

Grant Round Application for LRC-LXVI (66)

TECHNICAL ADVISOR COMMENTS LRC-LXVI (66) – A

“Viability of North Dakota Lignite as a Feedstock for a Commercial Charfuel Coal Refining Facility in North Dakota”

Submitted by: Carbon Fuels, LLC

Request for: \$1,493,171; Total Project Costs: \$2,986,343

Project Manager: Lee G. Meyer; Project Duration: 9 months

Description of the Project: Carbon Fuels, LLC proposes to demonstrate the viability of using North Dakota lignite as a feedstock for the proprietary Charfuel Coal Refining process, which processes coal into liquid fuels, petrochemicals, fertilizer, metallurgical coke and boiler fuel in a manner that is conceptually similar to the way crude oil is refined in conventional oil refineries. The project would involve configuring the 18 ton per day (tpd) Charfuel demonstration facility at Hazen Research in Colorado; testing ND lignite in two 6-7 hour test runs; document and report sample analyses of char, process stream gases and liquids; and generate pre-FEED documents for a 500/2500 tpd Charfuel demonstration facility in North Dakota.

Technical Peer Reviewers’ Key Comments:

All Reviewers

- Objectives: possibly achievable (1 reviewer); likely achievable (2 reviewers);
- The background of the investigator(s) is: limited (1 reviewer); better than average (2 reviewers);
- Scientific contribution is: small (2 reviewers); extremely significant (1 reviewer);
- Equipment purchase is: poorly justified (1 reviewer); justified (2 reviewers);
- Proposed budget value is: low value (2 reviewers); very high value (1 reviewer)
- Significant concern regarding two short (6-7 hour) tests from 18 tpd test facility providing adequate data to design a 500/2500 tpd commercial demonstration plant (all 3 reviewers).

Reviewer 09-1

Full disclosure of operating conditions and results are needed. It is critical to generate product yields under continuous recycle operation so reliable information can serve as the basis for mass and energy balances. The char market depends on mixing or replacing NDL. Char does not have an existing market or market value. It is unclear that the markets for the Charfuel© products has been adequately evaluated for the NDL case. **Recommendation: Do not fund**

Reviewer 09-2

Refining lignite to produce liquid fuels, petrochemicals, combustible char and touted as environmentally friendly. A large-scale Charfuel facility would expand the use of lignite, generate jobs, and boost local economies, general taxes and local taxes. The LRC R&D Director should be added to the Management Team and participate in review meetings. **Recommendation: Fund**

Reviewer 09-3

I feel that the request is for a large amount of funding with insufficient detail and potential results obtainable. With all the years of work on this process, why isn’t there a commercial process already in operation, especially if the economics are exceptionally profitable? Why does Carbon Fuels have a high degree confidence that a demonstration in North Dakota will draw significant private industry capital when they have not been able to do so to-date? This proposal did not even give general values on char to liquid fuels/chemicals splits. **Recommendation: Do not fund**

Technical Advisor’s Recommendation: Funding may be considered (Demonstration project funds)

On May 7, the Technical Advisor (TA) spent four hours at Hazen Research discussing the proposal and questions/concerns of the peer reviewers and TA as well as touring the 18 tpd Charfuel test facility. Following are the TA’s observations/findings:

This proposal provides an opportunity to explore the feasibility of converting lignite to other products of considerable value using a novel technology. Carbon Fuels (CF) has provided a conceptual plan beyond this project, albeit high level, leading to commercialization of the technology in North Dakota. The TA believes that this project as described in Phase I can be achieved. Analytical results and material balances will be provided. The applicant has attempted to address the peer reviewers' and TA's questions and concerns.

Evolving legislative and regulatory policies will require more efficient uses of coal with fewer emissions from coal conversion facilities. Fewer emissions will include all of the criteria pollutants as well as mercury and probably carbon dioxide. As touted, the CF Charfuel refining process would clearly be one of the cleanest lignite energy conversion processes being considered.

As purported in the proposal, the economic impact (tens of millions of dollars per year) from a commercial-scale Charfuel coal refining plant in North Dakota could be very substantial. In that respect, it is hard not to support investment of the approximately \$1.5 million requested.

On the other hand, investment of \$1.5 million in this project is a substantial amount of money for the Lignite Research, Development and Marketing Program. The reality of developing a 500/2500 tpd commercial demonstration facility and subsequently a 5000 tpd commercial facility in North Dakota after this project is difficult to quantify. Also, by investing in this project, the lignite industry and State of North Dakota are relying on CFs' and Hazen Research's assertion that two successful 6-7 hour tests in the 18 tpd test facility provide all the confidence necessary to scale up to a 500/2500 commercial demonstration unit. In addition, \$1,385,000 of the budget is dedicated to procurement, piping, instrumentation and controls. This is a considerable amount of money to invest in modifying an out-of-state facility so that it can accommodate the lignite testing. But, from a different perspective, while the million dollars plus of modifications is necessary, the testing is being conducted at an existing facility with over \$6 million in previous construction and operating costs and over \$12 million in engineering studies and analysis.

Even though CF believes there is a ready market for the Charfuel products, the TA still believes that at some point there needs to be a market study with respect to the products that would be produced in North Dakota. This may be more appropriate once the testing has been completed and a location for the 500/2500 tpd demo is contemplated.

Should the Lignite Research Council recommend funding for this project, the following contingencies should be considered:

- The LRC R&D Director should be added to the Management Team and participate in review meetings.
- Disbursement of NDIC funds will be on a reimbursement basis. \$200,000 will be disbursed upon execution of the contract. The remaining amount, up to \$1,293,171 will be provided to the contractor upon submission of the deliverables specified in Carbon Fuels application, supporting documents dated April 10 and May 11, 2009, and certification of expenditures equal to, or exceeding the amount, to be disbursed by the NDIC.

Conflict of Interest: North American Coal Corporation; MDU