



CO₂-EOR & Carbon Management: Highlights and Recent Developments

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Presented to:

12th Annual (2014) EOR Carbon Management Workshop

December 9, 2014

Midland, Texas



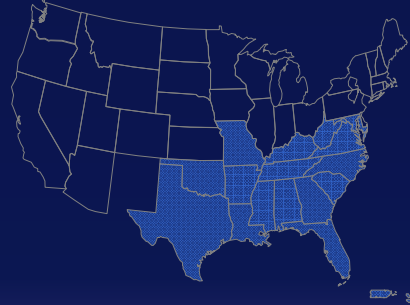
Presentation Outline

- About Southern States Energy Board (SSEB)
- Energy & Environmental Challenges to GHG Emissions Reductions: International, National, and Regional Perspectives
- Recent Government Frameworks to Incentivize Industry to Utilize CO₂ for EOR and Beyond
- Southeast Regional Carbon Sequestration Partnership
- Upcoming SSEB Events

Background

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.

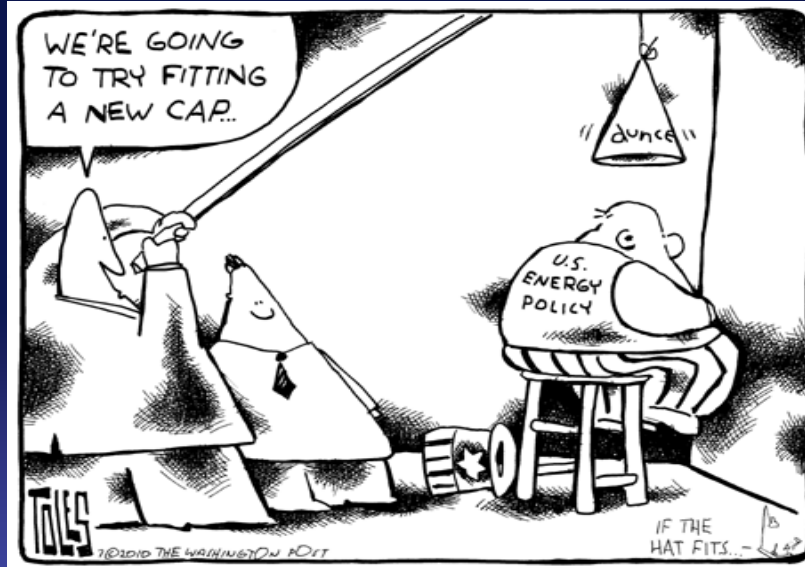
- SSEB Mission Statement



- Established 1960, expanded in 1978
- 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

International Energy & Environmental Challenges

- Increasing energy demand (2-3x increase)
- Water scarcity including drought in many areas
- National energy policy related to supply
- Selling power from Texas to Mexico
- U.S. Market Exports

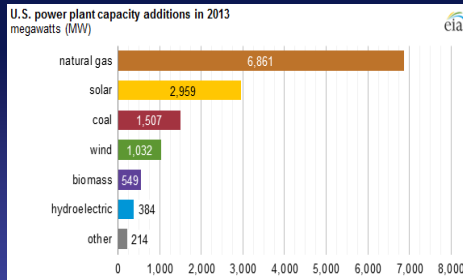


Setting the Stage – Nationally



1st Half 2014 (compare to 2013) - EIA

- U.S. primary energy consumption 50Q
 - +3% from 2013
 - Natural Gas + 5%
 - Coal + 3%
 - Nuclear + 1%
- U.S. primary energy production 42Q
 - +5% from 2013
 - Crude oil +15%
 - Natural Gas +5%
 - Renewables +4%
- U.S. primary energy imports 12Q
 - Down 6% from 2013
- U.S. primary energy exports 6Q
 - Up 8% from 2013



ARBITRAGE

BY M. COOL

KILL COAL!
STOP KEYSTONE
HALT LNG EXPORTS
BLOCK GHG!
REGULATE EVERYTHING



KEEP COAL!
PASS KEYSTONE
SUPPORT OIL & GAS EXPORTS
CLIMATE CHANGE IS A HOAX
STOP REGULATORY MORASS



IS THIS
"ALL OF THE ABOVE"
OR
"ONESZEFTSAL"?

What's in store for the 114th Congress?



- US oil and gas exports
- Federal energy subsidies including renewables
- State of US energy infrastructure
- Maximizing benefits of the shale revolution
- Implications of falling oil prices on policy issues
- Regulatory impediments to energy development
- Keystone XL pipeline

Comments on EPA's Clean Power Plan



- Princeton professor Robert Williams
 - Encourage CCS with captured CO₂ for EOR
 - Enact CO₂ EOR Portfolio Standard to support technology cost buy-down for early mover CCS projects
- American Coal Council
 - Proposal: lengthy, complex, ambiguous, over-reaching, results in loss of jobs
 - Jeopardize electric grid reliability
 - Hinder coal plant efficiency improvements and advanced coal technology
- Governor Tomblin on behalf of SSEB
- Opposition bloc of a dozen states
 - Rule is out of EPA's jurisdiction
 - GHG reductions achieved by the rule would be miniscule
 - Including compliance mechanisms outside power plants illegal
- Kentucky Energy & Environment Cabinet
 - Economic implications and impacts of higher electricity costs
 - Stranded utility assets; constrained economic dispatch; grid risks; market distortions
 - Unreasonable timeline
- Utility Responses in the South: Duke Power, TVA, Southern Company, EEI

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2014 Resolutions Adopted by SSEB Members



- 1. 2014 – Resolution to Support a Robust 2017-2022 Outer Continental Shelf Leasing Program
- 2. 2014 – Resolution Concerning Clean Water Act Regulations and EPA's Definitions of "Waters of the U.S."
- 3. 2014 – Resolution Supporting Fuel and Technology Diversity in the U.S. Electricity Generation Portfolio
- 4. 2014 – Resolution Concerning U.S. EPA's Proposed Greenhouse Gas Emission Guidelines for Existing Fossil-Fueled Power Plants
- 5. 2014 – Resolution Questioning Nuclear-Specific Provisions of U.S. EPA's Proposed 111 (d) Carbon Rule

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CCUS + EOR Drives Job Creation, Economic Growth in 2030



Powerlines, Pipelines, EOR, and CTL = Economic Comeback



**\$60
billion**

Annual Tax Revenues



**\$188+
billion**

Sales



**1,000+
thousand**

Jobs

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Criteria for New Energy-Related Projects



Politics

Policy

Economics

Organization

Technology

Regulatory

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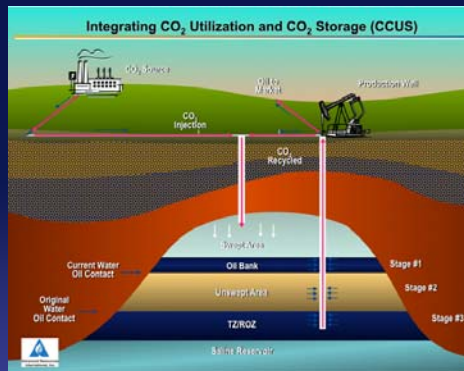
What Do We Need?

- Regional network of pipelines
- Reduce cost of CO₂ capture
- Encourage strong state laws (rate basing first-of-a-kind projects)
- Level playing field for fuels and technologies
- Public education and outreach
- New business models (polygen)
- New technologies, better measurements
- Model legislation (states)

State Perspectives: Recent Government Frameworks to Incentivize Industry to Utilize CO₂ for EOR and Beyond



- Since 2013, several hundred bills and regulations related to CO₂ have been proposed in the U.S., though only a fraction have been enacted.
- States leading the way:
 - Alabama
 - Florida
 - Idaho
 - Illinois
 - Kentucky
 - Louisiana
 - Michigan
 - Mississippi
 - Montana
 - New Mexico
 - Texas



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State Incentives for CCS/CCUS by Type



- Pore space/CO₂ ownership (IL, LA, MS, MT, ND, OK, TX, WV, WY)
- Long-term liability (IL, KS, KY, LA, MS, MT, TX, WV, WY)
- Financing sources/tax incentives (AL, CA, CO, FL, IL, IN, KS, LA, MI, MN, MS, MT, ND, NM, NY, OK, TX, VA, WY)
 - Grants, bonds, or incentives for IGCC plants, advanced clean coal technologies, or CCS specifically
 - Tax incentives (severance, ad valorem, sales, and/or franchise)
- Eminent domain (AL, IL, IN, KY, LA, MI, MS, TN)
- Offshore carbon repository program (TX)
- Organization (ID, IL, LA, MI, MT, TX)
 - Authority/Jurisdiction: CO₂ injection wells for oil/gas production and/or pipeline transport
 - Fee structure for UIC permit applications

SECARB Phase III



EPR2 | ELECTRIC POWER RESEARCH INSTITUTE

Anthropogenic Test
 Capture: Alabama Power's Plant Barry, Bucks, Alabama
 Transportation: Denbury
 Geo Storage: Denbury's Citronelle Field, Citronelle, Alabama

Early Test
 Denbury Resources' Cranfield Field
 Near Natchez, Mississippi
 CO₂ Source: Denbury
 CO₂ Transportation: Denbury
 Saline MVA: GCCC



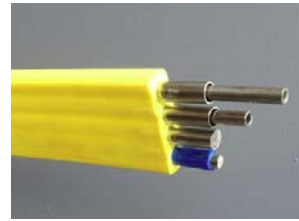
SECARB Acknowledgements

- The SECARB material is based upon work supported by the U.S. Department of Energy National Energy Technology Laboratory.
- Cost share and research support provided by SECARB/SSEB Carbon Management Partners.
- Anthropogenic Test CO₂ Capture Unit funded separately by Southern Company and partners.



SECARB “Firsts” and Accomplishments

- SECARB's Early Test was the first within the Regional Carbon Sequestration Partnerships (RCSP) to inject CO₂ in Phase III.
- SECARB's Early Test was the first of the RCSPs to monitor a 1 million metric ton injection. The Early Test is the fifth project worldwide to reach this CO₂ injection volume.
- SECARB, for the first time in an EOR + storage setting, placed pressure gauges in the above zone monitoring interval to test retention in the reservoir at Cranfield.
- The SECARB team has developed a field method for soil gas monitoring known as the process-based method, which was used at the Kerr farm in Saskatchewan to show that there was no leakage from the Weyburn site.
- SECARB was the first of the partnerships to inject CO₂ under a power plant at Plant Daniel in Escatawpa, Mississippi.
- SECARB's Anthropogenic Test in Alabama is the world's largest fully integrated CO₂ capture, transportation, and storage project utilizing CO₂ from a coal-fired power plant.
- Eleven countries have toured our Anthropogenic Test site; Belgium, Canada, China, France, Italy, Japan, Korea, Norway, Spain, Taiwan, and the United Kingdom.
- SECARB's Anthropogenic test was the first deployment of the Modular Borehole Monitoring (MBM) flat pack for CCS in a saline reservoir.



MBM Flat Pack



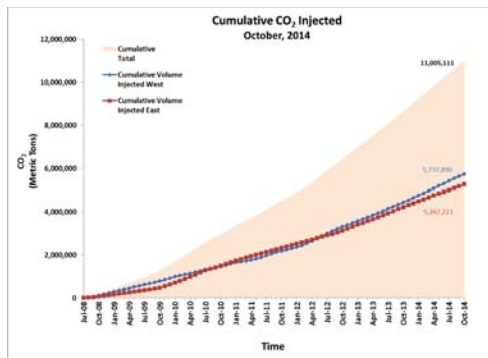
SECARB Recognition and Awards

- **International Carbon Sequestration Leadership Forum**
 - Early Test at Cranfield (October 2010)
 - Anthropogenic Test at Citronelle (November 2013)
- **Southern Company's 25 MW Carbon Capture Demonstration**
 - Mobile area Partner's for Environmental Progress (May 2012)
 - Savannah Ocean Exchange Industry Excellence Award (October 2012)
 - Feature article in Power Engineering Magazine (November 2012)
 - Mobile Chamber of Commerce Innovator of the Year (November 2012)
 - State of Alabama Engineering Hall of Fame (February 2013)
 - Southeastern Electric Exchange (S.E.E.) 2014 Industry Excellence Chairman's Award (June 2014)



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SECARB Early Test: CO₂ Injection/Storage Inventory



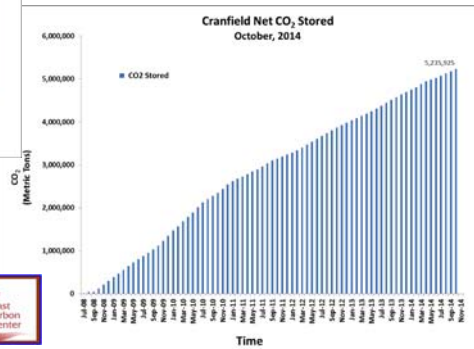
11,005,111 metric tons of CO₂ injected

5,235,925 metric tons of CO₂ stored

Difference is recycled CO₂ from EOR process

Cumulative Totals for Phase II and Phase III 2008-Present

Inventory as of October 31, 2014



Anthropogenic Test



CO₂ Monitored (as of 11/30/2014)

230,000 metric tons captured

(Note: CO₂ capture unit ran intermittently 14 months prior to start of storage program.)

114,101 metric tons injected & stored

Capture facility is currently offline
(planned restart in March 2015)

Active Surface and Sub-surface Monitoring

Soil Gas

Groundwater

Perfluorocarbon Tracer (PFT) Surveys

(PFTs were added to injection wellhead upon startup, and nearby wellheads will be surveyed regularly for PFTs at the surface)

Injection Zone

Experimental Tools



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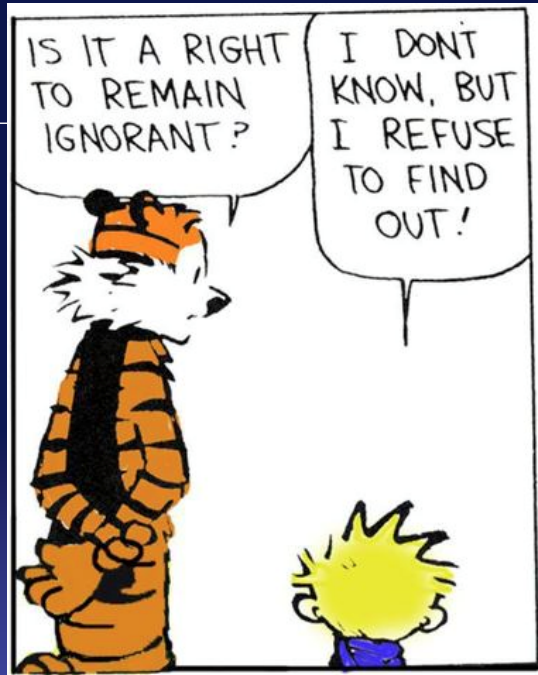


Mark Your Calendar!

Dates of Meeting*	SSEB Meetings	Location of Meeting
February 23, 2015	SSEB Associate Members Winter Meeting (held in conjunction with the National Governor's Association Winter Meeting)	Washington, DC
March 2015	Southeast Regional Carbon Sequestration Partnership 10 th Annual Stakeholders Briefing	Atlanta, Georgia
May 18-19, 2015	SSEB Coal and Advanced Power Systems Committee Meeting (held in conjunction with the Virginia Coal and Energy Alliance's Annual Meeting)	Kingsport, Tennessee
July 18, 2015*	SSEB 2015 Legislative Briefing (held in conjunction with the Southern Legislative Conference Annual Meeting)	Savannah, Georgia
August 20, 2015*	SSEB Associate Members Summer Meeting (held in conjunction with the Southern Governors' Association Annual Meeting)	St. Louis, Missouri
September 27-29, 2015*	SSEB 55 th Annual Meeting	White Sulphur Springs, West Virginia

*NOTE: Dates are subject to change for certain meetings.

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