LIGNITE ENERGY COUNCIL

JOHN W. DWYER, *President*

MEMORANDUM

Date: December 16, 1992

From: Clifford R. Porter

To: North Dakota Industrial Commission
Governor, Ed Schafer
Attorney General, Nicholas J. Spaeth
Attorney General-Elect, Heidi Heitkamp
Commissioner of Agriculture, Sarah Vogel

Subject: Clean Coal ~~Technology V Proposals from~~ North Dakota: ~~IGPFB Project Milton R. Young Unit 3 submitted by~~ BNI and Liquid Transportation Fuels submitted by DGC

I have completed a preliminary review of the two proposals submitted to the United States Department of Energy (DOE) under the Clean Coal Technology Program Round V solicitation. These two proposals were approved by the Industrial Commission for funding under the Lignite Research Fund, subject to certain conditions of funding, review and award by DOE.

During the process of preparing the proposals for the DOE, each of these two projects escalated in total project cost. The total cost of these two projects, as submitted to the DOE and as estimated in the proposals submitted to the Industrial Commission, are summarized as follows:

PROJECT TITLE	INTEGRATED GASIFICATION PRESSURIZED FLUIDIZED-BED(IGPFB) DEMONSTRATION PROJECT
PROJECT TEAM	BNI COAL, LTD., BABCOCK & WILCOX, MINNESOTA POWER
PROJECT COSTS	$425,850,506 AS SUBMITTED TO DOE ON 12/7/92 $330,000,000 AS SUBMITTED TO INDUSTRIAL COMMISSION ON 10/1/92 $95,850,506 ESCALATION
STATE COMMITMENT	$19,000,000 REMAINS UNCHANGED

P.O. BOX 2277, SUITE 200
1016 E. OWENS AVENUE
BISMARCK, ND 58502
TEL. (701) 258-7117
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PROJECT TITLE	PRODUCTION OF LIQUID TRANSPORTATION FUELS AT THE GREAT PLAINS PLANT
PROJECT TEAM	DAKOTA GASIFICATION COMPANY
PROJECT COSTS	$394,298,586 AS SUBMITTED TO DOE ON 12/7/92 $202,000,000 AS SUBMITTED TO INDUSTRIAL COMMISSION ON 10/25/92 $192,276,586 ESCALATION
STATE COMMITMENT	$15,000,000 REMAINS UNCHANGED

Review of these projects, the recommendation of the Lignite Research Council, and approval by the Industrial Commission was specified "in an amount not to exceed" for each project. Therefore, the State share on these projects has not changed. An escalation in total project cost, as a result of the more detailed engineering and cost estimations required for the DOE proposal, is not surprising. I am in the process of reviewing each of the proposals to DOE in more detail and will be preparing additional updated information.

The primary cause for the escalation of the IGPFB project is related to increased equipment cost for the gasifier section of the plant. The escalation in costs for the Liquid Transportation Fuels project at DGC is due to increased estimates for design engineering and increased feedstock costs.

The projected new coal production from BNI's Center mine for the IGPFB project as submitted to DOE is 622,051 tons per year. This production rate is from coal to electric power generation and assumes the high net cycle efficiency and a projected availability factor of 85%. The 622,051 tons per year estimate does not include any new production for the manufacturing of char. The estimated combined production of electricity and char from the Center Mine is 1,000,000 tons per year.

The attached summary sheet represents the most current estimates and updated information available on the projects. If the projects are selected and move toward demonstration and operation, it is reasonable to assume that project costs and operational factors will be updated further.

CRP/sb
Enclosures

cc: Karlene Fine

Great Plains SYNFUELS
DAKOTA GASIFICATION COMPANY
1600 East Interstate Avenue
Bismarck, ND 58501-0561 (701) 221-4400

October 23, 1992

Ms. Karlene Fine, Secretary
Office of the Industrial Commission
State of North Dakota
State Capitol
Bismarck, North Dakota 58505-0001

Dear Karlene:

Dakota Gasification Company (DGC) hereby submits the attached application for financial assistance in the cost of preparing a proposal to the Department of Energy (DOE) for Round V funding of the Clean Coal Technology Program (CCT-V). As you know, the Industrial Commission has approved funding up to $150,000 per applicant to assist in the cost of preparing a proposal.

Our proposal is entitled "Production of Liquid Transportation Fuels from Lignite at the Great Plains Synfuels Plant" and is based on feeding synthesis gas to a slurry Fischer-Tropsch reactor. Such fuels are environmentally desirable because they contain neither sulfur or aromatics. Although acceptance of this project by DOE would not immediately result in increased lignite consumption, commercial demonstration of this technology could result in a major new market for our lignite. Near-term benefits would mean increased plant job opportunities as well as a large number of jobs during the construction phase. Other economic benefits would also occur.

We are enclosing 35 copies of the report for your distribution to the Lignite Research Council members and to Clifford Porter, Lignite Energy Council Research and Development Director, for submittal for peer review.

If you have any questions or comments, please feel free to contact me.

Sincerely,

Kent E. Janssen

Kent E. Janssen
Vice President and
Chief Operating Officer

KEJ/DCP/dtg
Enc.
cc: John Dwyer

2.0 TITLE

PREPARATION OF CCT-V PROPOSAL TO THE U.S. DOE FOR A DAKOTA GASIFICATION COMPANY PRODUCTION OF LIQUID TRANSPORTATION FUELS FROM LIGNITE PROJECT AT THE GREAT PLAINS SYNFUELS PLANT.

Applicant:	Dakota Gasification Company Bismarck, ND
Principal Investigators:	Donald C. Pollock, Project Development Manager[1] Samuel Tam, Project Manager, Bechtel[2]
	1. 1600 E. Interstate Avenue Bismarck, ND 58501
	2. 50 Beale Street San Francisco, CA 94105-1895
Date:	October 25, 1992
Amount of Request:	$150,000

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Appendices

4.0 ABSTRACT

4.1 INTRODUCTION

Dakota Gasification Company (DGC) plans to submit a proposal entitled "Production of Liquid Transportation Fuels from Lignite at the Great Plains Synfuels Plant" to the U.S. Department of Energy (DOE) in response to Clean Coal Technology Program Round V (CCT-V) PON No. DE-PS01-92FE62647. This application to the Lignite Research Council requests $150,000 toward the cost of preparing the CCT-V proposal.

The U.S. DOE must approve DGC's proposal for the CCT-V demonstration project before contract negotiations commence. Negotiations with DOE for those projects which are selected will take six months to one year after DOE announces the successful projects on May 1, 1993.

4.2 PROJECT OBJECTIVE

- The immediate objective of this application is to be partially funded for the cost of preparing a successful CCT-V proposal to the U.S. DOE for funding a Liquid Transportation Fuels from Lignite Project.
- The overall objective of DGC's proposed project is to demonstrate the cost effectiveness and commercial readiness for production of environmentally clean liquid transportation fuels utilizing the slurry Fischer-Tropsch process.

4.3 EXPECTED RESULTS

- The expected results of this application are to partially fund the preparation of a qualified U.S. DOE CCT-V demonstration proposal for a slurry Fischer-Tropsch demonstration project.
- Expected results for the CCT-V project include: (1) demonstration of large scale slurry reactors for hydrodynamics, operability, reliability and controllability, (2) effectiveness of wax/catalyst separation, (3) environmentally acceptable disposal of spent catalyst and (4) the production of liquids fuels that meet or exceed the Federal Standard for on-highway transportation fuels as mandated by the Clean Air Act Amendment (CAAA).

4.4 DURATION

The CCT-V DOE proposal preparation process commenced on June 1, 1992 and the completion date will be December 4, 1992. The closing date for receipt of the proposal by DOE is December 7, 1992. If the U.S. DOE CCT-V demonstration application is approved to partially fund the proposed Liquid Transportation Fuels from Lignite Project, the starting date will be approximately May 1, 1994 and continue for 72 months.

4.5 TOTAL PROJECT COST

The total cost to prepare a DOE CCT-V demonstration proposal is estimated to be approximately $355,000.

Dakota Gasification Company	$114,000
Bechtel	$241,000

4.6 PARTICIPANTS

The team participants in the application process to fund the preparation of the DOE CCT-V proposal are:

- Dakota Gasification Company
- Bechtel

5.0 PROJECT SUMMARY

5.1 INTRODUCTION

DGC plans to submit a proposal entitled "Production of Liquid Transportation Fuels from Lignite" to the U.S. Department of Energy (DOE) in response to Clean Coal Technology Program Round V (CCT-V) PON No. DE-PS01-92FE62647. This application to the Lignite Research Council requests $150,000 toward the cost of preparing the CCT-V proposal to DOE.

DOE must approve DGC's proposal for the Clean Coal Technology V demonstration project before contract negotiations commence. The closing date for receipt of proposals by DOE is December 7, 1992. If successful, contract negotiations with DOE are expected by May 1, 1993, and the Cooperative Agreement Award and Phase I of the project start by May 1, 1994.

5.2 PROJECT OBJECTIVE

The objective is to prepare a quality proposal to be submitted as a qualified DOE CCT-V demonstration project application.

6.0 PROJECT DESCRIPTION

6.1 INTRODUCTION

The proposal to prepare a U.S. DOE demonstration project is an extensive proposal divided into four volumes as follows:

Volume I: Qualification Proposal
Volume II: Demonstration Project Proposal
Volume III: Commercial Concept Proposal
Volume IV: Cost and Financing Proposal

The purpose of the proposal is to prepare and submit to the U.S. DOE an acceptable CCT-V cost-sharing demonstration project in a timely manner as described in PON No. PS01-92FE62647.

The major participants in the preparation of the DOE CCT-V demonstration project proposal and the scope of their duties and responsibilities are listed below:

A. **Dakota Gasification Company**

Assist Bechtel in preparation of the DOE CCT-V proposal. DGC's scope of work can be broken into two categories: technical and commercial. The technical work will be involved primarily with providing information on the demonstration facility siting, process and utility integration with the existing gasification plant, and project environmental aspects. The commercial work will be involved with project funding and management.

B. **Bechtel**

Bechtel's work scope can be divided into two categories: technical and administrative. The administrative work consists of assembling and editing of final write-ups from Bechtel technical personnel and DGC, reproduction and mailing of the proposal. The technical work can be subdivided into three tasks: (1) demonstration facility; (2) commercial plant design; and (3) other inputs. Details on these three technical tasks are given below.

Demonstration facility - Bechtel and DGC will jointly develop the design basis and criteria for the proposed demonstration facility. Then Bechtel will develop the following for the proposed demonstration facility: process block flow diagram, preliminary plot plan, preliminary process flow diagrams, material and energy balances, list of major equipment with sufficient detail specifications for cost estimating purpose, a plant capital cost estimate with sufficient details to complete the necessary forms shown in the CCT-V PON, annual operating requirements and costs, and the construction schedule. This cost estimate would have an accuracy of approximately $\pm$30%.

Commercial plant design - Bechtel and DGC will jointly develop the design basis and criteria for the commercial plant. The commercial plant design will include the novel technology to be proven in the proposed demonstration facility. The commercial plant design will be in sufficient detail to meet the requirements in the CCT-V PON. The plant capital cost will be estimated

with Bechtel in-house cost data and using the capacity curve factoring technique.

Other inputs - Bechtel will provide DGC with data, such as estimated plant thermal efficiency, in order to meet the information required in the DOE PON.

C. **Definition of Responsibility**

The outlines for the volumes I to IV of the CCT-V proposal are shown in Table 6-1. This outline is defined in the DOE Program Opportunity Notice (PON). The responsibilities for Bechtel and DGC are shown as percents of the work required to complete each section. The party that has more than 50% share of the work will have the primary responsibility in submitting a finished product to Bechtel publication for assembling and reproduction.

Table 6-1
Clean Coal Technology V Proposal Outlines Showing
the Work Scope & Deliverables from Bechtel and DGC

		DGC	Bechtel
Volume I	Qualification Proposal	100%	0%
Volume II	Demonstration Project Proposal		
5.3.1	Sect. II.A Introduction		
5.3.1.1	Public Abstract	80%	20%
5.3.1.2	Project Summary Form	100%	0%
5.3.2	Sect. II.B Project Technical Description	0%	100%
5.3.3	Sect. II.C Detail Description of Novel Technology	0%	100%
5.3.3.1	Sect. II.C.1 Proposed Technology Description	0%	100%
5.3.3.2	Section II.C.2 Technology Development Status & Readiness for Demonstration	20%	80%
5.3.3.3	Sect. II.C.3 Adequacy, Appropriateness and Relevance of Demonstration	20%	80%
5.3.4	Sect. II.D Demonstration Facility Site		
5.3.4.1	Sect. II.D.1 Demonstration Facility Site Description	80%	20%
5.3.4.2	Sect. II.D.2 Demonstration Facility Site Suitability	80%	20%
5.3.5	Sect. II.E Project Environmental Aspects		
5.3.5.1	Sect. II.E.1 Air Emissions	75%	25%
5.3.5.2	Sect. II.E.2 Production and Handling of Other Effluents, Wastes, and Byproducts	75%	25%
5.3.5.3	Sect. II.E.3 EHSS Compliance	80%	20%
5.3.5.4	Sect. II.E.4 EHSS Risks and Impacts	100%	0%
5.3.6	Sect. II.F Technical & Management Approach		
5.3.6.1	Sect. II.F.1 Technical Approach	50%	50%
5.3.6.2	Sect. II.F.2 Management Approach	60%	40%
5.3.7	Sect. II.G Exceptions, Deviations & Assumptions	100%	0%
Volume III	Commercial Concepts Proposal		
5.4.1	Sect. III.A Introduction	80%	20%
5.4.2	Sect. III.B Environmental Performance	50%	50%
5.4.3	Sect. III.C Energy Efficiency	20%	80%
5.4.4	Sect. III.D Cost Performance	20%	80%
5.4.5	Sect. III.E Commercialization Potential	40%	60%
5.4.6	Sect. III.F Exceptions, Deviations & Assumptions	100%	0%
Volume IV	Cost and Financing Proposal		
5.5.1	Sect. IV.A Cost Estimate	0%	100%
5.5.2	Sect. IV.B Funding of First Budget Period	80%	20%
5.5.3	Sect. IV.C Funding of Remaining Budget Periods	80%	20%
5.5.4	Sect. IV.D Project Team Commitment	100%	0%
5.5.5	Sect. IV.E Exceptions, Deviations & Assumptions	100%	0%

6.2 PROJECT OBJECTIVE

The overall objective of the proposal is the preparation of an acceptable Application for Federal Assistance to U.S. DOE to partially fund a project to produce liquid transportation fuels from lignite.

6.3 METHODOLOGY

The project team will prepare and submit a proposal to the North Dakota Lignite Research Council according to NDAC 43-03-04.

6.4 ANTICIPATED RESULTS

The anticipated results are the NDLRC acceptance and recommendation to the North Dakota Industrial Commission to partially fund the proposal to prepare a U.S. DOE CCT-V demonstration project proposal.

6.5 FACILITIES

Dakota Gasification Company has a management staff, engineering and environmental and technical staff who will provide assistance in proposal preparation.

Bechtel has extensive proposal preparation resources in its San Francisco office. These resources include:

- A large staff of engineers, technicians, scientists, proposal specialists, draftsmen, graphic artists, technical writers, cost estimators, accountants and equipment operators.
- Word processors, copiers, copy cameras, computers, computer-aided design and engineering systems and the Corporate Information Center.

6.6 IMPACTS

Technology Advantages. The advantages of producing liquid transportation fuels from lignite at the Great Plains Synfuels Plant are as follows:

- Demonstrate the novel concept of coproduction of clean liquid transportation fuels and high Btu gas.
- Demonstrate the slurry Fischer-Tropsch process in commercial size equipment.
- Determine the slurry reactor operating limit constraints with regard to inlet gas superficial velocity and reactor catalyst concentration.
- Demonstrate that the middle distillate fuel produced by the slurry Fischer-Tropsch process because it contains zero sulfur, and zero aromatics are environmentally superior fuels with greatly reduced emissions.
- Demonstrate that spent Fischer-Tropsch catalyst can be disposed of in an environmentally acceptable manner.

- Investigate the properties and marketability of high molecular weight Fischer-Tropsch micro-crystalline wax.
- Demonstrate that catalyst can be satisfactorily separated from reactor wax in commercially available equipment.
- Demonstrate that the energy security of the United States can be improved by producing environmentally clean liquid transportation fuels from coal utilizing a gasification/slurry Fischer-Tropsch process combination and thus reduce the import of foreign oil.
- Demonstrate that there are no adverse environmental effects on air, water or solid wastes in the slurry Fischer-Tropsch process.

Demonstration Project Advantages. The advantages of siting a demonstration project at the Great Plains Synfuels Plant to produce liquid transportation fuels from lignite are as follows:

- The Great Plains Synfuels Plant is the United States' first commercial size plant to produce clean burning substitute natural gas (SNG) from lignite.
- The Great Plains facility has demonstrated the technical feasibility of producing synfuels from coal, and the lessons learned will allow second generation synfuels plants to be built at lower capital cost and with improved operability, maintainability and safety.
- Similarly, the lessons learned from demonstrating slurry Fischer-Tropsch will allow second generation plants for indirect liquefaction to be constructed at lower capital costs with improved operability, maintainability and safety.
- Demonstration of slurry Fischer-Tropsch technology at a commercial scale can be accomplished at much lower capital cost because of the infrastructure at the Great Plains plant. Clean coal derived synthesis gas is available as a feedstock without having to burden a project with the costs of mining, coal transport, gasification and gas clean-up that a grassroots project would require.
- The Great Plains facility infrastructure can also provide services to the demonstration project such as process and project engineering, laboratory, security, fire and safety, human relations, machine shop and maintenance personnel, warehouse, skilled electrical and instrument technicians and an environmental staff.
- The demonstration project will be located in North Dakota, a state not yet represented by a CCT project.
- Although the proposed demonstration project does not immediately increase lignite usage, a successful project will show the viability of lignite for second generation plants.

6.7 Project Need

The project need is to partially fund the preparation of a DOE CCT-V demonstration project application by the project team for proposal preparation, DGC and Bechtel. The estimated cost to prepare the proposal is $355,000.

The Clean Coal Technology program stems from Public Law 102-154 and provides funds to DOE to conduct cost shared Clean Coal Technology (CCT) projects for the design, construction, and operation of facilities that "... shall advance significantly the efficiency and environmental performance of coal-using technologies and be applicable to either new or existing facilities ... Further, these technologies can have application to power generation, industrial uses, commercial/residential markets, transportation and generation of coal-derived fuels or chemicals."

Domestic crude oil production is now nearly 25% below the peak of 9.6 million (MM) barrels per day (BPD)[1]. A steady decline in production has occurred. In 1990 production fell to 7.4 MM BPD and has further declined to 7.2 MM BPD in 1992. The range of projections for crude oil production for 2010 is from 6.1 to 4.2 MM BPD.

The U.S. demand for petroleum products is expected to grow between 0.6 and 1.4 percent per year over the next 20 years. In 1992 U.S. consumption is about 17.5 MM BPD. This is expected to grow to between 19.3 and 22.4 MM BPD by 2010.

The difference between supply and demand is made up by importing foreign crude oil and products. In 1990 the U.S. imported 42% of the petroleum demand. By 2010 net oil imports would account for between 53 and 69% depending on oil price.

North Dakota crude oil production is showing similar declines in production. In 1990 production was 100.6 thousand (M) BPD, in 1991 it had fallen to 98.3 M BPD and in August 1992 production had declined to 89.4 M BPD.

The recent history of domestic natural gas production differs considerable from that of domestic crude oil production. Natural gas production increases are from reserves discovered by conventional drilling as well as unconventional gas (coal bed methane drainage). From 1986 to 1990 natural gas production increased from 16.0 trillion cubic feet to 17.6 trillion cubic feet per year. With substantial changes in regulatory structure gas markets in the past several years have been capable of supplying more gas than could be sold. With such a glut the average wellhead price of gas fell to $1.72 per thousand cubic feet in 1990 as compared with an average of $3.18 per thousand cubic feet (in constant 1990 dollars) for 1982 through 1985. Projections for natural gas production in 2010 is 19.30 trillion cubic feet with an average wellhead price of $4.65 per thousand cubic feet.

The question regarding the high level of foreign oil imports relates to one of national energy security. The past history of disruptions of oil imports due to Middle East conflicts and the current unsettled conditions in

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[1] EIA/Annual Energy Outlook 1992.

what was the USSR and other parts of the world places the U.S. in the unenviable position of not having a secure oil supply. On the other hand, the U.S.'s most abundant energy source is coal. U.S. coal reserves are sufficient for the next several hundred years. Conversion of indigenous coal to liquid transportation fuels could reduce the U.S.'s reliance on foreign crude imports. The DOE recently, in a speech by Mr. James Randolph, Assistant Secretary for Fossil Energy, discussed DOE's strategic plans for coal[2]. A stated objective of this strategy is, "to demonstrate by 2010 advanced coal refining concepts for the clean and safe production of coal-based transportation fuels, chemicals and other products that can compete with natural products at a cost of no more than $30 per barrel of oil equivalent in 1991 dollars."

In addition, the Clean Air Act Amendments (CAAA) of 1990 mandates that highway diesel fuels sulfur content be reduced to 0.05% (500 PPM) by November 1, 1993. To accomplish this, a typical refinery must invest capital to construct and operate a middle distillate desulfurizer. This requirement will force many refiners to no longer produce highway diesel fuel since they do not wish to commit the capital to build new facilities. In addition, the CAAA calls for reducing the aromatics in gasoline. EPA could also call for reduction in aromatics in highway diesel fuel. Eventually all diesel fuel, both highway, off-highway and stationary uses, could fall under this mandate.

One of the unique properties of diesel fuel produced by the Fischer-Tropsch process is that it contains both zero sulfur and zero aromatics. This suggests that it should command a premium price since a refiner could blend Fischer-Tropsch diesel with conventional higher sulfur diesel cuts to produce a CAAA Compliance fuel and thus remain in the highway diesel market.

Substantiation of the improved burning characteristics for Fischer-Tropsch diesel fuels has been carried out by Detroit Diesel Corporation. Substantial reductions in unburned hydrocarbons, CO and particulates have been achieved.[3]

To meet these urgent national needs, the DOE continued with the fifth round of its Clean Coal Technology program (CCT-V). Program Opportunity Notice (PON) No. DE-PS01-92FE62647 solicits proposals to conduct cost-shared demonstration projects that advance significantly the efficiency and environmental performance of coal using technologies that are applicable to either new or existing facilities.

The project team is proposing the demonstration of Production of Liquid Transportation Fuels from Lignite using slurry Fischer-Tropsch reactors, a technology that is consistent with the objectives of the National Energy strategy (NES), the CAAA and the CCT-V PON. Slurry Fischer-Tropsch production of liquid transportation fuels derived from coal-based synthesis gas is an efficient, clean, cost-effective technology that can provide environmentally clean liquid fuels. The technology can be used with a number of different coal

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2 James Randolph, DOE, paper delivered 9/17/92 to International Committee for coal research, York, England.

3 Bemethum and Winsor, "Toward Improved Diesel Fuel." Paper presented at International Fuels and Lubricants Meeting, Toronto, Canada, October 7-10, 1991.

gasifiers as well as different coals. North Dakota lignite, because of its reactivity, gasifies extremely well and is a low cost feedstock for 21st Century liquefaction plants.

Federal and state funding is required to accelerate commercialization of coal-derived liquefaction.

7.0 STANDARDS OF SUCCESS

The standard of success for the Project Team's grant application to the North Dakota Research Council is the United States Department of Energy's acceptance and approval of the CCT-V demonstration proposal application.

8.0 BACKGROUND

8.1 DAKOTA GASIFICATION COMPANY

In October 1988 Basin Electric Power Cooperative (BEPC) purchased the Great Plains Synfuels Plant from the DOE. A new company, Dakota Gasification Company (DGC), was formed as a wholly owned subsidiary of BEPC. During the ensuing years DGC has successfully operated the Great Plains Synfuels Plant setting both new production records (20% over design capacity) and safety records (over 5 million manhours worked without a lost-time accident). At the same time a comprehensive R&D program was launched to increase profitability of gasification byproducts. New facilities have been constructed to manufacture phenol and crude cresylic acids and also a mixture of krypton and xenon (rare gases). Sales of the byproducts have contributed to the plant's profitability.

Several years ago it was recognized that as gas purchase contracts expire in the latter part of the 1990s, a situation could occur where gas might have to be sold at near spot gas prices. Since the manufacturing cost of SNG is essentially fixed, selling gas at near spot prices would have an extremely negative effect on profitability and could result in plant closure. This would have a disastrous effect on Mercer County and the State of North Dakota.

An effort was begun to explore alternative uses for the plant's synthesis gas since the mixture of H_2 and CO are essentially building blocks for a number of chemicals and fuels. Extensive studies showed that production of liquid fuels probably had the best chance of revenue generation.

In 1991 DGC commissioned The MITRE Corporation, a Washington, D.C. consultant, to study the production of liquid fuels from coal at the Great Plains plant. The study (completed in 1991) concluded that the Great Plains plant was a preferred location for production of liquid fuels from coal.[4] Although the hybrid plant concept called for both direct and indirect liquefaction at the same site, further study showed that the indirect liquefaction process was a lower cost option as well as manufacturing environmentally superior liquid fuels. Fuels produced by direct liquefaction require desulfurization and aromatics saturation to approach CAAA quality. Based on discussions with MITRE and others, the slurry reactor provides a considerable economic advantage in reduced capital cost compared to fixed fluidized bed or tubular reactors.

8.2 BECHTEL

Bechtel is an established A&E contractor with firm ties to the power, refining and petrochemical industries. Bechtel has been studying coal liquefaction processes for over 10 years and currently has several DOE contracts on liquefaction. One study compared slurry versus fixed bed reactors for Fischer-Tropsch and methanol[5]. Bechtel is currently conducting a two-year study

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4 Gray, David, et al, The MITRE Corporation. "Hybrid Plant Coal Liquefaction Concept at the Great Plains Synfuels Plant," November 1991.

5 Fox, Joseph, M., Bechtel. "Slurry Reactor Design Studies: Slurry vs. Fixed Bed Reactors for Fischer-Tropsch and Methanol" DOE/PC/89867, June 1990.

for DOE on Baseline Design/Economics for Advanced Fischer-Tropsch Technology. Quarterly reports for the periods January-March 1992 and April-June 1992 have been issued and are available through NTIS under Contract No. DE-AC22-91PC90027.

8.3 WORK BY OTHERS

Rentech, Inc., a small Denver, Colorado based company, has been doing R&D work on Fischer-Tropsch with slurry reactors for the past 11 years. The company was formed in 1981 to develop and market its proprietary process for the conversion of low value, carbon bearing solids and gases into high value, high quality liquid hydrocarbons. Fuelco, a subsidiary of Public Service of Colorado, has built a plant in Pueblo, Colorado using Rentech technology to produce liquid fuels from biomass gas produced from a local landfill. Rentech designed the two slurry Fischer-Tropsch reactors at the plant. Rentech also built a facility in Boulder, Colorado to manufacture the Fischer-Tropsch catalyst used at Pueblo. A 2" diameter slurry reactor pilot plant is also located at Boulder. The Fuelco plant has had some difficulties producing synthesis gas to feed to the Rentech reactors. For those periods when feed was available the slurry reactors performed well and met design objectives. Run length has not been sufficient to determine catalyst life. Rentech participated with DGC on a design and economic study to install a slurry reactor at the Great Plains plant. Economics were unfavorable due to a lack of economy of scale.

Exxon has been working on gas to liquid conversion processes since the early 1980s and has over 100 patents issued or allowed on the technology[6]. Exxon has developed and manufactured proprietary catalysts, conducted pilot scale tests, and operated a demonstration plant at Baton Rouge, LA. DGC has contacted Exxon regarding their technology and was told that, after giving in-depth consideration, because of Exxon's current business interests they would be unable to license their technology to DGC at this time[7] Exxon did indicate it would be appropriate for them to reconsider their position in the second quarter of next year.

Sasol, the South African company, has been using Fischer-Tropsch technology since 1955 to produce a wide range of fuels and chemicals from coal. Their first plants were based on Synthol technology using an entrained fluid bed reactor. Sasol has studied reactor technology for many years including tubular reactors (ARGE process), fixed fluidized bed, and most recently, slurry reactors. Sasol has submitted a very preliminary proposal to DGC for a commercial slurry Fischer-Tropsch plant at Great Plains. Sasol has operated a one-meter slurry reactor at Sasolburg and is now building a larger diameter reactor which will be commissioned in mid-1993. DGC will continue to communicate with Sasol about their developments.

The DOE PETC laboratory has sponsored a slurry reactor pilot plant in conjunction with Air Products for liquid phase methanol production. Recently a consortium was formed by PETC with Exxon, Air Products, Shell, Statoil and UOP to convert the LaPorte pilot plant for Fischer-Tropsch. A 20-day run was conducted in August 1992 and additional work is planned.

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6 Velocci, Jr. Anthony L., Creating liquid fuels from natural gas. The Lamp, Exxon quarterly publication for shareholders, Fall 1991, Vol. 73, No. 3, p. 14-17.

7 Ellis, E.G., Private Communication, Exxon, October 1992.

9.0 QUALIFICATIONS

9.1 DAKOTA GASIFICATION COMPANY

Dakota Gasification Company has operated the Great Plains Synfuels Plant since November 1988. The plant has continuously produced SNG since June 1984. The original owners defaulted on a government guaranteed loan and ownership reverted back to the DOE. In October 1988 Basin Electric Power Cooperative purchased the plant and adjacent coal mine from DOE and formed DGC. Currently the plant produces about 160 MMSCFD of SNG from 17,000 tons per day of lignite from the Freedom Mine.

9.2 BECHTEL

Bechtel is among the United State's largest A&E firms and has ties with the power industry, refining and petrochemicals. In addition to designing and building commercial plants, Bechtel does contract studies and proposals. The DOE study on Baseline Coal Liquefaction Design and Economics has been mentioned previously.

Through Bechtel's active involvement in the DOE Clean Coal Technology Program, they have gained a strong understanding of the proposal process, DOE negotiations and project implementation within the DOE requirements.

Some of the Clean Coal proposals and project in which they have participated and to which they have contributed include:

Round 1

- The City of Tallahassee CFB Retrofit Project
- Nucla CFB Demonstration Project for Colorado-Ute Electric Association
- Appalachian IGCC Project with M.W. Kellogg

Round II

- IGCC with Methanol, CO_2 and Ammonia Co-production at Cool Water
- Slagging Combustor Retrofit to Cyclone Boiler with TransAlta and Southern Illinois Power Corporation
- Coal Cleaning with FBC to Burn Middling Product with Virginia Power, Island Creek and EPRI
- Advanced PFBC Demonstration Project with Union Electric, Allison and Foster Wheeler
- Confined Zone Dispersion in-Duct FGD Retrofit with PENELEC

Round III

- Confined Zone Dispersion FGD Demonstration Project with PENELEC
- Elfuel Project (Beneficiation of North Dakota Lignite) with Minnesota Power & Light
- Electron Beam Flue Gas Treatment with Ebara Environmental

Round IV

- CT-121 FGD Demonstration with Southern Company Services
- COREX Iron Ore Reduction Process with Geneva Steel

Bechtel has been a long-time supporter of the Clean Coal Program through their direct relationship with the DOE organizations and through their active memberships in the Clean Coal Technology Coalition and the Council on Alternate Fuels. They are also a member of the National Coal Council and are active on a number of NCC task forces. Additionally, their Washington, D.C. office follows federal legislation and regulations and assigned personnel to cover the CCT Program.

10.0 VALUE TO NORTH DAKOTA

A market assessment for North Dakota lignite[8] reveals that lignite mining and utilization are important factors in North Dakota's economy. However, after strong growth in the decade 1975 to 1985, lignite demand has been on a plateau for several years and could decline if additional markets are not generated. In the last 10 years the market for lignite has been facing increased economic competition from Powder River Basin subbituminous coal.

In the Market Assessment Report Executive Summary, Sinor states that "From a risk/reward standpoint the best investment is partial conversion of the Great Plains plant to liquids production. Either methanol or gasoline/diesel production is technically feasible." Further, on p. 30 of the Market Assessment, Sinor states, "The highest ranking project possibilities investigated in this study are the manufacture of liquid fuels from part of the coal gas produced at Great Plains. Such projects would contribute significantly to the financial stability of the Great Plains facility, increase North Dakota revenue and jobs, and contribute to increased energy security for the United States. Methanol appears to be economically viable on its own but is subject to future price competition from low-cost natural gas in the Middle East. Gasoline and diesel fuel would require Clean Coal Technology cost sharing or the equivalent to be financially attractive, but face less market uncertainty and have the added benefit of increasing lignite consumption by 500,000 tons."

n.b. The lignite consumption referred to in the marketing study refers to the hybrid plant. The present proposal does not immediately utilize any incremental lignite production.

Future increased lignite production for liquid fuels depends primarily on the price of crude oil and petroleum, factors affecting energy security, and the ability to produce liquids for under $30/bbl crude oil equivalent. The information generated from the CCT-V demonstration project will contribute greatly to the design and subsequent reduction of second generation plants.

The proposed demonstration project at Great Plains will create approximately 20 new jobs at the plant (primarily operators) and 85-90 indirect jobs (secondary jobs generated in other sectors of the North Dakota economy). During the 24-30 month construction period there will be as many as 250-300 temporary construction jobs.

Even more important, over 700 jobs may be saved by the continued operation of the Great Plains plant.

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8 Sinor, J.E., Market Assessment for North Dakota Lignite, Final Report, April 9, 1992, J.E. Sinor Consultants.

11.0 MANAGEMENT

Dakota Gasification, as the project sponsor, will have the overall responsibility for preparation of the demonstration proposal and submittal to DOE. Bechtel will provide technical assistance, write parts of the proposal and prepare final documents in the format requested by DOE in the PON. The proposal preparation schedule is shown in Figure 11-1.

The project management organization is shown in Figure 11-2.

Figure 11-1

CLEAN COAL V PROPOSAL SCHEDULE

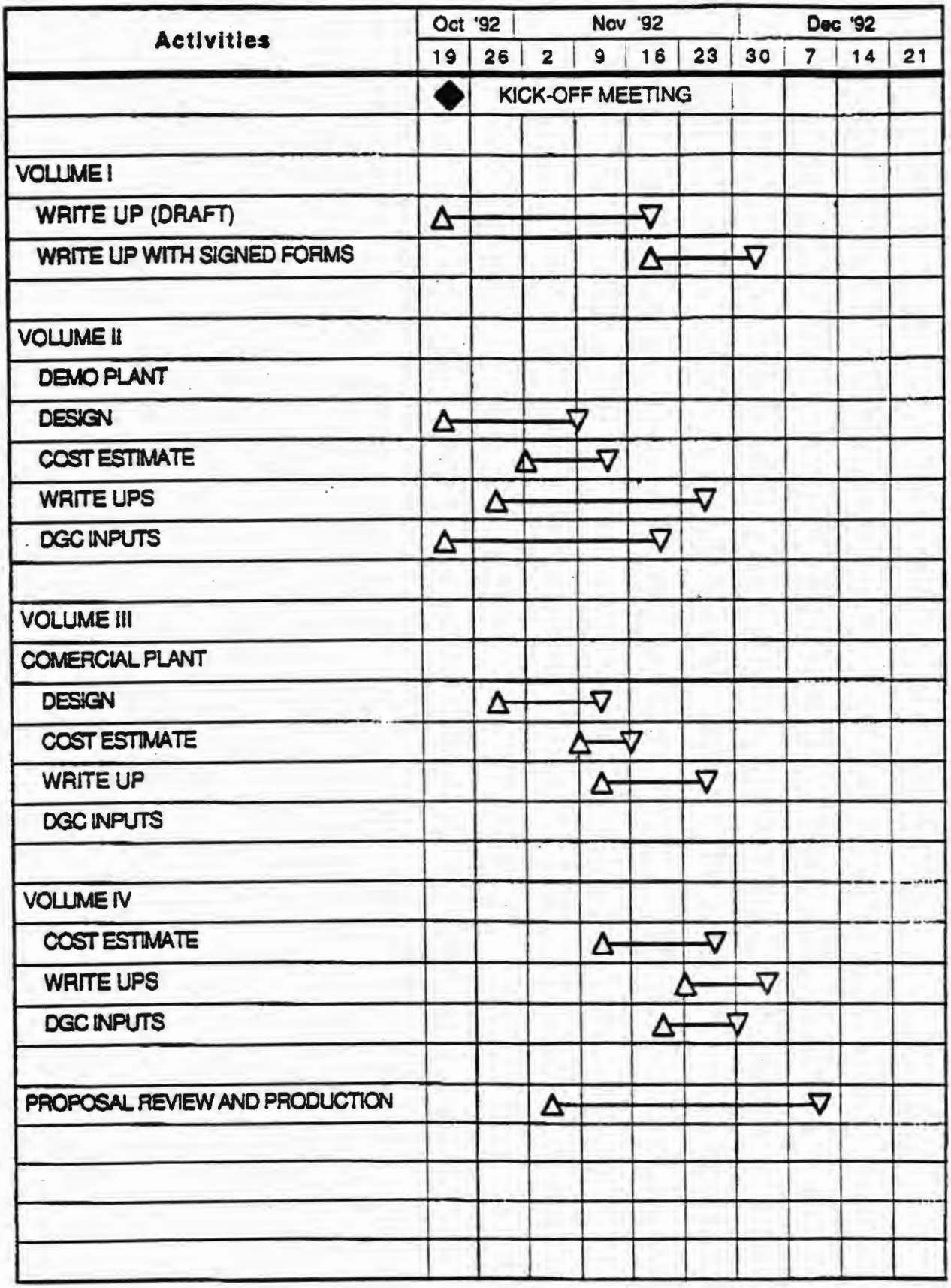
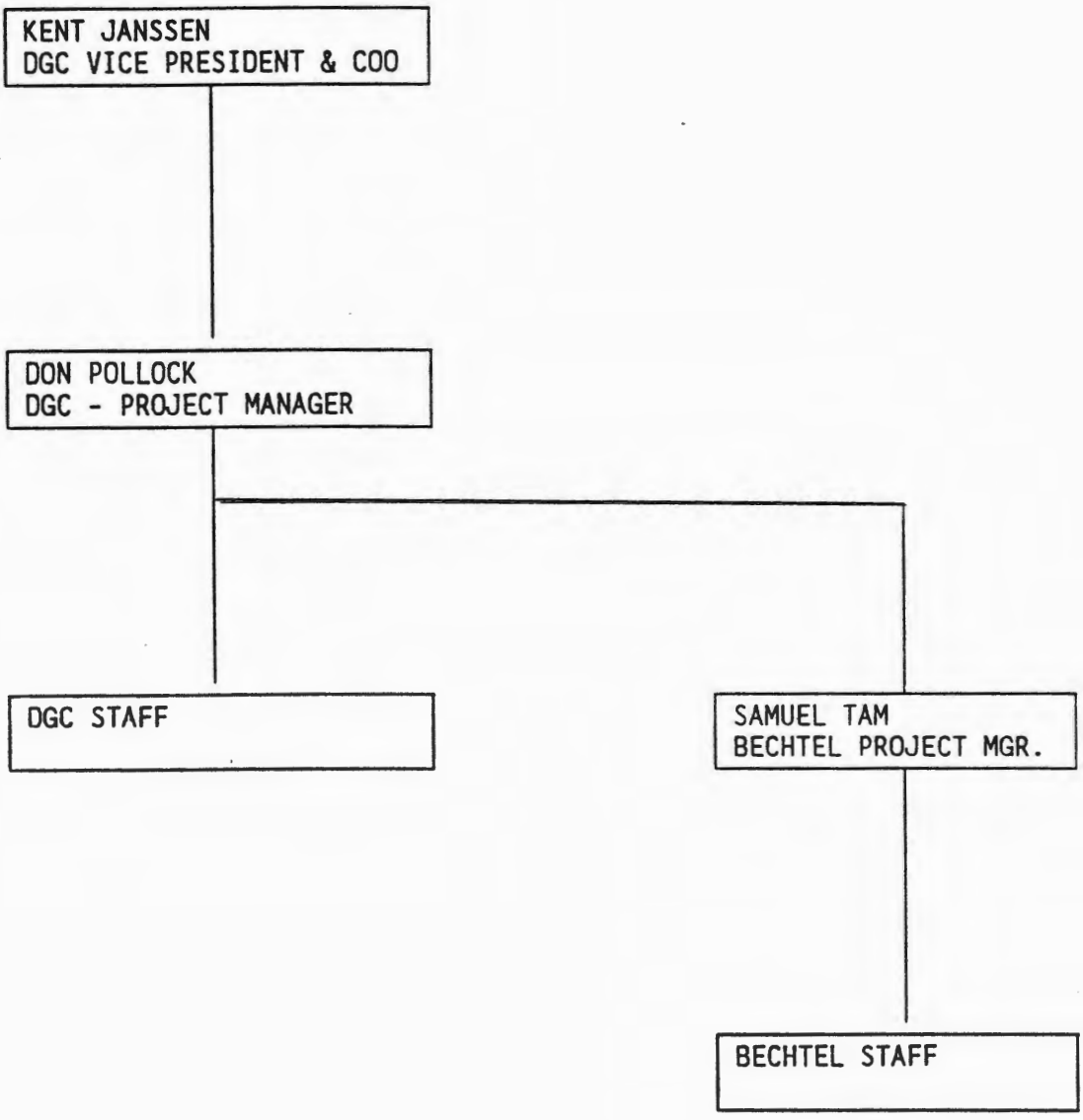


Figure 11-2

ORGANIZATION CHART



12.0 TIMETABLE

7/6/92	DOE PON Issued.
10/19/92 - 12/4/92	DOE Proposal Preparation.
10/23/92	ND Grant Applications Due.
12/4/92	Ship DOE Proposal.
12/7/92	DOE Proposal Due.
12/15/92	Issue Public Abstract By DOE.
12/7/92 - 4/30/93	Pre-Selection Environmental Review By DOE.
12/7/92 - 4/20/93	Process Licensor Review And Selection.
5/1/93	Selection For Negotiation By DOE.
5/1/93 - 4/30/94	Pre-Award Activities.
5/1/93 - 4/30/94	Post-Selection NEPA Review By DOE.
7/1/93 - 4/30/94	Project Definition Activities.
5/1/94	Cooperative Agreement Signed.
7/1/94 - 8/31/94	Post-Award Environmental Monitoring Review.
5/1/94	Main Demonstration Project Start.
5/1/94 - 5/1/95	Phase I: Design.
3/1/95 - 9/30/97	Phase II: Construction.
10/1/97 - 9/30/99	Phase III: Operation.
10/1/99	Commercial Operation.

13.0 BUDGET

The following information is the Project Team's best estimates relating to the cost of preparing the CCT-V demonstration project application to the U.S. Department of Energy.

Dakota Gasification Company:	
Internal manhours and corresponding expenses	$114,000
Bechtel:	
Internal manhours and corresponding expenses	$241,000
	$355,000

14.0 MATCHING FUNDS

The Project Team is committed to providing the resources (time, material and financing) to prepare and submit a CCT-V demonstration project to the U.S. Department of Energy. Letters of commitment are in Appendix D.

Estimated planned matching funds are as follows:

	$	%
North Dakota Lignite Research Fund	$150,000	42.3%
Private funds	205,000	57.7%
Total	$355,000	100.0%
Private Funding:		
Dakota Gasification Company	$205,000	100.0%