

LMFS-07-39 C
“A Study of Carbon Dioxide Capture Technologies and Costs Associated with
Lignite-Based Electrical Generating Stations”
Lignite Vision 21 Program Phase V

CONTRACTOR: The Shaw Group (Stone & Webster)

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CONTRACT AMOUNT: \$462,000

Project Schedule – 9 Months

Contract Date – 07/31/2009
Start Date – 07/10/2009
Completion Date – 05/31/2010

Project Deliverables

Status Report – 10/31/2009 (✓)
Status Report – 12/31/2009 (x)
Draft Final Report – 3/31/2010 (x)
Final Report – 5/31/2010 (x)

OBJECTIVE / STATEMENT OF WORK

The purpose of this study is to determine the most economical and technically viable CO₂ capture technologies for each plant that may be available for large-scale field testing within approximately five years. The study focus is CO₂ capture technologies for lignite-derived flue gas streams at the following sites: Leland Olds Station 1, Leland Olds Station 2, Milton R. Young Station 1, Milton R. Young Station 2, Coyote Station 1, R. M. Heskett Station 1, R. M. Heskett Station 2, Coal Creek Station 1 and Coal Creek Station 2.

STATUS

Project activity was initiated on August 17, 2009. On August 24, 2009 the first Leads Meeting was held. The staff began outreach to the power station personnel and industry sources towards initial contact with equipment suppliers. A preliminary assessment of CO₂ public domain reports and publications was initiated. Plant (Station) _ Data collection began in September 2009 in parallel with initial development of a list of viable technologies. Technologies were divided into three sub-systems: oxy-combustion, extraction and compression. Plant Data Requests were sent to Basin Electric Power Cooperative’s Leland Olds Station, Great River Energy’s Coal Creek Station, Minnkota Power Cooperative, Inc.’s Milton R Young Station, Montana-Dakota Utilities Co.’s R. M. Heskett Station and Otter Tail Power Company’s Coyote Station. This effort is 100% complete at the end of September 2009. The Lignite Energy Council (LEC) furnished a letter of introduction on September 19, 2009 to support the Shaw effort to collect project-specific information from equipment suppliers. Project Management activities included: project kickoff meeting and notes, fireside chats with the LEC representative, refinement of Project Contact Lists, Leads Meetings, collecting available technical reports and teleconference meetings. A summary of completion of functional areas is as follows:

Characterize Existing Plants

- Plant Data Request 1 – 100% complete
- Plant Data Request 2 – 20% complete
- Plant Data Request 3 (if needed)
- Assess Data – 5% complete
- Site visit – not started
- Summarize – not started

Identify Technologies

- Request information from primary phase suppliers and response received – 80% complete
- Soliciting information from second phase suppliers – 100% complete

Describe CO₂ systems – 50% complete

Technical Performance and Costs – 5% complete

- Evaluate supplier cost data (none received)-not started
- Formulate approach with deficient supplier data – 100%
- Obtain Plant Specific cost information – not started
- Concerns and Risks – just begun

Recommend Systems

- Narrowed viable extraction technology types – 90%
- Plant specific – not started

Status Report

A status report was received in December, 2009. The assessment of Coyote Station was completed and review comments submitted to Shaw. Comments were received from personnel at the Coyote Station in addition to those developed by the North Dakota Industrial Commission technical representative. Shaw Group made an oral presentation to the LEC's Lignite Technology Development Workgroup regarding their progress toward completing this activity.

Final report

The study performed in late 2009 assessed the CO₂ capture technologies and determined the most promising five-year implementation strategies at five lignite-fired North Dakota, USA existing power stations. CO₂ sequestration and storage was not included in the evaluation. The power stations studied included Coal Creek, Coyote, Heskett, Leland Olds and Milton R Young.

Major post-combustion and oxy-combustion technology suppliers were contacted along with conventional and evolving compressor suppliers to provide their most current available process and cost information. Post-combustion technologies were determined to be the best choice for each plant based on the current stage of technology development. A summary of the results and conclusions is as follows:

- Post-Combustion and to a lesser extent oxy-combustion technologies provide the most promising opportunities for 50% and 90% CO₂ Capture applications by 2015.
- CO₂ capture and compression will add at least 15% auxiliary load to the existing stations on top of the already 6-8% usual auxiliary load consumption.
- Backpressure steam turbines are beneficial at most of the generating stations and are capable of recovering some of the energy from the steam which can augment power production.
- The levelized cost of electricity at 90% capture was consistent among four of the five generating stations at about \$80/MWh. The exception was the smallest generating units where electricity costs climbed to \$120/MWh.
- Physical integration of the CO₂ capture system equipment onto the existing plant sites ranged from highly feasible to very difficult.