DAKOTA GASIFICATION COMPANY
A BASIN ELECTRIC POWER COOPERATIVE SUBSIDIARY

July 15, 2020

Ms. Karlene Fine
Executive Director
ATTN: Lignite Research, Development, and Marketing Program
North Dakota Industrial Commission
600 East Boulevard Avenue
State Capitol, 14th Floor
Bismarck, ND 58505

Dear Ms. Fine:

Subject: Dakota Gasification Company Proposal Entitled "Naphtha and Tar Oil Overhead Refining Project"

On behalf of the Dakota Gasification Company (DGC), I am pleased to submit the attached subject proposal for support from the Lignite Research, Development, and Marketing program. This application contains no confidential information with respect to DGC and its operations. Also enclosed is the $100 application fee.

We would welcome the opportunity to discuss the proposal upon review by the Lignite Research Council. DGC looks forward to completing this project should the Commission approve the requested grant.

Thank you for your consideration, and if you have any questions please feel free to contact me, or Dan Gallagher, at (701) 223-0441.

Sincerely,

Dale Johnson (Jul 15, 2020 11:19 CDT)

Dale A. Johnson
Vice President and Plant Manager
Basin Electric and Dakota Gasification Company

Naphtha and Tar Oil Overhead Refining Project

Proposal for support from the North Dakota Industrial Commission, Lignite Research, Development, and Marketing Program

Applicant: Dakota Gasification Company, Beulah, ND

Other Project Partners: Research Technologies, LLC

Principal Investigator: Dan Gallagher

Date of Application: July 17, 2020

Amount Requested: $142,500

Total Amount of Proposed Project: $285,000

Duration of Project: 4 Months

Expected Start: August 2020

Point of Contact:
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Bismarck, ND 58503

Table of Contents

Abstract **1**

Project Summary **2**

Project Description **3**

Objectives and Expected Results

Methodology

Facilities

Resources and Capabilities

Environmental Impacts

Technological Impacts

Economic Impacts

Need for Project

Background and Qualifications **6**

Dakota Gasification Company and Great Plains Synfuels Plant

Research Technologies, LLC

Value to North Dakota **9**

Project Management **10**

Management Overview

Timetable

Budget

Matching Funds

Standards of Success

Tax Liability Affidavit **12**

Abstract

The Dakota Gasification Company's Great Plains Synfuels Plant, located in Beulah, North Dakota, has shown itself to be a transformative cornerstone in the state of North Dakota, and within the coal industry. Founded in 1984, the one-of-a-kind facility continues to be a pillar of the community. It has created its own thriving economy as it continues to support and sustain families generationally. In addition, it continues to support various regional and international markets, from agriculture to fuel oil.

Dakota Gasification Company has continuously pursued new markets, and creation of new streams based on lignite coal. The company produces, markets, and sells a legacy coal-based stream called "Naphtha - BTX," in support of the BTX (Benzene/Toluene/Xylene) extraction and gasoline markets. However, undesirable impurities of the product have prevented the Synfuels Plant from capturing maximum value in these markets. As a result, a collaborative effort has been initiated with a Houston-based technical and engineering firm (Research Technologies) to improve the stream, double production, and create a higher valued product than currently exists. This effort will take a non-commercial fuel stream and make beneficial use of it as a blend with the Naphtha - BTX. The venture could double the volume from the Naphtha-BTX stream while also proving the potential for another value-added product from North Dakota lignite.

The collaboration to-date has yielded the birth of two new pilot streams that appear to have achieved our goal of reaching our market target by virtue of hydrotreating technology. In order to move forward to the approval phase, additional analysis and financial resources are required. Below are the estimated resources needed to advance this effort.

Project Needs

Resource	Total
Continuation of pilot work	$110,000
QA/QC lab work	$40,000
Project management, G&A	$10,000
Market Analysis	$25,000
Engineering Analysis	$40,000
Site Analysis	$60,000
Total Project Needs	**$285,000**

Total Project Cost: $285,000

Expected Timeline for Completion of Study and Results: EOY 2020

Project Summary

As part of its coal gasification process, the Great Plains Synfuels Plant, produces approximately 15 million gallons of naphtha and tar oil overheads annually. High sulfur and oxygenate content have limited the marketability of naphtha to niche markets. The installation of the tar oil stripper in 2014, which was primarily used to distill a fuel oil product called tar oil, resulted in separation of the tar oil overheads, though this stream has yet to be commercially-developed and the product is currently used as fuel in the boilers.

The proposed project would continue pre-front end engineering and design (FEED) activities to explore the feasibility of constructing a hydrotreater at the Synfuels Plant in order to further refine the naphtha and tar oil overheads into a blend suitable for gasoline blendstock. It is notable that the initial testing of this technology shows merit and potential customers have provided positive feedback based on a product data sheet derived from the testing.

The primary objectives of the project are to produce a product stream that is a 1) commodity; 2) retains its valuable properties; 3) significantly reduces its negative properties; and 4) is cost-effective to construct, operate, and market.

1) **Commodity:** Refines both naphtha and tar oil overheads, creating a product that is marketable in far-reaching gasoline and/or extraction market.
2) **Valuable properties:** Benzene and toluene.
3) **Negative properties:** Sulfur, high oxygenate content.
4) **Cost-effective:** Maximize efficiencies of existing plant infrastructure and processes.
    - Utilizes existing piping and loadout**.**
    - Combines product streams, creates efficiency in marketing and operations.

Successful completion of the proposed study will allow the Dakota Gasification Company to pursue another value-added stream from coal gasification. The Synfuels Plant has long served as a proving ground for new and innovative uses of lignite. While the Synfuels Plant remains a one-of-a-kind facility, successful demonstration of product streams at this plant continue to provide a foundation for future use of North Dakota lignite and concepts such as the energy polygeneration industrial complex (EPIC), and other efforts that will be needed to take full advantage of the state's 25 billion tons of recoverable lignite.

Project Description

The Dakota Gasification Company is exploring the feasibility of installing a hydrotreater at the Great Plains Synfuels Plant for the purpose of upgrading two liquid coproducts, naphtha and tar oil overheads. The upgrade would significantly increase the products' market value and, as accepted articles of commerce, allow access to a broader market. Control of the coproduct inventories would be enhanced so as to eliminate operating problems in the upstream portions of the Synfuels Plant. A feasibility study, pilot plant program and up-front engineering is now being performed by Research Technologies LLC, and have been underway for approximately 18 months. The process unit would be constructed by a qualified Engineering, Procurement, and Construction (EPC) firm on a turn-key basis with performance guarantees granted to the Dakota Gas Company. Operations would be handled by the existing staff at the Synfuels Plant.

Funds requested under this phase of study would be used to continue pre-FEED activities for the proposed project.

Objectives and Expected Results

The specific objectives of the project are to explore whether a hydrotreater would cost-effectively: (1) reduce the sulfur content of the coproducts from 11,000 to 50 ppm (parts per million); (2) control benzene content in order to access a variety of customers; (3) reduce other contaminates such as oxygenated compounds and nitrogen; (4) lower transportation costs via accessing customers located closer to Beulah; and (5) take advantage of existing and underutilized utilities and infrastructure available at the Synfuels Plant.

The expected result is that the analysis would demonstrate that installation of a hydrotreater would achieve the abovementioned objectives to improve the economics and marketability of the Naphtha-BTX stream. Such results would provide justification for a decision on whether to move forward with the project.

Methodology

The project is comprised of a number of steps which have been undertaken: (1) a review of the Synfuels Plant processes now used to generate the existing coproducts; (2) obtaining samples from the Synfuels Plant for analysis; (3) a pilot plant program to determine and optimize operating variables and catalyst, and finished product quality. Underway now are (1) a market study to determine optimum markets and a preferred set of customers and (2) obtaining commitments to purchase the finished coproducts.

The Dakota Gasification Company would utilize the requested funds to: (1) obtain technology and process engineering from Research Technologies; (2) develop an economic analysis to justify installation of hydrotreater; (3) arrange for the selected EPC firm to perform detailed engineering; and (4) site assessment.

The EPC firm would also perform construction, commissioning and startup, if a decision is made to move to this phase.

Facilities

The hydrotreater would be built at a specific location within the Synfuels Plant that has available square footage, tankage, and rail loading equipment that can be utilized as well as most all utilities required by the new process unit. Hydrogen, natural gas, cooling water, water treatment, and nitrogen are readily available at the proposed location. With the exception of a process heater, the equipment comprising the hydrotreater is to be skid mounted and fabricated at the shop of the EPC firm. When complete it would be shipped to Beulah for installation.

One significant effort during this phase of the project is to determine the condition of the piping and structure in the proposed site of the project. The ability to reuse existing infrastructure will have a significant impact on the cost of the project and the duration of construction.

Resources and Capabilities

This phase of study would utilize the following resources:

- Commitment of existing utilities and infrastructure at the Synfuels Plant
- Process technology
- Project engineering and management
- Services of existing QA/QC lab at Synfuels Plant
- Full-time and shared operating personnel
- Ongoing management

The resources listed above are available internally or through contracts with Research Technologies and the qualified EPC firms. All parties now engaged in the development of the project are fully capable of committing the necessary resources.

Environmental Impacts

The construction and operation of the hydrotreater is a nearly seamless addition to the Synfuels Plant. No significant impacts are expected on operating permits (primarily air emissions and stormwater management), industrial hygiene programs, or health and safety programs.

Technological Impacts

The day-to-day operation of the hydrotreater is less complex than existing operations at the Synfuels Plant. The hydrotreated naphtha and tar oil overheads conform to accepted commercial standards for products sold in large volumes by petroleum refiners. As such, the products can be managed as commodities that are readily marketable. Currently, the non-hydrotreated coproducts contain high levels of problematic sulfur and other contaminants, and are difficult to sell on a sustained basis.

Economic Impacts

The value resulting from hydrotreating the roughly 1,000 barrels per day of combined naphtha and tar oil overheads would add greater economic certainty for operation of the Synfuels Plant. While the pre-FEED study under this proposal would provide greater insight into total benefits and economics, the current impact is estimated to be approximately $10 million per year.

Need for Project

The hydrotreater project is needed primarily to produce a project that is in conformance with market expectations, as well as to eliminate operating difficulties and excessive related costs resulting from impurities currently contained in the naphtha and tar oil overheads. This project will improve the economics of the naphtha and tar oil overheads and make a positive contribution to opportunities for value-added lignite.

Background and Qualifications

Dakota Gasification Company and Great Plains Synfuels Plant

In over 35 years of operating the Great Plains Synfuels Plant, the Dakota Gasification Company has proven its ability to breakdown lignite coal and develop new products from its constituent elements. Basin Electric Power Cooperative, through its for-profit subsidiary, Dakota Gasification Company, owns and operates the Great Plains Synfuels Plant. The Synfuels Plant and Basin Electric's electric generating facilities - the Antelope Valley Station and Leland Olds Station - are provided with coal by the adjacent Freedom Mine, operated by the Coteau Properties Company.

The proximity of these coal-based facilities and the shared mine create an economy of scale that provides a cost advantage to each facility that they would otherwise not have on their own. As a result, this relationship ensures that as one facility gains a strategic advantage, such as through product and revenue diversification at the Synfuels Plant, the other facilities enjoy a cost benefit through continued efficiency in coal production and low costs.

The Synfuels Plant is the only commercial-scale coal gasification plant in the United States that manufactures natural gas. It is also the cleanest energy plant operating in the state of North Dakota, according to a comparison of emissions data available from the North Dakota Department of Health.

- Average daily production of natural gas is about 153 million cubic feet, the majority of which is piped to Ventura, IA, for distribution in the eastern United States.
- The Synfuels Plant supplies carbon dioxide to the world's largest carbon capture and storage project in Saskatchewan, Canada. Dakota Gas currently delivers between 2.5 and 3 million metric tons of carbon dioxide per year.
- The $2.1-billion plant began operating in 1984. Using Lurgi gasifiers, the Synfuels Plant gasifies lignite coal to produce valuable gases and liquids. Located five miles northwest of Beulah, ND, the Synfuels Plant has been owned and operated by Dakota Gas since 1988.
- Over $1.3 billion has been invested in the Synfuels Plant since 1988 to achieve environmental compliance, improve efficiency, and diversify the product slate.

Facts at a glance[1]

- The Synfuels Plant is the only commercial-scale coal gasification plant in the United States that manufactures natural gas.
- The $2.1-billion plant was built in response to America's quest for energy independence during the 1970s energy crisis by a group of five interstate pipeline companies, Great Plains Gasification Associates (GPGA), of which American Natural Gas (ANG) was the majority partner.

[1] https://www.dakotagas.com/about-us/at-a-glance

- Located near Beulah, ND, and adjacent to Basin Electric's Antelope Valley Station, a 900-megawatt baseload electric generating plant. The Synfuels Plant and Antelope Valley Station share certain facilities and coal and water supplies: Antelope Valley Station supplies the Synfuels Plant with electricity, and the Synfuels Plant supplies several of Basin Electric's gas peaking facilities with synthetic natural gas (SNG).
- Using the Lurgi process, ANG began gasifying lignite coal into SNG in 1984.
- U.S. Department of Energy (DOE) acquired the plant in 1985.
- Dakota Gas acquired the plant from the DOE in 1988 pursuant to an Asset Purchase Agreement. Dakota Gas made its final payment to the DOE in February 2010. The U.S. government has recouped $1.3 billion of its original investment in the plant through revenue sharing, tax credits surrendered and the revenue received during ownership.
- Fueled by domestic lignite coal reserves in western North Dakota.
- Capable of gasifying more than 6 million tons of coal annually.
- Capable of daily production of up to170 million standard cubic feet of synthetic natural gas.
- Capable of selling more than 54 billion standard cubic feet of synthetic natural gas annually.
- Transports synthetic natural gas through a 34-mile pipeline where it connects to the Northern Border Pipeline for delivery to homes and businesses in the eastern United States.
- Produces fertilizers, solvents, phenol, carbon dioxide, and other chemical products for sale.
- Dakota Gas has one for-profit subsidiary, Souris Valley Pipeline Ltd., which has the capacity to deliver up to 165 million standard cubic feet of carbon dioxide daily to two Canadian oil fields for enhanced oil recovery.
- The plant has delivered nearly 40 million metric tons of CO_2 for geologic sequestration since 2000.

The Dakota Gasification Company is led by a team that collectively has over 50 years of experience in chemical engineering. This staff will work closely with Research Technologies, LLC throughout the study process.

Research Technologies, LLC

Research Technologies LLC ("RT") is a technology development firm providing consulting and operating services to clients in the global refining and petrochemical sectors since 1980. The services provided include (i) enhancements of clients' process units through the implementation of new or improved process technologies, (ii) developing value-added modifications or additions to client's manufacturing facilities, (iii) engineering and operating process units or other facilities for clients and (iv) repurposing of oil and petrochemical processing facilities. During the last thirty six years, RT has successfully completed a variety of projects, all of which have increased the economic value of clients' operations.

- In 1981 RT designed and constructed for a client a light hydrocarbons processing unit which produces high-purity normal hexane for several polyolefins plants

operated by major chemical manufacturers located in the US Gulf. Production was subsequently expanded to include other specialty hydrocarbons.

- In 1983, an operating subsidiary of RT purchased, retrofitted, and operated the former T&S Refining Company facility in Louisiana. The T&S operation included a condensate fractionator, utilities, 370,000 barrel storage terminal and a barge dock. T&S operated successfully through 1989 at which time it was sold to a unit of Canadian Pacific Railroad.

- A client and affiliate of RT, in partnership with Sasol in 1997, designed, constructed and operated a pilot plant and semi-works facility in Texas based on innovative hydrogenation process technology jointly developed by Shell Chemical and RT. From this development work, commercial scale facilities were built by Sasol and have been successfully operating in South Africa through the present time.

- In 2003, based on services provided by RT, an RT client leased and operated a portion of a major refining complex located in New Jersey. Several processing units were reengineered and modified to process Doba Blend crude.

- RT led a client's 2004 project to reengineer key processing units at its US Gulf refinery in order to enhance the production of naphtha, kerosene and diesel fuel.

- In 2010, an affiliate of RT purchased, redesigned and operated a liquids terminal handling Eagle Ford crude oil.

Value to North Dakota

The Naphtha and Tar Oils Overhead project will provide value to North Dakota by demonstrating the potential for another value added stream of lignite at the Great Plains Synfuels Plant. This additional product stream will help support the Synfuels Plant and the benefits that it provides to the regional and state economy. In addition, it is to the benefit of the state's coal industry as a whole to prove the potential for value added use of lignite coal.

Great Plains Synfuels Plant Current Contributions to the State and Local Economy

- The facility is among the leading employers in Mercer County with approximately 500 employees.
- Average annual wages in Mercer County, North Dakota: $73,476[2].
- Approximately $6 million annually in coal conversion tax.
- The Dakota Gasification Company, along with Basin Electric, provided financial support for the Sakakawea Medical Center expansion.
- The Dakota Gasification Company is also a founding partner of the Energy Capital Cooperative Child Care center.

North Dakota's Energy Future

Polygeneration, petrochemicals, and value-added lignite will play an important role in North Dakota's energy future. Value-added product streams are critical to help industry and state leaders explore options to address challenges and take full advantage of North Dakota's energy resources. The Naphtha and Tar Oil Overheads Project proposed by the Dakota Gasification Company represents another opportunity that can be applied within both the coal and oil and gas industries. As increased oil and gas production results in additional need for refining and gas processing, proving the potential for a naphtha-tar oil blend could be an important product stream for the liquid fuels industry as well.

The proposed project would provide needed technical insight into the process of treating naphtha and tar oil overheads. This analysis will be valuable for further diversification of gasoline blend stock whether being derived from coal gasification processes, or liquid hydrocarbons.

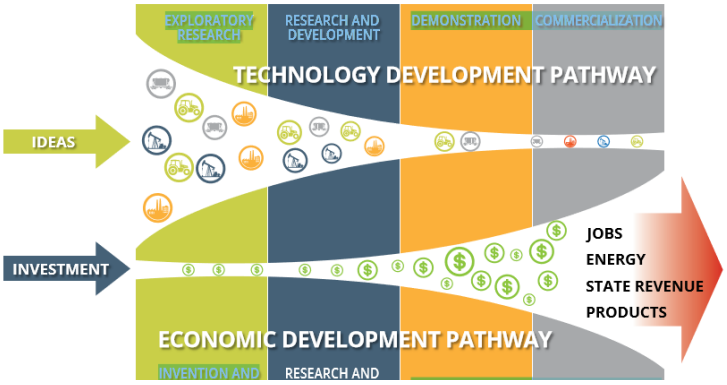

Image Courtesy of Energy and Environmental Research Center: https://undeerc.org/_files/docs/eerc-nd-energy-future.pdf

2 https://www.ndlmi.com/vosnet/lmi/profiles/profileDetails.aspx?enc=Elzv7W1H4bwmL+k+/LJ5/U/7zQP4cgr5xD+2pf4w2hd0PRUcvVAFHTxgvLL8Pe9N

Project Management

Management Overview

The project would be overseen directly by Research Technologies, LLC, with staff and technical assistance provided by Dakota Gasification Company.

Timetable

Assuming a grant award in August 2020, the proposed project and study would be completed along the following projected timeline:

- Pre-FEED study timeframe: Four months
- Expected results and analysis: EOY 2020
- Potential decision date for construction phase of hydrotreater: Q1 2021
- Operational target: Q1 2022

Budget

Total budget for this phase of the project is $285,000, see project description for breakdown of costs.

Matching Funds

Matching funds would consist of the following resources from the Dakota Gasification Company:

DGC In-Kind Cost-Share	$125,000
DGC Cash Cost-Share	$17,500
Total DGC Cost-Share	**$142,500**

The majority of matching funds would be met with in-kind contributions to the project. Such contributions would include project management, marketing analysis (return on investment, sensitivity analysis), staff travel, sampling costs, engineering hours (review process data, estimate of piping of all streams to appropriate location). Miscellaneous costs associated with the project would require cash outlays.

Standards of Success

The proposed project would be deemed successful if it demonstrates that the construction of a hydrotreater at the Great Plains Synfuels Plant would increase the value of naphtha and tar oil overheads and improve the profitability of the Synfuels Plant. Such data would provide support

for an informed decision to move ahead with construction of a hydrotreater, or demonstrate the need for additional analysis.

Tax Liability Affidavit

AFFIDAVIT OF MARK D. FOSS

Mark D. Foss being first duly sworn, does hereby state:

1. My name is Mark D. Foss. I am Corporate Secretary for Dakota Gasification Company ("Dakota Gas "), a North Dakota corporation.

2. The statements made in this Affidavit are based on information gained through my position and responsibilities as Corporate Secretary of Dakota Gas. as well as a review of information that is kept in the ordinary course of business and information provided to me by persons upon whom I regularly rely in the ordinary course of my duties.

3. Dakota Gas does not does not have an outstanding tax liability owed to the State of North Dakota or any of its political subdivisions.

FURTHER, AFFIANT SAYETH NOT.

Pursuant to 28 U.S.C. 1746, I declare under penalty of perjury that the foregoing is true and correct. Executed on July 14, 2020.

Mark D. Foss