



MVA-MMV 2012 Workshop Barry CCS Demo Update

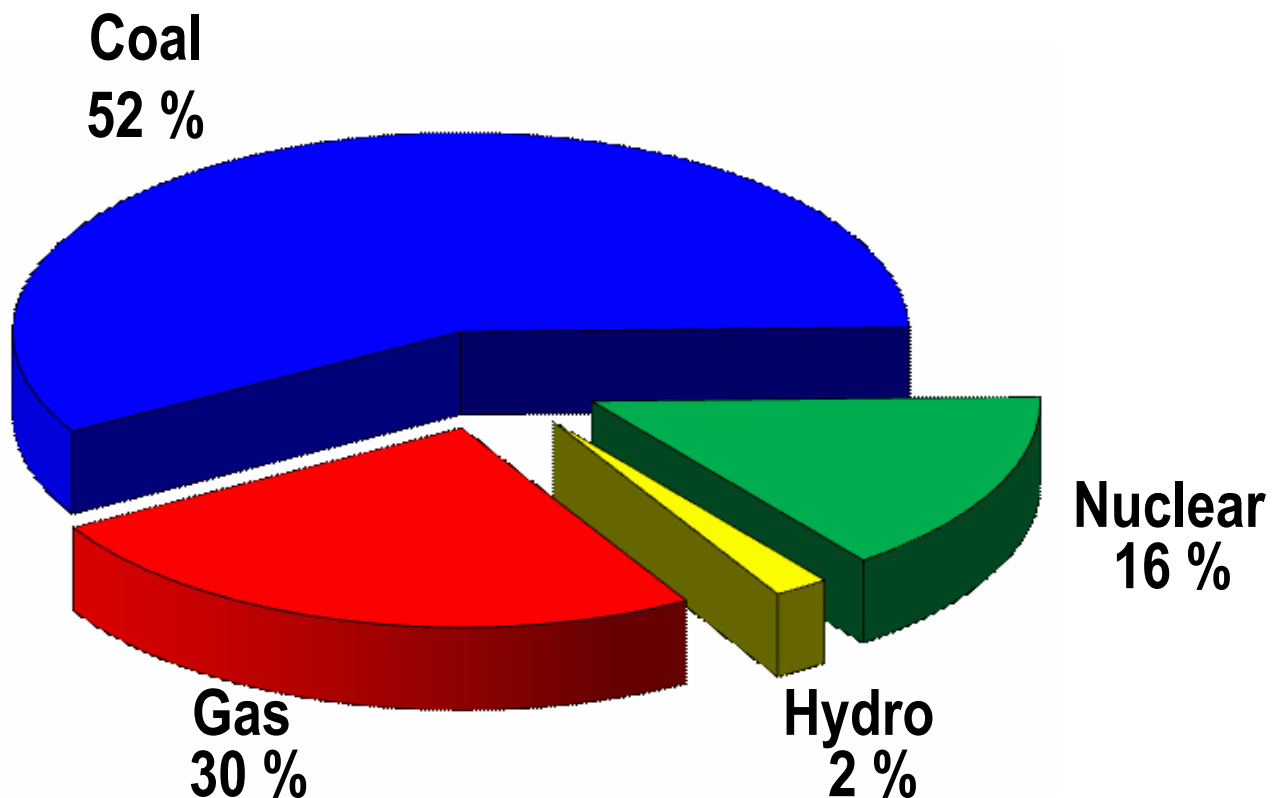
Ann Palmer
05-17-2012

Southern Company: SO

- **Headquarters:** Atlanta, Georgia
- **2011 revenues:** \$17.66 Billion
- **2011 net income:** \$2.20 Billion
- **Electric generating capacity:** 42,962 MW
- **Four regulated electric utilities:** APC, GPC, Gulf, MPC
- **One wholesale generator:** SPC



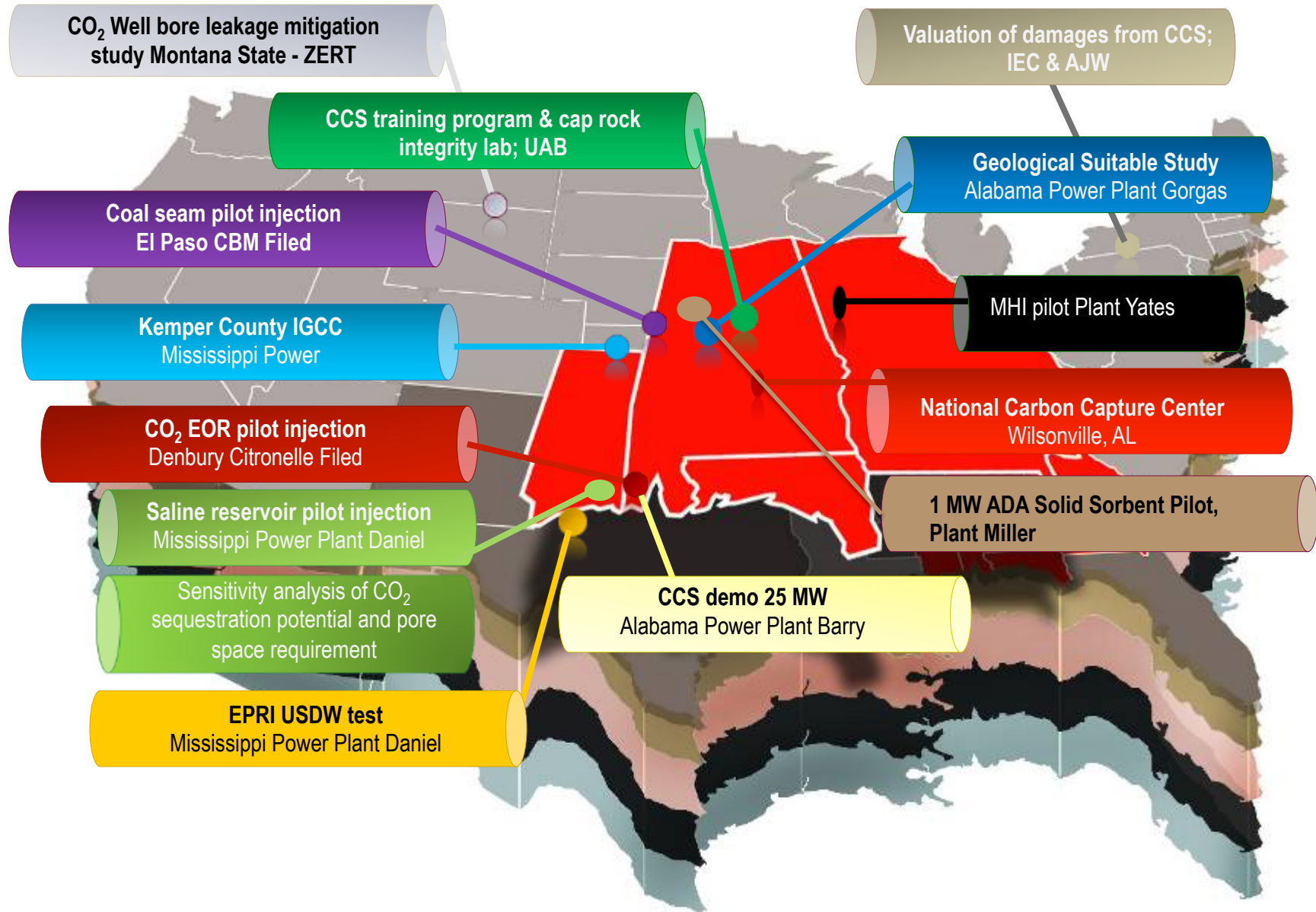
Diversified Energy Sources, 2011



Total Generation: 186 Million MWh

From 2011 Southern Company Form 10-K.

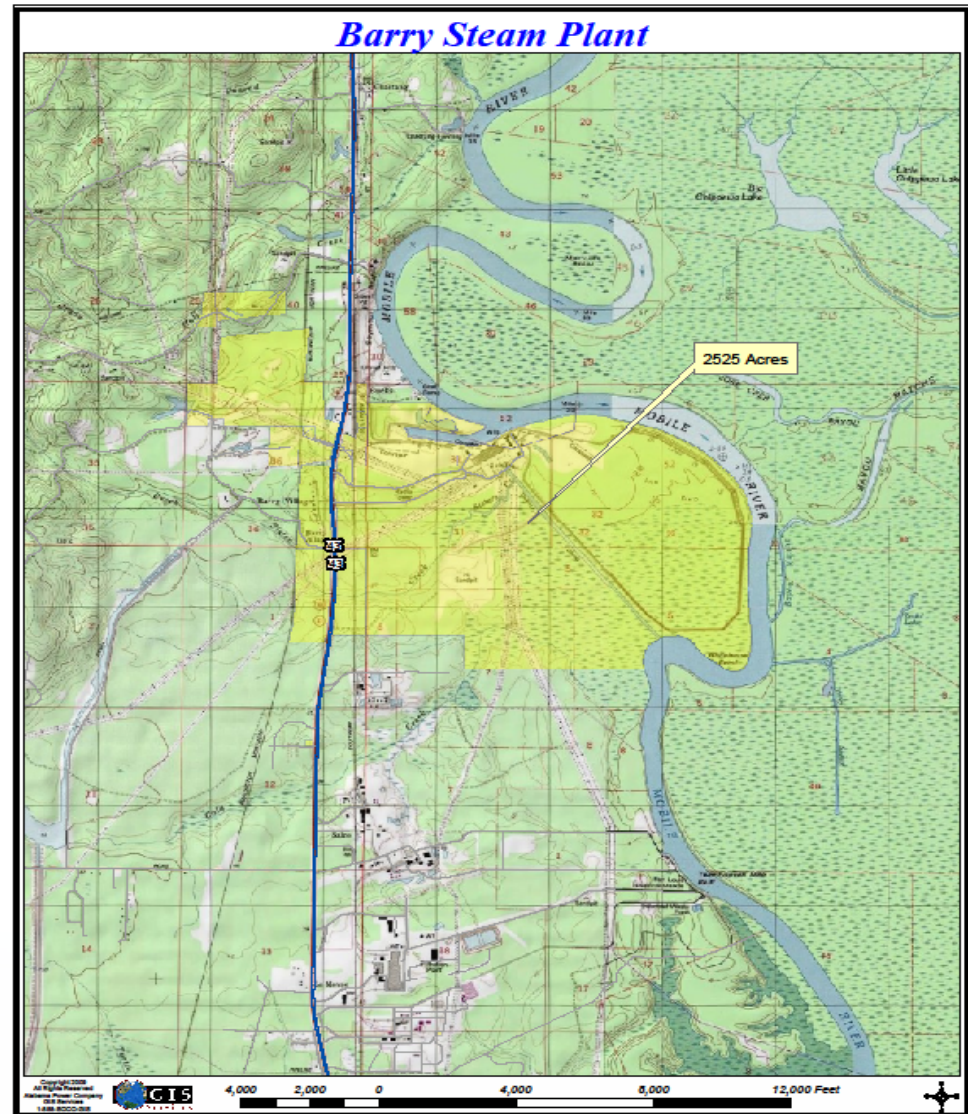
Southern Company CCS Research



Alabama Power – Plant Barry

Who Are We?

- 334 employees
- 5 coal units
 - 1400 MW capacity
- 2 natural gas units
 - 1200 MW capacity
- 2525 acre facility



CO₂ Capture and Storage Technology

Capture

- Pure CO₂ captured from plant flue gas

Compression

- Compressed to ~100-150 atm (~1500-2250 psi)

Pipeline Transport

- Transported to injection site via underground pipeline

Underground Injection

- Injected into deep geologic formations and sequestered for thousands of years

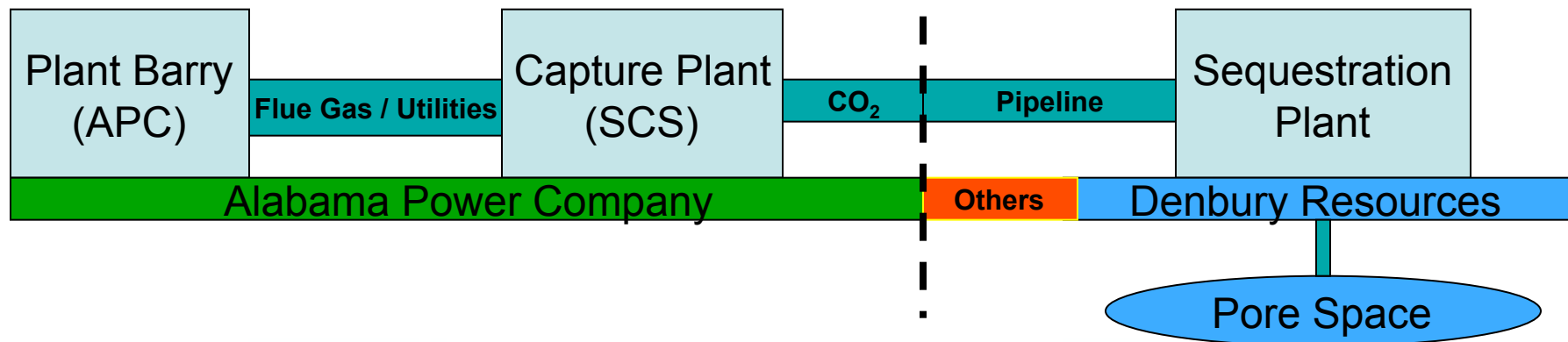
CCS Demo: Project Structure

Capture Project

- SO collaborating with MHI
- Location: APC's Plant Barry
- Execution and contracting: SO

Sequestration Project

- Project: DOE's SECARB Phase III
- Prime contractors: SSEB and EPRI
- CO₂: SO supplying
- Sequestration location: Denbury's Citronelle Oil Field



25 MW CCS Demo: Execution

2010

2011

1Q

2Q

3Q

4Q

1Q

2Q

3Q

4Q

Design

Construction

Pipeline cons

Startup

Operation

Foundation-Startup :
< ½ est time

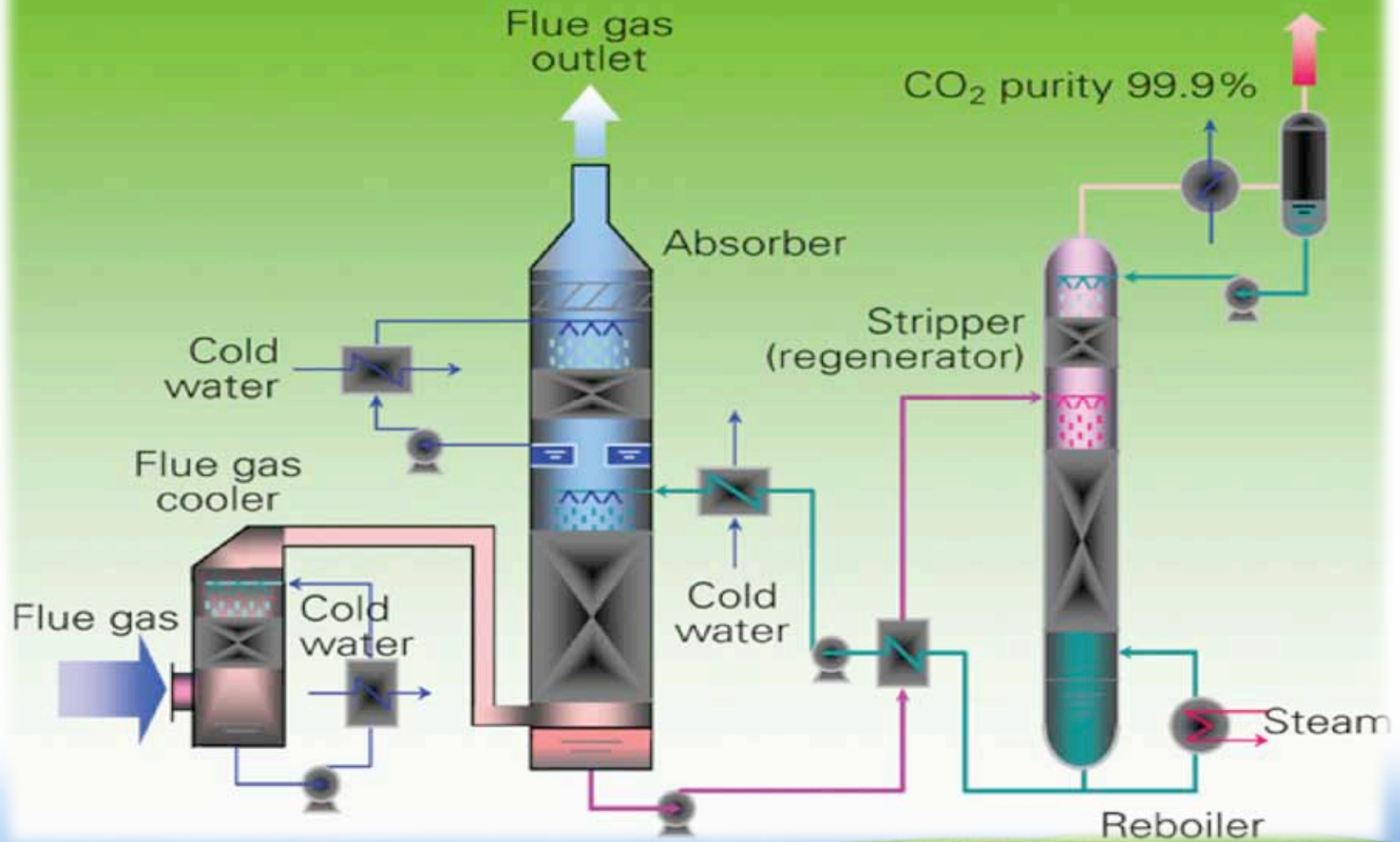
\$35 million construction
execution: staff <10

Man hours:
303,283
Safety: 1
recordable

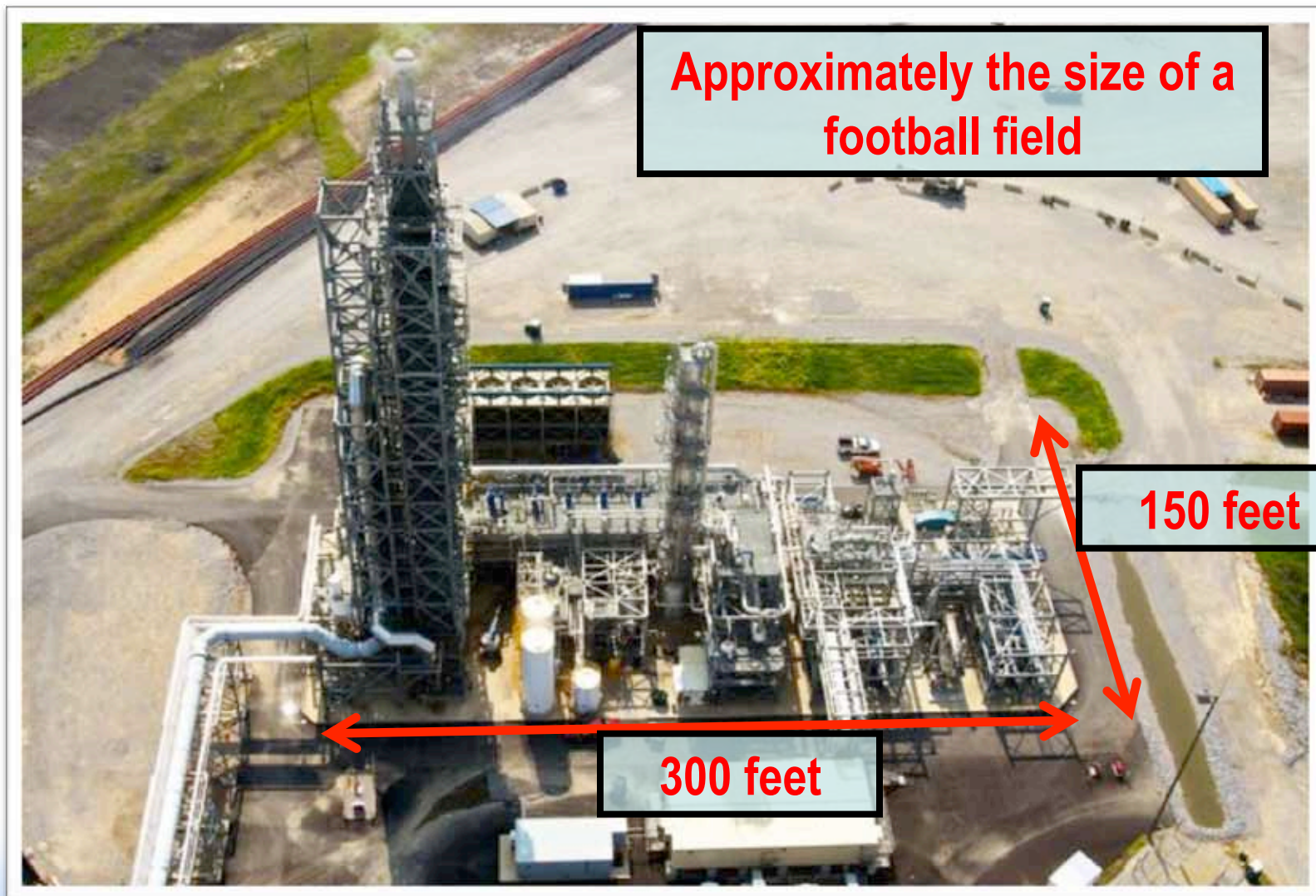
Staffing

- General Philosophy
 - Operated with IBEW and plant staff
 - MHI and SCS as support, test planning, troubleshooting
 - Maintenance via plant staff and outside contractors
- Staffing Levels
 - Operations – 1 PCO (control room), 1 APCO (field)
 - 1 each per shift (8 total) with relief shift (2) – 10 total persons
 - Chemistry – 1 full time chemist (40 hr week)
 - Team Leader (40 hr week)
 - Process Engineer (40 hr week)

Carbon Capture Process



25 MW CCS Demo – Industrial Pilot



2012 Update - Plant Barry

- Started up on June 2nd 2011
 - Steam Optimization and Parametric Testing
 - Compressor commissioning (Completed August 15, 2011)
 - Pipeline commissioning (Completed March 9, 2012)
- Unit 5 on reserve shutdown has been an issue
 - Capacity Factor ~ 38% (2011)
- Illinois basin coal test burn on unit 5 at Barry (October 7-October 22, 2011)
- +62,000 tons of CO₂ captured to date
- World's largest start to finish CCS project on coal fired power plant

2012 Outlook Going Forward

- Barry unit 5 (host unit) capacity factor increased to approximately 65%
- Pipeline in service June 2012 to complete the CCS chain
- Goals
 - 100 K tons CO₂ down the pipeline
 - Heat rate improvements
 - Robustness of plant with high impurities
 - Minimize amine emissions and KS-1 make-up requirement
- Test plans
 - Emissions testing
 - CO₂ compressor performance
 - Long-term parametric testing
 - Dynamic operation (load following testing)
 - Long term operability and reliability

CO₂ Stream Composition and Characterization

CCS Workshop Meeting
Plant Barry – Mobile, AL
5-17-12

Background

- The test campaign to analyze the product CO₂ in the pipeline generated from the capture facility was done in accordance with the permit for permission to inject CO₂ into the saline reservoir at Citronelle oil field
 - The results of the composition and characterization of the product CO₂ were submitted as part of a package sent to ADEM to receive our permit to inject
- Pipeline commissioned during the week of March 5-9, 2012

Background

- Pipeline connects the Barry carbon capture facility to the Citronelle oil field approximately 12 miles away
- CO₂ was sampled from the metering station along the pipeline
- Denbury analyzed for CO₂ purity, inert gases, organics, and other non-metals
- SoCo used Entec to analyze the CO₂ for particulates and metals (Sb, As, Be, Cd, Cr, Pb, Hg, Ni, and Se)

Sampling and Analysis

- Southern Company
 - Particulate and Metals with Hg testing was performed by Entec Service, Inc. and EPA methods 1-5 and 29 were used for analysis of the product CO₂.
 - Due to high P in the pipeline, a slipstream line was installed at the sampling ports and connected to the sampling and impinger train. Samples were pulled at a constant flow rate.
- Denbury
 - Conducted analysis for CO₂ purity, inert gases (N₂, O₂, Ar), and organic hydrocarbons using EPA approved test methods.

Questions?

