Development and Demonstration of Waste Heat Integration with Solvent Process for More Efficient CO₂ Removal from Coal-Fired Flue Gas

DE-FE0007525

Project Review Meeting
July 30, 2014
Heat Integration with 25 MW KM-CDR at Plant Barry

- Funded by industry consortium
- Fully integrated CO₂ capture/compression
- Storage in oil field (SCS and SECARB)
- 500 metric tons CO₂/day

Integrate waste heat recovery technology termed High Efficiency System into CCS and host coal unit.
Project Participants

Nick Irvin
Todd Wall

Katherine Dombrowski

Tim Thomas
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Bruce Lani
Total Project Budget ($MM)

- 14.1
- 4.1

- DOE Share
- Cost Share
Waste heat sources include flue gas and CCS plant streams.

Flue Gas
- Boiler [Temp. (F): 350]
- Heat Extractor [Temp. Between 194~204]
- Low Temp. ESP
- FGD
- CO₂ Capture Plant
- Treated Flue Gas
- Compressed CO₂

Stripper Overhead

Process Condensate

Compressed CO₂
Boiler feed water will be heated with CO$_2$ Cooler and Flue Gas Cooler.

**CO$_2$ Cooler**
Standard heat exchanger

**Flue Gas Cooler**
MHI proprietary heat exchanger
Boiler feed water will be heated with CO₂ Cooler and Flue Gas Cooler.
Project Objectives

Quantify tangential benefits:
- Better ESP performance
- Increase SO$_3$, Hg, Se capture
- Reduce CCS solvent consumption
- Reduce FGD H$_2$O consumption

Resolve operational problems of integration

Quantify energy efficiency improvements and assess reliability of flue gas cooler
Heat integration eliminates LP heaters 1-3
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Heat integration increases plant efficiency

- Reduced steam extractions for
  - BFW heating
  - CCS solvent regeneration

Net Plant HHV Efficiency (%)

- CCS: 28.9%
- CCS + FGC + CO2 Cooler: 29.7%
Heat integration decreases cost of CCS

Analysis per 2010 DOE Cost and Performance Baseline
Flue Gas Cooler proven on low S coals

Carbon steel tubes in good condition after 2 years operation at Japanese plant

What happens with higher sulfur coals fired in US?
Flue Gas Cooler Area – Plan View
Flue gas tie point dampers installed
Side View

Flue Gas Cooler
Flue Gas Cooler shell fabrication
Grating for FGC deck installed
CO₂ cooler received; platform installed
BP2 completes October 2014

BP1
- FEED and Target Cost Estimate
- Permitting

BP2
- Engineering, Procurement, Construction

BP3
- Operations
- Field Testing Analysis
Remaining project work

- Complete Construction
  - Oct 2014

- Commission
  - Nov 2014

- Operations and Testing
  - Dec 2014 - Dec 2015

- Verify efficiency
- Estimate reduction in FGD water use
- Measure corrosion, erosion
- Test water quality
- Measure SO$_3$, trace metal removal