



# Evaluation of Solid Sorbents as a Retrofit Technology for CO<sub>2</sub> Capture

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# Technical Approach



## Phase II: Refine Concept and Test

- Technical

- >90% CO<sub>2</sub> capture
- Produce high purity CO<sub>2</sub>

- Economic

- < 35% increase in COE
  - Capital Cost Drivers
    - Size of Equipment
    - Materials of Construction
    - Process Complexity
  - Operating Cost Drivers
    - Energy to release CO<sub>2</sub>
    - Energy to compress CO<sub>2</sub>
    - Sorbent Replacement



# Phase II Project Team

## DOE NETL Team Members

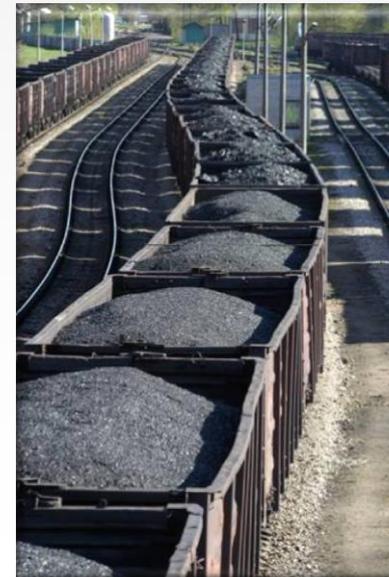
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- NETL
- ADA
- KBR
- EPRI
- Southern Company
- Luminant
- DTE
- AEP

### Key Contractors:

Stantec, Pressure Chemical

\$15M DOE  
\$3.75M Cost Share



## Phase II Project Objective

- Scale-up toward commercialization a solid sorbent-based post-combustion CO<sub>2</sub> capture technology for 90% CO<sub>2</sub> capture at a projected long-term cost that is expected to operate at less than a 35% increase in the cost of electricity.
- Demonstrate the technical, economic, and energy benefits through pilot testing



# Project Goals – 1 MW Slipstream Tests

- Develop performance data through operation of the system
  - Thermal management
  - Heat of Reaction
  - Working Capacity
  - Sorbent Attrition
- 90% CO<sub>2</sub> removal
- Generate a high purity CO<sub>2</sub> stream
- Successfully scale sorbents



# Project Outline

Stage 1:  
18 months

- Refine 500 MW concept with modeling and bench-testing
- Design 1 MW pilot

Scale down to  
1 MW

Validate  
Concept

- Manufacture Sorbents
- Construct and Install 1 MW pilot to validate 500 MW concept

Stage 3:  
15 months

- 1 MW Testing
- Develop 500 MW Preliminary Design
- Conduct Techno-economic analysis

Demonstration  
Phase

Stage 2:  
18 months



# Stage 1: Refine full-scale (500 MW) process design

- Commercial EPC review (KBR)
- CFD modeling of system
- Process model of integrated system
- Finalize sorbent selection
- Gather additional lab- and bench-scale data, as necessary
- Define data required for commercial design

*Goals: Reduce uncertainty of scale up  
Accelerate path to commercialization*



# Stage 1: 1 MW Pilot Design

- Develop detailed design
- Develop interface requirements
- Obtain permits



# Stage 2

- Procure (Manufacture) Sorbents
- Procure & Construct Pilot Equipment
- Install at Field Site



# Stage 3

- Pilot Operation and Evaluation
  - Parametric Field Tests (e.g., adsorption time, temperature, sorbent cycle rate, etc...)
  - Continuous Performance Testing (at least 2 months)
- Define and Collect Compression and Sequestration Specific Information
- Prepare Commercial Conceptual Design and Economics



# Stage 3 Assessment

- *A techno-economic analysis of the commercial design will be conducted by EPRI and KBR*



# Project Schedule

51 Month Project

- Stage 1: Process Design  
18 months (4Q10 - 1Q12)
- Stage 2: Construction  
18 months (2Q12 - 3Q13)
- Stage 3: Testing and Assessment  
15 months (4Q13 - 4Q14)





# Creating a Future with Cleaner Coal

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