

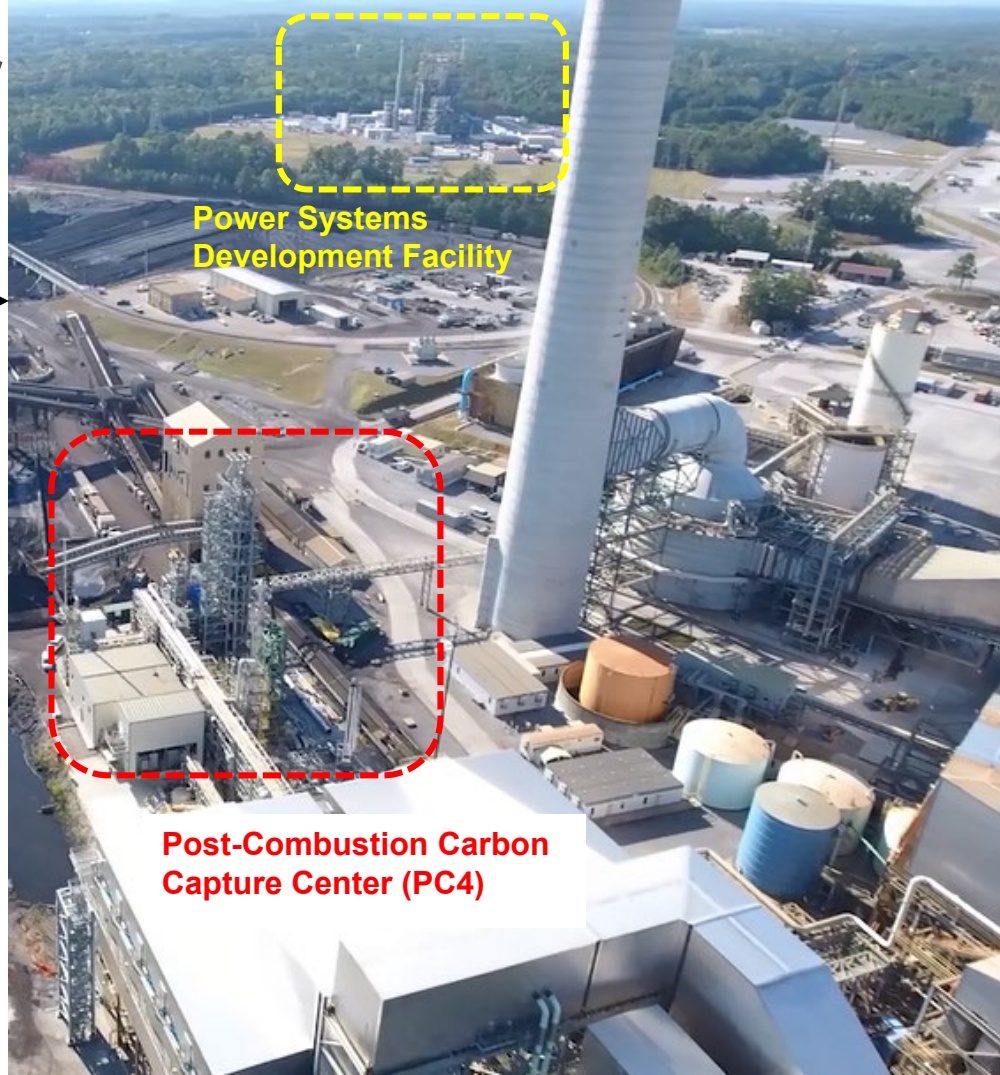
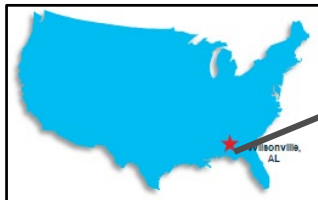
Industry Perspectives on CO₂ Capture

SSEB Meeting

Justin Anthony
March 27, 2019



National Carbon Capture Center



Power Systems Development Facility

Post-Combustion Carbon Capture Center (PC4)

Alabama Power Plant E.C. Gaston

U.S. DEPARTMENT OF ENERGY
NATIONAL ENERGY TECHNOLOGY LABORATORY
Southern Company
AMERICAN ELECTRIC POWER
CLEARPATH
CLOUD PEAK ENERGY
DUKE ENERGY
ExxonMobil
EPRI
ELECTRIC POWER RESEARCH INSTITUTE
Peabody
Wyoming INFRASTRUCTURE AUTHORITY

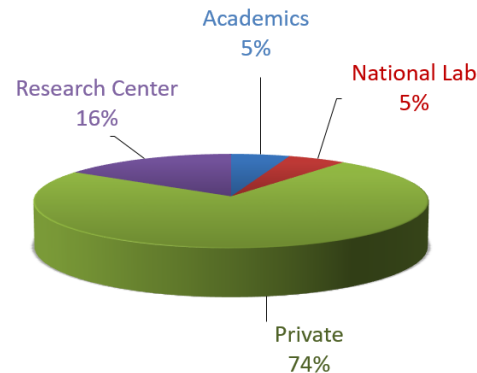
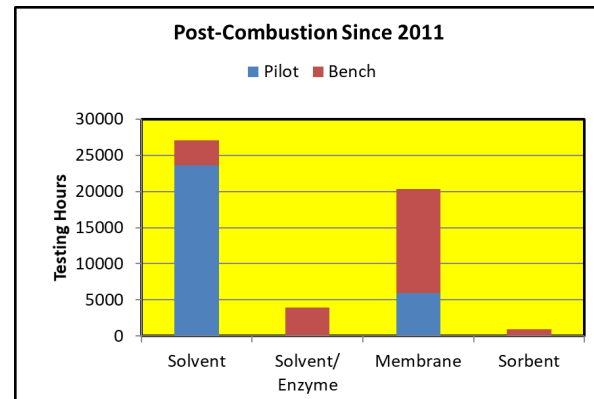
2014 - 2020
DOE & Industrial Sponsors
80/20 \$187.5 million -
Continue CO₂ Capture R&D
for Cost Reduction



Post-Combustion Capture Research



- **55,000 hours** of performance data collected
- **33 technologies** from **24 developers** tested
 - 74% are private companies
- **7 technologies** scaled up (or ready to) to 10+ MW
 - Aker, Carbon Clean Solutions, ION Engineering, Linde, MTR, RTI and Shell-Cansolv
- International collaboration: **7 countries**
 - Canada, Germany, India, Japan, Norway, UK, and China



Barry 25MWe Demo

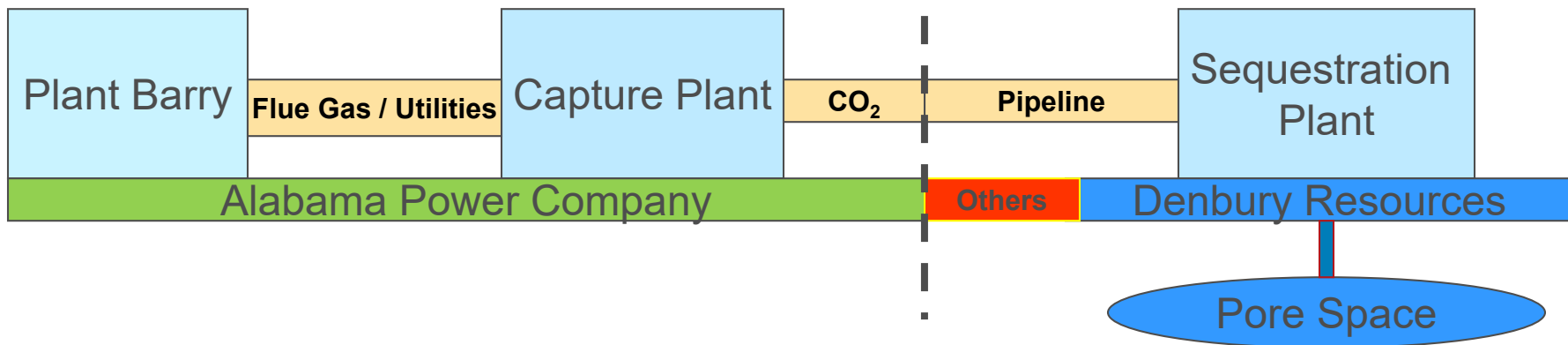


Capture Project

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

Sequestration Project

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



Plant Performance



- Gas In for CO₂ Capture Plant: June, 2011
- Commissioning of CO₂ Compressor: August, 2011
- Commissioning of CO₂ Pipeline: March, 2012
- CO₂ Injection Begins: August, 2012
- Project Ends: December, 2015

Items		Results
Total Operation Time	hrs	13,900
Total Amount of Captured CO ₂	metric tons	240,900
Total Amount of Injected CO ₂	metric tons	115,500
CO ₂ Capture Rate	metric tons per day	500
CO ₂ Removal Efficiency	%	90
CO ₂ Stream Purity	%	99.9+
Steam Consumption	ton-steam/ton-CO ₂	0.98

Lessons Learned



Item	Main Results
Baseline mass and heat balance	Verified that steam consumption was lower than expectation under the design condition (CO ₂ removal efficiency: 90%, CO ₂ capture rate: 500MTPD).
Emissions and waste streams monitoring	Successfully demonstrated amine emission reduction technologies under the various SO ₃ concentration condition (2013)
Parametric test for all process systems	Verified operation performance under several controlled operating parameters changes. (2011-2012) Demonstrated several improved technologies for the cost reduction. (e.g. MHI Proprietary spray distributor) (2013)
Performance optimization	Achieved 0.95 ton-steam/ton-CO₂ by optimizing steam consumption. (2011)
High impurities loading test	Verified that the amine emission increased as a result of higher SO₃ loading . (Oct. 2011) Verified that the impurities were removed from the solvent by reclaiming operation. (2012, 2013)

