CARBON FUELS, LLC

3600 So. Yosemite Street, Suite 360
Denver, Colorado 80237
Phone: 303-468-5700
Fax: 303-468-5705
www.carbonfuels.com

Lee G. Meyer
(303) 667-4286
lee.meyer@carbonfuels.com

VIA USPS EXPRESS MAIL

March 31, 2009

Ms. Karlene Fine, Executive Director
North Dakota Industrial Commission (NDIC)
Lignite Research, Development and Marketing Program
State Capitol, 14th Floor
600 East Boulevard Avenue, Dept. 405
Bismarck, ND 58505-0840

Carbon Fuels, LLC hereby submits an application for a Demonstration grant for a project entitled "Viability of North Dakota Lignite as a Feedstock for a Commercial Charfuel® Coal Refining Facility in North Dakota" under the NDIC/Lignite Research Council's Lignite Research, Development and Marketing Program. This project will demonstrate the viability of using North Dakota lignite as a feedstock for the proprietary Charfuel® Coal Refining Process, which processes raw 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; and is, in fact, compatible with today's oil refineries and fuels distribution infrastructure. The process captures CO_2 for industrial use, including Enhanced Oil Recovery (EOR), is environmentally benign (no emissions from the plant), and requires no process water.

Charfuel® Coal Refining Process is *not* a conventional "coal-to-liquids" process like Fischer-Tropsch, and offers substantial advantages relative to such conventional approaches in terms of better economics, lower environmental impact, no process water, lower capital cost, and higher BTU conversion efficiency.

The Carbon Fuels proposed Project submitted herewith meets numerous eligibility requirements of the Program, including each of the following (Chapter 43-03-02 of the Program guidelines):

- "Development, demonstration, and refinement of gasification and liquefaction technologies using lignite."
- "Conversions of lignite to other products and byproducts."
- "Development of markets for liquids or other byproducts derived from lignite."
- "Lignite-water mixtures or lignite-methanol mixtures and other lignite-derived fuels."
- "Lignite cleaning or beneficiation."
- "Lignite desulphurization and emission control."
- "Resource characterization and evaluation studies."
- "In general, any project which will utilize or enhance the development or use of lignite resources."

In addition, this proposed Project is a "clean coal demonstration project" as defined by a June 14, 1994 North Dakota constitutional amendment (North Dakota Constitution, Article X, Sec. 21, as modified by the Industrial Commission's Errata notice). This Project will advance the development of commercial Charfuel® coal refining plants which will be located in North Dakota, utilizing North Dakota lignite as feedstock. Carbon Fuels believes this Project clearly meets the criteria of a "clean coal demonstration project" for the following reasons:

- Charfuel® lignite coal refining plants would process North Dakota lignite in such a manner that it would "retrofit or replace existing facilities while achieving reductions of environmental emissions";
- Charfuel® lignite coal refining plants would "provide for future energy needs";
- Charfuel® lignite coal refining plants would "expand the use of lignite for non-energy needs" (petrochemicals, fertilizers and metallurgical coke); and,
- This Project would support the "design, construction and operation of near-commercial demonstration facilities and first-of-a-kind commercial facility" in North Dakota.

Carbon Fuels hereby agrees to complete the Project as described in the attached application if the commission makes the grant requested therein. The below signing officer of the company is authorized to contract on behalf of Carbon Fuels, LLC.

Sincerely,

Lee G Meyer

Carbon Fuels, LLC
Lee G. Meyer, Managing Director

Refining of North Dakota Lignite

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

Applicant

Carbon Fuels, LLC
3600 So. Yosemite St., Suite 360
Denver, Colorado 80237

Principal Investigator

Lee G. Meyer, CEO
Carbon Fuels, LLC

Date of Application

March 31, 2009

Requested Grant Amount

$1,493,171

Table of Contents

List of Figures

Abstract

Carbon Fuels, LLC is proposing this project (*"Project"*) to show the viability of using North Dakota lignite as a feedstock for the proprietary Charfuel® Coal Refining Process, which *refines raw coal* into liquid fuels (gasoline, jet fuel, "green diesel", fuel oil and marine fuels), petrochemicals, methanol; sulfur; ammonia (fertilizer); and, char (a high-energy, clean boiler, gasification or metallurgical coke feedstock) in a *process that is conceptually similar to the way crude oil is refined in conventional oil refineries,* and is, in fact, compatible with today's oil refineries and fuels distribution infrastructure. The Charfuel® Coal Refining Process captures CO_2 for industrial use, including Enhanced Oil Recovery (EOR), is environmentally benign (no emissions from the Charfuel® Coal Refining Plant), and requires no process water. The Charfuel® Coal refining Process is *not* a conventional coal-to-liquids process like Fischer-Tropsch, and offers substantial advantages relative to such conventional approaches in terms of better economics, lower environmental impact, lower capital cost, and higher BTU conversion efficiency. *Charfuel® Coal refining Process is a paradigm shift in clean coal utilization technology*

The proposed Project will configure Carbon Fuels' existing, fully permitted 18 ton per day "tpd" Charfuel® Demonstration Facility located at Hazen Research, Inc. (Golden, CO) to accommodate, process, and refine North Dakota lignite; and then operate the configured 18 tpd Charfuel® Demonstration Facility using North Dakota lignite to verify material balances and determine optimal operating conditions to develop a pre-Front End Engineering Design ("pre-FEED") package to for the development of a 500/2500 tpd Charfuel® Commercial Demonstration facility in North Dakota to refine ND lignite. Such facility could be co-located with a lignite mine mouth operation; an existing petroleum refinery; or an existing power generation facility in North Dakota. *The successful completion of this Project will lead to the construction and operation of one or more 5000 tpd Charfuel® refineries in North Dakota.*

Carbon Fuels has been in discussions with three North Dakota energy companies: NACCO, Tesoro Petroleum Corporation (*"TSO"*), and Montana-Dakota Utilities Co. (*"MDU"*)) regarding the

potential to construct a commercial-scale (5,000 ton/day lignite (MAF)) Charfuel® Coal Refining Plant(s) in North Dakota utilizing ND lignite coal.

The Project objectives are as follows: 1) configure the existing 18 tpd Charfuel® Demonstration Facility to operate using North Dakota lignite as a feedstock; 2) determine the viability of pre-drying lignite to optimize its characteristics as a feedstock for the Charfuel® Charfuel® Coal Refining Process; 3) operate the configured 18 tpd Charfuel® Demonstration Facility (in a once-through configuration and then a recycled configuration) to determine the optimal operating conditions for processing North Dakota lignite coal and verify the resulting material balances; 4) perform data evaluation and analysis for commercialization documents; and, 5) prepare a pre-FEED package for a co-located 500/2500 tpd Charfuel® Commercial Demonstration Facility in North Dakota.

The duration of this Project is approximately 9 months. The total Project cost is $2,986,343, of which $1,493,171 will be contributed by Carbon Fuels and North American Coal in the form of cash and in-kind contributions. The existing 18 tpd Charfuel® Demonstration Facility represents engineering studies, design and testing comprising over 15 years of effort by Carbon Fuels, and is the product of over $12M in engineering studies and analysis and over $6M in construction and operations costs. The participants in this Project are: Carbon Fuels LLC and Hazen Research, Inc.

Project Summary

This Project is to optimize the operating conditions and verify the material balances for processing North Dakota lignite coal using the Charfuel® Coal Refining Process, with the goal of construction and operation of commercial 5000 tpd Charfuel® Coal Refining Facilities within the state of North Dakota. The North Dakota Industrial Commission's Lignite Research Counsel Grant (*"Grant"*) will be used to generate and analyze the appropriate engineering and operating data obtained from operation of an existing scalable 18 tpd Charfuel® Demonstration Facility located at Hazen Research, Inc. in Golden, Colorado.

This Project will constitute the continuation of the commercialization of the Charfuel® Coal Refining Process. (A full description of the Charfuel® Coal Refining Process is provided in the "Background" section of this proposal.) This commercialization embodies a number of phases. The initial development of the Charfuel® Coal Refining Process included detailed engineering studies; bench-scale analysis; cold flow testing of critical components (U.S. DOE); economic and engineering analysis of commercially viable projects by leading engineering firms (Black & Veatch, Stone & Webster, Morrison-Knudsen Corporation, and Ford Bacon & Davis); the engineering and design of the 18 tpd Charfuel® Demonstration Facility; and fabrication and testing of vessels, construction and operation of the 18 tpd Charfuel® Demonstration Facility to successfully demonstrate the performance and integration of proprietary components under actual operating conditions. The amounts expended on this process by Carbon Fuels and its investors, along with grants from the State of Wyoming and the United States Department of Energy are in excess of $18 million.

Carbon Fuels' North Dakota lignite initiatives are to be conducted in two phases.

- Phase I (this Project) is to optimize the operating conditions and to verify the material balances of processing North Dakota lignite coal using the existing, scalable 18 tpd Charfuel® Coal Refining Demonstration Facility and preparation of pre-Front End Engineering Design documents. This phase will also include validation of pre-drying North Dakota lignite in the NACCO pilot coal drying facility.

- Phase II is the preparation of bankable FEED documents by an engineering, procurement and construction firm, such as Black & Veach, and the construction of a 500/2500 tpd Charfuel® Commercial Demonstration Facility, which will include siting the facility; solidifying agreements with co-location partners, suppliers and customers; and, completing the permitting process prior to financing and constructing the facility. Phase II is the precursor to the construction and operation of 5000 tpd Charfuel® commercial facilities in North Dakota.

Carbon Fuels is requesting funding in this proposal for Phase I and will use the grant in conjunction with its existing technology, engineering designs, and the existing scalable 18 tpd Charfuel® Demonstration Facility to optimize the operating conditions and verify the material balances for commercially processing North Dakota lignite coal using the Charfuel® Coal Refining Process.

The Project (Phase I) objectives are as follows:

- Configure the existing 18 tpd Charfuel® Demonstration Facility to operate using North Dakota lignite as a feedstock; and, determine the viability of pre-drying North Dakota lignite as a feedstock to optimize the utilization of process requirement of the Charfuel® Coal Refining Process.
- Operate the configured 18 tpd Charfuel® Demonstration Facility in a once-through configuration and a recycled configuration to determine the optimal operating conditions and verify the material balances of processing North Dakota lignite coal.
- Collect char, liquids and process gas stream samples for evaluation and analysis, as well as collection and analysis of data from the two runs.
- Prepare a pre-Front End Engineering Design documents to specify the Charfuel® system requirements for processing North Dakota lignite coal, as well as downstream refinery specifications for hydrocarbon liquids and power boiler requirements which will enable the preparation of a Front End Engineering Design document for a 500/2500 Charfuel® commercial Demonstration Facility to be co-located with an existing North Dakota energy facility (Tesoro's Mandan refinery, an existing North Dakota mine or an existing North Dakota power plant).

Phase II of the project will be performed by Carbon Fuels and/or co-location partners with financing from third party sources and/or joint ventures. Phase II will include building and operating a co-located 500/2500 tpd Charfuel® Commercial Demonstration Facility. Viability of Phase II will depend upon the successful completion of Phase I. The co-located 500/2500 tpd Charfuel® Commercial Demonstration Facility will be used as the model to construct one or more 5000 tpd Charfuel® Commercial facilities in North Dakota.

Phase I (the Project) will consist of four modules as follows:

Module #1 – Configuration of the existing 18 tpd Charfuel® Demonstration Facility specifically to run North Dakota lignite; generation of procedure manuals and test plan for the Project

This module will take approximately three months to complete at a total cost of $1,636,212.

Module #2 – Commission and operate the 18 tpd Charfuel® Demonstration Facility for two runs of North Dakota lignite; pre-dry the feedstock at the NACCO facility

This module will take approximately three months to complete at a total cost of $1,129,395.

Module #3 – Analysis of data, char, process stream gases, and liquid samples obtained from the processing of North Dakota lignite in the 18 tpd Charfuel® Demonstration Facility

This module will take approximately one month to complete at a total cost of $56,976.

Module #4 – Generation of pre-Front End Engineering Design documents (pre-FEED) for the construction of a 500/2500 tpd Charfuel® Commercial Demonstration Facility to be co-located with an existing energy facility in North Dakota

This module will take approximately two months to complete at a total cost of $163,760.

Project Description

The "Viability of North Dakota Lignite as a Feedstock for a Commercial Charfuel® Coal Refining Facility in North Dakota" Project has 4 main objectives.

- Configure Carbon Fuels' existing scalable 18 tpd Charfuel® Demonstration Facility to operate using North Dakota lignite as a feedstock and determine benefits of pre-drying lignite using North American Coal Corporation's proprietary coal drying process and facility prior to using the material in the Charfuel® Coal Refining Process.
- Operate the configured 18 tpd Charfuel® Demonstration Facility in two modes comprising a once-through operation and an operation employing recycle of heavier oils to the reactor for cracking.
- Evaluate the data to determine optimal operating conditions and verify material balances associated with processing North Dakota lignite coal, as well as perform analysis of data for pre-FEED commercialization documents.
- Prepare pre-Front End Engineering Design documents for a 500/2500 tpd Charfuel® Commercial Demonstration Facility to be co-located at an existing energy facility in North Dakota including pro forma economic analysis using existing North Dakota petroleum refinery capacity and power generation stations.

To meet these objectives, the Project has been broken into four modules, each with a specific number of tasks which are described in detail below:

Module #1 – Configuration of the existing 18 tpd Charfuel® Demonstration Facility specifically to run North Dakota lignite; generation of procedure manuals and test plan for Project

Module #2 – Commission and operate the 18 tpd Charfuel® Demonstration Facility for two runs of North Dakota lignite; pre-dry the feedstock at the NACCO facility

Module #3 – Analysis of data, char, process stream gasses, and liquid samples obtained from the processing of North Dakota lignite in the 18 tpd Charfuel® Demonstration Facility

Module #4 – Generation of pre-Front End Engineering Design (pre-FEED) documents for a 500/2500 tpd Charfuel® Commercial Demonstration Facility to be co-located with an existing energy facility in North Dakota

Figure 1: 18 tpd Charfuel® Demonstration Facility at Hazen Research, Inc. (Golden, Colorado)

The scalable 18 tpd Charfuel® Demonstration Facility (pictured above) has been successfully operated to demonstrate the integrated operability and viability of the proprietary Charfuel® Coal Refining Process. This scalable 18 tpd Charfuel® Demonstration Facility comprises four components.

The first component is a complete coal handling and drying facility on site at Hazen Research, Inc. (housed in structure behind the tower shown in Figure 1) to prepare the feed coal. Using NACCO proprietary coal drying process, Carbon Fuels will attempt to pre-dry the lignite coal to 24-26% moisture making grinding and subsequent removal of the remaining moisture in the 18 tpd Charfuel® Demonstration Facility easier and more efficient. The first component also includes high-pressure coal feed lock-hoppers and storage.

The second component consists of support peripheral equipment, including a high-pressure steam boiler, a complete quench system, including high-pressure pumps; and, an online mass spectrometer (housed in structure on right of the tower in Figure 1).

The third component is the tower and equipment installed within the tower. This equipment includes the coal de-aeration vessel, the coal injector, the hydrodisproportionation reactor, including quench system nozzles, the partial oxidization unit and high-pressure cyclones. Also included in this third component are a number of high-pressure vessels, including separation units, gas handling equipment and collection vessels for collecting liquid products and solid char. Support equipment, such as a cooling tower, high-pressure pumps and gauges, as well as system valves are also housed within this third component. Environmental control systems and the sampling system, including test modules, are also contained in this component. Process gas streams are sampled periodically, as well as real time, in the sampling system.

The fourth component is the instrumentation and control system which is housed in the structure behind the tower. This system comprises high-functioning, commercial-grade automated feedback control systems and monitoring interfaces, as well as all data collection functions. This system monitors and controls all operational and data collection components.

Carbon Fuels and Hazen Research have successfully completed the testing and analysis of high volatile bituminous coal from the Colo/Wyo mine in the 18 tpd Charfuel® Demonstration Facility (see Appendix A, Hazen Research letter). The methodologies, protocols and equipment to be used for the Project using North Dakota lignite are the same, or substantially the same, with the exception of configuration and modifications of the 18 tpd Charfuel® Demonstration Facility required handling and processing a high-moisture, very reactive lignite coal feed material. Therefore, Carbon Fuels has a high degree of confidence that North Dakota lignite will be a viable feedstock for the Charfuel® Coal Refining Process. This Project will benefit from all of the prior engineering studies with lower rank coals, the existing 18 tpd Charfuel® Demonstration Facility, as well as the successful completion of previous hot runs with Colo/Wyo coal.

While the co-product outputs from the Charfuel® Coal Refining Process differ in quantity depending on the characteristics of the coal feedstock, sufficient information has been obtained from prior operation of the 18 tpd Charfuel® Demonstration Facility, and the pre-drying of lignite, to predict that

commercially desirable quantities of high-value co-products can be obtained from the Charfuel® Coal Refining Process using North Dakota lignite as a feedstock. The proposed Project will allow the participants to determine the quality and quantity of co-products which could be expected from a commercial-scale Charfuel® Coal Refining Facility using North Dakota lignite. A complete economic analysis based upon the results of the lignite coal runs is part of the Project. This analysis would also be useful in the preparation of a Front End Engineering Design (FEED) package, which would designate the off-the-shelf downstream refining components necessary to construct a 500/2500 tpd Charfuel® Commercial Demonstration Facility in North Dakota. The results of Phase I are also required to validate that specific existing refineries, such as Tesoro's Mandan, North Dakota refinery, could accept lignite-derived naphtha feedstock from a commercial Charfuel® Coal Refining Facility.

Module #1 – Configuration of the existing 18 tpd Demonstration Facility to run on North Dakota lignite; generation of procedure manuals and test plan for Project

Module #1 includes the following Project tasks.

Task 1 - Project support services, contract administration and project management

Carbon Fuels will provide contract preparation and administration for Module 1 of the Project, as well as operational personnel to monitor and control the Instrumentation & Controls system ("I&C"); the Partial Oxidation Unit ("POX") operation; and the sampling system, as well as sampling and analysis protocol. Hazen Research will provide engineering and general support services for the operations portion of the Project. Carbon Fuels will provide overall project management and financial reporting. Hazen Research will be a third party contractor to Carbon Fuels and will provide operations, engineering, and plant management.

Task 2 – Configure 18 tpd Charfuel® Demonstration Facility design for North Dakota lignite

Carbon Fuels and Hazen Research will analyze the current 18 tpd Charfuel® Demonstration Facility design and specifications against requirements for handling, feeding, and operating with green, low-rank coals, such as North Dakota lignite, which present higher reactivity and volatility of entrained hydrocarbons. Computer models of the 18 tpd Charfuel® Demonstration Facility,

which have already been developed, will be run to assess parameters for obtaining optimal results. Dr. John Persichetti (see "Qualifications" section) will conduct these modeling runs. He, along with VECO Engineering, designed and built the computer simulation models of the 18 tpd Charfuel® Demonstration Facility.

Task 3 - Generation of final piping and instrumentation diagrams ("P&IDs") for North Dakota lignite

Based upon the computer simulation models, Charfuel® Demonstration Facility design P&IDs will be generated to accommodate faster quench times and handling of lighter liquid streams, as well as more CO_2 that will result from using lignite coal. New flow and material balances will be calculated for heat rate and the reducing atmosphere in the Partial Oxidation Unit (POX), based upon temperature requirements and hydrogen uptake.

Task 4 – Generation of the design reference project document

Based upon the P&IDs and computer simulations, the existing design reference project document will be modified. This document will provide specifications for costing the equipment modifications necessary for the 18 tpd Charfuel® Demonstration Facility to accommodate North Dakota lignite.

Task 5 - Generate test plan

Based upon the information and documents generated in Tasks 2, 3, 4, and 6, the existing test plan will be modified by Carbon Fuels in concert with Hazen Research to memorialize project objectives and procedures for both the once-through and the recycled runs. Critical process requirements and operational protocols will be detailed along with operations and safety procedures.

Task 6 - Sample and analysis protocol for North Dakota lignite

A detailed sampling procedure will be generated by Dr. Stan Harding (see "Qualifications" section), as well as the requirements for third party testing and analysis of acquired gas, liquid

and solid samples collected in both the once-through and the recycled runs. This procedure will be integrated into the test plan.

Task 7 - Mechanical design and modification drawings

The Project team, including Hazen Research and Carbon Fuels, will review mechanical design and modification drawings. Existing 3-D operational drawings will be modified to incorporate system modifications to assure ergonomic, thermal, and mechanical clearances and operations as well as to reduce piping costs. Approved, modified, and reviewed 3-D drawings will be used for piping bids. All process flow sheets, equipment lists, instrumentation process controls, and the test plan will be reviewed with Hazen Research representatives and implemented by the I&C contractor.

Task 8 – Equipment procurement, piping, and instrumentation and controls

Using modified 3-D mechanical design drawings, equipment specification sheets will be developed for procurement and installation of 18 tpd Charfuel® Demonstration Facility piping required to process North Dakota lignite. It is anticipated that additional quench nozzles and pumps, as well as modification of the POX burner will be required to accommodate the anticipated change in residence time when using North Dakota lignite.

Task 9 – Design of safety review and training

Hazen Research, in conjunction with Carbon Fuels personnel, will conduct a process hazard review, general safety review, and operator training program based upon the test plan.

Module #2 – Commission and operate the 18 tpd Charfuel® Demonstration Facility for two runs; pre-dry the feedstock

Module #2 includes the following Project tasks.

Task 1 – Project support services, contract administration and project management

Carbon Fuels will provide contract administration for Module 2 of the Project, as well as operational personnel to monitor and control the Instrumentation & Control system ("I&C"); the Partial Oxidation ("POX") operation; and the sampling system, as well as sampling and analysis

operations. Hazen Research will provide engineering and general support services for the operations portion of the Project. Carbon Fuels will provide overall project management and financial reporting. Hazen Research will be a third party contractor to Carbon Fuels and provide operations, engineering, and plant management.

Task 2 – Coal preparation system and coal feed system assembly

Based upon the Project documents, Hazen Research will modify the coal pulverizing and coal feed systems which are intact from previous operations and then conduct mechanical operational checkouts. Carbon Fuels will provide I&C modifications, if required, through the I&C contractor.

Task 3 – System checkouts and preliminary shakedown

Hazen Research, based upon project documents, will conduct system checks on all auxiliary systems, including those modified for this Project, as well as the high-pressure boiler, emergency quench water system, and compressed gas delivery systems. Mechanical checkouts (process piping, instrumentation, and electrical) of the entire system, as modified, will be completed. Leak checking in stages up to design pressure at ambient temperature will be completed along with instrumentation and process control checks performed in conjunction with Wunderlich-Malec (third party system control engineers). Testing of downstream collection systems will be tested at pressure and temperature using steam.

Task 4 – Coal pre-drying

Approximately 20 tons of North Dakota lignite feed will be required for the entire campaign. This proposal assumes that this material will be provided by NACCO, Run of Mine ("ROM"), Free on Board ("FOB"), Hazen Research (rail or truck, top size of 2-3 inches), pre-dried.

Task 5 – Coal procurement and preparation

Hazen Research will crush the lignite to approximately ¾-in top size and store in super-sacks prior to pulverization. Approximately 4 tons of "as-received" lignite (first run) will be pulverized to 70-80% minus 200 mesh and dried in a coal pulverizer swept with hot flue gas using Carbon

Fuels' pulverizing and drying equipment. Pulverized feed will be pneumatically transferred to the coal feed system utilizing inert nitrogen.

Task 6 – Hot run operations (once-through)

The 18 tpd Charfuel® Demonstration Facility will be gradually brought up to operating temperature in several stages with hot POX gas in a flow-through mode to protect and ensure that refractory linings are heat-soaked until operating temperature is reached. The system will then be brought up to design pressure in stages. At operating temperature and pressure, the coal feed will be started, and operations will commence for a 6-7 hour run. Water or surrogate oil will be used for quenching the reactor during the run (once-through operation). All data will be collected "real time" including POX, reactor and quench product temperatures. Samples will be made during the run using Carbon Fuels' sampling system and monitored and controlled by Dr. Stan Harding. At the end of the run, the system will be gradually cooled down, and samples (char and liquids) will be collected. Analysis will be performed at an independent testing facility. Gas costs for system heat-up and operations are included in this task.

Task 7 – Modifications for oil recycle

Based upon previously generated P&IDs, the system will be modified to allow the use of recycled oil for quenching the reactor. This will include process piping and quench pump modifications, as required. The oil recycle system will then be checked out at design pressure using steam. Oil from the once-through operation will be used to start the quench. I&C will be modified as needed for this run based upon the checkout run.

Task 8 – Operations with oil recycle

Approximately 4 tons of pre-dried lignite (second run) will be pulverized to 70-80% minus 200 mesh and dried in a coal pulverizer swept with hot flue gas in Carbon Fuels' pulverizing and drying equipment. Pulverized feed will be pneumatically transferred to the coal feed system utilizing inert nitrogen. The downstream system will be re-checked for leaks in stages up to system design pressure using steam. The 18 tpd Charfuel® Demonstration Facility will be

gradually brought up to operating temperature in stages with hot POX gas in a flow-through mode to protect and ensure that refractory linings are heat soaked. The system will then be brought up to design pressure in stages. At operating temperature and pressure, the coal feed will be started, and operations will commence for a 6-7 hour run. Recycle oil will be used for quenching the reactor during the run (recycle operation) to further crack the recycle oil to lighter liquid materials. All data will be collected "real time", including POX, reactor and quench product temperatures. Samples will be made during the run using Carbon Fuels' sampling system and monitored and controlled by Dr. Stan Harding. At the end of the run, the system will be gradually cooled down and samples (char and liquids) will be collected. Analysis will be performed at an independent testing facility. Gas costs for system heat-up and operations are included in this task.

Task 9 – Decommissioning and material disposition

At the conclusion of testing, equipment will be inspected and cleaned. Analysis of equipment wear will be made and reported for inclusion in the pre-FEED document. Material not required for samples will be disposed of.

Module #3 – Analysis of data, char, process stream gasses and liquid samples

Task 1 – Project support services, contract administration, and project management

Carbon Fuels will provide contract administration for Module 3 of the Project, as well as operational personnel to monitor and control analysis operations. Hazen Research will provide analysis and reporting of char analysis, engineering and general support services for this portion of the Project. Carbon Fuels will provide overall project management and financial reporting.

Task 2 – Gas sample analysis

Dr. Stan Harding will provide gas samples from the 18 tpd Charfuel® Demonstration Facility sampling system to selected third party independent testing facilities for analysis in accordance with the analysis and reporting protocol. Analysis data will be assembled and reviewed.

Task 3 – Liquid sample analysis

Dr. Stan Harding will provide liquid samples from the 18 tpd Charfuel® Demonstration Facility comprising separated liquids as well as recycle oil to selected third party independent testing facilities for analysis in accordance with the analysis and reporting protocol. Analysis data will be assembled and reviewed.

Task 4 – Char sample analysis

Hazen Research will collect and analyze the solid char samples in accordance with the analysis and reporting protocol. Analysis data will be assembled and reviewed.

Task 5 – Data assembly

Hazen Research and Carbon Fuels will assemble and correlate the data generated in Tasks 2, 3, and 4 in a format to be used in Module #4

Module #4 – Generation of pre-FEED documents for a co-located 500/2500 tpd Charfuel® Commercial Demonstration Facility in North Dakota (confidential)

Task 1 - Project support services, contract administration, and project management

Carbon Fuels will provide contract administration for Module 4 of the Project, as well as operational personnel to monitor and control data assemblage and entry. Carbon Fuels and Hazen Research will provide analysis and reporting of real time data streams which will be bundled for the report. Carbon Fuels will provide overall project management and financial reporting.

Task 2 – Data analysis & system requirements (once-through & recycle)

The real time data streams from both the once-through and recycle runs will be analyzed for POX performance and profiles, including feed temperatures, hydrogen and carbon monoxide production, as well as feed gas uptake. The reaction temperature profile will be analyzed along with the temperature profile of the quench; all pressure and temperature profiles of downstream collection vessels will be analyzed. All real time data, including control and monitoring system

requirements, will be appropriately filed for use in the pre-Front End Engineering Design (pre-FEED) documents.

Task 3 – Charfuel® system requirements from gas sample (once-through & recycle)

The real time gas streams from both the once-through and recycle runs will be analyzed for POX performance and profiles based upon real time gas analysis data. Gas samples from the downstream process will be analyzed for solids containment, hydrocarbon constituence, as well as molecule moiety determination (aliphatic, cyclic, and aromatic). H_2S, NH_3, Hg, H_2, and CO_2 constituence in the gas samples will be analyzed for quantity and quality. All real time data, including control and monitoring system requirements, will be correlated with sampling times and filed with gas analysis for use in the pre-FEED documents.

Task 4 – Charfuel® system requirements and refinery specifications of liquid samples (once-through & recycle)

The liquid samples from all downstream collection vessels from both the once-through and recycle runs will be analyzed for solids containment, hydrocarbon constituence, as well as molecule moiety determination (aliphatic, cyclic, and aromatic). All real time data, including control and monitoring system requirements, will be correlated with downstream vessel samples and filed with liquid analysis for use in the pre-FEED documents.

Task 5 – Charfuel® system requirements and combustor specifications of char (once through & recycle)

The solid samples from the char collection vessel (lock-hopper) from both the once through and recycle runs will be analyzed for hydrogen conversion, residual hydrocarbons, inorganic material, including sodium, chlorine, sulfur, nitrogen, and mercury. These elements will be compared against analysis of the feed coal. All real time data, including control and monitoring system requirements, will be correlated with downstream char vessel samples and filed with char analysis for use in the pre-FEED documents.

Task 6 – Pro forma economic study

Based upon these gas, liquid, and solids analyses, quality and quantity of co-products for a commercial 5000 tpd Charfuel® commercial facility will be calculated and a pro forma economic study will be performed using then-current feedstock and co-product prices. A sensitivity analysis will also be run to determine the economic sensitivity of the price of the various co-products from a 5000 tpd Charfuel® commercial facility located in North Dakota. Similar economic analysis will be run for a 500/2500 tpd Charfuel® Commercial Demonstration Facility to be co-located with an existing energy facility in North Dakota.

Task 7 – Draft report

A complete heat and material balance around the Charfuel® 18 tpd Demonstration Facility for both the once-through and recycle runs will be generated. Dr. John Persichetti will run simulation models for sizing the equipment to construct a 500/2500 tpd Charfuel® Commercial Demonstration Facility. A draft pre-FEED report will be prepared by Carbon Fuels with Hazen Research input, containing procedures, results, and conclusions from the Project, including the analysis from tasks 2-5 above. This document will contain sufficient information and analysis, including equipment requirements to allow complete, bankable pre-FEED documents for a 500/2500 tpd Charfuel® Commercial Demonstration Facility to be prepared by an engineering, procurement, and construction ("EPC") company. After participant review and input, a final report will be issued.

Task 8 – Final pre-FEED document

Based upon Task 7 above, Carbon Fuels will issue a complete confidential pre-FEED report and a non-confidential report for the Industrial Commission, which will indicate the findings and conclusions of the Project.

Standards of Success

The standards of success for determining the viability of North Dakota Lignite as a feedstock for a commercial Charfuel® Coal Refining Facility in North Dakota are as follows:

- Configure the existing 18 tpd Charfuel® Demonstration Facility to operate using North Dakota lignite as a feedstock.
- Operate the 18 tpd Charfuel® Demonstration Facility configured specifically for North Dakota lignite in a once-through configuration and a recycled configuration to determine the optimal operating conditions and verify the material balances of processing North Dakota lignite coal.
- Perform data evaluation and analysis for the preparation of engineering documents and financial pro formas for a 500/2500 tpd Charfuel® Commercial Demonstration Facility.
- Determine viability of providing hydrocarbon feed stock to Tesoro crude oil refinery
- Preparation of the pre-Front End Engineering Design (pre-FEED) documents for a 500/2500 tpd Charfuel® Commercial Demonstration Facility.
- Preparation of a Project final report.

Using the knowledge gained from this Project, Carbon Fuels will begin developing plans for a 500/2500 tpd Charfuel® Commercial Demonstration Facility in North Dakota (Phase II). This will include solidifying agreements with co-location partners, site selection, initiating the permitting process, preparation of bankable engineering documents and arranging for financing. Construction and operation of the 500/2500 tpd Charfuel® commercial Demonstration Facility in North Dakota will be a first-of-a-kind commercial facility.

Phase I (the Project) and Phase II would meet the definition of a “clean coal demonstration project” as defined by a June 14, 1994 North Dakota constitutional amendment (and subsequent Errata memorandum from the North Dakota Industrial Commission), including the following:

- It would process North Dakota lignite in such a manner that it would “retrofit or replace existing facilities while achieving reductions of environmental emissions”;

- It would “provide for future energy needs” not only in North Dakota but throughout the country;
- It would “expand the use of lignite for non-energy needs,” and, specifically produce petrochemical feedstocks, fertilizer and metallurgical coke; and,
- It would support the eventual “design, construction and operation of near-commercial demonstration facilities and first-of-a-kind commercial facilities.”

Background

Many North Dakota companies, such as NACCO, have worked diligently to improve the cost effectiveness and reduce the environmental impact of North Dakota lignite coal. They have initiated studies and projects that have been designed to reduce the moisture, sulfur, mercury, and ash content of the lignite in an effort to establish cost effective methods of improving lignite overall value. Previous attempts have taken a somewhat incremental approach trying to address each of these problems one at a time. No matter the success of these methods, the resultant lignite product still only had utility as a boiler fuel with a limited geographic range of use.

Lignite is a rank of coal that lies between peat and sub-bituminous. Lignite has had its organic structure partially modified, but has not been carbonized to the extent that bituminous coal has been carbonized. A characteristic of lignite coal is its high moisture content. It is also a less mature coal and thus has, in addition to the moisture, many lighter hydrocarbons which are valuable when removed or refined from the other constituents.

The total moisture content of lignite ranges from about 35% to 45%. Thus, a significant part of lignite is water. Most of the water is found in the familiar form of free water. The free water in lignite is held in the pores and fractures within the coal, much of which is on a microscopic scale. This water is available as process water when removed via the Charfuel® Coal Refining Process.

When burned in a utility boiler, the water in lignite accounts for 1/3 of the efficiency losses in the boiler and about 18% of the flue gas volume that is released from the boiler. As a result, more fuel is consumed, more emissions are produced, including CO_2, and larger flue gas equipment is needed to handle the higher flows. At the same time, almost 50% of heat input of the coal into the boiler is being discarded in the cooling towers and 20% is being released up the stack. This high water content, which is a negative for lignite's traditional applications, is a positive as all the process water required for the Charfuel® Coal Refining Process is extracted from the coal and, thus, this country's precious streams and rivers will not be disturbed by this process.

The basic concept behind the Charfuel® Coal Refining Process is the same as crude oil refining. Engineers and scientists have long ago realized that the solution to harness and create value from heterogeneous, pollutant-laden and rich-in-energy crude oil was refining through a hydro-cracking process. Similarly, Carbon Fuels' Charfuel® Coal Refining Process hydrocracks coal molecules to yield products identical to those refined from crude oil. As a result, refining lignite coal has the potential to yield far more value than lignite's traditional application as a power generation fuel in its raw form. Refining is the most elegant, complete solution to derive the value and utility of this abundant, domestic, high-energy-density natural resource, while greatly benefiting the citizens of North Dakota and the United States of America.

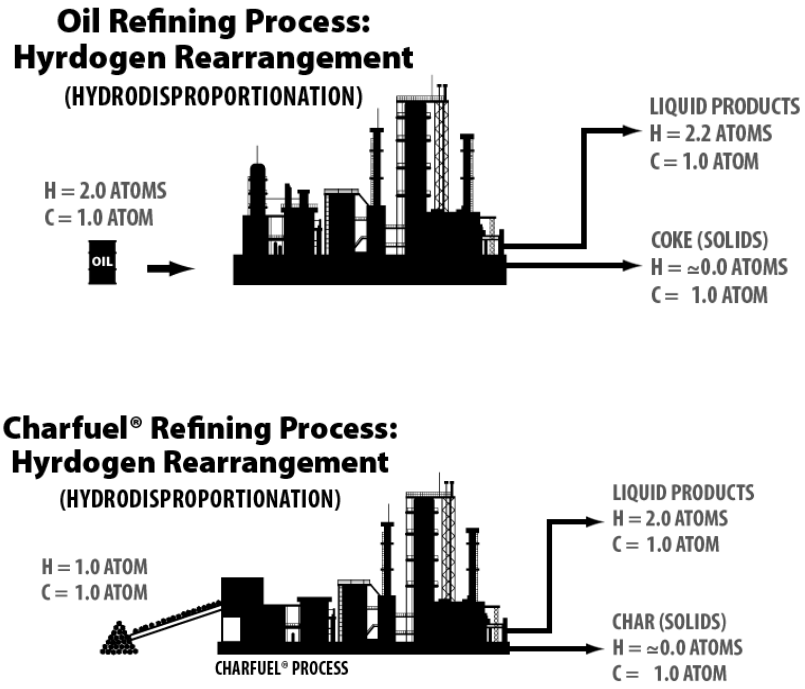


Figure 2: Crude Oil Refinery vs Charfuel® Coal Refinery

Carbon Fuels, LLC has developed the Charfuel® Coal Refining Process for the clean, efficient use of coal to produce a slate of valuable commodity co-products, including gasoline, jet fuel, "green diesel", fuel oil and marine fuels; petrochemicals, such as benzene, toluene, xylene; methanol; sulfur; ammonia (fertilizer); and, char, a high energy, clean boiler fuel, gasification feed-stock or a metallurgical

coke. The Charfuel® Coal Refining Process is environmentally benign using no external process water and having no carbon foot-print since the small amount of CO_2 produced is captured for industrial use. The technology is based upon over 15 years of effort by Carbon Fuels and $18M in engineering studies, analysis and validation work performed by well respected engineering companies, including Black & Veatch; Stone & Webster; Morrison-Knudsen Corporation; Ford Bacon & Davis; Ralph M. Parsons; Ebasco; Babcock and Wilcox, Hazen Research and support from the State of Wyoming.

The Charfuel® Coal Refining Process is *not* a conventional "coal-to-liquids" process such as the process that SASOL, RenTech Inc., and numerous others are employing with limited success. These processes involve: a more complicated series of process steps and conversions; require far higher costs to build and operate; require a significant amount of process water; are far less efficient; produces liquid products not compatible with petroleum distribution and use (engines) systems; and, is less environmentally friendly than the Charfuel® Coal Refining Process. The Charfuel® Coal Refining Process has major technology, economic and environmental advantages relative to any other known methods for converting coal into liquid fuels and other co-products. These advantages are described in the following sections.

Completely Compatible with Existing Petroleum Infrastructure & Markets. The refined products from the Charfuel® Coal Refining Process can utilize today's existing petroleum-based fuel distribution and retail infrastructure, thus avoiding the need to build the hundreds of billions of dollars of additional energy infrastructure that would be required to shift from petroleum fuels to other types of alternative fuels (e.g., ethanol, hydrogen, electric vehicles, etc.), and the many years of time that such a shift would require. Moreover, no engine modifications are required in order to use fuels produced with the Charfuel® Coal Refining Process; the fuel quality and characteristics are exactly the same as those produced from crude oil. Hence, there is no need for new engines/power-trains, pipelines, terminals, storage tanks, tankers, retail pumps or long product acceptance periods. The same is true for the range of valuable and essential petrochemical products derived from the Charfuel® Coal Refining Process. All Charfuel® Coal Refining Process outputs, such liquid fuels, fertilizer inputs, petrochemicals, and power plant feedstocks,

can immediately be sold into profitable commodities markets that already exist, and which have substantial need for additional supply. As such, Charfuel®-derived products are direct substitutes for petroleum-derived fuels and petrochemicals.

Low Environmental Impact. The Charfuel® Coal Refining Process has a low environmental impact, releasing no emissions into the atmosphere. With Charfuel® Coal Refining Process, all potential pollutants and greenhouse gases, including sulfur, nitrogen, mercury and carbon dioxide (CO_2) are captured before they ever reach the atmosphere, and are turned into valuable co-products, such as ammonia for fertilizer. Captured, industrial grade, CO_2 is used for enhanced oil recovery (EOR), or for safe disposal or sequestration. Therefore, the Charfuel® Coal Refining Process' emissions profile is substantially better than any of today's conventional petroleum refining practices—and even superior to many bio-fuels, such as corn-based ethanol, which produces a significant amount of CO_2. Importantly, unlike other processes that convert coal into liquid fuels or synthetic gases such as the SASOL coal-to-liquids process, as well as many bio-fuel manufacturing processes (such as ethanol), the Charfuel® Coal Refining Process uses substantially no external process water; and, therefore, does not rely on scarce groundwater or water from lakes and rivers. The process water used in the Charfuel® Coal Refining Process comes from the moisture in naturally contained in the coal.

Low Production of CO_2. The Charfuel® Coal Refining Process is *not* an oxidation process. Rather, it is a "reduction" process (i.e., hydrogenation, or adding hydrogen molecules), not an oxidation (adding oxygen) process. Oxidation is a major contributor to the production of CO_2. Because of this, the Charfuel® Coal Refining Process produces far lower volumes of CO_2 than other coal conversion processes, including the coal-to-liquids process.

Fuel Price Stability. The Charfuel® Coal Refining Process would allow stabilization of historically volatile fuel prices, as well as petrochemical prices which have been based upon the unstable price of crude oil. With large, stably priced domestic coal reserves, a Charfuel® Coal Refinery can produce these previously price unstable products at a stable price.

Produces Essential Petrochemicals. Today's most common alternative fuels, such as wind, solar, ethanol, biodiesel and hydrogen and conventional coal to liquids processes, do not produce any of the essential petrochemicals that are produced by refining crude oil (such as benzene, toluene and xylene). As much as 40% of crude oil is converted into these high-value petrochemicals as a result of the conventional oil refining process. These petrochemicals are critical for providing many of the economy's most important materials, including nearly every kind of plastic material. The Charfuel® Coal Refining Process yields the same petrochemicals as those derived from oil refining, and can continue to meet the market's demand for these valuable materials without reliance on crude oil.

Low Technology Risk. As shown in the comparison chart below, 95% of the Charfuel® Coal Refining Process utilizes "off-the-shelf" equipment/systems that are used in existing petroleum refineries and at coal-fired power plants. The proprietary elements of the Charfuel® Coal Refining Process account for just 5% of a commercial-scale Charfuel® Coal Refining Plant's capital costs. Therefore, capital risks are isolated, and technology risks are low.

Process Reliability and Flexibility. Because it uses many of the same "off-the-shelf" systems utilized by today's oil refineries, commercial-scale Charfuel® Facilities are expected to be very reliable (like petroleum refineries) having an online factor of greater than 95%. In addition, the Charfuel® Coal Refining Facility is modular (multiple reactor trains) and continuous, with a reactor residence time of less than one second, yielding a low "capital-to-throughput" cost. Furthermore, the Charfuel® Coal Refining Process can be combined with an integrated gasification combined cycle (IGCC) power plant to produce inexpensive, environmentally compatible, and dependable electricity with capture of CO_2. The Charfuel® Coal Refining Process is flexible, and can adjust product output yields between petrochemicals, liquid fuels, and boiler fuels (char) by a change in changing process parameters and downstream equipment. This flexibility allows a Charfuel® Coal Refinery to react to changing commodities markets for gasoline, diesel, jet fuel, fertilizers and petrochemicals allowing superior economic performance and a greater return on assets. This is unlike traditional coal gasification and liquefaction technologies, such as coal-to-liquids process, which have fairly rigid process parameters.

High Net Energy Density. The higher the net "energy density" of a fuel, the greater the amount of energy it stores per unit of volume. Charfuel® products are identical to those refined from crude oil, and thus have equal (high) energy densities. Thus, mileage (fuel economy) achieved with fuels derived from the Charfuel® Coal Refining Process is the same as that achieved with petroleum-derived fuels.

High Process Efficiency. The Charfuel® Coal Refining Process has an energy efficiency factor of 85% to 90% (coal BTUs to end-product BTUs). This means that 85% of the energy in the coal remains in the liquid fuels and co-products produced. Thus, the Charfuel® Coal Refining Process energy efficiency factor is comparable to that of petroleum refining.

Relatively Low Capital Cost. Commercial-scale coal-to-liquids plants require more than $5 billion to design and construct a plant producing approximately 1,500,000 gallons of liquid fuels per day (with no production of petrochemicals). In contrast, a greenfield Charfuel® Coal Refining Facility producing approximately 350,000 gallons of liquid fuel per day (plus high-value petrochemicals) can be designed and constructed for approximately $600 million which is less than 50% of a coal to liquids plant's capital cost per gallon of fuel production capacity. This is due in large part to the tremendous continuous throughput of the Charfuel® Coal Refining Process (reactor resident times are less than one second). Moreover, if a Charfuel® Coal Refining Facility is co-located with an existing oil refinery such that separate downstream (post-naphtha) refining systems are not required for the Charfuel® Coal Refining Plant, a full commercial-scale Charfuel® Coal Refining Plant could be constructed for approximately $250 million. Projected returns on investment for Charfuel® refineries are, therefore, far higher than projected returns on investment for coal-to-liquids plants.

Profitable at Nearly Any Market Price of Oil. In addition to the inherent manufacturing efficiencies of the Charfuel® Coal Refining Process and its relatively low capital cost, the fact that coal feedstock is far less expensive than crude oil (on a BTU bases) means that Charfuel® Coal Refining Process derived fuels can always compete with fuels and petrochemicals derived from petroleum—even at a $20-per-barrel market price for crude oil.

Existing Scalable Demonstration Facility. Over the course of the last several years, Carbon Fuels designed, developed, constructed and operated an 18 tpd Charfuel® Demonstration Facility, located at the site of Hazen Research in Golden, Colorado. This facility takes advantage of the infrastructure of Hazen Research (water, electricity, rail, truck and sample analysis) and is fully permitted. This 18 tpd Charfuel® Demonstration Facility was built specifically to validate the Charfuel® Coal Refining Process at a scale that would proved scale-up capability to a commercial sized Coal Refining Plant and also serve as a facility for the testing and analysis of various ranks of coal, as well as coal from specific mine locations, such as North Dakota lignite, to get process optimization data to support a commercial-scale Charfuel® refinery.

Figure 3: 18 tpd Charfuel® Demonstration Facility at Hazen Research, Inc. (Golden, Colorado)

The 18 tpd Charfuel® Demonstration Facility has successfully operated to demonstrate that the Charfuel® Coal Refining Process refines raw coal into various gas streams that can be further converted into a variety of liquid and gas products utilizing “off-the-shelf” oil refining processes and “off-the-shelf” gas processing and air separation technologies, such as those used in oil refineries, as well as for the production of industrial gases. The 18 tpd Charfuel® Demonstration Facility has also shown that such conversions occur in the Charfuel® Coal Refining Process at a very rapid rate, yielding an exceptionally high throughput rate.

At Carbon Fuels' direction, for more than 5 years, Hazen Research, Inc. has been an instrumental contributor to the development of the Charfuel® Coal Refining Process, the construction and operation of the Demonstration Facility, and the continued testing and analysis of the single coal previously tested at the Demonstration Facility. Hazen Research has also had an integral role in conducting feasibility studies relating to the development of commercial-scale Charfuel® plants, as well as providing ongoing process engineering for ongoing process optimizations and studies in support of various proposed commercial Charfuel® Coal Refining Plant developments. Hazen Research, Inc.'s staff will continue to provide significant input as to the research and engineering required to complete the proposed Project, and would continue to be involved in the design of a commercial-scale Charfuel® Coal Refining Facility in the event that such a facility were to be developed in North Dakota using North Dakota lignite.

The Charfuel® Coal Refining Process is technically viable and economically profitable. Over 95% of the capital costs for a Charfuel® coal refinery are for refinery units that are commercially available, while the other 5% relates to the proprietary hydrocracker which is the key process unit. Essential steps are the rapid heating and devolatilization of the coal and hydrogenation of the volatiles in a novel hydrodisproportionation (HDP) reactor. The Charfuel® Coal Refining Process captures and removes greenhouse gases; turns pollutants such as mercury, sulfur, and nitrogen into valuable co-products such as ammonia for fertilizer; and, since the Coal Refining Process has no emissions, it is environmentally benign. The Charfuel® Coal Refining Process accomplishes all of this while recovering valuable petrochemicals and petro-fuels that are identical to those produced from oil. The Charfuel® Coal Refining Process utilized abundant and domestic raw coal and air to produce an array of demanded products with established markets.

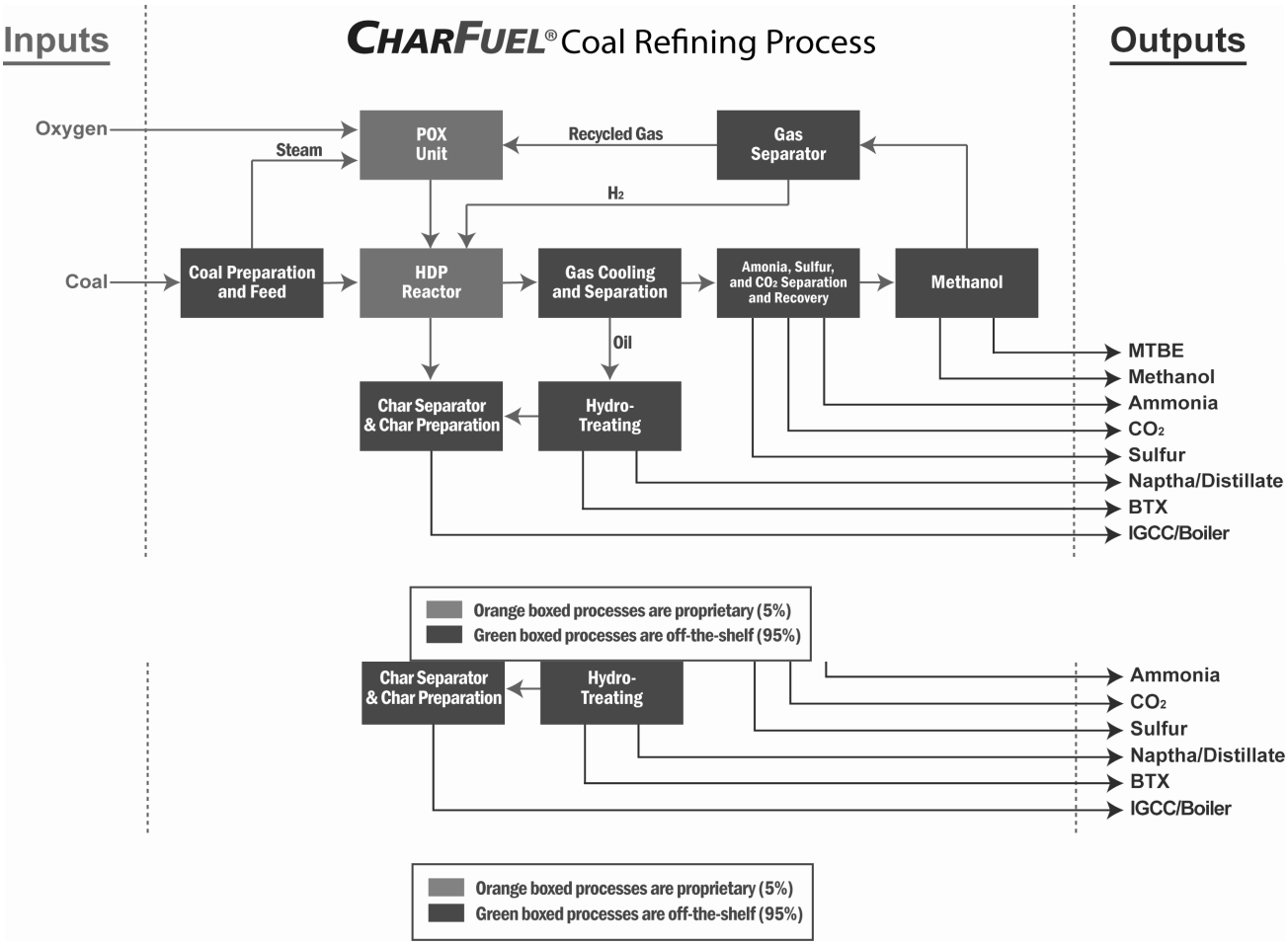


Figure 4: Flow Diagram of the Charfuel® Coal Refining Process

The solid char consists primarily of carbon and has an advantage over raw coal in that it has a greater BTU value (no moisture) per ton than coal with far fewer pollutants and toxins. This reduces the environmental impact of its combustion, as well as the need for expensive back end scrubbers. Char can be used for combustion, gasification, as well as coking for steel production.

Thus, the Charfuel® Coal Refining Process hydrocracks coal in conceptually the same manner as crude oil to produce the identical, uniform, high value co-products from raw coal. The elegant beauty of the Coal Refining Process is its simplicity. It has no moving parts. The resultant fuels have fewer pollutants than raw coal and the petrochemicals and petro-fuels are interchangeable with those produced from crude oil. Because the Charfuel® Coal Refining Process' co-products are identical to those derived

from crude oil, there is no need for new transportation or delivery systems. All standard land, water, and aviation engines are able to burn and transport it.

The Charfuel® Coal Refining Process has an energy efficiency of 85% (coal to end products), while removing pollutants and producing a slate of value-added products. Like oil, the constituent parts of coal are more valuable than the original coal itself. Currently, there are large markets for all of these products. The flexibility of the Charfuel® Coal Refining Process, a significant advantage, allows the mix of the outputs to be altered based on market conditions and desired output, further adding to the profitability of the Charfuel® Coal Refining Process.

Qualifications

The Project will be conducted and managed by Carbon Fuels, as well as by its primary third-party research and testing provider: Hazen Research, Inc. of Golden, Colorado. Both entities are highly skilled in the specific technical areas to be investigated under the Project, and have already successfully performed substantially similar investigations and analysis with sub-bituminous coal. Overviews of each entity's qualifications and credentials are provided below.

Qualifications & Credentials of Hazen Research, Inc.

Hazen Research, Inc. (www.hazenresearch.com) has been a critical contributor to the development of the Charfuel® Coal Refining Process over several years, performing numerous outsourced engineering, testing, validation and managerial roles on behalf of Carbon Fuels. In addition, Hazen has overseen the construction and operation of Carbon Fuels' 18 tpd Charfuel® Demonstration Facility located at Hazen Research main facility in Golden, Colorado.

Founded in 1961, Hazen Research is an internationally recognized independent firm of 120 professionals that performs industrial R&D for clients in the Energy, Minerals/Mining, Metallurgical, Chemical, and Environmental industries. Hazen Research's services include laboratory-scale research on new processes and adaptation of known technologies to new situations, followed by Demonstration plant demonstrations, preliminary engineering, and cost analysis. Projects range from beaker-scale experiments and analyses to multi-million dollar continuous demonstration plants. Hazen Research has 15 buildings on its main campus in Golden, Colorado containing an extensive inventory of laboratory and demonstration plant equipment.

Hazen Research has completed over 10,000 projects for industrial clients. In addition to its research and development services, Hazen Research specializes in designing and constructing small-scale industrial chemical plants and mineral-treatment facilities, including demonstration plants. In conjunction with this, Hazen Research possesses expertise in sophisticated data acquisition and computer modeling methods.

Hazen Research has developed hundreds of hydrometallurgical, pyrometallurgical, and mineral beneficiation processes for most commercial metals and industrial minerals, and for many inorganic chemicals. Hazen Research's energy clients have utilized its expertise to develop processes involving coal upgrading, combustion of alternative fuels, and conversion of a wide variety of feedstocks into energy sources. Waste characterization and treatability studies, waste reduction options, and valuable byproduct recovery from waste streams are routinely performed by Hazen Research for industrial clients.

Qualifications & Credentials of Carbon Fuels LLC's Management & Technical Team

Carbon Fuels' management and technical team comprises a group of highly experienced and successful professionals with a wide range of relevant experiences and expertise:

- **Lee G. Meyer, Founder & CEO**, oversees all areas of Carbon Fuels, LLC and its subsidiaries, including business development, strategic planning, engineering and technology development, marketing, finance, and operations. Mr. Meyer was a key member of the team that originally developed the Charfuel® technology, which included financial support from the State of Wyoming. Mr. Meyer has more than 35 years of experience as a corporate executive, chief counsel, patent attorney, chemical engineer, CFO and entrepreneur. Mr. Meyer formerly held executive positions with Texaco, Total Petroleum, Diamond Shamrock, and Alcan Aluminum, and began his career as an engineer at Martin Marietta. His corporate management work included extensive experience in the petroleum refining and coal mining industries. As an attorney, Mr. Meyer headed the intellectual property departments at several large national law firms.
- **Paul Papas, Ph.D., Senior Process Engineer,** holds a PhD in combustion engineering from Princeton, and brings a wide range of technical expertise to the Carbon Fuels team. Dr. Papas designed the current POX reactor and is one of the few engineers in the world with deep expertise in the core technologies, including POX burner technology, upon which the Charfuel® Coal Refining Process relies. Dr. Papas has published and conducted groundbreaking research in many areas of combustion and fluid mechanics, including reacting mixing layer dynamics and instabilities, metal combustion, ignition of solid fuels, solid propellants, thermo-acoustic

oscillations in industrial combustors, high-temperature fuel oxidation kinetics, and flame extinction. Dr. Papas was previously a National Research Council Fellow at the Naval Research Laboratory in Washington, DC. For eight years, he was a Senior Lecturer at the Swiss Federal Institute of Technology (EPFL) in Lausanne, Switzerland. Dr. Papas is currently an Associate Professor at the Colorado School of Mines.

- **Clifford Farris, Senior Petroleum Operations & Design Engineer,** has done extensive thermodynamic and design work on the 18 tpd Charfuel® Demonstration Facility. Mr. Farris has worked in the chemical, petroleum refining, energy, and environmental engineering fields for over 30 years, with emphasis on hydro-cracking design and process construction. Mr. Farris has extensive experience in commercialization of petroleum-based processes. He also has expertise in complex chemical reactions and their thermodynamics, as well as pressure systems for refining hydrocarbon products. Mr. Farris is a licensed professional engineer in Texas, Colorado, Indiana, and Arizona, and also has extensive experience in commercial plant commissioning and operations.
- **John Persichetti, PhD, Senior Modeling Engineer,** holds a doctorate in chemical/petroleum engineering and is an expert in computer simulation of refining systems and design. Dr. Persichetti designed and ran the simulation model of the 18 tpd Charfuel® Demonstration Facility and has done extensive thermodynamic and design work on the simulation model. Dr. Persichetti has worked in the chemical, petroleum refining, and energy fields for over 20 years, with an emphasis on turning technology developments into commercially viable processes. He spent five years at the National Institute of Standards and Technology (NIST) in applied research and modeling and, since 1997, has been teaching in the Department of Chemical Engineering at the Colorado School of Mines as a Lecturer. Dr. Persichetti is an expert in simulating a wide range of industrial processes using process simulation software including HYSYS, ASPEN Plus, and PRO/II.

- **Dr. N. Stanley Harding, Jr., Ph.D, Senior Sampling and Analysis Engineer,** is a chemical engineer, with significant experience in coal processes. Dr. Harding worked at Eyring institute, where the pre-cursor technology to the Charfuel® Coal Refining Process was developed. Much of Dr. Harding's career has been dedicated to sampling and analysis of coal gases and liquid products. Dr. Harding developed the sampling system for the 18 tpd Charfuel® Demonstration Facility.
- **Eric. Altman, VP of Finance,** brings business development, finance, and accounting experience. In his career with Black Diamond Financial Group, Calim Private Equity, Coopers & Lybrand and Fidelity Investments, he has worked with companies in sectors such as energy, software, biotechnology, entertainment, construction, real estate and lodging, mutual funds, and venture capital. Mr. Altman holds a BS in industrial economics from Union College and a joint MS/MBA degree from the Graduate School of Professional Accounting at Northeastern University.

Value to North Dakota

North Dakota lignite is a low BTU and high pollutant rank of coal. While this has traditionally limited the value and utility of this abundant natural resource, when it is refined through the Charfuel® Coal Refining Process and subsequently moved through the existing North Dakota petroleum infrastructure, it produces several high value products and solves numerous environmental issues. This combination of factors creates an ideal scenario for the commercialization of the Charfuel® Coal Refining Process in North Dakota.

The refining of North Dakota lignite coal will accomplish several important objectives for the state's economy. A key objective of the proposed Project is to validate the viability of North Dakota lignite as a feedstock for the Charfuel® Coal Refining Process. Carbon Fuels proposes to use North Dakota lignite as a feedstock in its existing 18 tpd Charfuel® Demonstration Facility to get the engineering data to produce bankable documents to support the development of a commercial Charfuel® Coal Refining Plant(s) to be located in North Dakota. Largely due to the exceptional economics and investment return potential of the Charfuel® Coal Refining Process, the likelihood of the Project findings being put to commercial use in North Dakota is high. The most likely users of the Project results will be commercial entities and joint ventures comprising independent energy project developers, large energy companies and/or Carbon Fuels itself.

Furthermore, each commercial Charfuel® Coal Refining Plant located in North Dakota would utilize approximately 2,500,000 tons of North Dakota lignite per year, and would further broaden North Dakota's diverse mix of energy resources. As the holder of the world's largest lignite reserves, North Dakota stands to gain enormously from the proposed Project, particularly from one or more commercial-scale Charfuel® plants that could be located in North Dakota based on the Project results. One or more Charfuel® plants in North Dakota can be expected to yield the following numerous benefits to the state.

Substantial Increase in Demand for Lignite Mined and Consumed in North Dakota

Each commercial-scale Charfuel® Coal Refining Plant located in North Dakota would consume approximately 2,500,000 tons of North Dakota lignite per year (5,000 tons/day (MAF)). Thus, each Charfuel® Coal Refining Plant in North Dakota would expand North Dakota's lignite production by nearly 10%, and would increase the North Dakota lignite industry's revenues by tens of millions of dollars per year. Over the course of each Charfuel® Coal Refining Plant's lifecycle (expected to be at least 40 years), this could represent more than $1 billion of additional revenue for the North Dakota lignite industry.

Diversification: Creation of Entirely New Value-Added Products from Lignite

Traditionally, lignite coal has largely been limited to "mine-mouth" applications (e.g., for pulverized coal power production) due to its high moisture content (making it difficult to transport cost-effectively) and its relatively low BTU value. With such traditional uses of lignite becoming more and more challenging due to more stringent environmental regulations and legislation, it is important for the lignite industry to diversify its markets and applications in order to assure the industry's longevity. The Charfuel® Coal Refining Process is the solution. It opens up entirely new categories of products that previously have not been produced from lignite.

Liquid Fuels. While liquid fuels have been produced from lignite coal in other parts of the world through traditional coal-to-liquids processes, this has not been done to-date with North Dakota lignite. A Charfuel® Coal Refining Plant in the state would add a very large new revenue stream for lignite from the sale of liquid fuels.

Petrochemicals. Another of these new product categories made possible by the Charfuel® Coal Refining Process is petrochemicals. The Charfuel® Coal Refining Process produces substantial volumes of high-value benzene, toluene, and xylene (BTX), which are used as primary inputs for making a wide range of plastics. BTX is often produced by oil refineries. Petrochemicals can account for as much as 40% of the revenue of a Charfuel® Coal Refining Plant, and thus represent a substantial contribution to diversifying the markets and revenues for lignite-based products.

Metallurgical Coke. The char material produced in large volumes by a Charfuel® Coal Refining Plant has the same reducing properties as metallurgical coke (made from coking coal), used as a reducing agent for producing carbon steel. In certain respects, char is actually superior to standard met coke because the char is substantially free of pollutants, which can "poison" high-grade carbon steel. Metallurgical coke fetches a far higher price in the commodities markets than raw coal does. As of spring 2009, coking coal sells for about $120/ton. In 2008, metallurgical coal reached historically high prices of approximately $300/ton. As such, the value added to lignite coal (which typically sells for less than $12/ton) is exceptionally high, and can easily absorb transportation costs required to ship this material to the nation's steel-making regions.

Fertilizers. The Charfuel® Coal Refining Process also produces substantial volumes of ammonia, which is a component of fertilizer. Most commercial ammonia is now produced with natural gas. Recent spikes in fertilizer prices, which were particularly acute in 2008, caused a substantial increase in operating costs for North Dakota's farmers, as well as farmers across the nation. The availability of additional ammonia supply in the market (in this case, derived from lignite) would lower the prices of fertilizers in the regional markets.

Total Value-Add. In general, through its value-added processing of lignite coal, a Charfuel® Coal Refining Plant can convert $12/ton raw lignite into more than $200/ton of marketable co-products.

Creation of Export Markets for North Dakota Lignite / Lignite-Derived Products

Because of the range of high-value co-products produced by the Charfuel® Coal Refining Process (described above), a Charfuel® Coal Refining Plant located in North Dakota would mean that North Dakota lignite-derived products would no longer be limited primarily to mine-mouth applications, and could thus be exported out of state. All of the co-products of the Charfuel® Coal Refining Process are of high enough value that they can absorb the costs of transport and handling to reach destination delivery points well outside the state borders, in some cases even outside of North America.

Through the char material that is produced in the Charfuel® Coal Refining Process, lignite could compete effectively with Powder River Basin ("PBR") coal as a blending feedstock, a common application for which PRB coal is shipped across the nation.

Expansion of North Dakota's Total Energy Exports

By expanding the use of North Dakota lignite beyond traditional mine-mouth pulverized coal power plant applications into the production of a range of high-value energy co-products, North Dakota's total energy exports, in terms of both revenues and volumes, will increase substantially if a Charfuel® Coal Refining Plant is located in the state.

Improvement in Air Quality for the State & Region

A Charfuel® Coal Refining Plant located in North Dakota would build upon North Dakota's tradition of environmental stewardship, and simultaneously address the concerns of new federal legislation and regulations that will affect the way lignite has traditionally been used. Not only does the Charfuel® Coal Refining Process "strip" substantially all pollutants from the coal during the Charfuel® Coal Refining Process and release no harmful emissions into the atmosphere (including CO_2, mercury and sulfur), power plants that would utilize the char material from a Charfuel® Coal Refining Plant as a blending fuel would see a reduction in their own mercury and sulfur-related emissions. Circulating fluidized bed power plants and IGCC power plants would experience an even greater reduction in emissions relative to using raw coal, because they could use 100% char feedstock, which is essentially pollutant-free. As a result, the need for expensive back-end scrubbers at power plants is reduced.

Industry Growth without Water Consumption

In the coal-producing western counties in North Dakota, water is a relatively scarce resource, and more and more water is being used for oil production in the state's massive Bakken formation. As such, water consumption is significant concern related to new industrial developments that propose to use large amounts of process water. In contrast, the Charfuel® process uses substantially no process water; it utilizes the moisture in the coal itself. Therefore, particularly in relation to other processes for

converting coal into liquid fuels (e.g., Fischer-Tropsch), a Charfuel® Coal Refining Plant located in North Dakota would not have a significant impact on the state's rivers, lakes or aquifers.

Job Creation & Job Preservation in the Lignite Industry

The Lignite Energy Council reports that the current lignite industry generates over 17,000 direct and indirect jobs for North Dakota. Because each Charfuel® Coal Refining Plant located in North Dakota would expand consumption of North Dakota lignite by close to 10%, this would represent at least several hundred additional jobs in the lignite industry itself. Moreover, by diversifying the applications for lignite, the Charfuel® process would provide for preservation of existing jobs in the lignite industry.

Economic Development & Job Creation in North Dakota

The lignite industry has been one of the most stable and prosperous industries in North Dakota for decades, accounting for more than $1 billion in annual business volume. By contributing substantially to the preservation and expansion of North Dakota's lignite industry, a Charfuel® Coal Refining Plant located in North Dakota would bolster this important industry and help sustain its major economic impact in North Dakota. Importantly, a Charfuel® Coal Refining Plant(s) in North Dakota would help diversify the lignite industry, which has historically been reliant primarily on pulverized coal power plants, which are facing increasingly stringent regulatory and legislative threats, especially at the federal level.

In addition to the overall economic impacts described above, each Charfuel® Coal Refining Plant located in North Dakota is expected to generate several hundred stable, well-paying, long-term direct and indirect jobs. Such jobs would be at the Charfuel® refinery itself (executives, engineers, operators, etc.), at the mining company providing the lignite feedstock, and at numerous support industry companies (engineering firms, service providers, professionals, contract maintenance, etc.). In addition, several hundred construction-related jobs would be generated during a Charfuel® Coal Refining Plant's construction period.

The range of co-products generated by a Charfuel® Coal Refining Plant may also spur the development of new businesses in the nearby region. For example, the production of large amounts of

ammonia at a Charfuel® Coal Refining Plant could bring additional private investment to build and operate new fertilizer production facilities, which would, in turn, serve North Dakota's large agriculture industry with more competitively priced fertilizers. In the event that the large amount of char material (gasification feedstock) produced by a Charfuel® Coal Refining Plant would help bring an integrated gasification combined cycle (IGCC) power plant to the state, this would create even greater job growth, industrial development, and wealth creation in the region.

Significant Expansion of Tax Revenue for North Dakota & Coal-Producing Counties

The lignite industry provides the State of North Dakota with a sizable and stable base of tax revenues, contributing to the general welfare of the entire state and its residents. Currently, the lignite industry generates about $65 million in annual tax revenue for North Dakota overall. Assuming a linear expansion of these tax revenues in proportion to the amount of coal produced and consumed in North Dakota, a Charfuel® Coal Refining Plant would generate approximately $6 million per year of additional tax revenues for North Dakota (by expanding the lignite industry by nearly 10%). This impact would be achieved at both the state and county levels (for coal-producing counties). Over the course of each Charfuel® Coal Refining Plant's lifecycle (expected to be at least 40 years), total increased tax revenues for North Dakota would be nearly $250 million.

Near-Term Commercialization & Attraction of Private Capital Investment

Carbon Fuels believes the probability of near-term commercialization of the Charfuel® Coal Refining Process is high. Already in other regions of the U.S., a large oil refining company, a large power generator, one of the largest users of jet fuel in the world, and a number of other large entities in relevant industries are advancing discussions to commercialize the Charfuel® Coal Refining Process using different types of coal. The fact that the Charfuel® Coal Refining Process uses stable domestic coal as a feedstock to produce petroleum-like products has stirred substantial commercial interest in the Charfuel® Coal Refining Process. This level of interest from industry at very high levels is evidence of the probability that the Charfuel® Coal Refining Process will soon be applied at a commercial scale. The

results obtained from a grant for the proposed Project would accelerate this, and may lead to the first commercial Charfuel® Coal Refining Plant being built in North Dakota.

The economics of a Charfuel® Coal Refining Plant are exceptionally profitable under most conceivable commodity markets pricing scenarios, including where commodities prices stand today (Spring 2009), and even far lower. This is due in large part to the Charfuel® process' low-cost feedstock (coal); relatively low capital cost; and high BTU-conversion efficiency. Such profitability is attractive to wide range of large energy investment funds and operating companies in the Energy industry. Carbon Fuels already has indications from large energy-oriented private equity investment funds and several large companies in the energy industry that they would have a high level of interest in providing capital to construct a specific Charfuel® Coal Refining Plant(s) after the completion of the proposed Project and the development of bankable engineering documents, and once sites have been selected. Several potential joint venture partners (large energy companies) have indicated a similar level of interest. Therefore, Carbon Fuels has a high degree of confidence that a proposed Charfuel® Coal Refining Plant(s) in the state of North Dakota would draw significant private industry capital once the proposed demonstration Project with North Dakota lignite has been completed. Developing long-term coal supply agreements and co-product off-take agreements with large commercial entities in North Dakota would enhance this.

Complementary Economic Benefits for Existing Energy Industries in North Dakota

The utilization of North Dakota lignite via the Charfuel® Coal Refining Process at a commercial scale is a unique opportunity to simultaneously benefit four of North Dakota's largest and most important industries: 1) Lignite Mining; 2) Refining; 3) Power Generation; and 4) Oil Production. A Charfuel® Coal Refining Plant located in North Dakota would not compete with, but, rather, would *enhance* the businesses of these industries that are already prominent in North Dakota. North Dakota lignite mining companies would have substantially expanded demand for their coal. Tesoro's Mandan refinery would have a stably-priced, ultra-clean additional naphtha feedstock source for its refining operations, which would likely increase its profit margins. Generators of coal-fired power in North Dakota would have a clean, pollutant-free "booster" fuel (char) to blend for their existing standard boilers (or to use without

blending in circulating fluidized beds or eventual IGCC plants). Oil producers and mineral rights owners would benefit from having a nearby source of industrial-grade CO_2 to utilize for stimulating production of declining oil wells.

Maintain North Dakota's Leadership in Energy Innovation

Much like North Dakota has been a national and global leader in constructing and operating one of the world's largest coal gasification plants and one of the world's largest carbon capture and sequestration facilities, North Dakota could remain a coal technology leader by having the world's first commercial-scale Charfuel® plant constructed within its borders. The likelihood of this would be greatly enhanced by the State's support of the proposed Project.

Achievement of Goals in Governor Hoeven's "Empower North Dakota" Strategic Plan

Governor John Hoeven and his staff/advisors recently developed a comprehensive strategic energy plan for the State of North Dakota entitled "Empower North Dakota." By enabling the development of a commercial-scale Charfuel® Coal Refining Plant in North Dakota, the Project will advance several of the key objectives of the "Empower North Dakota" plan:

1. *Construction of a coal-to-liquid-fuels plant in North Dakota*
2. *At least one new clean coal power plant in North Dakota* (possibly an IGCC, which can use char)
3. *CO_2 capture & sequestration* (a Charfuel® Coal Refining Plant captures all CO_2 produced and sells it for enhanced oil recovery (EOR))
4. *Combined-use energy parks* (a Charfuel® Coal Refining Plant optimally co-locates with an oil refinery or a power plant)
5. *Exceed North Dakota's historic peak oil production* (CO_2 from a Charfuel® Coal Refining Plant used for EOR will stimulate declining wells)
6. *New technologies promoting new partnerships* (Charfuel® technology inherently spurs new partnerships with coal mining companies, oil refineries, power plants, etc.)

Substantial Advancement of North Dakota's Clean Coal Energy Initiatives

A Charfuel® Coal Refining Plant located in North Dakota would, itself, be considered the cleanest coal energy project in the state of North Dakota to date, since it releases substantially no harmful emissions into the atmosphere. In addition, one of the most likely possibilities for North Dakota to have an advanced clean coal power plant within its borders (as called for in Governor Hoeven's "Empower North Dakota" plan) is the development of an integrated gasification combined cycle (IGCC) power plant. The char material produced by a Charfuel® Coal Refining Plant is an ideal feedstock for an IGCC power plant. As a result, the presence of a Charfuel® Coal Refining Plant in North Dakota would likely attract interest from the power industry to co-locate an IGCC or other type of clean coal power plant near the Charfuel® Coal Refining Plant. Such facilities could also be developed simultaneously with proper planning and coordination between the projects.

Reduced Need to Import Non-Lignite Coals for Blending

Some lignite-fired power plants around the country require blending of the lignite with a higher rank of coal (such as Powder River Basin coal) in order for their boilers to perform optimally. The char boiler fuel produced in a Charfuel® Coal Refining Plant, which is a booster fuel for blending with raw coal, would mitigate or eliminate the need to import out-of-state coals. Not only would this benefit North Dakota's lignite producers, it would also benefit North Dakota's rate-payers who ultimately pay the price of importing non-lignite coals from out of state. Additionally, it is possible that North Dakota could export some of the char produced by a Charfuel® Coal Refining Plant(s) in North Dakota to other states whose power plants require "booster" fuels.

Enhanced Oil Production in North Dakota

A Charfuel® Coal Refining Plant located in North Dakota would provide the state's oil producers with a nearby source of industrial-grade CO_2 to utilize for enhanced oil recovery (EOR) to get greater production from existing/declining wells. While carbon dioxide is widely cited as a greenhouse gas, there is an enormous distinction between CO_2 emitted into the atmosphere and that collected as an industrial-

grade product for use in EOR. Studies have shown that conventional oil recovery yields only 10% of a typical reserve, while methods such as gas injection with CO_2 can recover another 30% to 40%.

Greater Availability of Diesel Fuel in North Dakota

Recently, North Dakota has suffered from periods of diesel fuel shortages, which can greatly harm industry and agriculture; and, ultimately, consumers. The Charfuel® Coal Refining Process is inherently flexible in terms of what mix of co-products can be produced at any given time from a particular type of feedstock. As a result, during periods when diesel (or other type of fuel product) is in short supply, a Charfuel® Coal Refining Plant located in North Dakota can respond by producing more diesel and less of another co-product until when and if such shortage subsides.

Less Price Volatility for Liquid Fuels in North Dakota

The high volatility of prices for fuels derived from crude oil has a damaging effect for consumers and for industry. The source of such fuel price volatility is the volatility of the crude oil itself (not the refining). Therefore, utilizing a stably priced feedstock like coal under long-term supply agreements will have the effect of mitigating fuel price volatility for consumers and industry in North Dakota.

Management

The overall Project will be managed by Lee G. Meyer, principal investigator. Mr. Meyer has been a practicing chemical engineer, holds an MBA, as well as a MS in Technology Management, and is a lawyer and a licensed patent attorney. He has refinery and coal company experience, both on the technical side and the financial management side. In addition, Mr. Meyer is an inventor of the Charfuel® Coal Refining Process and a founder of Carbon Fuels. Mr. Meyer has managed the development of the Charfuel® Coal Refining Process, as well as overseen the numerous engineering studies, DOE grants, as well as the design, fabrication, construction, and operation of the 18 tpd Charfuel® Demonstration Facility. Mr. Meyer will be responsible for all contract activities and approve finalized engineering documents and financial reports to the commission.

The POX operation, as well as the design, has been the work of Dr. Paul Papas, who will be responsible for overseeing and managing all of the work associated with the POX unit and the interface with the reactor. In addition, Dr. Papas will act as the senior process engineer on the project.

Mr. Cliff Farris, a petroleum design engineer of 30 years experience, has been instrumental in the thermodynamics of the reactor/coal interface and will be responsible for managing the modification and design of the system to handle lignite, including the temperature profile within the reactor, as well as the quench timing and sequencing.

Dr. Persichetti, who has 20 years experience in computer modeling of hydrocarbon systems including refineries, has been instrumental in the design and operation of computer modeling of the operations of the 18 tpd Charfuel® Demonstration Facility. He will oversee and actually perform the computer simulation of the 18 tpd Charfuel® Demonstration Facility modifications to assure proper modifications and modular interface between components for the proper processing of North Dakota lignite.

Dr. Stanley Harding, who has been involved with sampling systems and analysis of coal liquids and gases for the majority of his career, designed the sampling system in use at the 18 tpd Charfuel

Demonstration Facility. Dr. Harding will oversee and operate the sampling system, as well as being responsible for interface with third party analytical labs and reports.

Mr. Eric Altman will manage and oversee the financial and fiscal aspects of the Project, as well as generate economic evaluations based upon the final analysis for the pre-Front End Engineering Design package. He will maintain Project books and generate periodic financial reports. Mr. Altman has been involved with Carbon Fuels and its operations for 6 years.

Mr. Rick Kenney, senior VP, of Hazen Research, who has led Hazen Research's efforts in the design, construction and operation of the 18 tpd Charfuel® Demonstration Facility, will oversee Hazen Research's involvement in the Project.

Mr. Rick Houston, a chemical engineer, who has been involved with Carbon Fuels for 15 years and is now employed by Hazen Research, will be the operations Project manager. Mr. Houston, while at Stone & Webster engineering, conducted heat and material balances for the Charfuel® Coal Refining Process interface with other well known engineering companies, managed the "cold flow", DOE project, which confirmed numerous commercial aspects of the Charfuel® Coal Refining Process and wrote the initial test plan for the 18 tpd Charfuel® Demonstration Facility.

All of the above personnel, as well as Hazen Research operation technicians, have worked together to design, develop, construct, and successfully operate the 18 tpd Charfuel® Demonstration Facility over the past six years. They are a coordinated team of experience, skill and possess the legacy knowledge that is essential for the timely and on budget completion of this project. Carbon Fuels has managed these individuals previously in successful campaigns, with each party playing an active role to ensure the successful completion of the Project on schedule and on budget, while meeting project objectives.

The Project team will evaluate the objectives in Module #1 at the completion of each operative task and, again, after modeling of the modified 18 tpd Charfuel® Demonstration Facility. Critical design review will be undertaken prior to commencing operations. Subsequent to the once through operation and preliminary analysis of the gas samples, liquid and solid co-products, a second critical design review

will be undertaken with further computer modeling, if necessary, to assure proper configuration based upon empirical data. Likewise, after the recycle run and preliminary gas, solid, and liquid analysis are available, a third critical design review will be held, including modeling, if necessary, to assure that the modifications and P&ID modifications developed after the once through run are viable. Finally, after the preparation of the draft pre-Front End Engineering Design, a critical design and information review will be held to undertake the release of the final pre-Front End Engineering Design documents.

Timetable

This Project is scheduled to start on June 1, 2009 and will be completed by February 28, 2010. Interim reports will be completed within 30 days of the end of each Module. The following schedule allows for nine months for completion of the Project, but the Project Manager will look for ways to reduce time as the goal of Carbon Fuels is to complete this Project as quickly as possible in order to start the process of generating the FEED documents for a 500/2500 tpd Charfuel® Commercial Demonstration Facility to be located in North Dakota.

CARBON FUELS LLC

Timetable of Project Schedule for Refining of North Dakota lignite

Module / Task #	Description	Estimated length of time to Complete
Module #1	**Configuration of 18 TPD Pilot Facility; and generaton of procuedure manuals and test plan for project**	
Task #1	Project Support Services, Contract Administration and Project Management	16 Weeks
Task #2	Configure 18 tpd Demonstration Facility Design for Lignite	6 Weeks
Task #3	Generation of final piping and instrumentation diagrams (P&IDs) for running North Dakota lignite	3 Weeks
Task #4	Generation of the design reference project document	2 Weeks
Task #5	Generate test plan	2 Weeks
Task #6	Sample and analysis protocol for North Dakota lignite	2 Weeks
Task #7	Mechanical design and modification drawing	6 Weeks
Task #8	Procurement, piping and instrumentation & controls	10 Weeks
Task #9	Design and Safety Review and Training	2 Weeks
Module #2	**Commission and Operate the 18 TPD Pilot Facility for two runs; and Pre-Dry the feed stock**	
Task #1	Project Support Services, Contract Administration and Project Management	8 Weeks
Task #2	Coal Preparation System and Coal Feed System Assembly	1 Week
Task #3	System Checkouts and Preliminary Shakedown	5 Weeks
Task #4	Coal Pre Drying	2 Weeks
Task #5	Coal Procurement and Preparation	3 Weeks
Task #6	Hot Run Operations (Once Through)	2 Weeks
Task #7	Modifications for Oil Recycle	2 Weeks
Task #8	Operations with Oil Recycle	2 Weeks
Task #9	Decommissioning and Material Disposition	1 Week
Module #3	**Analysis of Data, Char, Process Stream Gasses and Liquid Samples**	
Task #1	Project Support Services, Contract Administration and Project Management	4 Weeks
Task #2	Gas Sample Analysis	2 Weeks
Task #3	Liquid Sample Analysis	2 Weeks
Task #4	Char Sample Analysis	2 Weeks
Task #5	Data Assembly	2 Weeks
Module #4	**Generation of the pre - Front End Engineering Design Document for the collocated 500/2500 TPD Demonstration Commercial Scale Facility**	
Task #1	Project Support Services, Contract Administration and Project Management	8 Weeks
Task #2	Data Analysis & System Requirements(Once thru &	3 Weeks
Task #3	Charfuel® System Requirements from Gas Sample (Once thru & Recycle)	3 Weeks
Task #4	Charfuel® System Requirements and petroleum refinery specifications of liquid samples (Once thru &	3 Weeks
Task #5	Charfuel® System Requirements and combustor specifications of char (Once thru & Recycle)	3 Weeks
Task #6	Proforma Economic Study	4 Weeks
Task #7	Draft Report	4 Weeks
Task #8	Final Report	2 Weeks

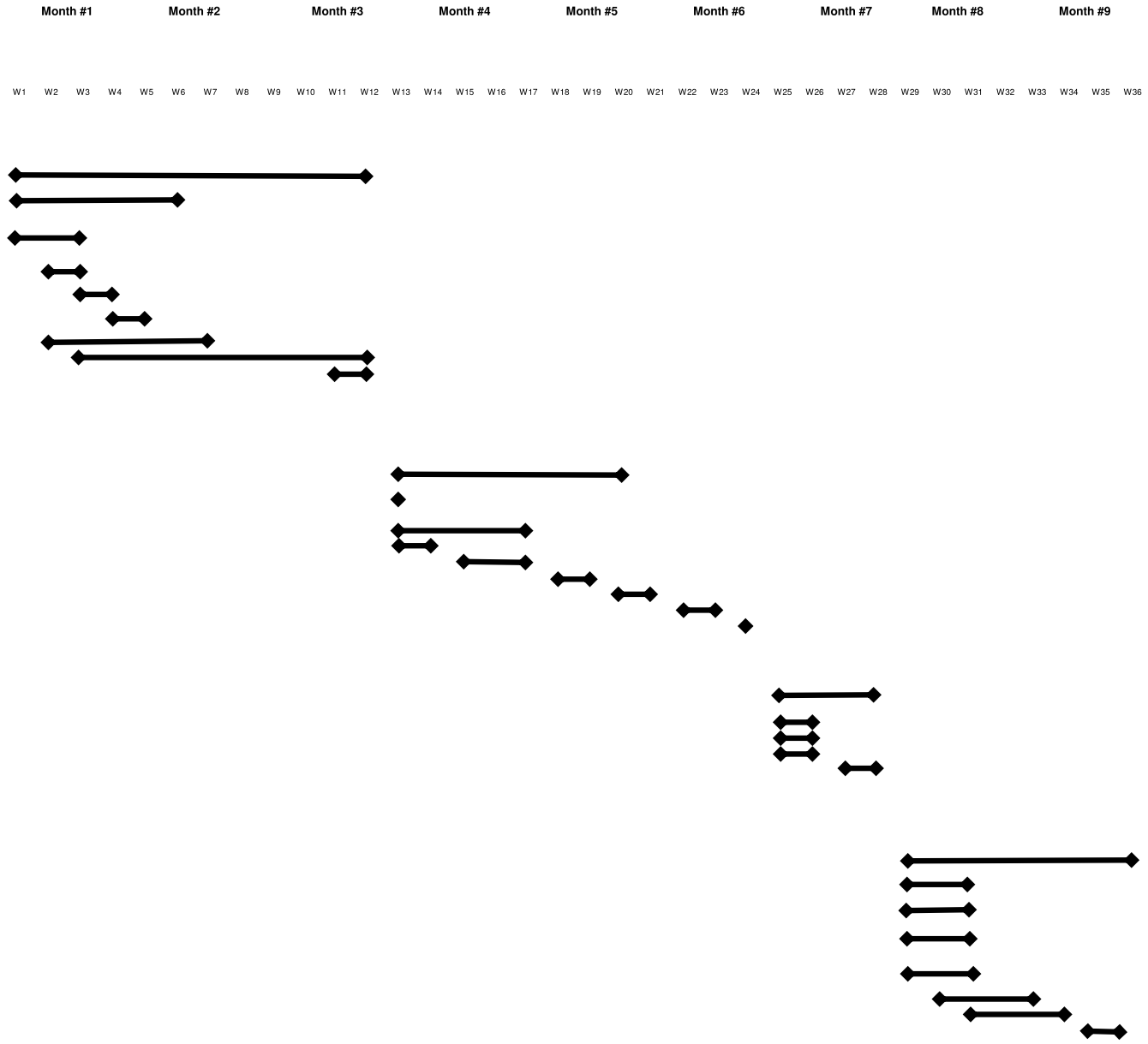


Figure 5: Schedule for "Refining of North Dakota Lignite" Project

Budget

Figure 6 is a summary of the Project budget. As shown, the total budget for the Project is $2,986,343. This includes equipment & materials purchases and use fees, engineering time, consultant time, contractors, plant labor costs, data analysis, project management, and reporting. This Project is a technology demonstration project for demonstrating the viability of North Dakota lignite as a feedstock, and, therefore, its return on investment will result from the subsequent development of a commercial-scale Charfuel® facility(s) to be located in North Dakota, which will be supported by the findings of the Project. This Project is being undertaken with the intention of verifying material balances and determining optimal operating conditions to develop a pre-Front End Engineering Design (pre-FEED) package to develop full Front End Engineering Design (FEED) documents for the design of a 500/2500 tpd Charfuel® Commercial Demonstration Facility in North Dakota to refine North Dakota lignite coal. The commercialization of this technology for North Dakota lignite will significantly improve the demand of North Dakota lignite, address significant environmental issues, create jobs and increase tax revenues, and provide North Dakota with a stable and domestic source for transportation fuels, petrochemicals, fertilizer, and clean boiler/gasification fuel for electricity production. The payback for this project will come from the construction and operation of a commercial-scale Charfuel® Coal Refining Plant(s) in North Dakota, which will increase the demand for North Dakota lignite and generate well-paying, stable jobs at the Charfuel® Coal Refining Plant, plus construction jobs, engineering jobs and mining jobs. It will also decrease North Dakota's need to import feedstock for creating electricity and transportation and heating fuels, and will increase North Dakota's ability to export electricity and transportation and heating fuels. The North Dakota Industrial Commission's participation in this Project is critical for the timely deployment of a commercial Charfuel® Coal Refining facility in North Dakota.

CARBON FUELS LLC

Itemized Budget of the Project Costs for Refining of North Dakota lignite

MODULE / TASK #	DESCRIPTION	CAPITAL COSTS	DIRECT OPERATING COSTS (including salaries)	INDIRECT COSTS	SUMMARY TOTALS
Module #1	**Configuration of 18 TPD Pilot Facility; and generaton of procuedure manuals and test plan for project**				
Task #1	Project Support Services, Contract Administration and Project Management	-	-	131,228	131,228
Task #2	Configure 18 tpd Demonstration Facility Design for Lignite	26,896	-	-	26,896
Task #3	Generation of final piping and instrumentation diagrams (P&IDs) for running North Dakota lignite	29,088	-	-	29,088
Task #4	Generation of the design reference project document	4,952	-	-	4,952
Task #5	Generate test plan	10,496	-	-	10,496
Task #6	Sample and analysis protocol for North Dakota lignite	528	-	-	528
Task #7	Mechanical design and modification drawing	9,744	-	-	9,744
Task #8	Procurement, piping and instrumentation & controls	1,385,000	-	-	1,385,000
Task #9	Design and Safety Review and Training	38,280	-	-	38,280
Sub-Total		**1,504,984**	**-**	**131,228**	**1,636,212**
Module #2	**Commission and Operate the 18 TPD Pilot Facility for two runs; and Pre-Dry the feed stock**				
Task #1	Project Support Services, Contract Administration and Project Management	-	-	123,081	123,081
Task #2	Coal Preparation System and Coal Feed System Assembly	24,000	-	-	24,000
Task #3	System Checkouts and Preliminary Shakedown	-	118,336	-	118,336
Task #4	Coal Pre Drying	-	4,500	-	4,500
Task #5	Coal Procurement and Preparation	-	19,780	-	19,780
Task #6	Hot Run Operations (Once Through)	-	395,892	-	395,892
Task #7	Modifications for Oil Recycle	-	21,644	-	21,644
Task #8	Operations with Oil Recycle	-	405,072	-	405,072
Task #9	Decommissioning and Material Disposition	-	17,090	-	17,090
Sub-Total		**24,000**	**982,314**	**123,081**	**1,129,395**
Module #3	**Analysis of Data, Char, Process Stream Gasses and Liquid Samples**				
Task #1	Project Support Services, Contract Administration and Project Management	-	-	7,008	7,008
Task #2	Gas Sample Analysis	-	21,056	-	21,056
Task #3	Liquid Sample Analysis	-	21,056	-	21,056
Task #4	Char Sample Analysis	-	5,000	-	5,000
Task #5	Data Assembly	-	2,856	-	2,856
Sub-Total		**-**	**49,968**	**7,008**	**56,976**
Module #4	**Generation of the pre - Front End Engineering Design Document for the collocated 500/2500 TPD Demonstration Commercial Scale Facility**				
Task #1	Project Support Services, Contract Administration and Project Management	**-**	**-**	8,160	8,160
Task #2	Data Analysis & System Requirements(Once thru & Recycle)	**-**	15,508	**-**	15,508
Task #3	Charfuel® System Requirements from Gas Sample (Once thru & Recycle)	**-**	15,060	**-**	15,060
Task #4	Charfuel® System Requirements and petroleum refinery specifications of liquid samples (Once thru	**-**	15,280	**-**	15,280
Task #5	Charfuel® System Requirements and combustor specifications of char (Once thru & Recycle)	**-**	10,000	**-**	10,000
Task #6	Proforma Economic Study	**-**	11,760	**-**	11,760
Task #7	Draft Report	**-**	68,000	**-**	68,000
Task #8	Final Report	**-**	19,992	**-**	19,992
Sub-Total		**-**	**155,600**	**8,160**	**163,760**
SUMMARY TOTALS		**1,528,984**	**1,187,882**	**269,477**	**2,986,343**

Figure 6: Itemized Budget of Costs for "Refining of North Dakota Lignite" Project

Matching Funds

The following Figure 7 is a schedule of the tasks that will be funded by the Grant and by Carbon Fuels, in the form of cash as well as the "In-Kind Contribution" of the use of Carbon Fuels' existing 18 tpd Charfuel® Demonstration Facility that comprises over 15 years of effort and is the product of over $18M in engineering studies, data analysis, construction costs and operations costs. Note that, because substantial mechanical changes to the 18 tpd Charfuel® Demonstration Facility will be required in order to process and validate North Dakota lignite as a feedstock (due to lignite's high-volatiles and high-moisture content), no other coal feed stocks will be able to be tested while the Project is underway. Thus, Carbon Fuels is fully contributing its Charfuel® Demonstration Facility during the course of the Project.

In addition to the in-kind contribution of its 18 tpd Charfuel® Demonstration Facility, Carbon Fuels will contribute $988,672 of cash for the Project. As may be applicable, Carbon Fuels may include cash contributions from a number of pending strategic investors and joint venture partners in the Coal Mining and Oil Refining industries with whom Carbon Fuels is in discussions regarding potential investment in and co-development of one or more Charfuel® facility(s) in the United States.

CARBON FUELS LLC

Matching Funds Detail

MODULE / TASK #	DESCRIPTION	SUMMARY TOTALS	CF MATCHING FUNDS	CF CONTRIBUTION IN-KIND	NDIC GRANT
Module #1	**Configuration of 18 TPD Pilot Facility; and generaton of procuedure manuals and test plan for project**				
Task #1	Project Support Services, Contract Administration and Project Management	131,228	-	-	131,228
Task #2	Configure 18 tpd Demonstration Facility Design for Lignite	26,896	-	-	26,896
Task #3	Generation of final piping and instrumentation diagrams (P&IDs) for running North Dakota lignite	29,088	-	-	29,088
Task #4	Generation of the design reference project document	4,952	-	-	4,952
Task #5	Generate test plan	10,496	-	-	10,496
Task #6	Sample and analysis protocol for North Dakota lignite	528	-	-	528
Task #7	Mechanical design and modification drawing	9,744	-	-	9,744
Task #8	Procurement, piping and instrumentation & controls	1,385,000	716,339	-	668,662
Task #9	Design and Safety Review and Training	38,280	-	-	38,280
Sub-Total		**1,636,212**	**716,339**	**-**	**919,874**
Module #2	**Commission and Operate the 18 TPD Pilot Facility for two runs; and Pre-Dry the feed stock**				
Task #1	Project Support Services, Contract Administration and Project Management	123,081	61,541	-	61,541
Task #2	Coal Preparation System and Coal Feed System Assembly	24,000	12,000	-	12,000
Task #3	System Checkouts and Preliminary Shakedown	118,336	59,168	-	59,168
Task #4	Coal Pre Drying	4,500	-	4,500	-
Task #5	Coal Procurement and Preparation	19,780	9,890	-	9,890
Task #6	Hot Run Operations (Once Through)	395,892	-	250,000	145,892
Task #7	Modifications for Oil Recycle	21,644	10,822	-	10,822
Task #8	Operations with Oil Recycle	405,072	-	250,000	155,072
Task #9	Decommissioning and Material Disposition	17,090	8,545	-	8,545
Sub-Total		**1,129,395**	**161,966**	**504,500**	**462,930**
Module #3	**Analysis of Data, Char, Process Stream Gasses and Liquid Samples**				
Task #1	Project Support Services, Contract Administration and Project Management	7,008	3,504	-	3,504
Task #2	Gas Sample Analysis	21,056	10,528	-	10,528
Task #3	Liquid Sample Analysis	21,056	10,528	-	10,528
Task #4	Char Sample Analysis	5,000	2,500	-	2,500
Task #5	Data Assembly	2,856	1,428	-	1,428
Sub-Total		**56,976**	**28,488**	**-**	**28,488**
Module #4	**Generation of the pre - Front End Engineering Design Document for the collocated 500/2500 TPD Demonstration Commercial Scale Facility**				
Task #1	Project Support Services, Contract Administration and Project Management	8,160	4,080	-	4,080
Task #2	Data Analysis & System Requirements(Once thru &	15,508	7,754	-	7,754
Task #3	Charfuel® System Requirements from Gas Sample (Once thru & Recycle)	15,060	7,530	-	7,530
Task #4	Charfuel® System Requirements and petroleum refinery specifications of liquid samples (Once thru	15,280	7,640	-	7,640
Task #5	Charfuel® System Requirements and combustor specifications of char (Once thru & Recycle)	10,000	5,000	-	5,000
Task #6	Proforma Economic Study	11,760	5,880	-	5,880
Task #7	Draft Report	68,000	34,000	-	34,000
Task #8	Final Report	19,992	9,996	-	9,996
Sub-Total		**163,760**	**81,880**	**-**	**81,880**
SUMMARY TOTALS		**2,986,343**	**988,672**	**504,500**	**1,493,171**

Figure 7: Carbon Fuels LLC Matching Funds Detail

Tax Liability Affidavit

March 31, 2009

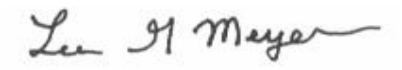
To Whom It May Concern:

Carbon Fuels, LLC does not have any outstanding tax liens or liabilities, and is current with all Federal and State tax reporting agencies.

If you have any questions, please contact me at 303-468-5700 or lee.meyer@carbonfuels.com.

Sincerely,

CARBONFUELS LLC



Lee G. Meyer, Manager

Appendices

Appendix A:

Hazen Letter about the 18 tpd Charfuel® Demonstration Facility Success & Process Scale-up

HAZEN RESEARCH, INC.

4601 Indiana Street • Golden, Colorado 80403 USA
Phone: (303) 279-4501 • Fax: (303) 278-1528
www.hazenresearch.com

March 23, 2009

E-mail and Mail Delivery

Mr. Lee Meyer
Carbon Fuels, LLC
3600 South Yosemite Street, Suite 360
Denver, CO 80237

Subject: Carbon Fuels Charfuel® Process Scaleup from 18 to 500 st/d
Hazen Project 10183

Dear Mr. Meyer:

Carbon Fuels, LLC has asked Hazen Research, Inc. to summarize our assessment and conclusion that scaling the 18-st/d pilot unit, currently located at the Hazen facility, supports the scaleup factor of a 500-st/d reactor planned for the next phase of the project. We understand that this information is requested to support the due diligence of investors in making an informed decision regarding the next steps in commercializing the Charfuel process.

Hazen has been in the business of developing processes for major industries for more than 47 years. We have helped our clients develop numerous innovative processes, many of which have become successful large-scale commercial operations. A typical development project at Hazen includes feedstock characterization, conceptual process flowsheet formulation, laboratory-scale studies to confirm basic process chemistry, bench-scale studies to provide some of the important process parameters (material handling properties of process streams, liquid–solid separation characteristics, etc.), and pilot-scale studies to gain operating information for the process and define process specifications. The pilot plant information may also include data on materials of construction, effects of recycle streams, and scaleup issues. In most cases, the development program provides the basis for completing a detailed design of a larger-scale demonstration plant or a commercial plant. For the mining or energy industries, the commercial plant may process many thousands or tens of thousands of tons of feedstock per day.

Simply stated, the Carbon Fuels Charfuel process converts (refines) coal to liquid fuels, chemicals, and synthesis gas. The coal feed and reactor systems are simple in concept, with fine coal being fed under pressure and by gravity into a reaction zone and material transfer through the reactor driven by gas flow, which is controlled by the system pressure drop. The reaction products are then quenched by nozzle flow

within the reactor to essentially stop the reaction. In this phase of the process there are no moving parts. Hazen has worked with Carbon Fuels in the development and demonstration of the Charfuel process since 2002. In support of this effort over the 7-yr period, Hazen has completed projects ranging from technical and economic assessments of the Charfuel process through design and operation of Stage 1 of the 18-st/d pilot plant. A list of the projects follows:

Hazen Project 9868:	Due Diligence Study of the Carbon Fuels Charfuel Coal Refining Process
Hazen Project 9919:	Carbon Fuels Process Development Program Phase I: 18-st/day Pilot Plant Design
Hazen Project 9976:	Macroeconomic Evaluation for the Carbon Fuels Coal Refinery Process
Hazen Project 10056:	Preparation for 18-st/d Pilot Plant
Hazen Project 10088:	Critical Path and Equipment Refurbishment Tasks for 18-st/d IPDU
Hazen Project 10183:	Carbon Fuels Pilot Plant
Hazen Project 10226:	Evaluation of the Economic Viability of Specific Collocation Scenarios for a Charfuel Commercial Facility

In the initial due diligence study (Project 9868), Hazen reviewed all prior technical information provided by Carbon Fuels, which included studies completed by Ford, Bacon & Davis, Ebasco Services, Morrison-Knudsen Engineers, and Stone and Webster Engineering Corporation. Based upon this prior technical information, Hazen determined that the scaleup from 18 to 500 st/d was supported by sound engineering data and analysis. Hazen's report[1] contained the following conclusions:

> "The studies reviewed by Hazen concluded that the operation of a 500-st/day demonstration unit was the next logical step in the process development. This would demonstrate the Charfuel process at a scale sufficiently large to verify the design of the HDP reactor and the coupling of this reactor with the POX unit." (page 9)

> "Although the [Charfuel] process will ultimately need to be demonstrated at a scale large enough to provide sufficient products for market tests (i.e. 500 st/day), many of the critical design questions can be answered at a much smaller, less-costly scale. A pilot-scale operation with a capacity of 10 to 25 st/day should be sufficient to identify and resolve process-related problems in integrating selected commercial and non-commercial process unit operations." (page 10)

In Project 9919, Hazen determined that a pilot plant was the next step required in developing the process and defined project objectives, including a critical review of the existing information on the 18-st/d pilot plant with refinement of the original design. As a result, Hazen proposed a phased program for the 18-st/d pilot plant in two stages. Stage 1 incorporated all unit operations in the critical front end of the process, excluding the gas conditioning and liquid recovery sections, which were judged to be more

[1]Gertenbach, Dennis D., et al. 2002. *Due diligence study of the carbon fuels Charfuel coal refining process.* Hazen Research, Inc. company report (Project 9868). May 17.

straightforward. In Stage 2, the gas conditioning and liquid recovery sections of the process would be added and the integrated pilot plant would then be operated to demonstrate the entire process with the exception of the gas recycle, which was determined to be impractical and unnecessary for the pilot plant. One of the key objectives of the 18-st/d pilot plant was to provide plant engineering and design information (process specifications) for use by a commercial engineering company in providing detailed designs for the scaled-up 500-st/d demonstration plant.

Under Hazen Projects 10056, 10088, and 10183, Hazen completed the final design of Stage 1 of the pilot plant; procured the required equipment, instrumentation, and supplies; fabricated the pilot plant, and completed the mechanical shakedown of all systems. The Stage 1 pilot plant was successfully operated and demonstrated the critical unit operations of the Charfuels process. Inspection of the inside of the HDP reactor revealed no significant wear, however the total operating time was limited. Erosion and other effects of the reactor walls will be better assessed in longer operating times and/or controlled wear tests. If wear is found to be present, it can be controlled by proper selection of the refractory lining material.

As part of the efforts under Project 10183, a top-level design of the entire (Stages 1 and 2) pilot plant was completed, including a process flow diagram; piping and instrumentation diagrams; heat and material balance modeling; process specifications; equipment, instrumentation, and supplies lists; and plot plans and elevation drawings for the pilot plant equipment and structures. Some of this work was subcontracted to VECO USA, Inc., a local engineering company. The gas separation step, which is practical on a commercial scale, is not feasible for the pilot plant and was determined not to be critical in proving the technology.

Project 9976 provided top-level economics (macroeconomic evaluation) for the operation of a 5,000-st/d commercial Charfuels facility. Project 10226 considered the economics of various scenarios in which a 500-st/d commercial demonstration Charfuel facility would be collocated with a utility, an oil refinery, or a steel mill. The issue of the proper scale factor for the next development after the pilot plant was addressed in the Project 10226 report.[2]

> "After reviewing the scaleup factors for engineering designs and the potential markets for products to be produced in the Charfuel demonstration facility, a production rate of 500 st/day as-received coal feed was selected for use in all of the scenarios. This size results in a scaleup factor of about 27, which is high, but not excessive, for a process demonstrating a green (uncommercialized) technology." (page 2)

Selecting an appropriate scaleup factor for moving a process from the pilot-plant scale to demonstration or commercial scale depends in large part on the status of the technology. Balancing the risk of a process failure at the commercial scale with development time and project costs also affects the decision. Certain unit operations in the Charfuel process (the hydrodisproportionation (HDP) reactor and the coal feed

[2]Reeves, Robert A., et al. 2005. *Evaluation of the economic viability of specific collocation scenarios for a Charfuel commercial facility.* Hazen Research, Inc. company report (Project 10226). May 17.

interface between the pressure oxidation (POX) reactor and the HDP reactor) represent new technology that is yet to be proven on commercial scale. However, the majority of the unit operations in the Charfuel process have been proven on a commercial scale. Previous engineering studies and Hazen's assessment have concluded that moving the technology from 18 to 500 st/d is reasonable.

Other factors to consider in the scaleup of the process technology are residence time and throughput, as well as the effects of these parameters on the size of process vessels and equipment. The Charfuel process is unique in this respect because of the high feed rates and relatively small size of the HDP reactor, the most critical unit operation in the process. The diameter of the reaction chamber in the HDP reactor for the 18-st/d pilot plant at Hazen is 2 in. In the 500-st/d reactor, the diameter increases only to about 10.5 in. Therefore, the increase in the size of the key component of the Charfuel process in scaling from 18 to 500 st/d is relatively small.

Please contact me if you have any questions or require further information.

Sincerely,

Charles W. (Rick) Kenney
Vice President

CWK/lmr

Appendix B:

Letters of Support from North Dakota Industry

TBS

Appendix C

Charfuel® Coal Refining Products

Appendix C: Charfuel® Coal Refining Products

The concept of refining crude oil, a hydrocarbon, to produce a slate of value-added refined products while simultaneously removing inherent pollutants such as sulfur and nitrogen was revolutionary a hundred years ago but today, is the norm. Coal, also a hydrocarbon, has not traditionally been used as a refinery feedstock because, as a solid, it is expensive and difficult to transport, burns unevenly and non-uniformly, and contains pollutants such as sulfur which harm the environment. However coal is our country's most abundant energy resource and now, using the Charfuel® Coal Refining Process, coal can be used in the same manner as oil to produce the identical value-added products while emitting no harmful environmental pollutants.

SYNGAS

Syngas is a combustible gas byproduct that is mainly composed of carbon monoxide, carbon dioxide, and hydrogen. It can be used as a power generation fuel as well as a chemical feedstock. Examples of syngas usage include natural gas steam reforming, liquid hydrocarbons to produce hydrogen, coal gasification, and synthetic petroleum for a fuel or lubricant.

CHAR

The hydrocracking process occurs as the carbonaceous particle heats up. Volatiles are released and char is produced resulting in high BTU char. The properties of the carbonaceous material determine the structure and composition of the char. The result is a clean gasifier or boiler fuel to be used for electricity generation at a coal fired power generation plant or a sweetener for pulverized coal to meet stringent environmental regulations. In addition, char is a direct substitute for metallurgical coke, which is a high-value input material for steelmaking and other industrial applications. Pricing for metallurgical coke in recent years has consistently exceeded $100 per ton.

AROMATIC LIQUIDS – BENZENE, TOLUENE, XYLENE (BTX)

Benzene (C_6H_6) is an aromatic hydrocarbon with a pungent, sweet odor composed of a minimum of one 6-carbon ring. Benzene is produced commercially as a solvent and a fuel additive in the rubber, insecticide, explosive, chemical, and pharmaceutical industries. Benzene is an important petrochemical for its industrial uses. Toluene is a derivative of Benzene as is Xylene, both of which can be used

independently for industry. The cost of BTX, and Benzene in particular, has risen dramatically since 2003.1 The sale of BTX provides a substantial portion of the revenue to the Charfuel® facility and fluctuations (including price increases) significantly affect the return on the Charfuel® facility investment.

NAPHTHA

Naphtha, a liquid hydrocarbon intermediate refining product, is used primarily as a feedstock for producing a high octane gasoline component via the catalytic reforming process. Naphtha is also used in the petrochemical industry for producing olefins in steam crackers and in the chemical industry for solvent applications.

ULTRA LOW SULFUR #4 FUEL OIL

When coal is hydrocracked, fuel oil is obtained as a distillate or residue. Fuel oil is generally any liquid petroleum product that is burned in a furnace or boiler for heating or in an engine for power. With this definition, diesel is a fuel oil which is used to heat residential and commercial space. It fuels trucks, ships, and some consumer vehicles. Diesel fuel is currently produced from petroleum, thereby amplifying the need for foreign oil imports. The Charfuel® Coal Refining Process produces equivalent syngas using domestic coal resources.

SULFUR

Sulfur (S) is an abundant, tasteless, odorless, multivalent, non-metal chemical element. Its commercial uses are primarily in fertilizers but it is also widely used in gunpowder, matches, insecticides, fireworks, and fungicides. Additionally, sulfur has many industrial uses. Through its major derivative, sulfuric acid (H_2SO_4), sulfur ranks as one of the most important industrial raw materials and is of high importance to every sector of the world's economies. Sulfuric acid production is the major end use for sulfur and consumption of sulfuric acid has been regarded as one of the best indices of a nation's industrial development. More sulfuric acid is produced in the United States every year than any other industrial chemical. Sulfur is also used in batteries, detergents, the vulcanization of rubber, fungicides, and in the manufacture of phosphate fertilizers. Sulfites are used to bleach paper and as a preservative

[1] Hazen Research, "Evaluation of the Economic Viability of Specific Collocation Scenarios for a Charfuel® Commercial Facility", May 17, 2005.

in wine and dried fruit. Sodium or ammonium thiosulfate is used as a photographic fixing agent. Magnesium sulfate, better known as Epsom salts, can be used as a laxative, a bath additive, an exfoliant, or a magnesium supplement for plants. Sulfur is used as the light-generating medium in the rare lighting fixtures known as sulfur lamps. Elemental sulfur crystals are commonly sought after by rock collectors for their brightly colored polyhedron shapes. Elemental sulfur is a chemical feedstock that can be sold.

AMMONIA

Ammonia (NH_3) is a compound that is normally encountered as a gas with a characteristic pungent odor. Ammonia used commercially is usually named anhydrous ammonia. Liquid ammonia is the best-known and most widely studied non-aqueous ionizing solvent. Its most conspicuous property is its ability to dissolve alkali metals to form highly colored, electrically conducting solutions containing solvated electrons. The main uses of ammonia are in the production of fertilizers, explosives, and synthesis of organo-nitrogen compounds. It is also the active ingredient in household glass cleaners.

METHANOL

Methanol (CH_3OH) is the simplest alcohol. It is a light, volatile, colorless, flammable, poisonous liquid with a distinctive odor that is somewhat milder and sweeter than ethanol (ethyl alcohol). It is used as an antifreeze, solvent, fuel, and as a denaturant for ethyl alcohol.

CO_2 RECOVERED

The enhanced oil recovery technique that is attracting the most new market interest is carbon dioxide enhanced oil recovery (CO_2)-EOR. First tried in 1972 in Scurry County, Texas, CO_2 injection has been used successfully throughout the Permian Basin of western Texas and eastern New Mexico and is now being pursued to a limited extent in Kansas, Mississippi, Wyoming, Oklahoma, Colorado, Utah, Montana, Alaska, and Pennsylvania. Until recently, most of the CO_2 used for enhanced oil recovery has come from naturally-occurring reservoirs. But new technologies, like the Charfuel® Coal Refining Process, are being developed to produce CO_2 from industrial applications such as natural gas processing, fertilizer, ethanol, and hydrogen plants in locations where naturally occurring reservoirs are not available. Undeveloped domestic oil resources still in the ground total 1,124 billion barrels. Of this

large in-place resource, 430 billon barrels are estimated to be technically recoverable. This resource includes undiscovered oil and "stranded" light oil amenable to CO_2 enhanced oil recovery (EOR) technologies. Using Charfuel® technology for CO_2 recovery increases the viability of U.S. domestic oil resources.

CARBON FUELS, LLC

3600 So. Yosemite Street, Suite 360
Denver, Colorado 80237
Phone: 303-468-5700
Fax: 303-468-5705
www.carbonfuels.com

Lee G. Meyer
(303) 667-4286
lee.meyer@carbonfuels.com

VIA E-MAIL

April 10, 2009

Mr. Jeff Burgess
Director of Research and Development
Lignite Energy Council
1016 E. Owens Avenue
P.O. Box 2277
Bismarck, ND 58502

Re: Errata to Carbon Fuels, LLC's application ("Application") for a Demonstration grant (dated March 31, 2009) under the NDIC/Lignite Research Council's Lignite Research, Development and Marketing Program; and responses to various e-mail questions by Mr. Jeff Burgess

Dear Jeff:

In accordance with our conversation yesterday morning, I have composed this clarification letter (sent to your attention), along with the attached Addendum A that specifically addresses your questions. Please include this letter and the attached addendum in the Carbon Fuels, LLC's Application.

First, I would like to correct a misstatement in our Application regarding the identity of North American Coal. Carbon Fuels inadvertently used the acronym "NACCO" to refer to North American Coal. This is inaccurate. Please replace "NACCO" with "North American Coal Corporation" in all places. Additionally, the drying facility referred to as belonging to North American Coal Corporation, actually belongs to Great River Energy. Therefore, all indications of North American Coal Corporation's ownership of the drying facility should be removed from the Application. The Application should also be amended to state that North American Coal Corporation is providing the coal for testing, pre-dried at their mine.

Second, it has been pointed out by others that in Phase 1, the objective is to "*determine commercial operating design criteria for the 500/2500 tpd Commercial Demonstration Plant"*, not to optimize the operating conditions for this particular lignite feedstock. We would like to make this change.

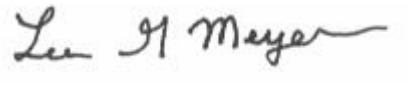
Third, it has also been pointed out that the tests to be performed on the feedstock and co-products have not been specified. In this regard, Module 1, Task 6, "Sample and Analysis Protocol for

North Dakota Lignite," should be amended to indicate that the protocol will include quantitative and qualitative characterizations, including, for example, Proximate; Ultimate; Heating Value; Volatile Content; Forms of Sulfur; Elemental Ash Analyses; Ash Fusion Temperature (oxidizing and reducing); Selected Trace Metals (Hg, As); and, Particle Size Distribution (pulverized coal feed and char). Other analyses will be completed, as the program proceeds and needs arise, particularly related to the char and its utilization. These additional tests and analyses may include physical handling properties (friability, angles of repose and reclaim, and dustiness), reactivity (self-heating potential and oxygen uptake), and surface characteristics (porosity, pore volume, and SEM analysis). Additionally, liquid product characterization will include standardized petroleum assays, including, for example, pH, aromatic content, trace metals, and the like. These tests will be developed with input from Tesoro.

Turning to the specific questions forwarded by you to my attention, the requested reports from Hazen Research, including Hazen 9868, 10226, and 9976, have been forwarded to you by Mr. Rick Kenney (with confidential information redacted) under separate cover.

Your other questions are specifically addressed in Addendum A attached hereto. If further questions remain please contact me.

Regards,



Carbon Fuels, LLC
Lee G. Meyer, Managing Director

ADDENDUM A

1.) With respect to your question regarding the 500/2500 tpd Commercial Demonstration Facility, the answer can be found on our website (www.carbonfuels.com), as you have acknowledged. This facility is the subject matter of the scale-up letter from Hazen, as well as the co-location scenario study (Hazen 10226). The proposed project includes defining design criteria for the 500 tpd portion of that facility. This facility would later be expanded to 2500 tpd, and thereafter to a full-scale 5000 tpd Commercial Plant.

2.) I believe, I already responded to your question regarding the 5000 tpd Commercial Plant input. Specifically, 5000 tpd refers to a moisture-ash-free feed, and is not run-of-mine coal tonnage.

3.) Regarding adequacy of 2 runs to determine design criteria, your question was, "*You indicate that approximately 20 tons of North Dakota lignite feed will be required for the entire campaign and the testing will involve two 6-7 hour tests of lignite. Is that enough to demonstrate the scale-up from 18 tpd test facility to the 500/2500 Charfuel Commercial Demonstration facility to be located in North Dakota?*"

Please remember that the residence time of the reactor is less than a second. Therefore, a six- or seven-hour run can process up to 10 tons of feed, which will provide a substantial amount of data, and is considerably more than standard pilot operations (especially when compared to batch processes). Thus, a large quantity of product (solid and liquid), as well as ample opportunity to take real-time gas samples, predicated upon variation in operating conditions is provided. Hazen has determined that these two planned runs would be more than adequate to provide the design criteria for a 500 tpd reactor facility to be co-located in North Dakota. Part of the reason for conducting this set of tests with lignite is to determine the suitability of this feedstock to the Carbon Fuels' process by varying reactor and operating conditions. As stated earlier, the objective is to determine commercial operating design criteria and verify heat and material balances, as well as characterize commercial grade products.

4.) Regarding the question about costs, you wrote, *"The budget indicates that the two 6-7 hour tests – Hot Run Operations (Module #2, Task #6) & Operations with Oil Recycle (Module #2, Task #8) – will cost $396,000 and $405,000, respectively. Can you explain why it costs this much for these two short-duration tests?*"

If you refer to the description of these two tasks in the Application, you will note that these runs require substantial operating preparation, which are included in these budget numbers. Even though, the actual runs are 6-7 hours, the entire operation takes several days. The facility is first gradually brought-up to operating temperature in several stages with hot POX gas in a flow-through mode to bring the whole system up to operating temperature. This can take up to 20 hours. The system then must be heat-soaked to assure stable operating temperatures. This requires substantial consumables (natural gas, oxygen, and nitrogen at a cost of over $72,000 per run). Next, the system is brought-up to pressure in stages. Pressure leaks and equipment verification are conducted at each stage to ensure accurate instrumentation, control, monitoring, sampling, and the like. Finally, at operating

temperature and pressure, the coal feed is started, and operations commenced. During the 6-7 hour run, samples are taken and the system's parameters varied to obtain data regarding yields. At the end of the run, the system is gradually cooled down, and mass samples (char and liquids) are collected. The system is then cleaned.

The estimated cost of these three budgetary components of the hot run: 1) System Check and Heat-Up; 2) Operations with Coal; and 3) Cool-Down, Inspection and System Cleaning are $50K, $67K, and $30K, respectively, which include labor and consumables. The run with recycled oil is slightly higher. In addition to the labor and consumables, Carbon Fuels will be making a $250K "In-Kind Contribution" for the use of the Carbon Fuels' existing 18 tpd Charfuel® Demonstration Facility, including wear and tear. Because substantial mechanical and operating changes to the 18 tpd Charfuel® Demonstration Facility will be required in order to process and validate North Dakota lignite as a feedstock (due to lignite's low rank, light-volatiles, and high-moisture content), no other coal feed stocks will be able to be tested in this configuration or while the Project is underway (including while the facility is being configured for lignite). Additionally, the facility will have to be re-modified to run other higher rank coals following the completion of the lignite Demonstration project. This re-modification cost is not being charged to this project.

5.) You next inquired about the procurement, piping, instrumentation and control budget. Specifically, you asked, *"The budget indicates that $1,385,000 will be dedicated to: 'procurement, piping, instrumentation & controls.' When I read Charles Kenney's letter included in your proposal, Mr. Kenney indicates that under Hazen projects 10056, 10088 and 10183, Hazen procured the required equipment, instrumentation, supplies, fabricated the pilot plant, and operated the 18 tpd Charfuel Demonstration Facility pilot plant, albeit operating time was limited. Please describe in more detail what piping, instrumentation & controls are needed as part of this project that aren't already in place as part of the existing 18 tpd Charfuel Demonstration Facility*."

The Hazen letter, to which you refer, related only to Stage 1 operation, which included coal preparation, coal feed, the POX reactor, HDP reactor, char separation, and flaring of the product stream after sampling. Once Stage 1 was complete, a complete analysis of the process and equipment was undertaken, including computer modeling of the equipment and process operation. To provide plant engineering and design information (process specifications) for use by a commercial engineering company in providing detailed designs for the scale-up to the 500 tpd Demonstration Plant, we needed to add the more straightforward gas conditioning and liquid recovery sections of the process to yield the complete integrated demonstration facility. Over a million dollars in equipment and modifications, including a brand new instrumentation and control system, was added to the 18 tpd Demonstration Facility since Stage 1. Modification to the existing 18 tpd Charfuel® Demonstration Facility in order to process lignite coal must be undertaken for the project. The specific components that will need to be configured and/or reconfigured on the 18 tpd facility for this project are:

Instrumentation & Controls	$105K

ADDENDUM A
CARBON FUELS, LLC

Process Equipment & Installation	$200K
Piping & Installation	$600K (matching cash contribution by Carbon Fuels)
Piping Insulation & Installation	$150K
Sampling System modification	$40K
System modification (coal feed, instrumentation)	$200K
Quench Nozzle System Modification	$60K
Control Valve Modifications	$30K