

Quarterly Technical Progress Report

Period of Performance: July 1, 2001 – September 30, 2001

Title: Cofiring Biomass with Lignite Coal

Cooperative Agreement No. DE-FG26-00NT40900

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Summary:

As of September 28, 2001, all the major project tasks have been completed. A presentation was given to the North Dakota State Penitentiary (NDSP) and the North Dakota Division of Community Services (DCS). In general, the feasibility study has resulted in the following conclusions:

- Municipal wood resources are sufficient to support cofiring at the NDSP.
- Steps have been taken to address all potential fuel-handling issues with the feed system design, and the design is cost-effective.
- Fireside issues of cofiring municipal wood with coal are not of significant concern. In general, the addition of wood will improve the baseline performance of lignite coal.
- The energy production strategy must include cogeneration using steam turbines.
- Environmental permitting issues are small and do not affect economics.
- The base-case economic scenario provides for a 15-year payback of a 20-year municipal bond and does not include the broader community benefits that can be realized.

Accomplishments:

- A presentation was completed on September 25, 2001, presenting the results of the project to NDSP and DCS.
- All major project tasks are complete, with the exception of a draft final report and a continuation application.

- The economics show that about 16,000 tons/yr of wood will have to be consumed to demonstrate a reasonable return on investment. We have a clear commitment for 8000 tons and expect that 16,000 will be available. Landfill records show 13,000 tons in the immediate vicinity, and our surveys suggest that 30,000 tons/yr are available within 100 miles.
- The feed system design comprises a technically conservative approach for handling large- diameter wood and includes adequate storage, drying facilities, and modifications to the boiler. Costs were minimized, but could be curtailed if a 10–15-year payback is not attractive to the funding agencies involved.
- Title V permitting issues can be avoided without detracting from the economics. The percentage of coal fired is the limiting factor because of SO₂ emissions. The economic scenario calls for 25% coal to be fired with 75% wood.
- Purchasing used steam turbines is a viable option for this facility. One condensing and one backpressure turbine can operate simultaneously, maximizing electrical production and providing redundancy to improve availability. Used steam turbines can be procured quicker and at significantly less cost. The used turbines that were selected have low hours; therefore, future operating and maintenance (O&M) costs should not be a problem.
- A sensitivity analysis and supplementary economic scenarios were calculated. The best-case scenario is a 7-year payback on a 10-year bond. The sensitivity analysis showed the most significant parameters that affect cost are availability, coal price, and cofiring percentage.
- Preliminary economic scenarios have been completed for Task 6, and a spreadsheet has been developed.
- Fuel characterization shows the obvious lower moisture content, lower sulfur content, and higher heating value of wood compared to coal. Advanced analysis shows that high K, Ca, and P in wood ash may be problematic; however, the amount of ash is significantly less than coal.
- PCQUEST (Predictive Coal Quality Effects Screening Tool) and FACT (Facility for the Analysis of Chemical Thermodynamics) modeling suggest that slagging or fouling will not increase for any blend of wood with lignite, and increasing biomass percentage will result in generally improved fireside performance. Relative to fouling, slagging, and opacity, results varied linearly, and no optimum blend level was identified. Opacity and lower-temperature fouling have the potential to only be moderately increased at very high blend ratios (above 80%).
- Blend ratios of 50% were run in the drop-tube furnace to create deposits. The biomass blends showed favorable results compared to the baseline lignite. Deposit crushing strengths were decreased by a factor of 2. Particle size of the fly ash tended

to increase, which would provide better capture efficiency. Sulfur emissions were reduced by 33% to 60%, and NO_x emissions were reduced by 20% to 56%.

- Test were carried out to simulate a stoker grate and to investigate clinkering. In general, small clinkers produced with biomass blends of 75% were more friable and smaller in size than the baseline lignite coal. Advanced analysis of the clinkers has not been completed.

Meetings:

Project presentation results:

NDSP is very interested in the application of this project at its facility. They are providing full cooperation for a Phase 2 continuation application, which is due at the end of October to the U.S. Department of Energy (DOE) National Energy Technology Laboratory (NETL).

Project Organization and Functions:

NETL has awarded the EERC a grant to carry out a feasibility study for NDSP. The Department of Corrections (DOC) and DCS are providing project cost share in the amount of \$20,000 and \$20,000, respectively. The EERC is subcontracting to K.J. Schwartz Engineering for support. The NETL project officer is Sean I. Plasynski, and the NETL contracts officer is Donna J. Jaskolka.

Budget Report:

Total Project	\$200,000	DOE Funding:	\$160,000
		DCS Funding:	\$20,000
		DOC Funding:	\$20,000

Funds Remaining as of \$30,274
9/24/01:

All cost share has been procured from DOC and DCS. The subcontract with K.J. Schwartz Engineering has been completed.

Schedule:

The project period is from October 1, 2000–September 19, 2001. The project was extended to the end of December because of the Biomass Conference of the Americas being postponed to December 17–21, 2001. A Phase 2 continuation application is due at the end of October and is on schedule. All major tasks are complete, with a very small percentage of wrap-up work yet to be done.