# Position and Response of Utilities Industries to Climate Change

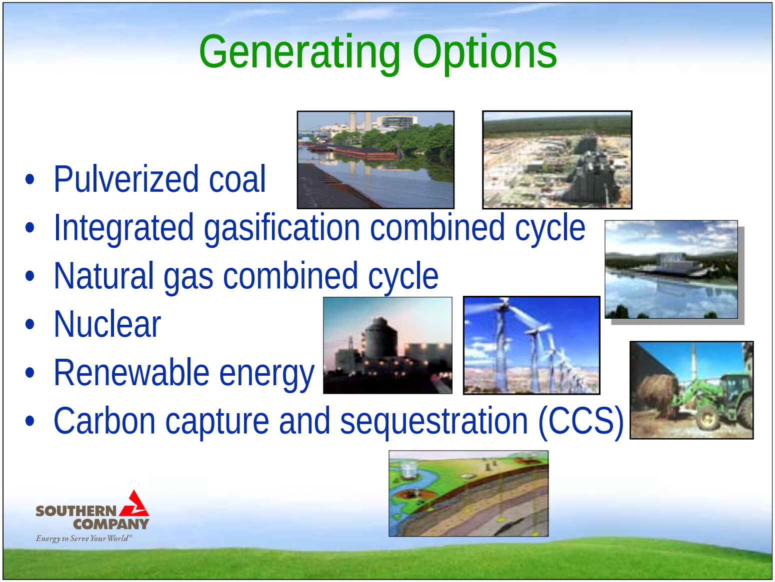
AAPG Annual Convention & Exhibition
June 8, 2009

Karl Moor
VP & Associate General Council
Southern Company Services

# Southern Company's Climate Change Policy

*Climate change is a challenging issue for our world and our nation. Southern Company is committed to a leadership role in finding solutions that make technological, environmental and economic sense. The focus of this effort must be on developing and deploying technologies that reduce greenhouse gases while making sure that electricity remains reliable and affordable. Southern Company believes that this is the most responsible approach to meeting the needs of the environment and its customers and shareholders.*

SOUTHERN COMPANY
Energy to Serve Your World®




**Presenter's Notes:** Pulverized coal –- burning coal that has been broken down to a consistency similar to face powder in a boiler to create steam which then drives large turbines to produce energy.

IGCC - a technology that turns coal into gas -- synthesis gas (syngas) –- and then combusts the gas to produce energy.

Natural gas combined cycle -- A combined-cycle gas turbine power plant consists of one or more gas turbine generators

equipped with heat recovery steam generators to capture heat from the gas turbine exhaust. Steam produced in the heat recovery steam generators powers a steam turbine generator to produce additional electric power. Use of the otherwise wasted heat in the turbine exhaust gas results in high thermal efficiency compared to other combustion based technologies. (definition from http://www.westgov.org/wieb/electric/Transmission%20Protocol/SSG-WI/pnw_5pp_02.pdf).

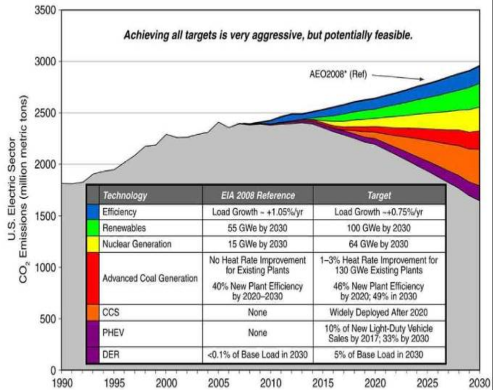
Nuclear -- Nuclear plants, like plants that burn coal, oil and natural gas, produce electricity by boiling water into steam. This steam then turns turbines to produce electricity. The difference is that nuclear plants do not burn anything. Instead, they use uranium fuel, consisting of solid ceramic pellets, to produce electricity through a process called fission.

Renewable Energy –- such as solar, wind, hydro, and biomass.

CCS –- CCS is a broad term that encompasses a number of technologies that can be used to capture carbon dioxide from point sources, such as power plants and other industrial facilities; compress it; transport it mainly by pipeline to suitable locations; and inject it into deep subsurface geological formations for indefinite isolation from the atmosphere. (Definition from WRI)

# Why is CCS Needed?

- Coal is abundant and inexpensive US resource
- Continued use of existing infrastructure with existing environmental controls and transmission
- Even with renewables, efficiency, and nuclear, CCS plays a significant role for the future



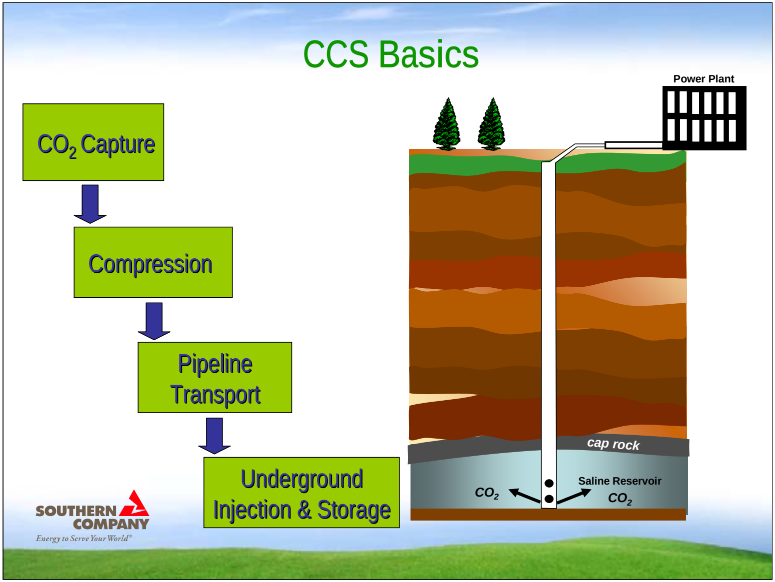

| Technology | EIA 2008 Reference | Target |
|---|---|---|
| Efficiency | Load Growth ~ +1.05%/yr | Load Growth ~+0.75%/yr |
| Renewables | 55 GWe by 2030 | 100 GWe by 2030 |
| Nuclear Generation | 15 GWe by 2030 | 64 GWe by 2030 |
| Advanced Coal Generation | No Heat Rate Improvement for Existing Plants<br>40% New Plant Efficiency by 2020–2030 | 1–3% Heat Rate Improvement for 130 GWe Existing Plants<br>46% New Plant Efficiency by 2020; 49% in 2030 |
| CCS | None | Widely Deployed After 2020 |
| PHEV | None | 10% of New Light-Duty Vehicle Sales by 2017; 33% by 2030 |
| DER | <0.1% of Base Load in 2030 | 5% of Base Load in 2030 |

**"The Power to Reduce $CO_2$ Emissions: The Full Portfolio", EPRI, 1018431, 2008**

SOUTHERN COMPANY
*Energy to Serve Your World®*

**Presenter's Notes:** The figure shows the "Potential for decarbonizing the U.S. electric sector -- the full portfolio. It is a comparison of EIA 2008 [5] projections for electricity sector annual emissions growth to a decreasing emissions profile resulting from assumptions of advanced technology development and deployment."

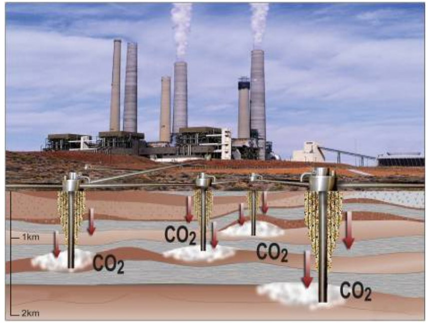
The work is intended to inform the overall discussion on climate policy, but it does not support or oppose any particular approach. It assumes that pilot projects starting in 2015 would capture 20% of the CO2 emitted by 20% of the new commercial-scale coal power plants coming online in that year. These fractions were increased steadily over each of the next five years to reach 90% of CO2 from 90% of new coal-based power plants coming online in 2020 and each year thereafter. CO2 emissions from these new plants were reduced by the appropriate amount.




**Presenter's Notes:** Carbon is captured from flue gas (PC plant) or separated from fuels (IGCC Plant) , compressed into a dense phase liquid, transported via a certified CO2 pipeline, and injected through a UIC permit into geologic formations.

# Before $CO_2$ can be stored, it must be captured

Capture is the separation of $CO_2$ from fuel or the flue gas stream




Two general classes of $CO_2$ capture technology are:

- Pre-combustion (IGCC)
- Post-combustion (PC)

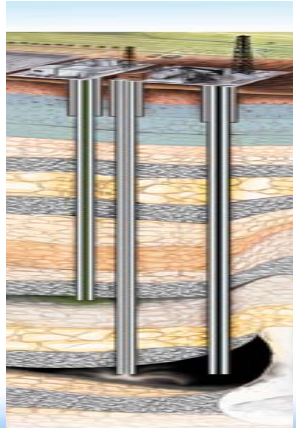
SOUTHERN COMPANY
*Energy to Serve Your World®*

**Presenter's Notes: Integrated Gasification Combined Cycle**, or IGCC, is a technology that turns coal into gas -- synthesis gas (syngas). It then removes impurities from the coal gas before it is combusted.  Southern is advancing both PC and IGCC capture technologies at this time to compare costs, reliability, and operational issues. (Kemper County 50% IGCC capture, Barry demo 25MW PC capture, Wilsonville National Carbon Capture Center -- looking at both technologies).

# Once $CO_2$ has been captured, it must be stored

## Our most secure options include:

- Storage in deep saline reservoir
- Storage associated with enhanced oil recovery ($CO_2$-EOR)
- Storage in coal seams with enhanced coal-bed methane recovery (ECBM)
- Storage in closed oil and gas fields

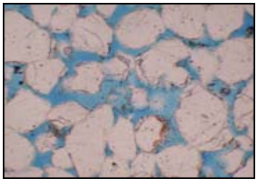


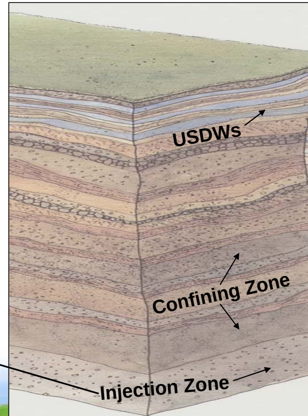
SOUTHERN COMPANY
*Energy to Serve Your World®*

**Presenter's Notes: Southeast geology survey --** Results from SECARB sequestration field testing indicates that numerous thick, regionally extensive, high porosity saline formations with excellent thick shale confining zones exist throughout the region. These formations contain huge storage potential, enough to accept the entire captured emissions of all CO2 for 100's of years.. Many of these formations contain low-dip or possess 3-way structural closure that we believe will limit or even contain the long-term migration of injected CO2.

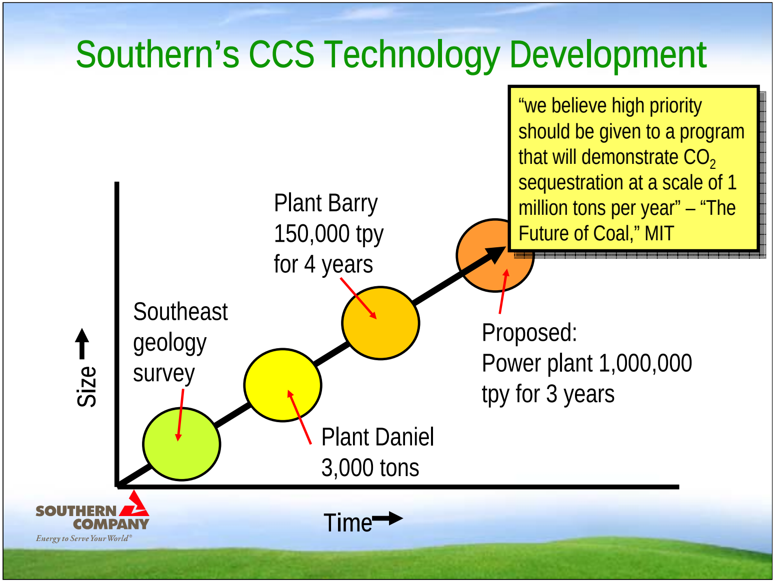
# Components of Safe Geologic Storage

- **Storage Formation –** A porous and permeable injection zone that can accept and store $CO_2$, i.e., sandstone.
- **Seal or Cap Rock Formation –** A confining zone or impermeable rock layer that impedes $CO_2$ flow, i.e., shale.






SOUTHERN COMPANY
*Energy to Serve Your World®*




**Presenter's Notes: Southeast geology survey --** Results from SECARB sequestration field testing indicates that numerous thick, regionally extensive, high porosity saline formations with excellent thick shale confining zones exist throughout the region. These formations contain huge storage potential, enough to accept the entire captured emissions of all $CO_2$ for 100's of years.. Many of these formations contain low-dip or possess 3-way structural closure that we believe will limit or even contain the long-term migration of injected $CO_2$.

**Plant Daniel Hosts Regional Carbon Sequestration Partnership Demonstration** -- With partners DOE, EPRI, and the Southern States Energy Board, Southern Company's Plant Daniel hosted a demonstration of $CO_2$ sequestration into a deep saline formation. Two (2) wells were drilled (an injection and an observation), each nearly 9500 feet deep, into which 3000 tons of $CO_2$ were injected in October 2008. The demonstration includes monitoring of the $CO_2$ once it has been injected. The other primary focus of the project is on public acceptance, permitting, outreach, and the overall logistics of deep well drilling and $CO_2$ injection at a coal-fired power plant.

**SECARB Phase III (25 MW Demo at Plant Barry)** –- Financial approval has been granted for 25MW capture project with sequestration managed through the DOE's Phase III SECARB program. An evaluation is ongoing to determine if the sequestration portion of the project will be performed onsite or at an offsite location. The owner/operator of the Citronelle Oil Field (Denbury) has agreed to allow 5th pilot to take place in the confines of the oil field. Texas BEG-led Cranfield Oil Field Tuscaloosa water-leg injection was to begin in 2008; Southern Company will participate with MMV activities.

**Proposed plant –-** scale up of the Plant Barry project. Part of DOE's Clean Coal Power Initiative (CCPI) Round 3. It would be a 170 MW capture plant and inject $CO_2$ into one of the large capacity and safe saline reservoirs of the Gulf Coast Region

# Uncertainty

At present no single coordinated framework exists to address the legal issues associated with CCS:

- Siting
- Underground injection
- Closure
- Transportation
- Long term storage issues
- Liability

SOUTHERN COMPANY
Energy to Serve Your World®

Source: Allison Wood, Hunton & Williams

# Who Owns the Storage Space?

- Who owns the geological reservoir depends on the geological formation in which the $CO_2$ is being stored:
  - – Deep saline aquifers ($CO_2$ dissolves in brine and eventually mineralizes) – drawing from water law
  - – Depleted oil and gas reservoirs ($CO_2$ droplets affix to rock pore space) – drawing from oil and gas law
  - – Unmineable coal seams ($CO_2$ molecules absorb to surface of coal) – unknown

SOUTHERN COMPANY
*Energy to Serve Your World®*

Source: Allison Wood, Hunton & Williams

**Presenter's Notes:**

•Ownership rights determined by state property law.

•Real property law recognizes multiple "estates."

•Most likely storage space in near future for anthropogenic $CO_2$ will be enhanced oil recovery operations (EOR).

-- In that case, need to look at the state rules regarding pore space ownership.

# Who Owns the $CO_2$?

- $CO_2$ can migrate under adjoining property owner's land
- No case law on CCS so commentators rely on oil and gas case law
- Early cases analogized fugacious resources to wild animals (*ferae naturae*)
- Led to non-ownership theory of stored natural gas and "rule of capture"

SOUTHERN COMPANY
Energy to Serve Your World®

Source: Allison Wood, Hunton & Williams

**Presenter's Notes:**

•Most states now follow "ownership in place" theory.

-- Gives owner of mineral rights a "possessory estate" to oil and gas injected into a defined storage reservoir.

•"Rule of capture" still applies if gas migrates under neighbor's land – not clear if "wild animal" analogy would apply to anthropogenic $CO_2$.

•Why do we care? Goes to questions of who is liable….

# What are Risks from CCS?

- Damage to human health, environment, property, including human exposure
- Groundwater contamination
- Subsurface resource damage
- Trespass

SOUTHERN COMPANY
Energy to Serve Your World®

Source: Allison Wood, Hunton & Williams

**Presenter's Notes:**

•Damage to human health, environment, property, including human exposure.

-- Exposure to high concentrations of $CO_2$, typically 7-10% or greater by volume in air, can be harmful to humans, as well as animal and plant life.

-- $CO_2$ is denser than air and upon release from a pipeline or underground storage site can accumulate in potentially dangerous concentrations in low-lying areas.

Groundwater contamination

-- Injection and long-term storage of $CO_2$ can contaminate underground sources of drinking water.

-- Migrates from underground storage site through undetected faults and fractures or through improperly drilled and managed injection wells.

-- Can enter aquifers directly or displace brines or other substances into aquifers.

-- Can also displace toxic metals, sulfates, or chloride into aquifers.

Subsurface resource damage

-- Accumulation of leaked $CO_2$ just below surface can cause soil acidification and displace oxygen in soils.

•Trespass

-- Migration of $CO_2$ can damage other underground resources.

-- $CO_2$ may displace brine in EOR operations; this could foul oil or gas resources.

# Risk Management: A Major Obstacle to Commercial Scale CCS Deployment

- Southern Company's approach to risk management breaks it down to four distinct areas:
  - Property ownership and trespass
  - Long-term maintenance and monitoring for closed sites
  - Environmental remediation
  - General tort liability for claims of damage to health, property, etc.

SOUTHERN COMPANY
*Energy to Serve Your World®*

**Presenter's Notes:**

**1. Property (including pore space) ownership and issues of trespass** -- These issues have not been consistently addressed to date, making it difficult to move forward with both commercial scale sequestration as well as with demonstration-scale R&D projects. We believe that interested states and groups are pursuing solutions to these issues and that, over time, given economic incentives, pore-space ownership and compensation issues will be addressed. There, however, may be a role for the federal government in encouraging resolution of these issues if a lag develops that would impede full and timely implementation of CCS.

**2. Long-term maintenance and monitoring for closed sites** -- This includes responsibility for the routine inspection and repairs necessary to insure the long-term integrity of all equipment and wells at a closed injection site.

**3. Environmental remediation** -- This includes the active or passive cleanup of environmental ecosystem damages that may be related to geologic sequestration, such as the impacts associated with $CO_2$ accumulations in groundwater or damages resulting from fluid movements resulting from the injection of $CO_2$.

**4. General tort liability** -- This includes claims of damage to health, property, or to the environment.

# Typical Phases of a CCS Project and Associated Risks

1. Pre-injection siting and permitting – unlikely to pose many risks
2. Injection inception – fairly high risk
3. Operations – high-risk
4. Closure and stabilization – reduced risk
5. Long-term care – minimal risk

SOUTHERN COMPANY
*Energy to Serve Your World®*

**Presenter's Notes:**

•**Pre-injection siting and permitting.** This phase is unlikely to pose many risk issues, but the work done in this stage will be critically important in the design of a successful project with a minimal risk profile. Insurance providers must be intimately involved with the site selection and characterization in order to be able to underwrite the policies.

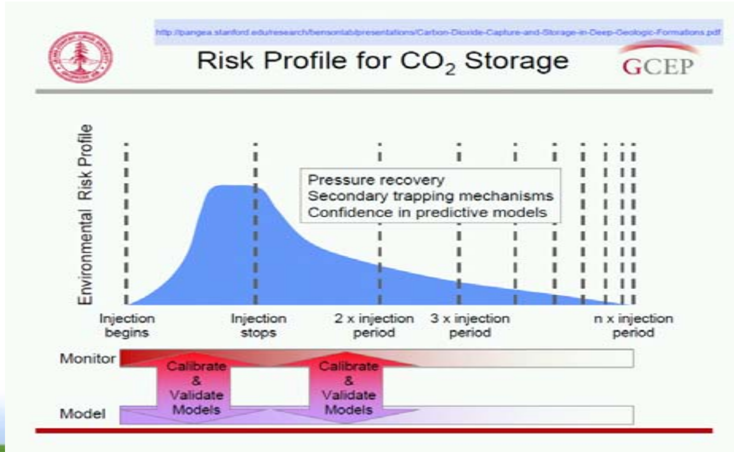
•**Injection inception.** The start of injection is a fairly high risk phase during the project. Gross failures of the geology for its intended purpose of containment could be revealed during startup. Risks arise from unexpected or unprecedented $CO_2$ movement and leakage, as well as unanticipated fluid movement. Southern Company has concluded that the risk management for the operator will likely be a combination of private and industry mutual insurance.

•**Operations.** The operations phase is also a high-risk time for the project. As the $CO_2$ continues to be injected, and despite the best site characterization possible, flaws in the containment may be revealed that could result in unprecedented $CO_2$ leaks and intrusion into drinking water. Again, Southern Company believes that a combination of private and industry mutual insurance would be the preferred risk mitigation tool.

•**Closure and stabilization.** The closure and stabilization phase includes the time after injection stops, when the risks of unintended $CO_2$ and fluid movement should decrease sharply as the $CO_2$ starts to stabilize and stop spreading. We would expect the risks to be handled by the same approach of private and industry mutual insurance, but with less expensive instruments that presumably would recognize the reduced risks of this phase.

•**Long-term care.** The long-term care phase begins once the site has stabilized and the $CO_2$ has stabilized in the storage reservoir. At this point, the risks come from decaying infrastructure and the residual risks of $CO_2$ movement and leakage or displaced formation fluids. Southern Company feels that the best approach for this phase is a third-party caretaker for the long-term maintenance of the wells and infrastructure. For commercial-scale deployment, however, we do not believe that this structure is the most efficient way to address the risk and remediation. We would prefer that the industry – those with the most CCS experience – be responsible for the risk and remediation instead of delegating this to a third-party. Southern has come to this conclusion after much careful consideration and review of existing mechanisms meant to address long-term risk in other aspects of our industry. We note, however, that other utilities do support the transfer of risk to a third-party, likely a governmental entity, to ensure appropriate monitoring and to undertake possible remediation of CCS projects in the long-term care phase. We are actively engaged in discussions about how best to apportion risk and responsibility with other interested parties.

# We Support Dr. Sally Benson's Risk Profile for CO2 Storage.



# Multi-Stakeholder Discussions Participants

- American Petroleum Institute
- American Public Power Association
- American Water Works Association
- Carbon Sequestration Council
- Clean Air Task Force
- Clean Water Action
- Edison Electric Institute
- Environmental Defense Fund
- Ground Water Protection Council
- Interstate Oil and Gas Compact Commission
- National Mining Association
- National Ground Water Association
- Natural Resources Defense Council
- North American Carbon Capture and Storage Association
- The Sierra Club
- Texas Carbon Capture and Storage Association

SOUTHERN COMPANY
*Energy to Serve Your World®*

Source: Bob Van Voorhees, Counsel to the Carbon Sequestration Council

**Presenter's Notes:** The Carbon Sequestration Council (CSC) was formed to provide a forum for inter-industry communication around key issues related to CCS including policy, funding, and legal issues. CSC has developed and participated in coordinated, multi-stakeholder approaches for providing input to a number of processes, including;

-EPA's technical and rule development workshops leading to the Agency's proposed rule regarding geologic sequestration of carbon dioxide under the Safe Drinking Water Act;

-the development of recommendations by the Ground Water Protection Council; and

-the development of regulatory frameworks by a number of states.

The Multi-stakeholder discussions rose out of the CCS contact group of the CSC.

# GS Multi-Stakeholder Discussions

- These organizations represent a broad array of interests in the issues associated with EPA's GS rulemaking
- Yet, each of these organizations signed at least one joint letter to EPA on the proposed geologic sequestration rule
- Most of these organizations also participated in multi-stakeholder discussions of interests and issues in an effort to reach consensus or at least to narrow differences
- Each joint letter to EPA has been signed both by industry and environmental NGOs with some variation in the mix from letter to letter and with some other signers as well

SOUTHERN COMPANY
*Energy to Serve Your World®*

Source: Bob Van Voorhees, Counsel to the Carbon Sequestration Council

**Presenter's Notes:** "EPA's GS rulemaking" refers to -- EPA's proposed rule for geologic sequestration of carbon dioxide under the Safe Drinking Water Act (SDWA) "Federal Requirements Under the Underground Injection Control (UIC) Program for Carbon Dioxide ($CO_2$) Geologic Sequestration (GS) Wells," 73 Fed. Reg. 43491-541 (July 25, 2008), Docket ID No. EPA–HQ–OW–2008–0390.

# More MSG Participants

- Anadarko Petroleum Corporation
- Blue Source LLC
- BP Alternative Energy North America Inc.
- BP America Inc.
- Denbury Resources Inc.
- Hydrogen Energy International LLC
- Occidental Petroleum Corporation
- Salt River Project
- Southern Company

SOUTHERN COMPANY
Energy to Serve Your World®

Source: Bob Van Voorhees, Counsel to the Carbon Sequestration Council

# MS Discussion Results

- Agreement on common principles
- Agreement on fundamentals of approach
- Agreement on basic siting and closure standards
- Agreement on a number of very detailed regulatory provisions and definitions
- Continuing discussions among the variety of stakeholders with common goal of having CCS technologies available

SOUTHERN COMPANY
*Energy to Serve Your World®*

Source: Bob Van Voorhees, Counsel to the Carbon Sequestration Council

# Broadest Agreement

- Agreed that EPA's proposal provides a solid foundation on which to develop the regulatory framework for geologic sequestration on issues within the purview of the SDWA and that development of this rule should proceed with EPA's proposal as the starting point
  – Nov. 17, 2008
- This was an important message to EPA, the States, and the incoming Obama Administration

SOUTHERN COMPANY
*Energy to Serve Your World*®

Source: Bob Van Voorhees, Counsel to the Carbon Sequestration Council

# MSG Discussion Principles

I. Geologic sequestration of CO2 (GS) could have a role to play in a greenhouse gas mitigation portfolio and should be one of the options considered.

II. GS can be performed in a safe and effective manner that does not endanger USDWs if projects are well managed and regulated adequately.

III. EPA's proposed rule on GS, with the necessary technical amendments and if implemented effectively, can ensure that GS projects are well managed, and hence will be safe and effective operations.

IV. It is desirable that stakeholders reach consensus to the degree possible on key issues raised by the proposed rule.

V. EPA should proceed with the promulgation of the rule under the proposed 2010-2011 timeline.

SOUTHERN COMPANY
Energy to Serve Your World®

Source: Bob Van Voorhees, Counsel to the Carbon Sequestration Council

# EOR + GS

- “We recommend that the rules be clarified to provide more certainty about the applicability of Class II requirements where GS of $CO_2$ occurs in connection with EOR/EGR activities.”
- “Specifically, the UIC rules should provide a ‘bright line’ definition as to the applicable class of wells where $CO_2$ injection for EOR/EGR production and for GS occur in tandem.”

SOUTHERN COMPANY
*Energy to Serve Your World®*

Source: Bob Van Voorhees, Counsel to the Carbon Sequestration Council

# The Bright Line

§ 144.6, 144.80 and 146.5, - Classification of injection wells

Injection wells are classified as follows – (b) Class II. Wells which inject fluids:

(4) For enhanced recovery of oil or natural gas where geologic sequestration is occurring during or in connection with enhanced recovery of oil or natural gas *provided* (i) there is reasonable expectation of more than insignificant future production volumes or rates as a result of carbon dioxide injection and (ii) operating pressures are no higher than reasonably necessary to produce such volumes or rates;

SOUTHERN COMPANY
Energy to Serve Your World®

Source: Bob Van Voorhees, Counsel to the Carbon Sequestration Council

# Specific Areas of Agreement

- Definitions for transmissive faults and fractures, carbon dioxide stream, confining zone, and area of review;
- Bases for injection pressure limitations;
- GS in basalts, coal seams, salt caverns, and shales;
- Coverage for area of review and corrective action requirements;
- How to address potential for interference between GS projects;
- Well construction requirements;
- Annulus pressure;
- Shut-off valves;
- Emergency response requirements;
- Closure standards; and
- Need for adequate implementation resources.

SOUTHERN COMPANY
*Energy to Serve Your World®*

Source: Bob Van Voorhees, Counsel to the Carbon Sequestration Council

**Presenter's Notes:** I have copies of the May 14th and 15th letters that were sent to EPA that go into more detail on these specific areas of agreement, if any anyone would like to have one.

# What is our Best Path Forward with CCS?

- Technology development needs to proceed at a firm crawl-walk-run pace; i.e., pilot projects provide proof of concept, demonstration projects need to be in the planning phases, and commercial-scale demonstrations need to be considered.
- Legal issues, costs, and risk all remain key issues. To best manage risk we must understand the risk and the best way to understand risk is to learn by doing.
- There will be an ongoing need for outreach & education to gain public acceptance.
- Must define project costs, impacts to operations, and associated costs of electricity.

SOUTHERN COMPANY
Energy to Serve Your World®

# Contributors

- Richard Esposito, Southern Company
- Allison Wood, Hunton & Williams
- Bob Van Voorhees, Counsel to Carbon Sequestration Council

SOUTHERN COMPANY
*Energy to Serve Your World®*