Clean Coal Technology Development
Southern Company Generation, Research & Technology Management
Richard A. Esposito, P.G.
Southern Company (NYSE:SO)

- Regional energy company
  - Alabama, Georgia, Gulf, Mississippi, and Southern Nuclear
  - Southern Power is the largest wholesale power producer in the Southeast
  - Southern Company Services is an in-house engineering design, construction, and research organization
  - More than 43,000 MW of electric generating capacity (79 plants)

- Core service area
  - 120,000 square miles in four southeastern states; 4.4 million customers and 26,000 employees

- One of the largest producers of electricity in the U.S. and one of the largest users of coal
Research Culture/Beliefs

• Maintain a corporate focus on R&D
• Learn by doing but collaborate externally to leverage resources and develop commercial partners
• Stay focused on the most strategic issues
• New technologies will address environmental challenges ahead
• Use a centralized R&D organization with top talent
• A successful technology portfolio brings multiple options to key business decisions
• Adopt intellectual property positions that do not impede technology deployment
• In-house expertise allows flexibility in commercial business models for technology deployment
Research & Development

Efforts that are key to our long-term CCS success

- Plant Ratcliffe IGCC
- Plant Barry CCS Demo
- Carbon Capture Center
- Site Characterization

Carbon Capture
Utilization Storage

Transportation

Geologic Storage

Applied Science and Laboratory Testing
National Carbon Capture Center

• Unique **flexible testing facility** where new processes can be tested on both coal derived syngas and flue gas at various scales.

• A technology development facilitator by providing facilities for **scale-up from bench-top to engineering-scale**.

• Include a **wide variety of participants and partners**. Develop “best-in-class” technology.

• Deliver innovation via a collaborative project portfolio that provides an **accelerated pathway to cost-effective CO₂ capture technology**.
Geology/Site Characterization

**Alabama Power William Crawford Gorgas Electric Generating Plant (Parrish, AL)**
- University of Alabama
- Geological Survey of Alabama
- Schlumberger Carbon Services

**Mississippi Power Victor J. Daniel Electric Generating Plant (Escatawpa, MS)**
- Southern States Energy Board/SECARB
- Electric Power Research Institute
- Advanced Resources International
Industry Leading R&D & Construction Expertise

- 15 years of development/demonstration in TRIG™ Technology
- Certified by the MPSC on June 3, 2010
- 582MW IGCC – COD May 2014
- ZLD facility
- 65% CO₂ Capture – 3.4 MMt CO₂/yr
- $2.4 Billion Capital Investment
  - $700M in federal incentives
  - CWIP rates will begin in 2012
  - Advanced due diligence discussion for federal loan guarantees
- TRIG™ Technology being deployed in China
Switchyard

Architectural Buildings

Gasifier

HRSG

Combined Cycle

Gasification Cleanup

Construction – February 20, 2012
Plant Barry CCS Demo

Fully integrated CO$_2$ capture, transport and storage project

- Construct and operate a 25 MW equivalent CO$_2$ capture unit at Alabama Power Plant Barry

- Construct and integrate/operate an 11 mile pipeline that will transport captured CO$_2$ to Citronelle Dome

- Site characterization, permit, inject, and monitor/model 300,000 metric tons of CO$_2$ into a saline formation

- Outreach & education, stakeholder acceptance, contracting, liability, pore space, etc.
Capture plant & compressor started operations on June 4, 2011 with 42,730 metric tons CO₂ captured to date.
SECARB Tour Overview

Citronelle SE Unit Injection Well D9-8

Alabama Power Pipeline
Basic Science and Lab Experimentation

Montana State Biofilm Lab
- Biological control of permeability
- Sealing leaking boreholes
- Sealing fractures and cap rocks

UAB Cap Rock Integrity Lab
- Long-term storage integrity
- Regulation of injection pressure
- Reassure stakeholders that geologic sequestration is safe and secure
Research Experience in Carbon Sequestration

The RECS program is heading to Southern Company in 2012

Thirty students selected to participate in a two week workshop where they learned about CCS from experts in industry, the research community, NGOs and the government; along with participating in group exercises, workshops, and field trips.
Other Supported Projects

- Plant Daniel CO₂ Impacts on Shallow Groundwater Study (EPRI/LBNL), 2010-2012.
- Valuation of Human Health and Ecological Risks and Damage Assessment Arising From CCS (Industrial Economics Inc.) (Phase I & Phase II), 2010-2012.
- CCS Technology and Pipeline Infrastructure Study (LANL), 2012.
- Florida Panhandle Pipeline Infrastructure Model (University of North Florida), 2011.
- Carbon Sequestration Simulation Center (UAB), 2012-2013.
- Transformation Reactions of Clay Mineralogy in CO₂ Storage Formations (Georgia State University), 2012.
- CO₂-EOR Initiative, Center for Climate and Energy Solutions (C2ES), 2011-2012
Anthropogenic Project Team

Capture
- SOUTHERN COMPANY
  - Permitting
  - Plant Integration & Construction
  - Site Host
  - Mitsubishi Heavy Industries
    - Design
    - Technology Provider
    - Advanced Amines
  - EPRI
    - Economic Evaluation
    - Knowledge Transfer
    - 3rd Party Evaluation

Transport
- SOUTHERN STATES ENERGY BOARD
- Storage
  - DOE
  - NETL
  - SOUTHERN STATES ENERGY BOARD
  - DENBRURY RESOURCES
  - DENBRURY RESOURCES
    - Pipeline Design
    - Pipeline Permitting & Construction
    - Field Operations
  - DRI

Site Prep/Drilling

Contractors

Dave Riestenberg

Christina Harvick

Tommy Miller

Economic Evaluation

Knowledge Transfer

3rd Party Evaluation