effort that fosters and sustains an innovative environment for the development of coal policies and technologies."

- Foster and facilitate communication, education and outreach between DOE, governors and legislative leaders within the SSEB region, state agencies, utilities, regulatory bodies, the private sector and non-profit organizations.
- Support global outreach to promote the adoption of U.S. technologies internationally and provide greater opportunities for U.S. companies in a globally challenging environment.
- Brief state policy-makers and regulators on the historical and current technical aspects of clean energy demonstration programs to gain support and regulatory approval for future commercial deployment and on establishing <u>a public-private consortium of experts to promote the rapid and transformative deployment of CCUS technologies</u>.

CCUS Commercialization

UH Center for Carbon Management in Energy (CCME)

Chuck McConnell

UNIVERSITY of HOUSTON

CENTER FOR CARBON MANAGEMENT IN ENERGY

- Founded in 2018
- Driven by industry members of the Energy Advisory Board at UH
- Science and Technology AND Public Policy, Legal, Business

- CCME addresses CCUS, Methane, Transformative Process Technologies all targeting EMISSIONS NOT Fuels
- CCME symposiums on CCUS, 45Q, H₂ transition, Decarbonized grid, Circular plastics economy. Ongoing schedule for 2021.

SSEB Awarded \$3.5MM Project to Accelerate Clean Coal and Carbon Management Technologies

"We applaud SSEB's association with the University of Houston to focus on commercial deployment of CCUS projects.... The time has come for CCUS to be deployed by private industry."

– The Honorable Steven Winberg, ASFE U.S. DOE

Full Press Release: <u>https://www.sseb.org/wp-</u> content/uploads/2020/09/carbon_management_announcement.pdf

SEPT. 17 - FOR IMMEDIATE RELEASE

SSEB Awarded \$3.5 Million Project to Accelerate Clean Coal and

Carbon Management Technologies Collaboration with the University of Houston's Center for Carbon Management in Energy for CO₂ Capture, Utilization, and Storage Commercialization Effort

Peachtree Corners, GA—Earlier this week, the Southern States Energy Board (SSEB) was awarded a five-year, \$3.5 million grant from the U.S. Department of Energy's Office of Fossil Energy to support and enhance the agency's mission of helping the United States meet its need for secure, affordable, and environmentally sourd fossil energy supplies.

The grant continues the work of the Board's Committee on Clean Coal Energy Policies and Technologies by convening the region's governors and legislative leaders within the SSEB region, state agencies, universities, utilities, regulatory bodies, the private sector, and non-profit organizations to foster and facilitate communication, education, and outreach on fossil energyrelated topics. The committee analyzes issues impacting the domestic and international commercial deployment of advanced power generation, power plant efficiency, water management, and carbon dioxide (CO₂) capture, utilization, and storage (CCUS) technologies by expanding the value chain for coal and col Jby-products with an emphasis on public policy.

SSEB also announced a new collaborative effort with the University of Houston's Center for Carbon Management in Energy (CCME) to create a public-private consortium of experts to promote the rapid and transformative deployment of CCUS technologies. The SSEB and CCME effort focuses beyond the research and development phase of technology development and centers on the commercial deployment needs of industry.

"The Office of Fossil Energy is glad to continue our partnership with the Southern States Energy Board," said Steven Winherg, Assistant Secretary for Fossil Energy at the U.S. Department of Energy (DOE). "We applaud SSEE's association with the University of Houston to focus on commercial deployment of CCUS projects. The American taxpayer has invested hundreds of millions of dollars in R&D; the time has come for CCUS to be deployed by private industry."

"The initiative brings together the findings and lessons learned from SSEB's leadership of the Southeast Regional Carbon Sequestration Partnership program, the Regional Initiatives for CCUS, and a dedicated support team co-located in Houston that is fundamental for commercialization acceleration," said Kenneth J. Nemeth, SSEB's Secretary and Executive Director.

"SSEB and CCME will work with industry to address a full range of early technology deployment risks through this publicprivate partnership," he said.

"The advancement of CCUS technologies and the structure of projects within DOE's Carbon Management Program portfolio have provided great foundational work at early and late stages of development in CO₂ capture, utilization systems, and geologic storage," said Charles McConnell, Executive Director of the University of Houston's CCME.

"Pilots and demonstrations in several of the key partnerships have led to early-stage commercial deployments, but this is a recognition that greater emphasis and alignment with industry on commercialization challenges and opportunities is required to accelerate the broad deployment of CCUS in the marketplace." Be said.

Through the SSEB and CCME partnership, there will be an increased emphasis in stakeholder engagement and workforce development focused on public, industry, and university education, as well as outreach opportunities directly supporting commercial CCUS deployment.

"Access to reliable clean coal technology supports economic development and job growth," Winberg said. "There is a bright future for 21st century coal."

###

SSEB & UH CCME Collaboration

- Create a public-private consortium of experts to promote the rapid and transformative deployment of CCUS technologies
- Focus beyond the research and development phase of technology development and center on the commercial deployment needs of industry

Workflow Highlights

- Establish a Leadership Committee and Public-Private CCUS Commercial Deployment Consortium (12/31/20)
- Develop a CCUS Commercial Deployment Consortium Roadmap (FY2021)
- Provide CCUS Facility Design Support to Industry (9/30/21)
 - Seek opportunities to provide CCUS facility design support to industry
- Maintain robust Stakeholder Engagement and Workforce Develop strategic and tactical roadmap (10/1/20 – 9/30/25)
 - Directly support commercial CCUS deployment
 - Convene, Host and Engage the marketplace through events
- Solicit and assemble ongoing feedback from participants on obstacles to CCUS deployment (10/1/20 9/30/25)

Upcoming Activities

Immediate Short Term Goal:

Convene identified participants and the experience of industry, academia, and government to accelerate CCUS deployment in the Southern region, and across the US. Leadership Team identified. (12/2020)

First Year Goal:

Identify and Address key challenges to commercial risk in the broad marketplace in terms of technologies, transportation and distribution infrastructure, legal and policy and to promote regional knowledge transfer and inform marketplace and government stakeholders.

• Analysis and tactical Roadmap (9/30/21)

Step I: Recruit Leadership Team

- Recruit Leadership Team to Guide Development of Roadmap
- Coordinate effort with Regional Initiatives ensures complementary effort to regional R&D activities

Step 2: Develop & Initiate Roadmap

- CCUS Commercial Deployment Consortium Roadmap Development
- Phased initiation of Roadmap over 3 phases and 4 years (FY22-25)

Roadmap's Contents (preliminary)

- Near- and long-term management and staffing of the Consortium and the roles and responsibilities of all personnel and participants;
- Funding/membership mechanisms for establishing a selfsustaining Consortium;
- Involvement of the Regional Initiatives to ensure the project is complementary to, and builds upon, existing research and development efforts;
- Services and expertise to be provided through the Consortium's structure, including an assessment of challenges and obstacles to deployment of CCUS technologies;
- Workforce development needs to support the rapid acceleration of CCUS technologies commercialization; and
- Plan to obtain commitments to join a Consortium from a broad spectrum of public-private partners, especially representatives from industry, universities, and the CCUS community.

Ongoing Activities

- CCUS Facility Design Support to Industry (full performance period)
 - Seek opportunities to provide CCUS facility design support to industry
 - Collaborate with Regional Initiatives and other DOE and NETL-funded carbon management projects
- Stakeholder Engagement and Workforce Development (full performance period)
 - Directly support CCUS deployment
 - Host and support events
 - Solicit and assemble feedback from participants on obstacles to CCUS deployment (can feed findings into the Regional Initiatives)

POCs

Name	Title	Email	Office	Cell
Ken Nemeth	Secretary & Executive Director	nemeth@sseb.org	(770) 242-7712	(404) 405-2744
Kim Gray	Managing Director	gray@sseb.org	(770) 282-3576	(770) 715-0237
Ben Wernette	Geologist	wernette@sseb.org	(770) 282-3578	(334) 332-5921
Charles McConnell	Executive Director, Carbon Management and Energy Sustainability, UH Energy	<u>cmcconnell@uh.edu</u>		(832) 922-5799
Ramanan Krishnamoorti	Professor of Chemical & Biomolecular Engineering, Petroleum Engineering, and Chemistry, Chief Energy Officer, UH Energy	<u>ramanan@uh.edu</u>	(713) 743-4307	

Friend us on Facebook at facebook.com/southernenergy

For meeting updates, visit our website at **www.sseb.org**

Follow us on Twitter at twitter.com/ssenergyboard

Got a question? Give us a call at 770.242.7712

View past meetings and more at youtube.com/southernstatesenergy

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

6325 Amherst Court Peachtree Corners, Georgia 30092 (770) 242-7712 nemeth@sseb.org www.sseb.org

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

Project ECO₂S Phase III

- Site screening, well pad clearing, and spudding the well
- Dedicated wellsite entry checkpoint for signing in/out and COVID-19 screening

