Presentation Outline

- CCS overview
- Southern Company’s portfolio of CCS projects
- Barry 25 MW Demonstration Project
  - Background
  - Current Status and Update
  - Pictures
CO$_2$ Capture and Sequestration Technology

- **CCS is a four-step process**
  - Pure CO$_2$ captured or concentrated
  - Compressed to ~100-150 atm (~1500-2250 psi)
  - Transported to injection site
  - Injected deep underground into geological formations and sequestered safely for thousands of years
Phased Approach to Technology Deployment

Goal = commercial CCS decision by 2020

“we believe high priority should be given to a program that will demonstrate CO₂ sequestration at a scale of 1 million tons per year” – “The Future of Coal,” MIT

- Site Characterization, MVA, Risk, (ARRA)
- Plant Barry, AL 150,000 tpy for 4 years (RCSP)
- Southeast geology survey’s
- Plant Daniel, pilot (RCSP)
- Citronelle, EOR pilot (DOE)
- Commercial Demo 1,000,000 tpy
Southern Company CCS Research

- CO₂ Well bore leakage mitigation study Montana State - ZERT
- CCS training program & cap rock integrity lab; UAB
- Coal seam pilot injection El Paso CBM Filed
- Kemper County IGCC Mississippi Power
- CO₂ EOR pilot injection Denbury Citronelle Filed
- CCS demo 25 MW Alabama Power Plant Barry
- Valuation of damages from CCS; IEc & AJW
- Geological Suitable Study Alabama Power Plant Gorgas
- MHI pilot Plant Yates
- National Carbon Capture Center Wilsonville, AL
- Saline reservoir pilot injection Mississippi Power Plant Daniel
- Sensitivity analysis of CO₂ sequestration potential and pore space requirement
- EPRI USDW test Mississippi Power Plant Daniel
Goals and timeline

- Deploy integrated capture and sequestration demos to understand integration of capture plant and injection field
  - Demonstrate capture at multiple scales to drive down costs
  - Sequestration of at least 1MMTPY for 5 years by 2020 in southeast geology with anthropogenic CO₂
- Advance capture technology performance to preserve the new and retrofit PC coal option
- “Learn by doing” to create competitive advantage and maintain leadership position in technology development
- “25 MW demo is key step to support this process”
Southern Company CO₂ Capture and Storage Project - 25 MW Integrated CCS Demo

Successful demonstration of the 500 tpd demonstration plant will lead to the provision of COMMERCIAL CO₂ recovery plant for coal fired power stations.

**Commercialization Schedule**

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<td>Operation</td>
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**Construction Photograph - Pipe Rack Modules**

**Plant Barry Power Station**

**Project Scope Schematic**

Plant Barry Power Station, Alabama

Plant Area 30 m x 90 m
Simplified CO$_2$ Scrubbing Process (Amine)

Key Points: needs >99% SO$_2$ removal; consumes process steam
CO₂ Capture - Key Concerns

- Not commercially proven on large utility boilers; R&D and scale-up efforts ongoing
- Very high capital cost estimates (75% increase over no capture case)
- Large footprint required for equipment
- Operational concerns
  - High energy penalty for CO₂ stripping and regeneration of solvent (up to 30%)
  - Solvent degradation (from SO₂, NO₂)
  - Reliability (corrosion and foaming)
25 MW Integrated CCS Demo – APC Plant Barry

• CO₂ Capture and Compression
  – SCS/MHI collaboration with partners
  – KM-CDR capture technology (500 TPD)

• Transportation and Sequestration
  – DOE SECARB Phase III “Anthropogenic Test”
  – 150k tpy for up to 4 years into saline geology
  – ~15 mile CO₂ pipeline to Citronelle Field

• Objectives/Goals
  – Advance saline sequestration technology through large field test
  – Characterize operations to support full scale deployment
  – Continue outreach and education to insure seamless deployment
MHI Process

- Improved economics over traditional amine
- MHI has proven, conservative approach to process deployment
- KM-CDR process development
  - Coal fired 10 tpd - J Power, 2005
  - Natural gas fired 160 tpd – Malaysia, 1999
  - Natural gas fired 285 tpd – Japan, 2005
  - Natural gas fired 400 tpd – UAE, 2008
  - **Coal fired 500 tpd (25 MW) – SoCo, 2010**

*CO₂ Scrubber, Japan*
Integrated CCS Demo – Current Status

• Capture Plant
  – Design: complete
  – Construction: 90% complete
  – Start up and commissioning: underway
  – Gas In: June 2011
  – Compressed Gas: July 2011

• Transportation and Sequestration
  – Characterization well complete
  – Denbury beginning initial pipeline and surface facility work
  – Procurement underway
25 MW Integrated CCS Demo – Progress Photos
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25 MW Integrated CCS Demo – Progress Photos
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25 MW Integrated CCS Demo – Progress Photos
25 MW Integrated CCS Demo – Progress Photos (5-7-10)
Thanks for your attention!

Questions?