INDUSTRIAL COMMISSION OF NORTH DAKOTA

Doug Burgum
Governor

Drew H. Wrigley
Attorney General

Doug Goehring
Agriculture Commissioner

Monday, September 30, 2024
Governor's Conference Room or Microsoft Teams – 1:00 pm
Meeting Coordinators:
Karen Tyler, Executive Director
Reice Haase, Deputy Executive Director
Brenna Jessen, Recording Secretary

Join on your computer or mobile app

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Or call in (audio only)

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I. Roll Call and Pledge of Allegiance

II. Office of the Industrial Commission – Karen Tyler

A. **Consideration of August 27th, 2024 Industrial Commission Meeting Minutes** (Attachment 1)

B. **Review of Memo from Lt. Governor, Chief Deputy AG, and Deputy Ag Commissioner and Consideration of Compensation Recommendation** (Attachment 1A)

C. Other Office of Industrial Commission business

(approximately 1:15 pm)

III. Department of Mineral Resources – Nathan Anderson, Mark Bohrer

A. **Consideration of the following DMR cases:**

i. Order No. 33451 issued in Case No. 30793 regarding a petition of Resonance Exploration (North Dakota) LLC for the unitized management, operation, and further development of the proposed West Roth-Madison (Fylling) Unit Area in Bottineau County, ND (Attachment 2)

ii. Order No. 33452 issued in Case No. 30794 regarding an application of Resonance Exploration (North Dakota) LLC to determine the plan of unitization for the West Roth-Madison (Fylling) Unit Area, Bottineau County, ND, has been signed, ratified or approved by owners of interest (Attachment 2A)

B. Other Department of Mineral Resources business

Meeting Closed to the Public for Executive Session Pursuant to NDCC 44-04-18.4, 44-04-19.1 and 44-04-19.2

(approximately 1:30 pm)

IV. Proprietary Technology Commercialization and Public-Private Partnership Discussion in executive session pursuant to 44-04-18.4(2)(c)(6) and 44-04-18.4(5) – Josh Teigen, Commerce Commissioner

Meeting Returns to Public Session

(approximately 2:15 pm)

V. Formal Action Taken in Public Session

VI. North Dakota Building Authority – DeAnn Ament, Mindy Piatz

A. Presentation of June 30, 2024, Audit, (Attachment 3) Mindy Piatz, Brady Martz
B. Other Building Authority Business

(approximately 2:30 pm)

VII. North Dakota Public Finance Agency – DeAnn Ament

A. **Consideration of the Following State Revolving Fund Loan Applications:**
    i. Fargo – Clean Water - $15,000,000 (Attachment 4)
    ii. Jamestown – Clean Water - $3,321,000 (Attachment 5)
    iii. Mandan – Drinking Water - $5,462,000 (Attachment 6)
B. Presentation of a Memo of State Revolving Fund Loans Approved by Advisory Committee (Attachment 7)
    i. All Seasons Water Users District – Drinking Water - $1,856,000 increase to previously approved $1,738,000
    ii. Dakota Rural Water District – Drinking Water - $107,000 increase to previously approved $2,176,000
    iii. Wilton – Drinking Water – $431,000 increase to previously approved $1,688,000
    iv. Wilton – Clean Water - $201,000 increase to previously approved $1,319,000
C. Other North Dakota Public Finance Authority Business

(approximately 3:15 pm)

VIII. Renewable Energy Program – Reice Haase

A. Presentation of Renewable Energy Program Project Management and Financial Report (Attachment 9)

B. **Consideration of Renewable Energy Council recommended projects for Grant Round 54:**

   i. R-054-B: ACS NewCarbon RNG Project; Submitted by NewCarbon Feedstocks, LLC; Total Project Costs: $930,000; Amount Requested: $455,000 (Attachment 10)

   ii. R-054-C: VBD NewCarbon RNG Project; Submitted by NewCarbon Feedstocks, LLC; Total Project Costs: $930,000; Amount Requested: $455,000 (Attachment 11)

   iii. R-054-D: Accelerating the Waste-to-Fuels Commercialization for the Sandwich Gasifier; Submitted by Singularity Energy Technologies; Total Project Costs: $978,950; Amount Requested: $486,950 (Attachment 12)

C. Other Renewable Energy Program business

(approximately 3:45 pm)

IX. Legal Update* – Phil Axt, John Reiten

A. Litigation Status:

   i. EPA Mercury and Air Toxics Rule
   ii. EPA Carbon Rule
   iii. EPA Methane OOOO Rule
   iv. BLM Venting and Flaring Rule
   v. BLM Conservation Rule
   vi. CEQ NEPA Phase 2 Rule
   vii. EPA WOTUS Rule

B. Federal Regulatory Update:

   i. BLM Resource Management Plan

C. Other Legal Updates

* Possible Executive Session under N.D.C.C. 44-04-19.1(9) & 44-04-19.2 for attorney consultation

Meeting Closed to the Public for Executive Session Pursuant to NDCC 6-09-35, 44-04-19.1 and 44-04-19.2

(approximately 4:00 pm)

X. Bank of North Dakota Executive Session – Don Morgan, Kirby Evanger, Gus Staahl

A. **Consideration for Approval of One Loan (Confidential Attachment 13)**
B. Report on Two Problem Loans (Confidential Attachments 14-15)
C. Presentation on Problem Loans as of August 31, 2024 (Confidential Attachment 16)
D. Presentation of Confidential Meeting Minutes (Confidential Attachment 17)
E. Other Bank of North Dakota Confidential Business

Meeting Returns to Public Session

XI. Adjournment

Next Meeting – October 29th, 2024, 1:00 pm
Governor's Conference Room

Minutes of a Meeting of the Industrial Commission of North Dakota

Held on August 28th, 2024 beginning at 12:30 p.m.

Governor's Conference Room – State Capitol

Present: Governor Doug Burgum, Chairman

Attorney General Drew H. Wrigley

Agriculture Commissioner Doug Goehring

Also Present: This meeting was open through Microsoft Teams so not all attendees are known.

Agency representatives joined various portions of the meeting.

Governor Burgum called the meeting of the Industrial Commission to order at approximately 1:10 p.m.

Ms. Karen Tyler took roll call, and Governor Burgum, Commissioner Goehring, and Attorney General Wrigley were present.

Governor Burgum invited the room to stand and join the Commission in saying the Pledge of Allegiance.

OFFICE OF THE INDUSTRIAL COMMISSION

Ms. Karen Tyler presented for consideration of approval the July 2nd, July 30th, and August 14th, 2024, Industrial Commission meeting minutes.

It was moved by Commissioner Goehring and seconded by Attorney General Wrigley that the Industrial Commission approve the July 2nd, July 30th, and August 14th, 2024, Industrial Commission meeting minutes.

On a roll call vote, Governor Burgum, Attorney General Wrigley, and Commissioner Goehring voted aye. The motion carried unanimously.

NORTH DAKOTA PUBLIC FINANCE AGENCY

Ms. DeAnn Ament presented for consideration of approval the following State Revolving Fund loan applications:

i. Grand Forks – Clean Water $6,922,000

The project is Phases 3 through 5 which will upgrade aging septic systems by installation and connection to the City's sanitary sewer system. The requested loan term is 30 years, and the City will issue an improvement bond payable with special assessment collections. The annual payment will average $298,390.

It was moved by Commissioner Goehring and seconded by Attorney General Wrigley that the Industrial Commission approve the Clean Water State Revolving Fund loan request for $6,922,000 for the City of Grand Forks.

On a roll call vote, Governor Burgum, Attorney General Wrigley, and Commissioner Goehring voted aye. The motion carried unanimously.

A RESOLUTION WAS MADE

RESOLUTION APPROVING
LOAN FROM CLEAN WATER STATE REVOLVING FUND

WHEREAS, the Industrial Commission has heretofore authorized the creation of a Clean Water State Revolving Fund Program (the "Program") pursuant to N.D.C.C. chs. 6-09.4 and 61-28.2; and

WHEREAS, the Clean Water State Revolving Fund is governed in part by the Master Trust Indenture dated as of July 1, 2011 (the "Indenture"), between the North Dakota Public Finance Authority (NDPFA) and the Bank of North Dakota (the Trustee); and

WHEREAS, the City of Grand Forks (the "Political Subdivision") has requested a loan in the amount of $6,922,000 from the Program for phases three through five of the installation of a sanitary sewer collection system to serve areas currently on septic systems in need of replacement, which will remove the potential for underground nutrient shifts impacting the watershed; and

WHEREAS, the NDPFA's Advisory Committee is recommending approval of the Loan; and

WHEREAS, there has been presented to this Commission a form of Loan Agreement proposed to be adopted by the Political Subdivision and entered into with the NDPFA;

NOW, THEREFORE, BE IT RESOLVED by the Industrial Commission of North Dakota as follows:

1. The Loan is hereby approved, as recommended by the Advisory Committee.

2. The form of Loan Agreement to be entered into with the Political Subdivision is hereby approved in substantially the form on file and the Executive Director is hereby authorized to execute the same with all such changes and revisions therein as the Executive Director shall approve.

3. The Executive Director is authorized to fund the Loan from funds on hand in the Clean Water Loan Fund established under the Indenture upon receipt of the Municipal Securities described in the Political Subdivisions bond resolution, to submit to the Trustee a NDPFA Request pursuant to the Indenture, and to make such other determinations as are required under the Indenture.

4. The Commission declares its intent pursuant to Treasury Regulations '1.150-2 that any Loan funds advanced from the Federally Capitalized Loan Account shall be reimbursed from the proceeds of bonds issued by the NDPFA under the Indenture.

Adopted: August 27, 2024

ii. Southeast Water Users District – Drinking Water - $5,666,000

The project will design and construct a new water treatment plane to improve water quality for users. The requested loan term is 30 years. The District will issue revenue bonds payable from user fees and the annual payment will average $241,303.

It was moved by Commissioner Goehring and seconded by Attorney General Wrigley that the Industrial Commission approve the Drinking Water State Revolving Fund loan request for $5,666,000 for the Southeast Water Users District.

On a roll call vote, Governor Burgum, Attorney General Wrigley, and Commissioner Goehring voted aye. The motion carried unanimously.

A RESOLUTION WAS MADE

RESOLUTION APPROVING
LOAN FROM DRINKING WATER STATE REVOLVING FUND

WHEREAS, the Industrial Commission has heretofore authorized the creation of a Drinking Water State Revolving Fund Program (the "Program") pursuant to N.D.C.C. chs. 6-09.4, 61-28.1, and 61-28.2; and

WHEREAS, the State Revolving Fund is governed in part by the Master Trust Indenture dated as of July 1, 2011 (the "Indenture"), between the North Dakota Public Finance Authority (the "NDPFA") and the Bank of North Dakota (the "Trustee"); and

WHEREAS, Southeast Water Users District (the "Political Subdivision") has requested a loan in the amount of $5,666,000 from the Program to design and construct a new iron and manganese removal water treatment plant to improve water quality for users in Dickey, LaMoure and Logan Counties; and

WHEREAS, NDPFA's Advisory Committee is recommending approval of the Loan; and

WHEREAS, there has been presented to this Commission a form of Loan Agreement proposed to be adopted by the Political Subdivision and entered into with the NDPFA;

NOW, THEREFORE, BE IT RESOLVED by the Industrial Commission of North Dakota as follows:

1. The Loan is hereby approved, as recommended by the Advisory Committee.

2. The form of Loan Agreement to be entered into with the Political Subdivision is hereby approved in substantially the form on file and the Executive Director is hereby authorized to execute the same with all such changes and revisions therein as the Executive Director shall approve.

3. The Executive Director is authorized to fund the Loan from funds on hand in the Drinking Water Loan Fund established under the Indenture upon receipt of the Municipal Securities described in the Political Subdivisions bond resolution, to submit to the Trustee a NDPFA Request pursuant to the Indenture, and to make such other determinations as are required under the Indenture.

4. The Commission declares its intent pursuant to Treasury Regulations '1.150-2 that any Loan funds advanced from the Federally Capitalized Loan Account shall be reimbursed from the proceeds of bonds issued by the NDPFA under the Indenture.

Adopted: August 27, 2024

Ms. Ament presented a memo of State Revolving loans approved by PFA Advisory Committee.

i. Dayton – Clean Water - $350,000

The purpose of this project is to replace water meters with meters compatible with meter reading software to accurately bill for water that will be purchased from rural water once the switch is made in the summer of 2024. The requested term is 20 years. The City will issue revenue bonds payable with water and sewer user fees, and the average annual payment will be $20,396.

Ms. Ament presented a memo on the sale of a $200,920,000 State Revolving Fund Program Bonds, Series 2024A.

The Authority competitively sold the Series 2024A Bonds on August 23, 2024 to make loans to political subdivisions of the State of North Dakota and certain other entities (the "Borrowers") through the purchase of certain obligations issued by such Borrowers, for use in connection with the financing or refinancing of water pollution control and drinking water projects, and pay costs of issuance related to the Series 2024A Bonds. The Authority received six bids, as summarized below.

Bidder	Net Interest Cost	True Interest Rate
Jefferies LLC	$84,058,349.79	3.3992%
BofA Securities	$84,597,878.66	3.4265%
Wells Faro Bank, N.A.	$84,724,866.32	3.4330%
Morgan Stanley & Co, LLC	$85,055,507.15	3.4497%
J.P. Morgan Securities LLC	$85,082,369.28	3.4511%
Mesirow Financial, Inc.	$85,206,259.01	3.4574%

DEPARTMENT OF MINERAL RESOURCES

Mr. Mark Bohrer presented for consideration of approval the following cases:

i. Order No. 33694 issued in Case No. 31008 regarding the confiscation of all production-related equipment and salable oil at the Oltmans Ocelot 1-21 well in Stark County, ND.

It was moved by Commissioner Goehring and seconded by Attorney General Wrigley that the Industrial Commission approves Order No. 33694 issued in Case No. 31008 authorizing the confiscation of all production-related equipment and salable oil at the Oltmans Ocelot 1-21 well (File No. 36308), NENW Section 21, T.139N., R.96W., Wildcat Field, Stark County, ND, operated by Freedom Energy Operating, LLC, or any working interest owner, pursuant to NDCC §§ 38-08-04 and 38-08-04.9., and providing such other and further relief.

On a roll call vote, Governor Burgum, Attorney General Wrigley, and Commissioner Goehring voted aye. The motion carried unanimously.

ii. Order No. 33664 issued in Case No. 30992 regarding an application of Zargon Oil (ND) Inc. authorizing the conversion of the E.J. Feland 25-6 well in Bottineau County, ND for the injection of fluids for enhanced oil recovery.

It was moved by Commissioner Goehring and seconded by Attorney General Wrigley that the Industrial Commission approves Order No. 33664 issued in Case No. 30992 approving the application of Zargon Oil (ND) Inc. for an order authorizing the conversion of the E.J. Feland 25-6 well (File No. 6738), with a location in the SENW of Section 25, T.163N., R83W., Bottineau County, ND, Haas-Madison Unit, for the injection of fluids into the unitized formation pursuant to NDAC Chapter 43-02-05, and such other relief as is appropriate.

On a roll call vote, Governor Burgum, Attorney General Wrigley, and Commissioner Goehring voted aye. The motion carried unanimously.

Mr. Ed Murphy gave a presentation of the North Dakota Geological Survey Quarterly Report. (The full report can be found on the website).

Wilson M. Laird Core and Sample Library

During the second quarter of 2024, geologists from two oil companies, the Geological Survey and EERC, professors from West Virginia University and Minnesota State University-Moorhead, and graduate students from UND studied 10,164 feet of core. Additionally, 1,066 feet of core was sent to the Williston Basin Petroleum Conference core workshop in Bismarck for a quarterly total of 11,230 feet. A total of 4,972 feet of core was photographed generating 6,577 standard photographs and 3,241 feet of core was photographed with a tripod generating 256 photographs for the subscription site.

Williston Basin Petroleum Conference

Twenty-five hundred people attended the 31st Williston Basin Petroleum Conference in Bismarck from May 14-16. The conference began in 1993 as the International Williston Basin Horizontal Well Workshop and was sponsored by the North Dakota and Saskatchewan Geological Surveys. The conference was created as an opportunity for geologists and engineers in both Canada and the United States to share their successes and failures regarding the relatively new technology of horizontal drilling. In 2006, the North Dakota Petroleum Council was brought in as a partner as a means of taking much of the time-consuming conference preparation away from the Geological Survey on the even numbered years when the conference was held in Bismarck. At that time, the conference was rebranded as the Williston Basin Petroleum Conference & Prospect Expo.

Over the years, the North Dakota conferences have grown significantly in both size and content. In 1993, it had a handful of booths, a dozen presentations (compared to 56 presentations in 2024), and 179 attendees. During the first 15 years of the conference, attendance averaged 385 participants, but jumped to an average of 2,850 over the last 16 years, with a high of 4,250 in 2014. While the Bakken Play has been largely responsible for that, the partnership with the ND Petroleum Council has been able to capitalize on that interest.

Critical Minerals Drilling Project

During the 68th Legislative Session, the Geological Survey received $500,000 in one-time funding to complete a 50-hole drilling project in western North Dakota targeting coals within and immediately beneath the Bear Den Member of the Golden Valley Formation and the Rhame bed at the top of the Slope Formation. Two geologists spent 400 hours correlating the coals from thousands of electric logs in an effort to choose ND Trust Lands surface and mineral tracts that held the most promise for

intercepting these target zones. Additionally, hundreds of hours were spent obtaining a permit from ND Trust Lands, securing contracts with drilling and logging companies, field checking the proposed drill sites, contacting Trust Lands lessees and the surface owners of Trust Lands mineral tracts, and procuring drilling supplies. Seventy-five tracts were chosen, 25 Trust Lands surface and mineral tracts and 50 tracts with Trust Lands minerals and private surface.

To date, we have spent over 800 hours on drilling preparation and anticipate another 800 hours will be spent drilling/coring the holes. The drilling project is scheduled to start the first week in September and is anticipated to take two truck-mounted rigs, three weeks to complete.

Woolly Mammoth in Northwestern North Dakota

In August of 1988, I was doing fieldwork in Bowman County when I was asked to investigate a site in northwestern North Dakota where woolly mammoth bones were reportedly encountered while digging the foundation for a garage. By the time I received the information, the slab had been poured, the garage was built, and there were no bones left at the surface. I met with the high school science teacher at the job site and got the names of the three construction workers who had encountered the bones. The homeowner said he would allow us to remove the slab to go after the bones as long as we got it poured back in during the month of September. I contacted a number of agencies and professors at ND universities, but no one had the time, nor the funds, to undertake the job on such short notice. Last December, after thinking about this for thirty-five years, I contacted the homeowner and obtained permission for the Geological Survey and the State Historical Society to investigate the site. We went up there in May and the Historical Society conducted ground-penetrating radar and resistivity surveys, both inside and around the perimeter of the garage. Preliminary interpretation of the ground-penetrating radar confirmed the location where two of the three construction workers said the mammoth bones were encountered. The homeowner allowed us to dig along the outside wall at this spot and 100 kindergarteners through 6th graders, along with a handful of 7th and 8th graders, from the nearby town came by on one of the last days of school to see what we were doing. Clint Boyd gave each grade a short presentation and showed them a woolly mammoth tooth and archaeologists Margaret Patton and Brittany Brooks explained how the ground-penetrating radar and resistivity surveys work. We allowed each student to participate in the dig by removing a shovelful of the foundation backfill from the site. That backfill turned out to contain several pieces of bone and tusk. In addition, when we got below the fill, we found three, undisturbed bones. We covered those bones with plaster to protect them until the paleontology and archaeology crews can get back up there this fall to do a detailed excavation.

STATE ENERGY RESEARCH CENTER

Mr. Charles Gorecki presented the State Energy Research Center Annual Report. (The full report can be found on the website).

North Dakota is blessed with abundant energy opportunities (including coal, oil and gas, wind, biofuels, and solar), exceptional agricultural production, and a highly skilled workforce. To keep North Dakota globally competitive while focusing on resource and environmental stewardship, new and more efficient energy production technologies and methods are needed. This includes innovative energy and agricultural synergies and the creation of new value-added products from raw materials and energy by-products/wastes. Recognizing this need, the 66th Legislative Assembly of North Dakota, through Senate Bill SB2249, named the University of North Dakota (UND) Energy & Environmental Research Center

(EERC) the State Energy Research Center (SERC) of North Dakota. SERC is built on the EERC's long history as a leader in critical energy research, with the purpose of serving the state of North Dakota by developing technologies to ensure a prosperous energy future for the state.

The availability of commercially deployable technologies and concepts to serve the state in the future is dependent on continually creating innovative ideas. Exploratory research feeds research and development, eventually leading to demonstration and commercialization.

Funding for SERC activities, up to $7.5 million per biennium, is provided from a small portion of the oil and gas production and extraction taxes. Currently, SERC funding has been directed by the Legislature through June 30, 2029, and activities will continue according to the scope of work with the North Dakota Industrial Commission (NDIC) through that date.

SERC was given the mandate to provide practical, pioneering technologies and methods to support North Dakota's energy opportunities and benefit the state's economy and environment. Three corresponding work tasks were created to execute SERC's mandate:

- Task 1 – Perform Exploratory Research for North Dakota Energy
- Task 2 – Provide Prompt Expertise for North Dakota
- Task 3 – Advocate and Educate Through Outreach

Task 1 Annual Summary

Over the past year, 53 fundamental research concepts were identified and evaluated, with 18 new projects ultimately selected for SERC funding. These projects are listed below, along with the four projects that were ongoing at the time of last year's annual report. Six projects were completed this past year, resulting in 16 projects ongoing.

In addition to those projects, the EERC began a new exploratory research effort this year entitled "SERC Strategic Initiatives." These topical initiatives were selected for their strategic relevance to the state of North Dakota, its energy and other industries, its environment, and its people. It is anticipated that the strategic topics within this effort may change based on evolving opportunities and value to the state. The strategic initiatives that began this year are listed below:

- Maximizing National Security Opportunities with North Dakota's Energy Industries (ongoing)
- Critical and Novel Materials to Support North Dakota's Energy (ongoing)
- Strategic Operational Development to Support North Dakota Energy Research (ongoing)
- Enhancing the Nexus Between North Dakota's Energy Opportunities and Tribal Nations (ongoing)

To date, inventions from SERC have resulted in 11 U.S. patent applications submitted (not including an additional 21 continuation, continuation in part (CIP), divisional, or foreign applications), six U.S. patents received, one signed license agreement, and one license agreement at the final stages of negotiation at the time of this reporting.

Task 2 Annual Summary

North Dakota Grid Resiliency Plan Completion and Update:

In the fall of 2023, the EERC completed a North Dakota Grid Resiliency Plan for the North Dakota Transmission Authority (NDTA) as part of a larger project for the North Dakota Department of Commerce (effort discussed in the previous SERC annual report). The resiliency plan evaluates risks and threats that various hazards pose to the North Dakota electric grid and addresses gaps in improving grid resiliency. It also focuses on a resilience assessment framework that evaluates the current resilience strategies and provides recommendations for improving grid resiliency in the context of emerging catastrophic threats to the regional grid. Following the plan's completion, NDTA requested that the EERC update the resiliency plan based on feedback received from the federal government. At its April 2024 meeting, NDIC approved the use of $87,000 of Task 2 funding to update the state grid resiliency plan. To accomplish the update, the current plan will be reviewed and revised or updated as needed. Key activities performed throughout the year included the following:

- Recent grid reliability assessments by Southwest Power Pool, Midcontinent Independent System Operator, the North American Electric Reliability Council, and the Federal Energy Regulatory Commission were reviewed, and relevant data have been gathered.
- The generation and transmission adequacy sections in the existing grid resiliency report were updated based on the latest data.
- Demand growth data for North Dakota began to be collected, and the risk profiles were reviewed to determine if any changes or updates are needed.

North Dakota 20-year CO_2 EOR Forecast

At its November 2023 meeting, NDIC approved the use of $135,000 of Task 2 funding to execute a project focused on enhanced oil recovery (EOR). This project is forecasting incremental oil production associated with CO2 EOR in North Dakota's conventional and unconventional reservoirs. The forecast focuses on realistic development scenarios in the 2024–2045 time frame and includes the projected CO2 availability and demand and a prediction of yearly net CO2 use and incremental oil production. The EERC is working with the Bank of North Dakota and the North Dakota Tax Department to evaluate the economic impacts of a broad EOR program in the state. Key activities performed throughout the year include the following:

- Potential realistic development scenarios were outlined, and the forecasting of incremental oil production associated with CO2 EOR was performed using analytical models. Both unconventional and conventional reservoirs were investigated, with a focus on potential development in the 2025 to 2044 time frame (20 years).
- The unconventional reservoirs included in the study were the Bakken and Three Forks Formations of the Bakken petroleum system. The conventional reservoirs included in the study were 21 fields representing approximately 28% of conventional oil in place.
- Technical activities for this project were completed, and a draft final report was prepared and submitted to the Bank of North Dakota and the North Dakota Tax Department for their review.
- The EERC will present the findings of this work at a future NDIC monthly meeting.

Task 3 Annual Summary

This task is focused on outreach activities to advocate for and educate about North Dakota's energy industries. Within this task, opportunities to collaborate with other North Dakota institutions of higher education were created. During the last year, the primary education and outreach activities have been related to the Energy Hawks Program.

Energy Hawks:

The multidisciplinary Energy Hawks Program brings together students from a variety of academic programs and institutions to collaborate on identifying value-added opportunities for North Dakota energy. Highlights from the Energy Hawks Program over the last year are discussed below.

Public Engagement Presentations

With the objectives of energy outreach and education, as well as recruiting Energy Hawks applicants, a panel discussion entitled "Energy Hawks Present: The Future of Energy" was planned and carried out on the UND campus by the Energy Hawks Program as follows:

- The event held March 14, 2024, was open to the public and featured EERC and UND College of Engineering and Mines research staff as panel members engaging in discussion focused on current and future energy issues, facilitated by a former Energy Hawks intern. Information on the Energy Hawks Program was also provided.
- An estimated audience of 30 UND students attended and engaged the panelists with questions. Learnings from this panel discussion were captured to support similar events that may be held in the future.

2023 Program

The 2023 Energy Hawks Program consisted of 14 students: 13 from UND and one from Minot State University (Figure 8). Bismarck State College (BSC), North Dakota State University (NDSU), Williston State College, NHS College, and Dickinson State College declined the offer to participate in 2023. The 14 students spent 10 weeks learning about all forms of North Dakota energy. The 2023 program consisted of a team-building workshop at the EERC, a weeklong in-person tour of western North Dakota's energy industry, and on-site and hybrid on-site/virtual participation at the EERC. Three concept research projects were developed and presented by the 2023 Energy Hawks to EERC research staff.

Mr. Gorecki presented a report on CO_2 Enhanced Oil Recovery Forecast prepared under Contract SERC-2019 Task 2.

The goal for the study is to forecast plausible CO_2 EOR development scenarios (5-20 million tons CO_2/year) in North Dakota's unconventional and conventional reservoirs over 20 years.

Bakken

- Incremental oil recoveries ranged from 337 million barrels (MMbbl) to 1 billion barrels (Bbbl) under low- and high-CO_2-availability scenarios, with an average of 694 MMbbl under the baseline CO_2 scenario of 10 million tonnes (MMt) CO_2/year.
- CO_2 supply demands ranged from 93 to 294 MMt, depending on the scenario.

- If EOR were operated to maintain higherCO_2-utilization rates or we achieved greater IOR ratios, greater than 15 MMt CO_2/year would be needed (CO_2 supply constrained).

Conventional Reservoirs

- Incremental oil recoveries were 105 MMbbl, and CO_2 supply demand was 88 MMt.

Bakken CO_2 EOR Development Assumptions

- **Baseline case:** CO_2 was limited to 10 MMt of CO_2/year. The baseline case assumed 6 thousand cubic feet (Mcf)/bbl (0.3 tonnes/bbl) and an increased oil recovery (IOR) ratio of 1.3.
- **Low-/high-CO_2-availability cases:** Two additional sensitivity cases were considered using 50% less (5 MMt CO_2/year) and 50% more (15 MMt CO_2/year).
- **High-CO_2-utilization case:** The high-CO_2-utilization case used 3x more CO_2 per incremental barrel than the baseline case (17.3 Mcf/bbl, or 0.9 tonnes/bbl) to explore a scenario where operators were incentivized to store CO_2.
- **High-IOR case:** The high-IOR case increased the IOR from 1.3 to 1.6, and CO_2 utilization was 9.6 Mcf/bbl (0.5 tonnes/bbl).

Conventional 20-Year CO_2 EOR Performance

- Maximum daily oil rate: 23 Mbbl/day
- Average daily oil rate: 14 Mbbl/day
- Cumulative incremental oil production over 20 years: 105 MMbbl
- Maximum and average CO_2 utilization were 17,000 and 12,000 tonnes of CO_2/day, respectively
- Cumulative purchased CO_2 over 20 years: 88 MMt CO_2

NORTH DAKOTA TRANSMISSION AUTHORITY

Mr. Claire Vigesaa presented the following reports (The full reports can be found on the website):

i. Transmission Authority Annual Report

Budget

The 68th ND Legislative Assembly appropriated $300,000 to operate the NDTA for the 2023-2025 biennium. The Legislative Assembly also appropriated $1,124,856 for the 15% match requirement for the FY22/FY23 IIJA Grid Resilience Formula Grant Program. This match enabled North Dakota to access $7,499,037 in DOE funds for grid enhancing project awards to utilities serving North Dakota consumers.

The NDTA accessed funds from both the NDIC lignite litigation budget as well as the Enhance, Protect & Preserve fund to commission a ND Transmission Capacity Study and EPA rule impact studies on Mid-Continent Independent System Operator (MISO) and the Southwest Power Pool (SPP).

The NDTA has financed one project, Rainbow Energy's purchase of the NEXUS HVDC line that originates at Coal Creek Station and terminates in the Minneapolis area. The bond financing's term is 20 years with interest at a rate of 3.55% per annum secured by the mortgaged property.

Activities

IIJA GRID RESILIENCY GRANTS: The $7,499,037 DOE award (for FY22 & FY23) under the Bipartisan Infrastructure Law – Section 40101(d) created a new activity for the NDTA. The 68th ND Legislative Assembly voted to provide the 15% state match, $1,124,856. The ND Industrial Commission entered a contract with EERC to provide grant administrative support. Applications were solicited in October 2023 for projects in North Dakota that would "prevent outages and enhance the resilience of the electric grid". Twelve applications were received, totaling $17,355,257 in requests. Outside technical reviewers scored the applications; the NDIC granted four awards at their December 2023 commission meeting.

GRID RESILIENCE AND INNOVATION PARTNERSHIP (GRIP) – DOE GRANT: For the GRIP opportunity, a state entity is required to be the primary applicant. The NDIC, at their December 2023 commission meeting moved to accept that role for the North Dakota Association of Electric Cooperatives grant application. That application did not get DOE encouragement to move forward. However, Grid United's GRIP project application received DOE encouragement to apply. In March 2024, the NDIC moved to support collaboration and participation with the Montana Department of Commerce for Grid United's GRIP application to support the North Plains Connector project.

MIDWEST GOVERNORS ASSOCIATION (MGA): The MGA established an initiative (MID-GRID 2035) for regional transmission education and planning to position the Midwest as a modern energy producer and low-cost energy provider, with the goal to establish a long-term transmission grid vision for the region. The NDTA participated in three conferences held by the MGA, MID-GRID 2035 quarterly meeting at SPP Headquarters – September 2023, the MGA Transmission Summit in Detroit – November 2023 and the MGA Transmission Summit in Welch, MN – April 2024.

MIDWEST RELIABILITY ORGANIZATION (MRO**):** On October 25, 2023, the NDTA became a member of the MRO in the Adjunct Sector. MRO's primary responsibilities are to: ensure compliance with mandatory reliability standards by entities who use, own or operate the North American bulk power system; conduct assessments of the grid's ability to meet electric power demand in the region; and analyze regional system events. Additionally, MRO creates an open forum for stakeholder experts in the region to discuss important topics related to addressing risk and improving reliable operations of the grid. MRO serves as a vital link between grid owners, users, operators, and other stakeholders who share common reliability interests in the region. The organization presents opportunities to learn with electric grid operators in the region. Board representation from our constituents include Darcy Neigum-MDU, JoAnn Thompson-Otter Tail Power Company, Lloyd Linke-WAPA, Priti Patel-Great River Energy, and Sandra Johnson-Xcel Energy.

REGIONAL TRANSMISSION ORGANIZATIONS: North Dakota is served by two regional transmission organizations, Mid-Continent Independent System Operator (MISO) and the Southwest Power Pool (SPP). The NDTA attends numerous committee meetings for both MISO and SPP to keep abreast of initiatives that impact grid reliability, particularly for North Dakota. Both RTOs are undergoing transformative shifts due to significant load growth, changing generation mixes and transmission development.

NDTA Studies

The North Dakota Transmission Authority periodically conducts independent evaluation of factors that affect the grid reliability of electric transmission in North Dakota. In 2024, three studies were commissioned, the Impact of EPA's MATS Rule on Generation Adequacy, DOE's Final Carbon rule impact study on MISO & SPP, and a North Dakota Transmission Capacity Study. The first study provided an analysis of the proposed Mercury and Toxic Air Standards rule. The study revealed dire consequences to grid reliability and generation resource adequacy. The MATS rule would essentially shutter ND Lignite coal generation, a critical dispatchable generation resource. The graph below shows that by 2026, MISO would depend on intermittent resources for power reserve margins and by 2029, would be dependent on intermittent generation resources to meet peak demand.

The second study, Final Carbon rule impact study, on MISO and SPP manifested even more dire consequences to grid reliability and generation resource adequacy. As noted in the slide below, the study shows that MISO will be dependent on non-dispatchable generation to meet projected peak demand in winter 2028. The study also shows that SPP would have dire consequences from the proposed EPA Carbon Rule; depending on non-dispatchable generation in 2028 for winter peak demand and post 2030…impossible to meet demand.

The third study, the North Dakota Transmission Capacity Study, assessed the capacity of the ND transmission grid. The first phase of the study was completed in February, this phase summarized the current proposed generation and transmission projects in the state and reported their impact on ND transmission capacity. The second phase will provide key analyses of ND transmission capacity: steady-state power flow analysis. The study developed long-term transmission models to perform steady-state assessments of ND transmission capacity. The study is to be completed in the third quarter of 2024.

ii. Resource Adequacy in North Dakota Annual Report

Risks to Grid Reliability

The North American Electric Reliability Corporation (NERC) has identified five significant evolving and interdependent risks to grid reliability. Those five include:

Energy Policy: With increase legislative focus on decarbonization, decentralization and electrification, energy policy is expected to drive rapid change. NERC emphasizes that there is great need to increase coordination and collaboration among all policy makers, regulators as well as the operators and owners of the bulk electric system. With the higher proportion of variable and renewable fueled resources, resource adequacy and capacity accreditation must be critically assessed.

Grid Transformation: NERC recommends that operators ensure sufficient operating flexibility; ensuring that flexible ramping/balancing capacity is available to meet the changing patterns of variability and new characteristics of system performance.

Extreme Weather Events: As for extreme weather events, NERC recommends that grid operators conduct special assessments of extreme event impacts and creating simulation models to establish protocols/procedures for system recovery and resiliency. Further, planning and construction of transmission infrastructure should be accelerated.

Security: To combat both physical and cyber security threats, recommendations include the facilitation/development of planning approaches, models, and simulation to reduce the number of critical facilities. Ultimately mitigating impacts relative to the exposure to attacks.

Critical Infrastructure Interdependencies: Recent storm events have exposed weaknesses in the coordination of natural gas supplies as well as water resources and digital communications.

Transmission Capacity Study

Power Systems Engineering (PSE) was commissioned to complete a North Dakota Transmission Capacity Study. The first phase of the study included research into available recent transmission studies covering North Dakota. PSE reviewed those studies, identified projects, and formulated conclusions based on the results. Included in this phase was a summary of the currently proposed generation and transmission projects in the state and their reported impact on ND transmission capacity.

The second phase of the study focuses on key analyses of ND transmission capacity: steady-state powerflow analysis and optional dynamic stability analyses. PSE will develop near-term, and long-term transmission models to perform steady-state assessments of ND transmission capacity. The study is to be completed in the 3rd quarter of 2024.

ND Grid Resiliency Report

The NDTA supports the development of the ND Grid Resiliency Plan, a section in the North Dakota State Energy Security and Resiliency Plan. The report is updated annually with help from the EERC staff. Threats to North Dakota's electric grid include extreme weather events, changing generation fuel mix, resource adequacy, supply chain interruptions, aging infrastructure, and physical/cyber-attacks. This report provides information that will help communities ensure that the electric grid infrastructure is more resilient when catastrophic events occur. North Dakota utilities have a long history of expeditious and safe system restorations following floods, winds and ice storms. The 2023 December Ice Storm manifested the collaborative spirit among investor-owned utilities and cooperatives working to safely restore vital electric service to North Dakotans.

LEGAL UPDATE

A. Litigation Status:
    i. Northwest Landowners v. NDIC – Summary judgement was granted in favor of the State.
    ii. BLM Venting and Flaring Rule – Waiting for judge to rule on decision.
    iii. BLM Conservation Rule - Waiting for judge to rule on decision.
    iv. Council of Environmental Quality NEPA Phase II Rule – have completed initial summary judgement brief
    v. EPA Mercury and Air Toxics Rule – Filed emergency stay application with the Supreme Court
    vi. EPA Carbon Rule – Supreme Court directed EPA to respond - Replies have been filed and are waiting on Supreme Court's decision.
    vii. EPA Methane/OOOO Rule – Filed emergency stay application with the Supreme Court.
B. Federal Regulatory Update:

i. BLM Resource Management Plan – Came out on August 8th this year. There is a 30-day protest period from the date it was released. There is also a 60-day Governor's Consistency Review/challenge period.
ii. DAPL Environmental Impact Statement – No updates
iii. EPA Methane Tax Rule – No updates, waiting for rule to come out

NORTH DAKOTA MILL AND ELEVATOR

Ms. Cathy Dub presented the Report on Fiscal Year 2024 Transfers to the Agricultural Products Utilization Fund and the General Fund.

North Dakota Mill & Elevator

FY 2024 Transfers

	Dollars	**Percent**
FY 2024 Profit	$ 20,795,168	
Ag Product Utilization Fund	$ 1,039,758.	41 5.0%
General Fund	$ 9,877,704.85	50% of remaining profits
Total Transfers	$ 10,917,463.26	

* Transfers made Monday, July 22, 2024

Mr. Vance Taylor presented the 4th Quarter and Full Year 2024 Operations Report.

Operations in the 4th Quarter led to a profit of $5,767,217 compared to a profit of $5,923,246 in last year's 4th Quarter. For the year we had a profit of $20,795,168 compared to $17,238,265 last year. Sales for the 4th Quarter were $122,415,824 compared to $125,978,112 last year. Sales for the fiscal year came in at $504,415,675. This is 5.3% less than last year. Operating costs for the 4th Quarter are $14,061,483 compared to $14,875,571 last year, a decrease of 5.5%. Year-to-date operating costs are $50,226,703 compared to $48,487,503 last year, an increase of $1,739,200. For the 4th Quarter we experienced a profit of $5,767,217 compared to a profit of $5,923,246 last year. Gross margins as a percent of gross sales for the Quarter was 17.0% compared to 17.5% last year, a decrease of .5%.

Mr. Taylor presented for consideration of approval the 2025 Capital Plan.

The FY 2025 Capital Projects for consideration include Terminal Leg Head and Boot Replacements Engineering ($550,000), B Mill Upgrades ($1,700,000), K-Mill Tanks and Splitters ($110,000), H-Mill and Cleaning House Upgrades ($220,000), D-Mill Bucket Elevator and Cleaning House Upgrades ($350,000), G & I Mill Impactors ($140,000), A-Mill Rollstand Components ($180,000), Tote Packers -2 ($350,000), Small Packing Line Shrink Tunnel ($110,000), C-Mill Rollstand Controllers ($250,000), Rotex Screeners ($200,000), A/B Mill 9th Floor Project Engineering ($250,000), Track 3 Flour Loadout Engineering ($250,000), Roof Replacements ($1,050,000), Road and Lot Upgrades ($350,000), Rail Track Upgrades ($1,250,000), Lockers and Bathrooms Upgrade ($150,000), Lab Equipment ($170,000), Front End Payloader ($400,000), Skidsteer ($100,000), Air Compressors – 3 ($150,000), Spare Transformers – 2

($250,000), Switchgear Replacements ($450,000), Computers/Technology ($500,000), Other Capital ($500,000). The total new capital projects equal $9,780,000.

It was moved by Commissioner Goehring and seconded by Attorney General Wrigley that the Industrial Commission approve the North Dakota Mill and Elevator FY 2025 capital expenditures plan as presented.

On a roll call vote, Governor Burgum, Attorney General Wrigley, and Commissioner Goehring voted aye. The motion carried unanimously.

Mr. Taylor presented for consideration of approval the 2025 Gain Share Plan.

It was moved by Commissioner Goehring and seconded by Attorney General Wrigley that the Industrial Commission approve the North Dakota Mill and Elevator FY 2025 gain sharing plan as presented.

On a roll call vote, Governor Burgum, Attorney General Wrigley, and Commissioner Goehring voted aye. The motion carried unanimously.

It was moved by Attorney General Wrigley and seconded by Commissioner Goehring that under the authority of North Dakota Century Code Sections 6-09-35, 44-04-18.4, 44-04-19.1, 44-04-19.2, the Industrial Commission enter into executive session for the purposes of Mill and Elevator confidential business, to discuss confidential business related to a public-private partnership, and for Bank of North Dakota confidential business.

On a roll call vote, Governor Burgum, Attorney General Wrigley, and Commissioner Goehring voted aye. The motion carried unanimously.

The Commission is meeting in executive session regarding Mill and Elevator confidential business pursuant to N.D.C.C. 44-04-18.4 to consider those items listed on the agenda. Only Commission members, their staff, Commission staff, and Mill and Elevator staff will participate in that executive session.

After the Mill and Elevator executive session, the Commission will meet in executive session regarding confidential business related to a public-private partnership pursuant to N.D.C.C. 44-04-18.4 to consider those items listed on the agenda. Only Commission members, their staff, Commission staff, and Department of Commerce staff will participate in that executive session.

After the public-private partnership executive session, the Commission will meet in executive session regarding Bank of North Dakota confidential business pursuant to N.D.C.C. 6-09-35 and 44-04-19.2 to consider those items listed on the agenda under Bank of North Dakota confidential business. Only Commission members, their staff, Commission staff, and BND staff will participate in that executive session.

Any formal action taken by the Commission will occur after it reconvenes in open session.

Governor Burgum reminded the Commission members and those present in the executive sessions that the discussions must be limited to the announced purposes which is anticipated to last approximately 1 hour and 30 minutes.

The executive session began at approximately 3:30 p.m.

Meeting Closed to the Public for Executive Session Pursuant to NDCC 6-09-35, 44-04-18.4, 44-04-19.1 and 44-04-19.2.

NORTH DAKOTA MILL AND ELEVATOR EXECUTIVE SESSION

Industrial Commission Members Present
Governor Doug Burgum
Attorney General Drew H. Wrigley
Agriculture Commissioner Doug Goehring

Mill and Elevator Members Present
Vance Taylor
Cathy Dubb

Others in attendance

John Reiten	Governor's Office
Zach Greenberg	Governor's Office
Jace Beehler	Governor's Office
Karen Tyler	Industrial Commission Office
Reice Haase	Industrial Commission Office
Brenna Jessen	Industrial Commission Office
Erin Stieg	Industrial Commission Office

PUBLIC-PRIVATE PARTNERSHIP DISCUSSION

Industrial Commission Members Present
Governor Doug Burgum
Attorney General Drew H. Wrigley
Agriculture Commissioner Doug Goehring

Commerce Members Present
Josh Teigen

Others in attendance

John Reiten	Governor's Office
Zach Greenberg	Governor's Office
Karen Tyler	Industrial Commission Office
Reice Haase	Industrial Commission Office
Brenna Jessen	Industrial Commission Office
Erin Stieg	Industrial Commission Office

BANK OF NORTH DAKOTA EXECUTIVE SESSION

Industrial Commission Members Present
Governor Doug Burgum
Attorney General Drew H. Wrigley
Agriculture Commissioner Doug Goehring

BND Members Present
Don Morgan
Kirby Evanger
Rob Pfennig
Craig Hanson

Others in attendance

John Reiten	Governor's Office
Zach Greenberg	Governor's Office
Jace Beehler	Governor's Office
Karen Tyler	Industrial Commission Office
Reice Haase	Industrial Commission Office
Brenna Jessen	Industrial Commission Office
Erin Stieg	Industrial Commission Office

The executive session ended at 5:46 p.m. and the Commission reconvened in open session.

During the Mill and Elevator executive session, the Commission discussed the Mill's 2025 Strategic Plan. No formal action was taken in that executive session.

It was moved by Commissioner Goehring and seconded by Attorney General Wrigley that the Industrial Commission approve the 2025 North Dakota Mill and Elevator Strategic Plan.

On a roll call vote, Governor Burgum, Attorney General Wrigley, and Commissioner Goehring voted aye. The motion carried unanimously.

During the public-private partnership executive session, the Commission discussed that item listed on the agenda. During the Bank of North Dakota executive session, the Commission discussed those items listed on the agenda under Bank of North Dakota confidential business.

No formal action was taken during either executive session.

BANK OF NORTH DAKOTA

Mr. Rob Pfennig presented the Second Quarter 2024 Performance Highlights.

Second quarter 2024 ended with assets of $10.7 billion driven by continued growth in the loan portfolio. The loan portfolio grew to nearly $6 billion. The timing of funding in the State Institution loan program as well as BND's Match program did not meet budget expectation in the Commercial Loan category. Activity in the Farm and Ranch program led the Ag portfolio to strong results. The student loan portfolio continues to focus on state-sponsored DEAL loans. As of June 2024, the Bank has transferred $20 million

to the Statewide Interoperable Radio Network, $13 million to buydown programs, and $2.3 million to other State programs. During 2023, the Bank transferred $140 million to the General Fund, $30.5 million to buydown programs, $52 million to the Infrastructure Revolving Loan fund, and $5.7 million to other state programs.

Year-to-Date net income as of June was $100 million. Interest Income exceeded budget by $5.4 million primarily due to higher rates on securities as well as rates and volumes in the commercial participation program offset by lower than budgeted balances at the Federal Reserve. A combination of higher average deposit balances, rates, and larger Federal funds purchased, contributed to the higher interest expense. Non-Interest Expense is $2.3 million under budget. This consists of several operating components largely due to timing of incurrences, specifically with IT projects, loan servicing expenses, legal, and other service-related expenses.

Mr. Don Morgan presented the Commission members the May and June Nonconfidential Committee and Advisory Board minutes for their review.

Being no further business, Governor Burgum adjourned the meeting of the Industrial Commission at 6:04 p.m.

North Dakota Industrial Commission

Brenna Jessen, Recording Secretary

Reice Haase, Deputy Executive Director

Karen Tyler, Executive Director

Industrial Commission of North Dakota

Doug Burgum
Governor

Drew H. Wrigley
Attorney General

Doug Goehring
Agriculture Commissioner

TO: Industrial Commission Members

FR: Tammy Miller, Lt. Governor

Claire Ness, Chief Deputy Attorney General

Tom Bodine, Deputy Agriculture Commissioner

DT: September 30, 2024

Pursuant to a request made by Governor Burgum at the June 26, 2024, Industrial Commission meeting, we have reviewed the compensation levels of the Industrial Commission Administrative Office staff. A summary of current salaries and current biennium compensation changes is attached to this memo.

Current salary levels of Reice Haase, Brenna Jessen, and Andrea Rebsom reflect salary increases provided between January and April 2024, as a result of changes in job duties. Salary increases were funded by salary savings from the Executive Director position.

Mr. Haase received a 22% salary increase retroactive to July 1, 2023. He is an unclassified employee, and his salary level is in the top 50% of all surveyed deputy positions. No further changes are recommended at this time.

Ms. Jessen and Ms. Rebsom received salary increases of 14.5% and 10% respectively. Both currently exceed salary midpoints, and no further changes are recommended at this time.

Erin Stieg is the newest member of the Administrative Office, joining the staff in December of 2023. Ms. Stieg qualified for the 4% legislatively approved salary increase in July, and her moving expenses were covered which equated to 9% of her salary. No further changes are recommended at this time.

We do recommend a salary adjustment for Executive Director Karen Tyler equal to the remaining appropriation for the Executive Director's salary, approximately $40,000, effective July 1, 2024.

State Capitol 14th Floor
600 E. Boulevard Ave.
Bismarck ND 58505-0840

Karen Tyler, Executive Director
Reice Haase, Deputy Executive Director

Phone | 701-328-3722
Email | ndicinfo@nd.gov
Website | ndic.nd.gov

Further, it is our observation that over time, the compensation level for the Executive Director role may not have kept pace with the growing demands and responsibilities of the position, as the Industrial Commission portfolio of authority has expanded to include 15 agencies and programs, plus the occasional addition of temporary programs. This compensation constraint may be attributable to the funding mechanism for the Administrative Office, whereby the Commission agencies and programs are assessed to cover the budget of the Administrative Office. This model may result in a disinclination to create increased costs that must be passed along to the other agencies and programs. Going forward, and in planning for the 2025-2027 biennium, we recommend that consideration be given to re-evaluating and adjusting the Executive Director salary to reflect the workload, diversity of responsibilities, required expertise, and the executive nature of the role.

Tammy Miller

Lieutenant Governor

Claire Ness

Chief Deputy Attorney General

Tom Bodine

Deputy Agriculture Commissioner

State Capitol 14th Floor
600 E. Boulevard Ave.
Bismarck ND 58505-0840

Karen Tyler, Executive Director
Reice Haase, Deputy Executive Director

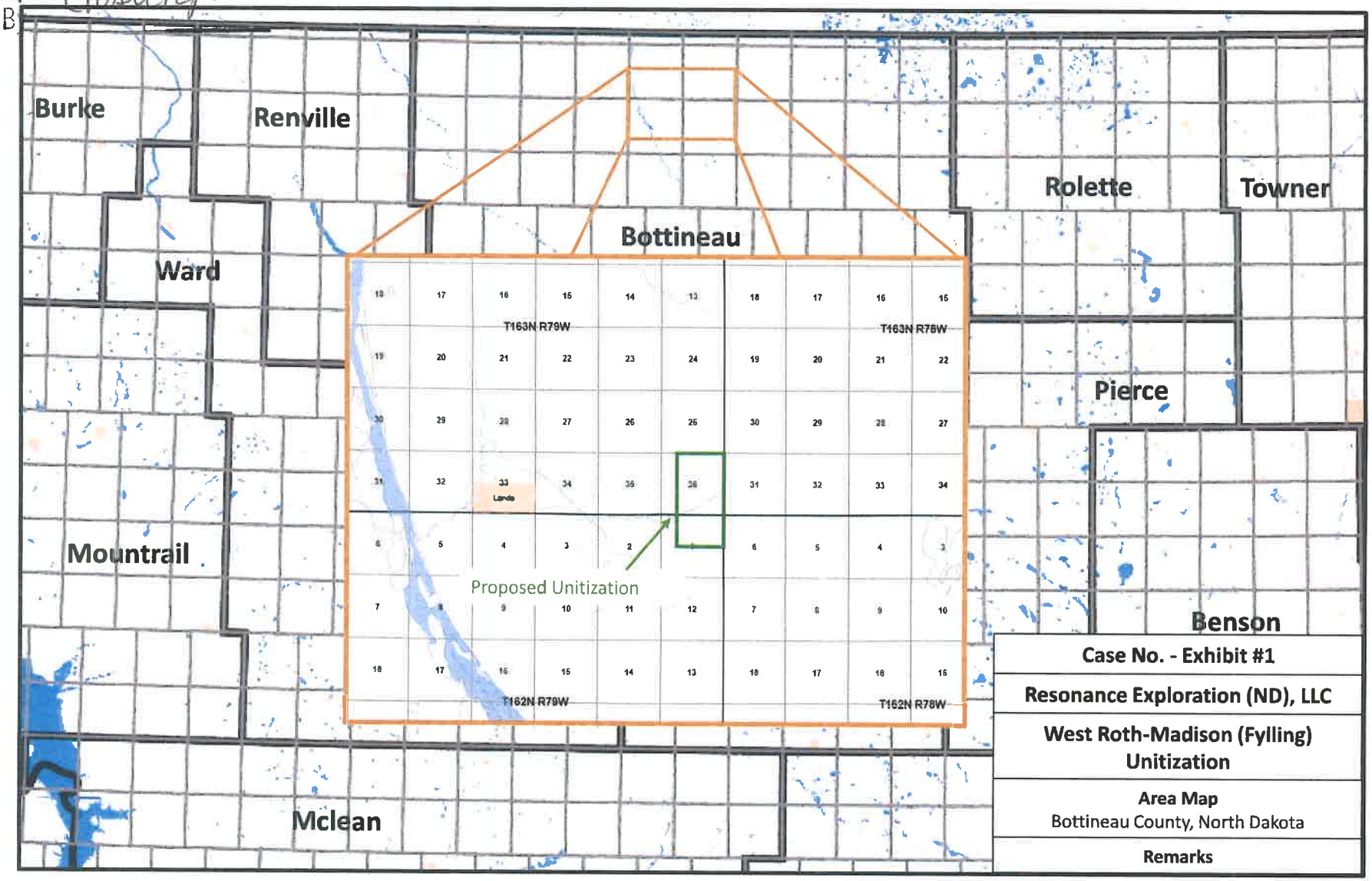
Phone | 701-328-3722
Email | ndicinfo@nd.gov
Website | ndic.nd.gov

Attachment 2

Docket for Hearing
Friday, May 31, 2024
N.D. Oil & Gas Division N.D. Oil & Gas Division 1000 East Calgary Avenue

Case No. 30793, Order No. 33451: Petition of Resonance Exploration (North Dakota) LLC for an order providing for the unitized management, operation, and further development of the proposed West Roth-Madison (Fylling) Unit Area, consisting of lands within the West Roth Field in Bottineau County, North Dakota; for approval of the unit agreement and unit operating agreement constituting the plan of unitization for the proposed West Roth-Madison (Fylling) Unit Area; for approval of the plan of operation; vacating the applicable spacing orders; and for such further and additional relief.

INDUSTRIAL COMMISSION
STATE OF NORTH DAKOTA
DATE 5/31/24 CASE NO. 30793
Introduced By Resonance
Exhibit # 1 Gosling
Identified By



Case No. - Exhibit #1
Resonance Exploration (ND), LLC
West Roth-Madison (Fylling) Unitization
Area Map Bottineau County, North Dakota
Remarks

Attachment 2A

Docket for Hearing
Friday, May 31, 2024
N.D. Oil & Gas Division N.D. Oil & Gas Division 1000 East Calgary Avenue

Case No. 30794, Order No. 33452: Application of Resonance Exploration (North Dakota) LLC for an order of the Commission determining that the plan of unitization for the West Roth-Madison (Fylling) Unit Area, Bottineau County, ND, has been signed, ratified or approved by owners of interest owning that percentage of the working interest and royalty interest within said unit as is required by applicable statutes and rules of the Commission.

Financial Statements
June 30, 2024 and 2023

North Dakota Building Authority

(A Component Unit of the State of North Dakota)

NORTH DAKOTA BUILDING AUTHORITY

Table of Contents

BradyMartz

Independent Auditor's Report

The Industrial Commission
The Legislative Assembly
State of North Dakota
Bismarck, North Dakota

Report on the Financial Statements

Opinion

We have audited the accompanying financial statements of the North Dakota Building Authority, a component unit of the State of North Dakota ("Authority") as of and for the years ended June 30, 2024 and 2023, and the related notes to the financial statements, which collectively comprise the Authority's basic financial statements as listed in the table of contents.

In our opinion, the financial statements referred to above present fairly, in all material respects, the respective financial position of the North Dakota Building Authority, a component unit of the State of North Dakota as of June 30, 2024 and 2023, and the respective changes in financial position and cash flows thereof for the years then ended in accordance with accounting principles generally accepted in the United States of America.

Emphasis of Matter

As discussed in Note 1 to the financial statements, the financial statements present only the North Dakota Building Authority Fund and do not purport to, and do not, present fairly the financial position of the State of North Dakota as of June 30, 2024 and 2023, the changes in its financial position or its cash flows for the years then ended in conformity with accounting principles generally accepted in the United States of America. Our opinion is not modified with respect to this matter.

Basis for Opinion

We conducted our audits in accordance with auditing standards generally accepted in the United States of America and the standards applicable to financial audits contained in *Government Auditing Standards*, issued by the Comptroller General of the United States. Our responsibilities under those standards are further described in the Auditor's Responsibilities for the Audit of the Financial Statements section of our report. We are required to be independent of the North Dakota Building Authority and to meet our other ethical responsibilities, in accordance with the relevant ethical requirements relating to our audit. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinions.

Responsibilities of Management for the Financial Statements

Management is responsible for the preparation and fair presentation of these financial statements in accordance with accounting principles generally accepted in the United States of America; and for the design, implementation, and maintenance of internal control relevant to the preparation and fair presentation of financial statements that are free from material misstatement, whether due to fraud or error.

(continued on next page)

In preparing the financial statements, management is required to evaluate whether there are conditions or events, considered in the aggregate, that raise substantial doubt about the North Dakota Building Authority's ability to continue as a going concern for twelve months beyond the financial statement date, including any currently known information that may raise substantial doubt shortly thereafter.

Auditor's Responsibilities for the Audit of the Financial Statements

Our objectives are to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinions. Reasonable assurance is a high level of assurance but is not absolute assurance and therefore is not a guarantee that an audit conducted in accordance with generally accepted auditing standards and *Government Auditing Standards* will always detect a material misstatement when it exists. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control. Misstatements are considered material if there is a substantial likelihood that, individually or in the aggregate, they would influence the judgment made by a reasonable user based on the financial statements.

In performing an audit in accordance with generally accepted auditing standards and *Government Auditing Standards*, we:

- Exercise professional judgment and maintain professional skepticism throughout the audit.
- Identify and assess the risks of material misstatement of the financial statements, whether due to fraud or error, and design and perform audit procedures responsive to those risks. Such procedures include examining, on a test basis, evidence regarding the amounts and disclosures in the financial statements.
- Obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the Authority's internal control. Accordingly, no such opinion is expressed.
- Evaluate the appropriateness of accounting policies used and the reasonableness of significant accounting estimates made by management, as well as evaluate the overall presentation of the financial statements.
- Conclude whether, in our judgment, there are conditions or events, considered in the aggregate, that raise substantial doubt about the Authority's ability to continue as a going concern for a reasonable period of time.

We are required to communicate with those charged with governance regarding, among other matters, the planned scope and timing of the audit, significant audit findings, and certain internal control-related matters that we identified during the audit.

Required Supplementary Information

Accounting principles generally accepted in the United States of America require that the management's discussion and analysis on pages 4-7 be presented to supplement the basic financial statements. Such information is the responsibility of management and, although not a part of the basic financial statements, is required by the Governmental Accounting Standards Board, who considers it to be an essential part of financial reporting for placing the basic financial statements in an appropriate operational, economic, or historical context. We have applied certain limited procedures to the required supplementary information

(continued on next page)

in accordance with auditing standards generally accepted in the United States of America, which consisted of inquiries of management about the methods of preparing the information and comparing the information for consistency with management's responses to our inquiries, the basic financial statements, and other knowledge we obtained during our audit of the basic financial statements. We do not express an opinion or provide any assurance on the information because the limited procedures do not provide us with sufficient evidence to express an opinion or provide any assurance.

Other Reporting Required by *Government Auditing Standards*

In accordance with *Government Auditing Standards*, we have also issued our report dated August 22, 2024 on our consideration of the Authority's internal control over financial reporting and on our tests of its compliance with certain provisions of laws, regulations, contracts, and grant agreements and other matters. The purpose of that report is solely to describe the scope of our testing of internal control over financial reporting and compliance and the results of that testing, and not to provide an opinion on the effectiveness of the Authority's internal control over financial reporting or on compliance. That report is an integral part of an audit performed in accordance with *Government Auditing Standards* in considering the Authority's internal control over financial reporting and compliance.

Brady Martz

BRADY, MARTZ & ASSOCIATES, P.C.
BISMARCK, NORTH DAKOTA

August 22, 2024

The discussion and analysis of the financial performance of the North Dakota Building Authority (Authority) that follows is meant to provide additional insight into the Authority's activities for the years ended June 30, 2024, 2023 and 2022. Please read it in conjunction with the Authority's financial statements and footnotes, which are presented within this report.

FINANCIAL HIGHLIGHTS:

The 2023 Legislature did not authorize any construction projects for the 2023-2025 biennium. The 2021 Legislature also did not authorize any construction projects for the 2021-2023 biennium.

Cash has decreased by $2,397 to $64 at June 30, 2024, because of payments to the Universities. The Authority's leases receivable decreased $5,733 to $101,364 at June 30, 2024 as construction is complete and lease payments are being made. There were no bonds issued in fiscal years 2024, 2023 and 2022.

Based on certain bond covenants, the Authority is required to establish and restrict prescribed amounts of resources for debt service reserves. In addition, bond proceeds for the construction of projects are also classified as restricted.

The State agencies pay as rent the debt service on the related bonds. The leases also provide that the State agencies pay as additional rent to the Authority reimbursement for trustee fees, paying agent fees, registrar fees, audit fees, arbitrage rebate payments and fees, and other reasonable and necessary expenses incurred by the Authority or the Trustee on behalf of the Authority.

REQUIRED FINANCIAL STATEMENTS:

The discussion and analysis are intended to serve as an introduction to the Authority's financial statements. The financial statements of the Authority provide accounting information similar to that of many other business entities. The Statement of Net Position summarizes the assets, deferred outflows of resources, and liabilities, with the difference reported as net position. It also serves as the basis for analysis of the soundness and liquidity of the Authority. The Statement of Revenues, Expenses and Changes in Net Position summarize the Authority's operating performance for the year. The Statement of Cash Flows summarizes the flow of cash through the Authority as it conducts its business.

(continued on next page)

CONDENSED STATEMENT OF NET POSITION
JUNE 30, 2024, 2023 AND 2022

	2024	2023	2022
ASSETS			
CURRENT ASSETS - RESTRICTED	**$ 5,044**	$ 10,248	$ 21,109
NONCURRENT ASSETS - RESTRICTED	**96,902**	99,911	98,577
TOTAL ASSETS	**$ 101,946**	**$ 110,159**	**$ 119,686**
DEFERRED OUTFLOWS OF RESOURCES	**$ -**	**$ 178**	**$ 607**
LIABILITIES			
CURRENT LIABILITIES	**$ 3,577**	$ 7,347	$ 9,883
NONCURRENT LIABILITIES	**98,369**	102,990	110,410
TOTAL LIABILITIES	**$ 101,946**	**$ 110,337**	**$ 120,293**
NET POSITION	**$ -**	**$ -**	**$ -**

Cash and Investments

Certain Authority cash and investments, which are included in the restricted current and noncurrent assets, are restricted for the debt service of bond issues or for construction. Additional discussion of cash and investments can be found at Note 2 to the financial statements.

Leases Receivable

Obligations of North Dakota agencies and university system are classified separately on the Statement of Net Position as "leases receivable" and included in the restricted current and noncurrent assets of the Statement of Net Position. These leases are pledged to the various bond issues. No losses for market value declines are anticipated and an allowance has not been provided. Note 3 to the financial statements contains further information regarding leases receivable.

Bonds Payable

In order to provide state agencies with funds to finance projects, the Authority has issued bonds to facilitate the purchase of the lease. The bonds payable are included in the restricted current and noncurrent liabilities of the preceding statement. The bonds are direct obligations of the Authority and are secured by leases purchased under the applicable resolutions, interest earnings and certain accounts established pursuant to the applicable bond resolutions. Further details are contained in Note 4 to the financial statements.

(continued on next page)

STATEMENTS OF REVENUES, EXPENSES AND CHANGES IN NET POSITION
YEARS ENDED JUNE 30, 2024, 2023 AND 2022

	2024	2023	2022
OPERATING REVENUES			
Lease interest	**$ 2,951**	$ 3,258	$ 3,624
Other	**68**	66	77
	3,019	3,324	3,701
NONOPERATING REVENUE			
Investment interest	**11**	21	23
TOTAL REVENUE	**3,030**	3,345	3,724
OPERATING EXPENSES			
Interest expense	**2,996**	3,307	3,679
Operating	**34**	38	45
	3,030	3,345	3,724
CHANGE IN NET POSITION	**-**	-	-
TOTAL NET POSITION, BEGINNING OF YEAR	**-**	-	-
TOTAL NET POSITION, END OF YEAR	**$ -**	$ -	$ -

Lease Interest

The state agencies have agreed to pay as rent the debt service (principal and interest) on the related bonds, to the extent that the bond funds and earnings are used to pay construction and other eligible costs of the projects. See Note 3 to the financial statements for further details of the leases.

Economic and Budgetary Information

The Authority is economically dependent on the North Dakota University System and agencies of the State of North Dakota.

As discussed in financial statement Note 1, the Authority operates through a biennial appropriation provided by the State Legislature. The Authority prepares a biennial budget, which is included in the Governor's budget that is presented to the State Legislature at the beginning of each legislative session. The Authority has continuing appropriation from monies received from the sale of indebtedness, lease payments and revenues generated by projects authorized by the legislature for the acquisition of authorized projects and the payment of rentals for these projects.

The Authority has a bond rating of AA by Standard and Poor's and Aa2 from Moody's Investor's Service.

(continued on next page)

Contacting the North Dakota Building Authority's financial management

The information in this report is intended to provide the reader with an overview of the Authority's operations along with the Authority's accountability for those operations. Questions concerning any of the information provided in this report or requests for additional financial information should be addressed to the North Dakota Building Authority, PO Box 5509, Bismarck, ND 58506-5509.

NORTH DAKOTA BUILDING AUTHORITY
STATEMENTS OF NET POSITION
JUNE 30, 2024 and 2023
(In Thousands)

ASSETS	2024	2023
CURRENT ASSETS - RESTRICTED		
Cash and cash equivalents at the Bank of North Dakota	$ 64	$ 2,461
Investments at the Bank of North Dakota	235	235
Leases receivable	4,462	7,186
Lease interest receivable	283	366
Total restricted current assets	5,044	10,248
NONCURRENT ASSETS - RESTRICTED		
Lease receivable	96,902	99,911
Total restricted noncurrent assets	96,902	99,911
Total assets	$ 101,946	$ 110,159
DEFERRED OUTFLOWS OF RESOURCES		
Deferred loss on bond refunding	$ -	$ 178
Total deferred outflows of resources	$ -	$ 178
LIABILITIES		
CURRENT LIABILITIES		
Accounts Payable	$ 6	$ 6
Due to Universities	-	1,181
Bonds payable	3,230	5,795
Interest payable	341	365
Total current liabilities	3,577	7,347
NONCURRENT LIABILITIES		
Bonds payable	98,369	102,990
Total liabilities	$ 101,946	$ 110,337
NET POSITION	$ -	$ -

See Notes to Financial Statements

NORTH DAKOTA BUILDING AUTHORITY
STATEMENTS OF REVENUES, EXPENSES AND CHANGES IN NET POSITION
YEARS ENDED JUNE 30, 2024 and 2023
(In Thousands)

	2024	2023
OPERATING REVENUES		
Lease interest	**$ 2,951**	$ 3,258
Other	**68**	66
	3,019	3,324
OPERATING EXPENSES		
Interest expense	**2,996**	3,307
Operating	**34**	38
	3,030	3,345
OPERATING LOSS	**(11)**	(21)
NONOPERATING REVENUE		
Investment interest	**11**	21
CHANGE IN NET POSITION	**-**	-
TOTAL NET POSITION, BEGINNING OF YEAR	**-**	-
TOTAL NET POSITION, END OF YEAR	**$ -**	$ -

See Notes to Financial Statements

NORTH DAKOTA BUILDING AUTHORITY
STATEMENTS OF CASH FLOWS
YEARS ENDED JUNE 30, 2024 and 2023
(In Thousands)

	2024	2023
OPERATING ACTIVITIES		
Receipts of rent	$ 9,980	$ 9,998
Receipts of additional rent and other	102	70
Payment to project vendors	(2,428)	(10,446)
Payments to service providers	(34)	(34)
Net cash from (used for) operating activities	7,620	(412)
NONCAPITAL FINANCING ACTIVITIES		
Principal payment on bonds payable	(5,795)	(5,955)
Interest paid on bonds payable	(4,233)	(4,526)
Net cash used for non-capital financing activities	(10,028)	(10,481)
INVESTING ACTIVITIES		
Interest received	11	21
Proceeds from sale and maturity of investment securities	235	663
Purchase of investment securities	(235)	(235)
Net cash from investing activities	11	449
NET CHANGE IN CASH AND CASH EQUIVALENTS	(2,397)	(10,444)
CASH AND CASH EQUIVALENTS, BEGINNING OF YEAR	2,461	12,905
CASH AND CASH EQUIVALENTS, END OF YEAR	$ 64	$ 2,461
RECONCILIATION OF OPERATING LOSS TO NET CASH USED IN OPERATING ACTIVITIES		
Operating loss	$ (11)	$ (21)
Adjustments to reconcile operating loss:		
Net amortization of bond premium and deferred loss	1,213	1,196
Reclassification of interest income and expense to other activities	(1,202)	(1,181)
Changes in assets and liabilities:		
Lease receivable	6,439	(2,770)
Due to colleges, universities and state agencies	1,181	2,358
Accounts payable	-	6
NET CASH FROM (USED FOR) OPERATING ACTIVITIES	$ 7,620	$ (412)

See Notes to Financial Statements

NOTE 1 - SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES

Nature of Operations

The North Dakota Building Authority (Authority) was established July 1, 1985, by the North Dakota Legislature, as provided in Chapter 54-17.2 of the North Dakota Century Code, as a separate instrumentality of the State of North Dakota. The purpose of the Authority is to promote the general welfare of the citizens of the State by providing projects for use by the State in providing public services by altering, repairing, maintaining or constructing buildings primarily for use by the State and making any improvements connected to those buildings or pertaining to those buildings and necessary to the use of those buildings in providing services to the public.

Reporting Entity

In accordance with Governmental Accounting Standards Board (GASB), the financial reporting entity of North Dakota Building Authority should include all component units over which North Dakota Building Authority exercises such aspects as (1) appointing a voting majority of an organization's governing body and (2) has the ability to impose its will on that organization or (3) the potential for the organization to provide specific financial benefits to, or impose specific burdens on North Dakota Building Authority. GASB further defined component units as reporting units that are legally separate, tax exempt affiliated organization that meet all of the following criteria:

- The economic resources of the organization entirely or almost entirely directly benefit North Dakota Building Authority or its constituents, and
- North Dakota Building Authority or its component units, are entitled to or can otherwise access, a majority of the economic resources of the organization, and
- The economic resources that North Dakota Building Authority is entitled to, or can otherwise access, are significant to North Dakota Building Authority.

Based upon criteria set forth by GASB, no organizations were determined to be part of the reporting entity. North Dakota Building Authority is included as part of the primary government of the State of North Dakota's reporting entity.

Budgetary Process

The Authority operates through a biennial appropriation provided by the State Legislature. The Authority prepares a biennial budget, which is included in the Governor's budget that is presented to the State Legislature at the beginning of each legislative session. The State Legislature enacts the budgets of the various State departments through passage of specific appropriation bills. The Governor has line item veto powers over all legislation subject to legislative override. Once passed and signed, the appropriation becomes the Authority's financial plan for the next two years. The Authority has continuing appropriation for monies received from the sale of indebtedness, lease payments and revenues generated by projects authorized by the legislature for the acquisition of authorized projects and the payment of rentals for these projects.

(continued on next page)

Basis of Accounting and Measurement Focus

The North Dakota Building Authority is presented in the accompanying financial statements as a proprietary fund type – an enterprise fund.

An enterprise fund is used to account for operations that are financed and operated in a manner similar to private business enterprises, where the intent is that costs of providing goods or services to the general public or other funds on a continuing basis be financed or recovered primarily through user charges. The Authority recovers its costs through administrative charges to agencies and earnings on funds.

As a proprietary fund type, the Authority accounts for its transactions using the accrual basis of accounting. Revenues are recognized when they are earned, and expenses are recognized when they are incurred.

When both restricted and unrestricted resources are available for use, it is the Authority's policy to use restricted resources first, and then unrestricted resources as they are needed.

Use of Estimates

In preparing financial statements in conformity with generally accepted accounting principles, management is required to make estimates and assumptions that affect the reported amounts of assets, deferred outflows of resources, and liabilities at the date of the balance sheet and the reported amounts of revenues and expenses during the reporting period. Actual results could differ from those estimates.

Cash and Cash Equivalents

The Authority considers all highly liquid investments purchased with an original maturity of three months or less to be cash equivalents.

Investments

The Authority's investments consist entirely of certificates of deposit and are reported at amortized cost.

Funds held by trustee under bond resolutions are to be invested to the fullest extent possible in investment obligations selected by the Authority. The maturity date or the date on which such investment obligations may be redeemed shall coincide as nearly as practicable with the date or dates on which moneys in the funds or accounts for which the investments were made will be required.

Leases Receivable

The Authority's leasing operations, as lessor, consist of leasing real estate property under capital leases.

Lease payments are due upon receipt. In the event of non-payment, the item or installment so in default shall continue as an obligation of the agency until the amount in default has been fully paid. The agency agrees to pay interest on any basic rent in default at the rate or rates of interest payable on the Bonds as specified in the Indenture. The agency agrees to pay interest on Additional Rent in default at the rate or rates of interest equal to the Bank of North Dakota Base Rate.

(continued on next page)

Restricted Assets

The Authority, based on certain bond covenants, is required to establish and maintain prescribed amounts of resources that can be used only to service outstanding debt. Other restricted assets can only be used for construction projects financed by related bonds.

Operating and Non-operating Revenues

Operating revenues consist of sales of goods and services, quasi-external operating transactions with other funds, grant revenue for specific activities that are considered to be operating activities of the grantor, receipts from other agencies for reimbursement of operating transactions and other miscellaneous revenue. Grants that would qualify as an operating activity are those that do not subsidize an existing program, rather they finance a program the agency would not otherwise undertake.

All other revenues that do not meet the above criteria are classified as non-operating.

NOTE 2 - DEPOSITS AND INVESTMENTS

Deposits

The North Dakota Building Authority is required to maintain its deposits at the Bank of North Dakota. As of June 30, 2024, the Building Authority had the following deposits (amount in thousands):

	Cash	Investments	Total
Current assets - restricted	$ 64	$ 235	$ 299
	$ 64	$ 235	$ 299

The North Dakota Building Authority is required to maintain its deposits at the Bank of North Dakota. As of June 30, 2023, the Building Authority had the following deposits (amount in thousands):

	Cash	Investments	Total
Current assets - restricted	$ 2,461	$ 235	$ 2,696
	$ 2,461	$ 235	$ 2,696

(continued on next page)

Custodial and Concentration of Credit Risk

Custodial credit risk for deposits is the risk that, in the event of the failure of a depository financial institution, the Building Authority will not be able to recover deposits or will not be able to recover collateral securities that are in the possession of an outside party. The Building Authority does not have a formal policy that limits custodial credit risk for deposits. None of the Building Authority's deposits are covered by depository insurance. The Building Authority's deposits are uncollateralized and all of the funds are held on deposit at the Bank of North Dakota and are guaranteed by the State of North Dakota (NDCC Section 6-09-10).

Cash is restricted for the following purposes:

	2024	2023
Construction	$ -	$ 2,429
Debt service	64	32
	$ 64	$ 2,461

Investments

The Building Authority has their moneys invested in certificates of deposit with the Bank of North Dakota as allowed by the Trust Indenture. Funds held by trustees or the Authority under bond resolutions are to be invested to the fullest extent possible in investment obligations selected by the Authority. The maturity date or the date on which such investment obligations may be redeemed shall coincide as nearly as practicable with the date or dates on which monies in the funds or accounts for which the investments were made will be required. The investments are restricted for debt service.

Interest Rate Risk

Interest rate risk is the risk that changes in interest rates of debt securities will adversely affect the fair values of an investment.

As of June 30, 2024, the Authority held certificates of deposit with the following maturity dates (amounts are in thousands):

Investment Type	Less Than 1	1 - 5 Years	6 - 10 Years	Total
Certificates of Deposit	$ 235	$ -	$ -	$ 235

As of June 30, 2023, the Authority held certificates of deposit with the following maturity dates (amounts are in thousands):

Investment Type	Less Than 1	1 - 5 Years	6 - 10 Years	Total
Certificates of Deposit	$ 235	$ -	$ -	$ 235

(continued on next page)

NOTE 3 - LEASES RECEIVABLE

After receiving Legislative authority, the Authority purchases or constructs various facilities, which are generally financed by bonds. The facilities are leased to State agencies under terms described below.

The terms of the leases commence as of the date of the sale of the bonds and expire at the end of each biennium on June 30, subject to successive automatic two-year extensions under the provisions of each lease (unless the Legislature specifically fails to appropriate sufficient moneys for the payment of rent under the lease during any two-year renewal term).

Under the lease agreements, the State agencies have agreed to pay as rent the debt service on the related bonds from funds appropriated by the Legislature from the General Fund or other special funds, which may include federal funds.

The Authority is not required to make any expenditures in connection with the leases of the facilities. Upon expiration of a lease, the facility is conveyed to the appropriate agency. At June 30, 2024, future minimum lease payments under agreements are as follows:

	Total Minimum Payment	Unearned Interest Income	Lease Receivable
2025	$ 8,469	$ 4,007	$ 4,462
2026	8,457	3,840	4,617
2027	8,457	3,665	4,792
2028	8,461	3,480	4,981
2029	8,447	3,286	5,161
2030-2034	41,375	13,213	28,162
2035-2039	41,192	6,980	34,212
2040-2041	15,652	675	14,977
	$ 140,510	$ 39,146	$ 101,364

The leases also provide that the State agencies pay as additional rent to the Authority for trustee fees, paying agent fees, registrar fees, letter of credit fees, audit fees and other reasonable and necessary expenses incurred by the Authority or the Trustee on behalf of the Authority.

(continued on next page)

NOTE 4 - LONG-TERM DEBT

Changes in Bonds Payable

The following is a summary of changes in bonds payable for the years ended June 30, 2024 and 2023:

	Bonds payable
Balance, June 30, 2022	$ 116,365
Additions	-
Retirements	(5,955)
Amortization of bond premium	(1,625)
Balance, June 30, 2023	108,785
Additions	-
Retirements	(5,795)
Amortization of bond premium	(1,391)
Balance, June 30, 2024	$ 101,599

Maturities of Bonds Payable

Maturities of principal and interest on all bonds are as follows:

	Principal	Interest	Total Debt Service
Year Ending June 30,			
2025	$ 3,230	$ 4,007	$ 7,237
2026	3,385	3,840	7,225
2027	3,560	3,665	7,225
2028	3,750	3,480	7,230
2029	3,930	3,285	7,215
2030-2034	22,240	13,213	35,453
2035-2039	28,055	6,980	35,035
2040-2041	13,335	675	14,010
	81,485	39,145	120,630
Unamortized bond premium	20,114	(20,114)	-
	$101,599	$ 19,031	$ 120,630

The following summarizes the Authority's bonds outstanding at June 30, 2024 and 2023:

Description and Due Date	Interest Rate	Original Value	2024	2023
Series 10A Bonds 12/1/16-12/1/30	3.50 - 6.25	$ 2,355	**$ 1,235**	$ 1,390
Series 17A Bonds 12/1/18-12/1/23	5.00	18,430	**-**	2,875
Series 20A Bonds 12/1/21-12/1/40	5.00	112,858	**100,364**	104,520
Total bonds payable			**101,599**	108,785
Less current portion			**3,230**	5,795
Long-term portion			**$ 98,369**	$ 102,990

2010 Series A

Interest on the 2010 Series A Bonds is payable semi-annually on June 1 and December 1 of each year. Bonds maturing on or after December 1, 2016 are subject to optional redemption in whole or in part. The bonds are secured by the funds, user charges and all rights, titles and interests of the Authority as lessor, including all basic lease payments, investment earnings on the funds and any other income derived by the Authority with respect to the lease.

2017 Series A

Interest on the 2017 Series A Bonds is payable semi-annually on June 1 and December 1 of each year. The bonds are not subject to optional redemption prior to maturity except under extraordinary circumstances. The bonds are secured by the funds, user charges and all rights, titles and interests of the Authority as lessor, including all basic lease payments, investment earnings on the funds and any other income derived by the Authority with respect to the lease.

2020 Series A

Interest on the 2020 Series A Bonds is payable semi-annually on June 1 and December 1 of each year. The bonds are not subject to optional redemption prior to maturity except under extraordinary circumstances. The bonds are secured by the funds, user charges and all rights, titles and interests of the Authority as lessor, including all basic lease payments, investment earnings on the funds and any other income derived by the Authority with respect to the lease.

Listing of Projects

Issue	Size	Agency	Project Description
2010A	$2,355	Veteran's Home	New Facility
2017A	18,430	University System	DSU - Murphy Hall Renovation
		University System	MSU Bottineau - Thatcher Hall Addition and Renovation
		University System	NDSCS - Electrical Distribution
		University System	NDSU - Hazardous Material Handling and Storage Facility
		University System	UND - Energy Conservation Projects
		Historical Society	Heritage Center Collections Expansion
		Department of Corrections	James River ET Building Improvements
		Department of Corrections	James River Program and Building Code Improvements
		OMB	State Capital Complex Fire Suppression System
		Attorney General	Crime Laboratory Renovation and Addition
		Parks and Recreation	Turtle River State Park Office Building Construction
		University System	MSU - Moore Hall Renovation
		University System	NDSCS - Butte Gym Remodeling
		University System	NDSU - Animal Facility
		Department of Corrections	YCC Gym Renovation
		Department of Corrections	YCC Pine Cottage Remodel
		University System	WSC - Health and Wellness Center
		University System	MSU - Old Main Renovation
2020A	88,585	University System	DSU - Pulver Hall
		University System	NDSU - Sugihara Hall
		University System	UND - Gamble Hall
		University System	VCSU - Communication & Fine Arts Center
		University System	UND - Deferred Maintenance

Reserve Funds

	2024		2023	
	Required Reserve Balance	**Reserve Balance**	Required Reserve Balance	Reserve Balance
2010A	**$ 235**	**$ 235**	$ 235	$ 235
	$ 235	**$ 235**	$ 235	$ 235

The 2010 bond agreements require the establishment and maintenance of reserve funds to be used for debt service payments if amounts in the bond funds are insufficient to make the payments. Funds are also required for any positive arbitrage due the Federal government.

NOTE 5 - DUE TO UNIVERSITIES

The North Dakota Building Authority is responsible for the distribution of construction voucher reimbursement as requested by the individual colleges and universities for approved projects. The below table provides the detail of the payables at June 30, 2024 and 2023.

	2024	2023
University of North Dakota	**$ -**	$ 1,181

NOTE 6 - PROJECT FINANCING

Cumulative amount paid from the respective Series 2020A project funds to pay project costs as of June 30:

	2024	2023
Construction Funding		
University System		
Dickinson State University	**$ 4,000**	$ 4,000
North Dakota State University	**40,000**	39,975
University of North Dakota - Nistler College of Business	**6,000**	6,000
University of North Dakota - Deferred Maintenance	**30,000**	27,994
Valley City State University	**30,000**	29,778
	$ 110,000	**$ 107,747**

Amount of Principal, interest and administrative fees paid by the borrower as of June 30:

	2024	2023
Lease Receipts		
NDUS Office/Campuses	**$ 8,469**	$ 18,025
State Penitentiary	**144**	501
Health and Consolidate	**-**	341
Soldiers Improvement	**186**	410
Job Service	**-**	232
Attorney General	**330**	648
OMB	**284**	565
Parks and Recreation	**31**	66
Historical Society	**593**	1,180
	$ 10,037	$ 21,968

NOTE 7 - RELATED PARTY

The North Dakota Building Authority is related to the Bank of North Dakota through common management under the Industrial Commission of North Dakota. The Authority's deposits and investments are held by the Bank of North Dakota.

The Bank of North Dakota acts as the trustee for the bondholders having been duly appointed by the Authority. The Bank also acts as the paying agent, registrar, and escrow agent for the bonds issued and defeased by the Authority. Fees paid by the Authority to the Bank of North Dakota for these services for the years ending June 30, 2024, and 2023, were $11 and $13, respectively.

The Authority also obtains accounting services from the North Dakota Public Finance Authority. Fees paid for these services for the years ended June 30, 2024, and 2023, were $3 and $3, respectively.

NOTE 8 - COMMITMENTS

The Authority committed funds to complete various construction and modernization programs at June 30, 2024 and 2023 as follows:

	2024 Amount	2023 Amount
North Dakota State University	$ -	$ 200
University Of North Dakota	-	2,006
Valley City State University	-	222
	$ -	$ 2,428

NOTE 9 - RISK MANAGEMENT

The Authority is exposed to various risks of loss related to torts, theft of, and damage to assets and errors and omissions. These risks of loss are covered under the insurance policies owned by the North Dakota Industrial Commission, North Dakota Public Finance Authority and North Dakota Office of Management and Budget. The State Bonding Fund currently provides the agencies with blanket fidelity bond coverage in the amount of $2,000 for its employees. The State Bonding Fund does not currently charge any premium for this coverage.

There have been no significant reductions in insurance coverage from the prior year. In addition, there have been no claims filed or settled in the past three fiscal years.

NOTE 10 - SUBSEQUENT EVENTS

No significant events occurred subsequent to the Authority's year end. Subsequent events have been evaluated through August 22, 2024, which is the date these financial statements were available to be issued.

Independent Auditor's Report on Internal Control over Financial Reporting and on Compliance and Other Matters Based on an Audit of Financial Statements Performed in Accordance with *Government Auditing Standards*

The Industrial Commission
The Legislative Assembly
State of North Dakota
Bismarck, North Dakota

We have audited, in accordance with auditing standards generally accepted in the United States of America and the standards applicable to financial audits contained in *Government Auditing Standards* issued by the Comptroller General of the United States, the financial statements of North Dakota Building Authority, as of and for the year ended June 30, 2024, and the related notes to the financial statements, which collectively comprise the Authority's basic financial statements, and have issued our report thereon dated August 22, 2024.

Report On Internal Control over Financial Reporting

In planning and performing our audit of the financial statements, we considered the Authority's internal control over financial reporting (internal control) as a basis for designing audit procedures that are appropriate in the circumstances for the purpose of expressing our opinion on the financial statements, but not for the purpose of expressing an opinion on the effectiveness of the Authority's internal control. Accordingly, we do not express an opinion on the effectiveness of the Authority's internal control.

A *deficiency in internal control* exists when the design or operation of a control does not allow management or employees, in the normal course of performing their assigned functions, to prevent, or detect and correct misstatements on a timely basis. A *material weakness* is a deficiency, or a combination of deficiencies, in internal control such that there is a reasonable possibility that a material misstatement of the entity's financial statements will not be prevented or detected and corrected on a timely basis. A *significant deficiency* is a deficiency, or a combination of deficiencies, in internal control that is less severe than a material weakness, yet important enough to merit attention by those charged with governance.

Our consideration of internal control was for the limited purpose described in the first paragraph of this section and was not designed to identify all deficiencies in internal control that might be material weaknesses or significant deficiencies. Given these limitations, during our audit we did not identify any deficiencies in internal control that we consider to be material weaknesses. However, material weaknesses may exist that have not been identified.

Compliance and Other Matters

As part of obtaining reasonable assurance about whether the Authority's financial statements are free from material misstatement, we performed tests of its compliance with certain provisions of laws, regulations, contracts and grant agreements, noncompliance with which could have a direct and material effect on the financial statements. However, providing an opinion on compliance with those provisions was not an objective of our audit, and accordingly, we do not express such an opinion. The results of our tests disclosed no instances of noncompliance or other matters that is required to be reported under *Government Auditing Standards*.

Purpose of this Report

The purpose of this report is solely to describe the scope of our testing of internal control and compliance and the result of that testing, and not to provide an opinion on the effectiveness of the entity's internal control or on compliance. This report is an integral part of an audit performed in accordance with *Government Auditing Standards* in considering the Authority's internal control and compliance. Accordingly, this communication is not suitable for any other purpose.

Brady Martz

BRADY, MARTZ & ASSOCIATES, P.C.
BISMARCK, NORTH DAKOTA

August 22, 2024

SUMMARY OF NORTH DAKOTA BUILDING AUTHORITY AUDIT FOR FISCAL YEAR ENDED JUNE 30, 2024 PREPARED BY BRADY, MARTZ & ASSOCAITES, P.C. AUGUST 22, 2024

Purpose of the audit: To determine the financial statements are free from material misstatement.

Type of opinion: Unmodified

Summary of finding/recommendations: No findings/recommendations

Explanations of significant audit adjustments and correct or uncorrected misstatements:

1. The following material misstatements were identified as a result of the audit procedures performed, which were corrected by management:
    a. None

2. The following uncorrected misstatements were identified as a result of the audit procedures performed, which were determined by management to be immaterial both individually and in the aggregate:
    a. None

Disagreements with management or difficulties encountered in performing the audit: None

Other items to highlight in the report: None

Cost of the audit:
Current audit $14,225
Prior audit $13,750

Independent Auditor's Communication to the Industrial Commission of North Dakota

The Industrial Commission
The Legislative Assembly
State of North Dakota
Bismarck, North Dakota

We have audited the financial statements of the North Dakota Building Authority ("Authority") for the year ended June 30, 2024. Professional standards require that we provide you with information about our responsibilities under generally accepted auditing standards and *Government Auditing Standards*, as well as certain information related to the planned scope and timing of our audit. We have communicated such information to you on July 29, 2024. Professional standards also require that we communicate to you the following information related to our audit.

Significant Audit Findings

Qualitative Aspects of Accounting Practices

Management is responsible for the selection and use of appropriate accounting policies. The significant accounting policies used by the Authority are described in Note 1 to the financial statements. No new accounting policies were adopted and the application of existing policies was not changed during 2024. We noted no transactions entered into by the Authority during the year for which there is a lack of authoritative guidance or consensus. All significant transactions have been recognized in the financial statements in the proper period.

Accounting estimates are an integral part of the financial statements prepared by management and are based on management's knowledge and experience about past and current events and assumptions about future events. Certain accounting estimates are particularly sensitive because of their significance to the financial statements and because of the possibility that future events affecting them may differ significantly from those expected. There are no significant estimates affecting the financial statements.

The financial statement disclosures are neutral, consistent, and clear.

Difficulties Encountered in Performing the Audit

We encountered no significant difficulties in dealing with management in performing and completing our audit.

Corrected and Uncorrected Misstatements

Professional standards require us to accumulate all known and likely misstatements identified during the audit, other than those that are clearly trivial, and communicate them to the appropriate level of management. No such misstatements were detected as a result of our audit procedures.

Disagreements with Management

For purposes of this letter, a disagreement with management is a financial accounting, reporting, or auditing matter, whether or not resolved to our satisfaction, that could be significant to the financial statements or the auditor's report. We are pleased to report that no such disagreements arose during the course of our audit.

Management Representations

We have requested certain representations from management that are included in the management representation letter dated August 22, 2024.

Management Consultations with Other Independent Accountants

In some cases, management may decide to consult with other accountants about auditing and accounting matters, similar to obtaining a "second opinion" on certain situations. If a consultation involves application of an accounting principle to the Authority's financial statements or a determination of the type of auditor's opinion that may be expressed on those statements, our professional standards require the consulting accountant to check with us to determine that the consultant has all the relevant facts. To our knowledge, there were no such consultations with other accountants.

Other Audit Findings or Issues

We generally discuss a variety of matters, including the application of accounting principles and auditing standards, with management each year prior to retention as the Authority's auditors. However, these discussions occurred in the normal course of our professional relationship and our responses were not a condition to our retention.

Other Matters

We applied certain limited procedures to the management's discussion and analysis which is required supplementary information (RSI) that supplements the basic financial statements. Our procedures consisted of inquiries of management regarding the methods of preparing the information and comparing the information for consistency with management's responses to our inquiries, the basic financial statements, and other knowledge we obtained during our audit of the basic financial statements. We did not audit the RSI and do not express an opinion or provide any assurance on the RSI.

Restriction on Use

This information is intended solely for the use of the North Dakota Industrial Commission, Legislative Audit and Fiscal Review Committee, and management of the North Dakota Building Authority and is not intended to be, and should not be, used by anyone other than these specified parties.

Very truly yours,

Brady Martz

BRADY, MARTZ & ASSOCIATES, P.C.
BISMARCK, NORTH DAKOTA

August 22, 2024

RESOLUTION APPROVING
LOAN FROM CLEAN WATER STATE REVOLVING FUND

WHEREAS, the Industrial Commission has heretofore authorized the creation of a Clean Water State Revolving Fund Program (the "Program") pursuant to N.D.C.C. chs. 6-09.4 and 61-28.2; and

WHEREAS, the Clean Water State Revolving Fund is governed in part by the Master Trust Indenture dated as of July 1, 2011 (the "Indenture"), between the North Dakota Public Finance Authority (NDPFA) and the Bank of North Dakota (the Trustee); and

WHEREAS, the City of Fargo (the "Political Subdivision") has requested a loan in the amount of $15,000,000 from the Program to replace antiquated residential and commercial water meters with advanced metering infrastructure that will provide real time information and readings; and

WHEREAS, the NDPFA's Advisory Committee is recommending approval of the Loan; and

WHEREAS, there has been presented to this Commission a form of Loan Agreement proposed to be adopted by the Political Subdivision and entered into with the NDPFA;

NOW, THEREFORE, BE IT RESOLVED by the Industrial Commission of North Dakota as follows:

1. The Loan is hereby approved, as recommended by the Advisory Committee.

2. The form of Loan Agreement to be entered into with the Political Subdivision is hereby approved in substantially the form on file and the Executive Director is hereby authorized to execute the same with all such changes and revisions therein as the Executive Director shall approve.

3. The Executive Director is authorized to fund the Loan from funds on hand in the Clean Water Loan Fund established under the Indenture upon receipt of the Municipal Securities described in the Political Subdivisions bond resolution, to submit to the Trustee a NDPFA Request pursuant to the Indenture, and to make such other determinations as are required under the Indenture.

4. The Commission declares its intent pursuant to Treasury Regulations '1.150-2 that any Loan funds advanced from the Federally Capitalized Loan Account shall be reimbursed from the proceeds of bonds issued by the NDPFA under the Indenture.

Adopted: September 30, 2024

_____
Governor Doug Burgum, Chairman

Attest:

_____
Karen Tyler, Executive Director
Industrial Commission of North Dakota

September 16, 2024

PUBLIC FINANCE AUTHORITY ADVISORY COMMITTEE

RECOMMENDATION TO THE INDUSTRIAL COMMISSION

The Advisory Committee, at its September 16, 2024 meeting, reviewed, discussed, and recommends approval of a $15,000,000 Clean Water State Revolving Fund Program loan to the City of Fargo.

North Dakota Public Finance Authority
Advisory Committee

Keith Lund, Chairman
Linda Svihovec
John Phillips

NORTH Dakota | Public Finance Authority
Be Legendary.

Memorandum

To: Public Finance Authority Advisory Committee
Miles Silbert, PFM Financial Advisors LLC
Kylee Merkel, Bank of North Dakota

From: DeAnn Ament, Executive Director

Date: September 9, 2024

Re: City of Fargo
Clean Water State Revolving Fund

Purpose of the Project: Replace antiquated residential and commercial water meters with advanced metering infrastructure that will provide real time information and readings.

Project Amount:

CWSRF Request	$ 15,000,000
Project Total	$ 15,000,000

Population to Benefit from the Project: 135,588; $111 per person
Population Served by the System: 135,588
Is the Project Area Within the Extraterritorial Jurisdiction of a City: No

The requested term for the Clean Water State Revolving Fund (CWSRF) loan is 20 years. The City of Fargo will issue revenue bonds payable with sales tax and water fund revenues. The average annual payment for the revenue bonds will be $893,858. The 110% coverage requirement will be $983,243 and the required debt service reserve will be $906,550.

City Sales Tax:

The City collects a 2% sales tax and ½ of 1% is dedicated to CWSRF and DWSRF financed infrastructure.

	2019	2020	2021	2022	2023
2% City Sales Tax	$49,623,454	$51,720,983	$60,456,732	$65,918,347	$69,144,866
1/2 of 1%	$12,405,864	$12,930,246	$15,114,183	$16,479,587	$17,286,217
Debt Service	$5,618,117	$5,636,083	$5,930,876	$5,957,230	$5,935,800
Excess Sales Tax	$6,787,747	$7,294,163	$9,183,307	$10,522,357	$11,350,417

The City has 24,681 residential water accounts that pay a monthly base charge of $17.55 which includes 2,000 gallons. There are 5,750 commercial accounts that pay a monthly base charge which ranges from $55.95 to $745.95 depending on the meter size. The volume charge is $4.90/1,000 above the first 2,000 gallons.

Water Fund:

	2020	2021	2022	2023
Interest Revenue	$4,535	$57,825	$24,729	$22,661
Operating Revenue	23,773,689	26,123,374	25,679,019	29,109,021
Operating Expenses	23,191,294	23,128,967	25,557,494	27,424,202
Net Operating Expenditures	586,930	3,052,232	146,254	1,707,480
Depreciation	7,601,751	7,746,117	7,847,571	8,110,737
Adjusted Net Operating Income	$8,188,681	$10,798,349	$7,993,825	$9,818,217
Revenue Bond Payments	$4,817,427	$4,889,982	$4,975,904	$5,789,292
Net Operating Coverage	170%	221%	161%	170%

Projected Water Fund Net Operating Coverage:

	2024	2025	2026	2027
Proforma Net Operating Revenue[1]	$19,219,294	$11,254,069	$8,193,130	$9,372,334
Proforma Debt Service	$7,392,248	$7,388,598	$7,359,371	$8,884,122
Proforma Net Operating Coverage	260%	152%	111%	105%

[1]Includes water rate revenues and sales tax which is ½ of the ½ of 1% since this is only a water projection.

The existing excess sales tax will be sufficient to meet the 110% net operating coverage. The City annually reviews the rates and adjusts as needed every two years. The net operating revenues of the water fund provide satisfactory backing should sales tax be inadequate.

The City's outstanding indebtedness as of December 31, 2023:

	Original Amount	Amount Outstanding
Governmental Activities		
Improvement Bonds	$ 672,725,000	$ 506,650,000
GO Bonds	38,745,000	27,255,000
Sales Tax Revenue Bonds *	83,887,000	50,083,000
Taxable Appropriation Bonds	28,840,000	27,235,000
Appropriation Bonds	8,103,000	7,670,000
SRF Notes Payable *	97,505,936	40,333,837
TIF Revenue Notes	6,433,705	4,690,989
Direct Bank Loan	6,000,000	2,319,516
Mercantile Parking Garage	2,000,000	2,000,000
BND Infrastructure Loan	15,000,000	11,279,481
	$ 959,239,641	$ 679,516,823
Business-Type Activities		
Revenue Bonds	$ 2,875,000	$ 1,463,495
Direct Bank Loan	3,000,000	300,000
SRF Notes Payable *	305,699,000	250,863,977
Appropriation Bonds	7,810,000	3,370,000
	$ 319,384,000	$ 255,997,472

*All payments have been made as agreed. The City has ten CWSRF and five DWSRF loans with outstanding balances of $291,197,814 and two CFP loans with outstanding balances of $50,083,000.

With $935,514,295 total debt outstanding, the debt per person is $6,900.

The City of Fargo is located in Cass County at the intersection of Interstate Highways 94 and 29. The estimated current population is 135,588. Based on the 2020 census, the total population was 125,990; this is an increase of 20,441 from the 2010 census. The largest employers in the City are Sanford Health Facilities with 9,181 employees, North Dakota State University has 2,324 employees and Fargo Public Schools employs 2,273.

K-12 School Enrollment:

				Projected
2020-2021	**2021-2022**	**2022-2023**	**2023-2024**	**2024-2025**
11,169	11,195	11,288	11,319	11,400

The City's 2023 taxable valuation was $808,920,288. This is an increase of $202,534,286 over the 2019 taxable valuation.

Property Tax Collections 7/31/2024:

Levy Year	Dollar Amount of Levy	Amount Collected to Date of Application	Percentage Collected
2023	$47,682,349	$43,192,948	91%
2022	$40,652,011	$38,729,680	95%
2021	$36,279,891	$34,454,559	95%

Special Assessment Collections 7/31/2024:

Year	Dollar Amount	Amount Collected to Date of Application	Percentage Collected
2023	$42,562,481	$40,897,955	96%
2022	$39,463,391	$38,962,352	99%
2021	$38,099,705	$37,948,476	100%

Mill Levy History:

Year	City	School	Park District	State and County	Other	Total for Each Year
2023	57.00	154.13	34.08	46.00	5.39	296.60
2022	55.00	154.38	38.09	48.00	6.03	301.50
2021	53.00	154.38	33.85	48.75	6.03	296.01
2020	53.00	154.38	29.60	48.92	6.22	292.12
2019	53.00	154.38	28.67	50.00	6.39	292.44

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Memorandum

TO: DeAnn Ament, Executive Director
North Dakota Public Finance Authority

FROM: PFM Financial Advisors LLC

DATE: September 13, 2024

RE: Marketplace Analysis - Clean Water State Revolving Fund Program
City of Fargo

The City of Fargo ("City") has presented a request to the Authority and the North Dakota Department of Environmental Quality ("Department") for a $15,000,000 loan under the Clean Water State Revolving Fund Program ("CWSRF Program"). The CWSRF Program is used to make subsidized interest rate loans to political subdivisions for the purpose of constructing various wastewater treatment projects and landfill projects as approved by the Department in accordance with federal and state regulations and an updated Intended Use Plan prepared by the Department.

The City intends to use the proceeds to replace antiquated residential and commercial water meters with advanced metering infrastructure that will provide real time information and readings.

The municipal securities to be acquired by the Authority will be revenue bonds payable from sales tax and water fund revenues. The City's average annual payment under the proposed loan will be approximately $893,858 indicating a 110% net revenue coverage requirement of approximately $983,243. The City will be required to deposit $906,550 into a reserve fund with payments of $181,310 per year for the first five years of the loan. The City collects a 2% sales tax and ½ of 1% is dedicated to Clean Water and Drinking Water SRF financed infrastructure. The projected pro forma net operating coverage, which includes the sales tax and water revenues, is 2.60x, 1.52x, 1.11x and 1.05x respectively, for years 2024-2027. The City reviews their sales tax and water rates annually and adjusts the rates as needed. The excess sales tax, water fund, and as needed rate increases will provide sufficient net revenues to meet the 110% coverage requirement.

As of December 31, 2023, the City has the following outstanding debt:

	Amount Outstanding
Governmental Activities	
Improvement Bonds	$ 506,650,000
GO Bonds	27,255,000
Sales Tax Revenue Bonds *	50,083,000
Taxable Appropriation Bonds	27,235,000
Appropriation Bonds	7,670,000
SRF Notes Payable *	40,333,837
TIF Revenue Notes	4,690,989
Direct Bank Loan	2,319,516
Mercantile Parking Garage	2,000,000
BND Infrastructure Loan	11,279,481
	$ 679,516,823
Business-Type Activities	
Revenue Bonds	$ 1,463,495
Direct Bank Loan	300,000
SRF Notes Payable *	250,863,977
Appropriation Bonds	3,370,000
	$ 255,997,472

The City currently has two CFP loans with an outstanding amount of $50,083,000, and ten CWSRF and five DWSRF loans with a total outstanding amount of $291,197,814. The City is current in its payments for its outstanding Authority loans.

Funding for the construction of the City's projects has been included in a list of approved projects as prepared and updated by the Department. As an authorized participant in the CWSRF Program, the City will benefit substantially from the subsidized fixed rate loans made under the Program. Consequently, no other financing mechanism can provide a greater cost advantage than that offered by the CWSRF Program.

BND
Bank of North Dakota

PO BOX 5509, 1200 Memorial Hwy.
Bismarck, ND 58506-5509
800.472.2166
800.366.6888 TTY
701.328.5600
bnd.nd.gov

Memorandum

To: Industrial Commission

From: Kylee Merkel, Business Banker
Bank of North Dakota

Date: September 9, 2024

RE: City of Fargo
Clean Water State Revolving Fund Program

ND Public Finance Authority has delivered to BND their memo which recommends approval of a $15,000,000 loan to the City of Fargo under the Clean Water State Revolving Fund (CWSRF). The entire cost of the project is $15,000,000, with CWSRF financing the full project.

Proceeds of the loan will be used to replace residential and commercial water meters with advanced metering infrastructure. The requested loan term is 20 years. The City will issue a revenue bond payable from sales tax and water fund revenues. The annual payment will average $893,858.

The City collects a 2% sales tax, of which ½ of 1% is dedicated to clean water and drinking water state revolving fund financed infrastructure. The sales tax sunsets in 2028. If the city sales tax collections would be insufficient to meet the required 110% net operating coverage, or the city sales tax is not extended, the City would utilize water user fees and implement any necessary rate increases.

½ of 1% City Sales Tax Debt Service Coverage:

	2021	2022	2023	Projected
2% City Sales Tax Collections	60,456,732	65,918,347	69,144,866	69,144,866
1/2 of 1%	15,114,183	16,479,587	17,286,217	17,286,217
Existing SRF Debt Service	5,930,876	5,957,230	5,935,800	5,935,800
Proposed Loan Debt Service				893,858
Total Debt Payments	5,930,876	5,957,230	5,935,800	6,829,658
Debt Service Coverage	254.84%	276.63%	291.22%	253.11%

The existing sales tax collections will be sufficient to service both the existing and proposed State Revolving Fund loans. Should sales tax collections be insufficient to service the debt, the water fund also has capacity to service the debt.

BND
Bank of North Dakota

PO BOX 5509, 1200 Memorial Hwy.
Bismarck, ND 58506-5509

800.472.2166
800.366.6888 TTY
701.328.5600

bnd.nd.gov

Water Fund Debt Service Coverage:

Water Fund	2021	2022	2023
Operating Revenue	26,123,374	25,679,019	29,109,021
Interest Revenue	57,825	24,729	22,661
Operating Expenses	-23,128,967	-25,557,494	-27,424,202
Net Operating Revenue	3,052,232	146,254	1,707,480
Plus: Depreciation	7,746,117	7,847,571	8,110,737
Adjusted Net Operating Revenue	10,798,349	7,993,825	9,818,217
Current Annual Debt Service	4,889,982	4,975,904	5,789,292
Debt Service Coverage	220.83%	160.65%	169.59%

The City currently serves 24,681 residential water accounts that pay a monthly base rate of $17.55. There are also 5,750 commercial water accounts that pay a monthly base rate ranging from $55.95 to $745.95, depending on meter size. All accounts pay a volume charge of $4.90 per 1,000 gallons, above the first 2,000 gallons. The City annually reviews and adjusts rates as needed.

Outstanding Debt (as of December 31, 2023):

	Original Amount	Amount Outstanding
Governmental Activities		
Improvement Bonds	$672,725,000	$506,650,000
GO Bonds	38,745,000	27,255,000
Sales Tax Revenue Bonds	83,887,000	50,083,000
Taxable Appropriation Bonds	28,840,000	27,235,000
Appropriation Bonds	8,103,000	7,670,000
SRF Notes Payable	97,505,936	40,333,837
TIF Revenue Notes	6,433,705	4,690,988
Direct Bank Loan	6,000,000	2,319,516
Mercantile Parking Garage	2,000,000	2,000,000
BND Infrastructure Loan	15,000,000	11,279,481
	959,239,641	679,516,822
Business-Type Activities		
Revenue Bonds	2,875,000	1,463,495
Direct Bank Loan	3,000,000	300,000
SRF Notes Payable	305,699,000	250,863,977
Appropriation Bonds	7,810,000	3,370,000
	319,384,000	255,997,472
Total Debt	$1,278,623,641	$935,514,294

BND
Bank of North Dakota

PO BOX 5509, 1200 Memorial Hwy.
Bismarck, ND 58506-5509

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701.328.5600

bnd.nd.gov

Average annual debt service requirements are estimated at $65,711,790, which is an average of $522.13 per resident.

Historical census populations for the City of Fargo were 125,990 in 2020, 106,024 in 2010 and 91,324 in 2000. The largest employers in the City are Sanford Health Facilities, North Dakota State University and Fargo Public Schools.

Based upon the PFA recommendation and the benefits obtained with this project, BND concurs with their evaluation and support of the request.

Kylee Merkel
Business Banker

walking up to individual homes. The City has other meter manufacturer brands in the water system, including, but not limited to Badger and Sensus.

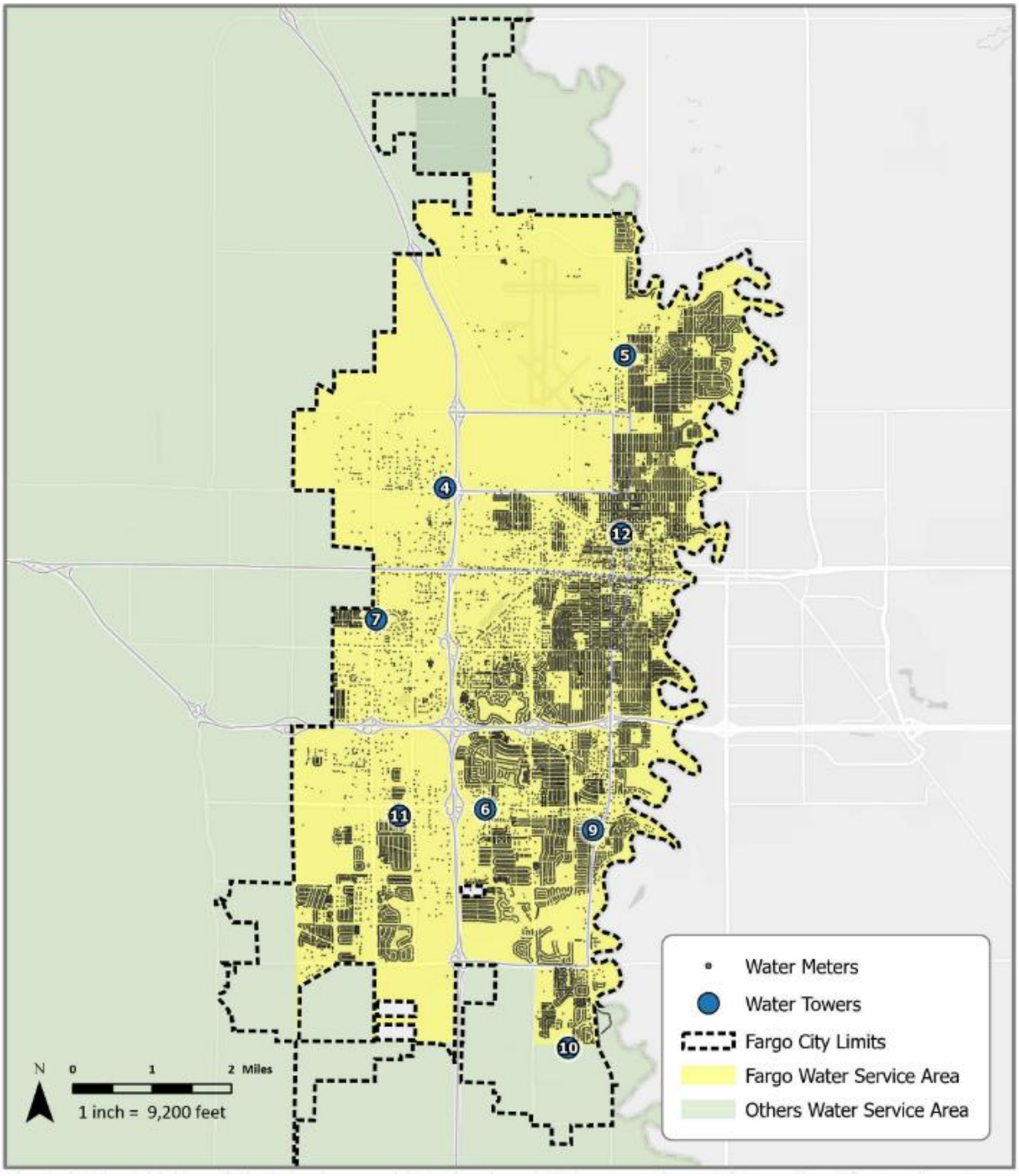

Figure 1. Water Meter and Water Tower Locations

Some of the neighborhoods within Fargo's city limits are served by Cass Rural Water District, in which Cass Rural Water District owns and operates the water metering infrastructure. For this project, only the City water meters are being upgraded (area depicted in yellow in the above figure).

RESOLUTION APPROVING
LOAN FROM CLEAN WATER STATE REVOLVING FUND

WHEREAS, the Industrial Commission has heretofore authorized the creation of a Clean Water State Revolving Fund Program (the "Program") pursuant to N.D.C.C. chs. 6-09.4 and 61-28.2; and

WHEREAS, the Clean Water State Revolving Fund is governed in part by the Master Trust Indenture dated as of July 1, 2011 (the "Indenture"), between the North Dakota Public Finance Authority (NDPFA) and the Bank of North Dakota (the Trustee); and

WHEREAS, the City of Jamestown (the "Political Subdivision") has requested a loan in the amount of $3,326,000 from the Program to replace antiquated residential and commercial water meters with advanced metering infrastructure that will provide real time information and readings; and

WHEREAS, the NDPFA's Advisory Committee is recommending approval of the Loan; and

WHEREAS, there has been presented to this Commission a form of Loan Agreement proposed to be adopted by the Political Subdivision and entered into with the NDPFA;

NOW, THEREFORE, BE IT RESOLVED by the Industrial Commission of North Dakota as follows:

1. The Loan is hereby approved, as recommended by the Advisory Committee.

2. The form of Loan Agreement to be entered into with the Political Subdivision is hereby approved in substantially the form on file and the Executive Director is hereby authorized to execute the same with all such changes and revisions therein as the Executive Director shall approve.

3. The Executive Director is authorized to fund the Loan from funds on hand in the Clean Water Loan Fund established under the Indenture upon receipt of the Municipal Securities described in the Political Subdivisions bond resolution, to submit to the Trustee a NDPFA Request pursuant to the Indenture, and to make such other determinations as are required under the Indenture.

4. The Commission declares its intent pursuant to Treasury Regulations '1.150-2 that any Loan funds advanced from the Federally Capitalized Loan Account shall be reimbursed from the proceeds of bonds issued by the NDPFA under the Indenture.

Adopted: September 30, 2024

_____
Governor Doug Burgum, Chairman

Attest:

_____
Karen Tyler, Executive Director
Industrial Commission of North Dakota

September 16, 2024

PUBLIC FINANCE AUTHORITY ADVISORY COMMITTEE

RECOMMENDATION TO THE INDUSTRIAL COMMISSION

The Advisory Committee, at its September 16, 2024 meeting, reviewed, discussed, and recommends approval of a $3,326,000 Clean Water State Revolving Fund Program loan to the City of Jamestown.

North Dakota Public Finance Authority
Advisory Committee

Keith Lund, Chairman
Linda Svihovec
John Phillips

NORTH Dakota | Public Finance Authority
Be Legendary.

Memorandum

To: Public Finance Authority Advisory Committee
Miles Silbert, Public Financial Management, LLC
Kylee Merkel, Bank of North Dakota

From: DeAnn Ament, Executive Director

Date: September 10, 2024

Re: City of Jamestown
Clean Water State Revolving Fund

Purpose of the Project: Replace antiquated residential and commercial water meters with advanced metering infrastructure that will provide real time information and readings.

Project Amount:

CWSRF Request	$ 3,321,000
Project Total	$ 3,321,000

Population to Benefit from the Project: 15,849
Population Served by the System: 15,849
Is the Project Area Within the Extraterritorial Jurisdiction of a City: No

The requested term for the Clean Water State Revolving Fund (CWSRF) loan is 20 years. The City will issue revenue bonds payable with water fund revenues. The average annual payment for the revenue bonds will be $195,352. The 110% coverage requirement will be $214,888 and the required debt service reserve will be $203,000.

The City has 4,963 residential and 489 commercial users which pay a monthly water base rate of $27.20 with $3.40/100 cubic feet in excess of 400 cubic feet.

Water Fund:

				Unaudited
	2020	2021	2022	2023
Interest Revenue	$18,028	$14,402	$24,170	$56,181
Operating Revenue	5,514,863	5,749,451	5,688,657	6,139,334
Operating Expenses	2,941,367	3,089,211	4,148,841	3,915,699
Net Operating Revenue	2,591,524	2,674,642	1,563,986	2,279,817
Depreciation	348,453	393,861	488,098	311,591
Transfer In	-	-	2,541,826	-
Adjusted Net Operating Revenue	$2,939,977	$3,068,503	$4,593,910	$2,591,408
Revenue Bond Payments	$972,159	$1,054,120	$3,242,730	$950,550
Net Operating Coverage	302%	291%	142%	273%
Proforma CWSRF Payment	$195,352	$195,352	$195,352	$195,352
Proforma Net Operating Coverage	252%	246%	134%	226%

The existing net operating revenue will be sufficient to meet the 110% coverage requirement.

The City outstanding indebtedness as of December 31, 2023:

	Original Debt	Outstanding Balance
Revenue Bonds:		
Water [1]	$ 15,042,701	$ 5,600,000
Sewer [1]	17,306,208	10,798,000
Solid Waste [1]	4,249,147	2,852,028
	$ 36,598,056	$ 19,250,028
Improvement Bonds:		
Water and Sewer [1]	$ 13,249,509	$ 7,251,700
Other	37,021,054	20,904,531
	$ 50,270,563	$ 28,156,231
Total Debt	$ 86,868,619	$ 47,406,259

[1] All payments have been made as agreed. The City has eleven Clean Water SRF and thirteen DWSRF loans with outstanding balances of $25,881,728.

Per resident, the outstanding bond debt is $2,991 and the average annual bond payment is $411.

The City of Jamestown is in Stutsman County, on Interstate 94, 99 miles west of Fargo. The total population according to the 2020 census is 15,849; this is an increase of 422 from the 2010 census. The largest employers in the Jamestown Public Schools with 368 employees, the ND State Hospital with 450 employees and the Anne Carlsen Center with 595 employees.

K-12 School Enrollment:

			Current	Projected
2021-2022	**2022-2023**	**2023-2024**	**2024-2025**	**2025-2026**
2,187	2,122	2,145	2,080	2,070

The City's 2023 taxable valuation was $53,578,747. This is an increase of $7,371,906 over the 2019 taxable valuation.

Property Tax Collections as of August 31, 2024:

Levy Year	Dollar Amount of Levy	Amount Collected to Date of Application	Percentage Collected
2023	$6,343,919	$6,080,163.96	96%
2022	$6,013,735	$5,959,106.76	99%
2021	$5,744,114	$5,727,146.96	100%

Special Assessment Collections as of August 31, 2024:

Year	Dollar Amount	Amount Collected to Date of Application	Percentage Collected
2023	$2,933,865	$2,826,816	96%
2022	$2,791,009	$2,759,744	99%
2021	$2,762,082	$2,850,661	103%

Mill Levy History:

Year	City	School	Park District	State and County	Total for Each Year
2023	118.41	102.00	41.38	75.38	337.17
2022	117.92	102.00	40.20	71.98	332.10
2021	118.36	102.00	40.21	71.09	331.66
2020	117.95	100.00	39.36	67.33	324.64
2019	117.93	100.00	39.55	70.63	328.11

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Memorandum

TO: DeAnn Ament, Executive Director
North Dakota Public Finance Authority

FROM: PFM Financial Advisors LLC

DATE: September 13, 2024

RE: Marketplace Analysis - Clean Water State Revolving Fund Program
City of Jamestown

The City of Jamestown ("City") has presented a request to the Authority and the North Dakota Department of Environmental Quality ("Department") for a $3,321,000 loan under the Clean Water State Revolving Fund Program ("CWSRF Program"). The CWSRF Program is used to make subsidized interest rate loans to political subdivisions for the purpose of constructing various wastewater treatment projects and landfill projects as approved by the Department in accordance with federal and state regulations and an updated Intended Use Plan prepared by the Department.

The City intends to use the proceeds to replace antiquated residential and commercial water meters with advanced metering infrastructure that will provide real time information and readings.

The municipal securities to be acquired by the Authority will be revenue bonds payable with water fund revenue. The City's average annual payment under the proposed loan will be approximately $195,352 indicating a 110% net revenue coverage requirement of approximately $214,888. The City will be required to deposit $203,000 into a reserve fund with payments of $40,600 per year for the first five years of the loan. Pro forma net operating coverage of the Water Fund was 2.52x, 2.46x, 1.34x and 2.26x for 2020-2023, respectively. The existing Water Fund Revenues will provide sufficient net revenues to meet the 110% coverage requirement.

As of December 31, 2023, the City has outstanding Revenue Bonds of $19,250,028, and outstanding Improvement Bonds of $28,156,231. The City currently has eleven CWSRF loans and thirteen DWSRF loan with an outstanding combined total balance of $25,881,728. The City is current in its payments for its outstanding Authority loan.

Funding for the construction of the City's projects has been included in a list of approved projects as prepared and updated by the Department. As an authorized participant in the CWSRF Program, the City will benefit substantially from the subsidized fixed rate loans made under the Program. Consequently, no other financing mechanism can provide a greater cost advantage than that offered by the CWSRF Program.

BND
Bank of North Dakota

PO BOX 5509, 1200 Memorial Hwy.
Bismarck, ND 58506-5509

800.472.2166
800.366.6888 TTY
701.328.5600

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Memorandum

To: Industrial Commission

From: Kylee Merkel, Business Banker
Bank of North Dakota

Date: September 11, 2024

RE: City of Jamestown
Clean Water State Revolving Fund Program

ND Public Finance Authority has delivered to BND their memo which recommends approval of a $3,321,000 loan to the City of Jamestown under the Clean Water State Revolving Fund (CWSRF). The entire cost of the project is $3,321,000, with CWSRF financing the entire project.

The project will replace water meters with advanced metering infrastructure. The requested loan term is 20 years. The City will issue a revenue bond payable with water user fees. The annual payment will average $195,352.

Debt Service Coverage:

Water Fund	2020	2021	2022	Internal 2023	Projected
Operating Revenue	5,514,863	5,749,451	5,688,657	6,139,334	6,139,334
Interest Revenue	18,028	14,402	24,170	56,181	56,181
Operating Expenses	-2,941,367	-3,089,211	-4,148,841	-3,915,699	-3,915,699
Net Operating Revenue	2,591,524	2,674,642	1,563,986	2,279,817	2,279,817
Plus: Transfers In	0	0	2,541,826	0	0
Plus: Depreciation	348,453	393,861	488,098	311,591	311,591
Adjusted Net Operating Income	2,939,977	3,068,503	4,593,910	2,591,408	2,591,408
Current Debt Service	972,159	1,054,120	1,172,730	950,550	950,550
Proposed Debt Service					195,352
Total Debt Service					1,145,902
Debt Service Coverage	302%	291%	392%	273%	226%

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The City currently serves 4,963 residential connections and 489 commercial connections. All connections pay a monthly base rate of $27.20 and a volume charge of $3.40 per 100 cubic feet, in excess of 400 cubic feet. The existing revenues will generate sufficient net operating revenues to service both the new and existing debt.

Outstanding Debt (as of December 31, 2023):

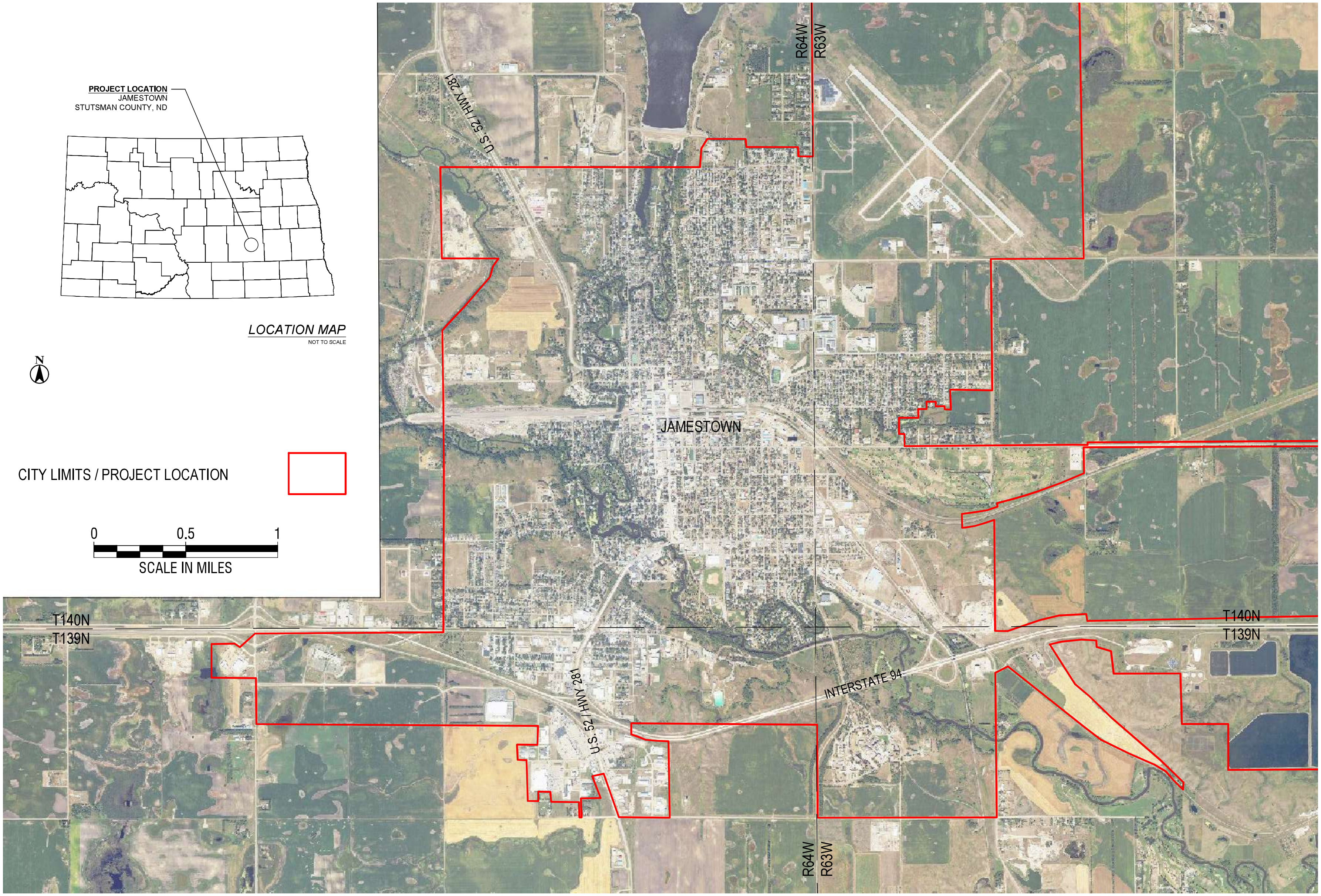
	Original Amount	Current Balance
Water Revenue Bonds	15,042,701	5,600,000
Sewer Revenue Bonds	17,306,208	10,798,000
Solid Waste Revenue Bonds	4,249,147	2,852,028
Water/Sewer Improvement Bonds	13,249,509	7,251,700
Other Improvement Bonds	37,021,054	20,904,531
	86,868,619	47,406,259

Average annual debt service requirements are estimated at $6,713,259, which is an average of $423.58 per resident.

Historical census populations for the City of Jamestown were 15,849 in 2020, 15,427 in 2010 and 15,527 in 2000. The largest employers in the City are Anne Carlsen Center, North Dakota State Hospital and Jamestown Public Schools

Based upon the PFA recommendation and the benefits obtained with this project, BND concurs with their evaluation and support of the request.

Kylee Merkel
Business Banker



WATER METER REPLACEMENT PROJECT
CITY OF JAMESTOWN
STUTSMAN COUNTY, ND

PROJECT AREA MAP

Drawn By: J.B. | Surveyed By: | Project No: J21-00-051
Checked By: T.D. | Designed By: | Date: AUG 2023

Rev No	Date	By	Description

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SECTION EX
SHEET NO. 1

Q:\2021\001_051 Jmst Radio Read Water Meters\20_CADD_J2100051_EG_BASEMAP_J2100051.dwg 8/29/2023

RESOLUTION APPROVING
LOAN FROM DRINKING WATER STATE REVOLVING FUND

WHEREAS, the Industrial Commission has heretofore authorized the creation of a Drinking Water State Revolving Fund Program (the "Program") pursuant to N.D.C.C. chs. 6-09.4, 61-28.1, and 61-28.2; and

WHEREAS, the State Revolving Fund is governed in part by the Master Trust Indenture dated as of July 1, 2011 (the "Indenture"), between the North Dakota Public Finance Authority (the "NDPFA") and the Bank of North Dakota (the "Trustee"); and

WHEREAS, the City of Mandan (the "Political Subdivision") has requested a loan in the amount of $5,462,000 from the Program to construct a new reservoir to replace Collins Reservoir which would provide additional capacity and redundancy for the City; and

WHEREAS, NDPFA's Advisory Committee is recommending approval of the Loan; and

WHEREAS, there has been presented to this Commission a form of Loan Agreement proposed to be adopted by the Political Subdivision and entered into with the NDPFA;

NOW, THEREFORE, BE IT RESOLVED by the Industrial Commission of North Dakota as follows:

1. The Loan is hereby approved, as recommended by the Advisory Committee.

2. The form of Loan Agreement to be entered into with the Political Subdivision is hereby approved in substantially the form on file and the Executive Director is hereby authorized to execute the same with all such changes and revisions therein as the Executive Director shall approve.

3. The Executive Director is authorized to fund the Loan from funds on hand in the Drinking Water Loan Fund established under the Indenture upon receipt of the Municipal Securities described in the Political Subdivisions bond resolution, to submit to the Trustee a NDPFA Request pursuant to the Indenture, and to make such other determinations as are required under the Indenture.

4. The Commission declares its intent pursuant to Treasury Regulations '1.150-2 that any Loan funds advanced from the Federally Capitalized Loan Account shall be reimbursed from the proceeds of bonds issued by the NDPFA under the Indenture.

Adopted: September 30, 2024

_____
Governor Doug Burgum, Chairman

Attest:

_____
Karen Tyler, Executive Director
Industrial Commission of North Dakota

September 16, 2024

PUBLIC FINANCE AUTHORITY ADVISORY COMMITTEE

RECOMMENDATION TO THE INDUSTRIAL COMMISSION

The Advisory Committee, at its September 16, 2024 meeting, reviewed, discussed, and recommends approval of a $5,462,000 Drinking Water State Revolving Fund Program loan to the City of Mandan.

North Dakota Public Finance Authority
Advisory Committee

Keith Lund, Chairman
Linda Svihovec
John Phillips

NORTH Dakota | Public Finance Authority
Be Legendary.

Memorandum

To: Public Finance Authority Advisory Committee
Miles Silbert, Public Finance Management
Kylee Merkel, Bank of North Dakota

From: DeAnn Ament, Executive Director

Date: September 10, 2024

Re: City of Mandan
Drinking Water State Revolving Fund Program Loan Application

Purpose of the Project: Construct a new reservoir to replace Collins Reservoir which would provide additional capacity and redundancy for the City.

Project Amount:

DWSRF Request	$ 5,462,000
DWR Cost Share	2,020,120
Project Total	$ 7,482,120

Population to Benefit from the Project: 14,524; $515/person
Population Served by the System: 24,206 plus Missouri West Water System which serves 8,100 people
Is the Project Area Within the Extraterritorial Jurisdiction of a City: No

The requested term for the DWSRF loan is 20 years. Accordingly, the average annual payment loan will be approximately $320,736. The required debt service reserve is $328,825 and the 110% net operating coverage requirement is $352,810.

Connections:

	2022	2023	2024	2025	2026
Residential	8,246	8,429	8,615	8,801	8,992
Commercial	762	779	796	813	831

The current water/wastewater base rate is $32.05 for residential and $64.10 for commercial and both pay $3.00/100 cubic foot of water usage and $1.65/100 cubic foot of wastewater disposal. The City anticipates raising the monthly base rate for residential $3.28 and for commercial $6.56 over the next two year which will result in annual revenue of approximately $401,748.

Water & Wastewater Fund:

	2020	2021	2022	2023
Operating Revenue	$9,038,542	$12,373,258	$11,710,926	$10,216,792
Operating Expenses	5,806,222	6,253,921	6,315,164	6,648,226
Net Operating Revenue	3,232,320	6,119,337	5,395,762	3,568,566
Depreciation	2,365,212	2,579,500	2,530,360	2,801,245
Adjusted Net Operating Revenue	$5,597,532	$8,698,837	$7,926,122	$6,369,811
Revenue Bond Payments	$2,763,599	$2,704,720	$2,724,636	$2,710,801
Net Operating Coverage	203%	322%	291%	235%
Proforma Rate Increase Revenue	$401,748	$401,748	$401,748	$401,748
Proforma DWSRF Payment	$320,436	$320,436	$320,436	$320,436
Proforma Net Operating Coverage	195%	301%	273%	223%

Existing net revenues coupled with the proposed water/wastewater base rate increases should allow the City to continue meeting the coverage requirements.

Outstanding Debt December 31, 2023:

	Original Debt	Outstanding Debt
General Obligation Bonds - Bridge	$ 870,000	$ 190,000
Improvement Bonds	50,173,109	33,318,854
Sales Tax Revenue Bonds - Sports Complex	15,275,000	13,185,000
Revenue Bonds - Airport	695,000	430,000
Revenue Bonds - Water & Sewer [1]	39,823,634	22,430,256
Total	**$ 106,836,743**	**$ 69,554,110**

[1] Payments to the NDPFA have been made as agreed. The City has eight DWSRF loans with a total outstanding balance of $16,324,921 and five Clean Water SRF loans that total $5,860,000. The City had debt service reserves of $2,388,866.

With $69,554,110 of debt outstanding, that is $2,876 per resident and an average annual payment per resident of $263.

The City of Mandan is located in Morton County on Interstate 94. Based on the 2020 census, the total population is 24,206; this is an increase of 5,875 over the 2010 census. The largest employers in the City are Mandan Public Schools with 700 employees, HIT, Inc. (social assistance) employs 641 and NISC (information services) with 450 employees.

K-12 School Enrollment:

			Current	Projected
2020-2021	**2021-2022**	**2022-2023**	**2023-2024**	**2024-2025**
4,037	4,223	4,277	4,368	4,375

The City's 2023 taxable valuation was $124,190,171. This is an increase of $27,969,562 over the 2019 taxable valuation.

Property Tax Levies and Collections as of 8/31/2024:

Levy Year	Dollar Amount of Levy	Amount Collected to Date of Application	Percentage Collected
2023	8,617,594	8,273,463	96%
2022	7,300,894	7,244,830	99%
2021	6,682,236	6,671,974	100%

Special Assessment Levies and Collections 8/31/2024:

Year	Dollar Amount	Amount Collected to Date of Application	Percentage Collected
2023	5,095,097	4,540,252	89%
2022	4,602,813	4,455,224	97%
2021	4,625,863	4,586,730	99%

City of Mandan Mill Levy:

Year	City	School	Park District	State and County	Other	Total for Each Year
2023	63.93	127.22	29.13	56.74	4.10	281.12
2022	63.85	130.15	29.15	60.23	4.41	287.79
2021	63.98	130.15	28.29	58.74	4.47	285.63
2020	63.21	108.15	28.84	57.71	4.41	262.32
2019	63.54	107.95	28.98	61.02	4.50	265.99

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Memorandum

TO: DeAnn Ament, Executive Director
North Dakota Public Finance Authority

FROM: PFM Financial Advisors LLC

DATE: September 13, 2024

RE: Marketplace Analysis - Clean Water State Revolving Fund Program
City of Mandan

The City of Mandan ("City") has presented a request to the Authority and the North Dakota Department of Environmental Quality ("Department") for a $5,462,000 loan under Drinking Water State Revolving Fund Program ("DWSRF Program"). The DWSRF Program is used to make subsidized interest rate loans to political subdivisions for the purpose of constructing various water treatment, distribution, and storage facilities as approved by the Department in accordance with federal and state regulations and an updated Intended Use Plan prepared by the Department.

The City intends to use the proceeds to construct a new reservoir to replace Collins Reservoir to provide additional capacity and redundancy for the City.

The municipal securities to be acquired by the Authority will be revenue bonds payable from water & wastewater user fees. The City's average annual payment under the proposed loan will be approximately $320,736 indicating a 110% net revenue coverage requirement of approximately $352,810. The City will be required to deposit $328,825 into a reserve fund with payments of $65,765 per year for the first five years of the loan. Over the next two years the City intends to raise the monthly base rates for residential users by $3.28 and commercial users by $6.56, which will generate annual revenues of approximately $400,000. Pro forma net operating coverage of the Water & Wastewater Fund was 1.95x, 3.01x, 2.73x and 2.23x for 2020-2023, respectively. The existing net operating revenue and increase in rates will provide sufficient net revenues to meet the 110% coverage requirement.

As of December 31, 2023, the City has outstanding $190,000 of General Obligation Bonds, $33,318,854 of Improvement Bonds, $13,185,000 of Sales Tax Revenue Bonds, $22,430,256 of Water/Sewer Revenue Bonds and $430,000 of Airport Revenue Bonds outstanding. The City currently has five Clean Water SRF totaling $5,860,000 outstanding and eight Drinking Water SRF loans totaling $16,324,921 outstanding. The City is current in its payments for its outstanding Authority loan.

Funding for the construction of the City's projects has been included in a list of approved projects as prepared and updated by the Department. As an authorized participant in the DWSRF Program, the City will benefit substantially from the subsidized fixed rate loans made under the Program. Consequently, no other financing mechanism can provide a greater cost advantage than that offered by the DWSRF Program.

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Bismarck, ND 58506-5509

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701.328.5600

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Memorandum

To: Industrial Commission

From: Kylee Merkel, Business Banker
Bank of North Dakota

Date: September 10, 2024

RE: City of Mandan
Drinking Water State Revolving Fund Program

ND Public Finance Authority has delivered to BND their memo which recommends approval of a $5,462,000 loan to the City of Mandan under the Drinking Water State Revolving Fund (DWSRF). The entire cost of the project is $7,482,120, with Department of Water Resources providing a $2,020,120 cost-share grant.

The project will construct a new reservoir to replace the Collins Reservoir. The requested loan term is 20 years. The City will issue a revenue bond payable with water user fees. The annual payment will average $320,436.

Debt Service Coverage:

Water and Sewer Fund	2021	2022	2023	Projected
Operating Revenue	12,373,258	11,710,926	10,216,792	10,216,792
Projected Rate Increase				401,748
Operating Expenses	-6,253,921	-6,315,164	-6,648,226	-6,648,226
Net Operating Revenue	6,119,337	5,395,762	3,568,566	3,970,314
Plus: Depreciation	2,579,500	2,530,360	2,801,245	2,801,245
Adjusted Net Operating Income	8,698,837	7,926,122	6,369,811	6,771,559
Current Debt Service	2,704,720	2,724,636	2,710,801	2,710,801
Proposed Debt Service				320,736
Total Debt Service				3,031,537
Debt Service Coverage	322%	291%	235%	223%

The City currently serves 8,615 residential connections that pay a monthly base rate of $16.03 and 796 commercial connections that pay a monthly base rate of $32.06. All connections pay a volume charge of $3.00 per 100 cubic feet. The City anticipates raising the monthly base rate $3.28 for residential connections and $6.56 for commercial connections, over the next two years. The existing revenues,

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combined with the anticipated increases, will generate sufficient net operating revenues to service both the new and existing debt.

Outstanding Debt (as of December 31, 2023):

	Original Amount	Current Balance
General Obligation Bonds	870,000	190,000
Improvement Bonds	50,173,109	33,318,854
Sales Tax Revenue Bonds	15,275,000	13,185,000
Water/Sewer Revenue Bonds	39,823,634	22,430,256
Airport Revenut Bonds	695,000	430,000
	106,836,743	69,554,110

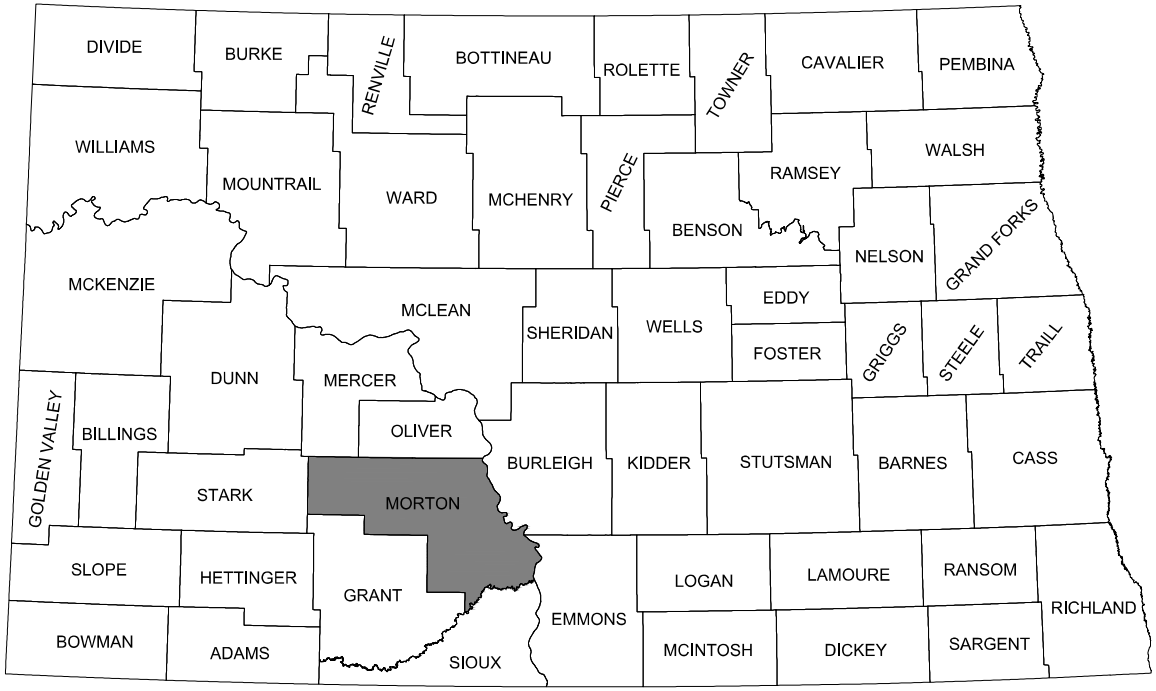
Average annual debt service requirements are estimated at $8,293,893, which is an average of $342.64 per resident.

Historical census populations for the City of Mandan were 24,206 in 2020, 18,331 in 2010 and 16,718 in 2000. The largest employers in the City are Mandan Public School District, Housing Industry Training (HIT) and National Information Solutions Cooperative (NISC).

Based upon the PFA recommendation and the benefits obtained with this project, BND concurs with their evaluation and support of the request.

Kylee Merkel
Business Banker

File: W:\MM\Mandan\00510-2022-1022\CAD Dwgs\00-General\Plan Sheets\Location Maps.dwg



STATE OF NORTH DAKOTA

1 / 001 **PROJECT LOCATION MAP**
MORTON COUNTY

2 / 001 **PROJECT VICINITY MAP**
MORTON COUNTY

Industrial Commission
of North Dakota

Doug Burgum
GOVERNOR

Drew H. Wrigley
ATTORNEY GENERAL

Doug Goehring
AGRICULTURE COMMISSIONER

NORTH Dakota | Public Finance Authority
Be Legendary.

Memorandum

To: Industrial Commission: Governor Doug Burgum, Attorney General Drew H. Wrigley, Agriculture Commissioner Doug Goehring

From: DeAnn Ament, Executive Director

Date: September 16, 2024

Re: All Seasons Water Users District, Drinking Water State Revolving Fund
Dakota Rural Water District, Drinking Water State Revolving Fund
Wilton, Drinking Water State Revolving Fund
Wilton, Clean Water State Revolving Fund

Under current policy, the Public Finance Authority can make loans under the State Revolving Fund Program in an amount not to exceed $2,000,000 and under the Capital Financing Program in an amount not to exceed $500,000 without seeking the final approval of the Industrial Commission. Within this policy, once the loan has been approved, the Public Finance Authority is required to provide the details of the loan to the Industrial Commission. Accordingly, the Public Finance Authority and its Advisory Committee used this policy to approve the following loans.

The committee reviewed All Seasons Water Users District's Drinking Water State Revolving Fund (DWSRF) request for a $1,856,000 increase to a previously approved $1,738,000 (total $3,594,000) loan which is eligible for $1,285,733 of loan forgiveness, so the net loan will be $2,308,267. The total project cost is $10,674,000 with the Department of Water Resource's Cost Share program providing $7,080,000. The project will connect the additional water source for System 1 (NAWS) to System 4 to provide adequate water supply to System 4. Also, it will expand the System 4 water treatment plant and wellfield to provide adequate supply for both Systems. The requested term for the loan is 30 years. The district will issue revenue bonds payable from system revenues.

The committee reviewed Dakota Rural Water District's DWSRF request for a $107,000 increase to their previously approved $2,176,000 (total $2,286,000) loan towards a $9,115,000 project. The Department of Water Resource's Cost Share program will provide $6,832,000. The project will construct transmission lines to connect 500 new users to a clean and safe drinking water source. The requested loan term is 30 years. The district will issue revenue bonds payable with system revenues.

The committee reviewed the City of Wilton's DWSRF application for a $431,000 increase to a previously approved $1,688,000 (total $2,119,000) loan towards a $11,350,870 project. Other funding is provided by the Clean Water State Revolving Fund (CWSRF) $1,520,000, Department of Water Resource's Cost Share program $3,136,800, Burleigh County ARPA funds $770,025, USACE Sec 594 Grant $3,583,833 and local funds $221,212. The city will replace water mains and related appurtenances. The requested loan term is 30 years. The city will issue revenue bonds payable from water user fees.

The committee reviewed the City of Wilton's CWSRF application for a $201,000 increase to a previously approved $1,319,000 (total $1,520,000) loan towards a $11,350,870 project. Other funding is provided by the DWSRF $2,119,000, Department of Water Resource's Cost Share program $3,136,800, Burleigh County ARPA funds $770,025, USACE Sec 594 Grant $3,583,833 and local funds $221,212. The city will replace sanitary sewer mains and related appurtenances. The requested loan term is 30 years. The city will issue revenue bonds payable from water user fees.

The Public Finance Authority's Advisory Committee approved these loans at their September 16, 2024, meeting.

NORTH Dakota | Public Finance Authority
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Memorandum

To: Public Finance Authority Advisory Committee
Miles Silbert, Public Financial Management LLC
Kylee Merkel, Bank of North Dakota

From: DeAnn Ament, Executive Director

Date: September 3, 2024

Re: All Seasons Water Users District
Drinking Water State Revolving Fund Loan

Purpose of the Project: Connect the additional water source for System 1 (NAWS) to System 4 to provide adequate water supply to System 4. Also, expand System 4 water treatment plant and wellfield to provide adequate supply for both Systems.

Project Amount:

DWSRF Request	$1,856,000
DWSRF Original Request	1,738,000
DWSRF Loan Forgiveness	(1,285,733)
Net DWSRF Loan	$2,308,267

DWSRF Total Request	$ 3,594,000
SWC Cost Share	7,080,000
Total Project Cost	$10,674,000

Population to Benefit from the Project: 1,150; $9,282/person
Users Served by the System: 1,582 connections plus five Cities with a total population of 488
Is the Project Area Within the Extraterritorial Jurisdiction of a City: No

The requested Drinking Water State Revolving Fund (DWSRF) loan term is 30 years. The District will issue revenue bonds payable with user fees for this loan. The average annual payment on the loan will be $97,177. The required debt service reserve is $102,200 and the 110% net operating coverage requirement is $106,894.

All Seasons Water Users District provides water services to 1,582 residential users and 5 bulk users in the Counties of Bottineau, McHenry, Pierce, Towner and Benson as well as the Cities of Rock Lake, Bisbee, Willow City and Upham.

				Projected	
Connections:	**2022**	**2023**	**2024**	**2025**	**2026**
Residential	1,565	1,579	1,582	1,589	1,597
Bulk/Commercial	10	10	10	10	10

Monthly Base Rates:	2022	2023	2024	2025	2026
System 1,3,4	$36	$36	$40	$40	$42
System 4.2,5	$46	$46	$48	$48	$50

Users pay $7.50/1,000 gallons. The monthly $2 per user base rate increase will result in additional annual revenue of $37,968.

Net Operating Revenue:			Unaudited	
	2020	2021	2022	2023
Interest Revenue	$4,659	$2,737	$1,930	$3,383
Operating Revenue	1,648,819	1,850,650	1,823,706	1,992,808
Operating Expenses	1,759,921	1,905,462	1,938,961	2,068,717
Net Operating Revenue (Expense)	-106,443	-52,075	-113,325	-72,526
Depreciation	633,915	631,980	660,023	660,023
Adjusted Net Operating Revenue	$527,472	$579,905	$546,698	$587,497
Existing Debt Payments	$338,160	$345,698	$328,549	$333,300
Net Operating Coverage	156%	168%	166%	176%
Proforma Rate Increase Revenue	$37,968	$37,968	$37,968	$37,968
Proforma New DWSRF Payments	$97,177	$97,177	$97,177	$97,177
Proforma Net Operating Coverage	130%	140%	137%	145%

The base rate increases along with the anticipated rate increase will provide sufficient net operating revenue to meet the 110% net operating coverage requirement.

Listed below is a summary of the total outstanding debt of as of September 30, 2023:

	Initial Outstanding Debt	Outstanding Debt
Revenue Bonds	$ 4,687,300	$ 3,213,905
NDPFA Revenue Bonds*	2,976,625	650,398
Totals	**$ 7,663,925**	**$ 3,864,303**

* Payments to the NDPFA have been made as agreed. The District has three DWSRF loans with a balance of $233,877 outstanding and one Capital Financing Program loan with $416,521 outstanding.

The population of the connections is estimated to be 4,307. This is an increase of 230 since the 2010 census. Major employers in the service area are Walmart with 125 employees, Bottineau Public School District has 120 employees and Dakota College employs 116.

School Enrollment:

2019-2020	2020-2021	2021-2022	2022-2023	2023-2024
642	673	662	654	655

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Memorandum

TO: DeAnn Ament, Executive Director
North Dakota Public Finance Authority

FROM: PFM Financial Advisors LLC

DATE: September 13, 2024

RE: Marketplace Analysis - Drinking Water State Revolving Fund Program
All Seasons Water Users District

The All Seasons Water Users District ("District") has presented a request to the Authority and the North Dakota Department of Environmental Quality ("Department") for a $1,856,000 increase to their previously approved $1,738,000 loan for a total of $3,594,000 of which $1,285,733 will be loan forgiveness for a total net loan of $2,308,267 under the Drinking Water State Revolving Fund Program ("DWSRF Program"). The DWSRF Program is used to make subsidized interest rate loans to political subdivisions for the purpose of constructing various water treatment, distribution and storage facilities as approved by the Department in accordance with federal and state regulations and an updated Intended Use Plan prepared by the Department.

The District intends to use the proceeds to connect an additional water source from System to System 4, ensuring an adequate water supply for System 4. Additionally, the project aims to expand the water treatment plant and wellfield of System 4 to provide sufficient supply for both Systems.

The municipal securities to be acquired by the Authority will be revenue bonds payable from water user fees. The District's average annual payment under the proposed net loan amount will be approximately $97,177 indicating a 110% net revenue coverage requirement of approximately $106,894. The District will be required to deposit $102,200 into a reserve fund with payments of $20,440 per year over the first five years of the loan. The District intends to raise their monthly base rate $2 per user which will generate additional annual revenues of approximately $38,000. Proforma net operating coverage of the water fund was 1.30x, 1.40x, 1.37x and 1.45x for 2020-2023, respectively. The monthly base rate increase will provide sufficient net revenues to meet the 110% coverage requirement.

As of September 30, 2023, the District has $3,213,905 of revenue bonds outstanding and $650,398 of SRF revenue bonds outstanding. The District has three Drinking Water SRF loans with an outstanding total balance of $233,877 and one Capital Financing Program loan with $416,521 outstanding. The District is current in its payments for its outstanding Authority loans.

Funding for the construction of the District's projects has been included in a list of approved projects as prepared and updated by the Department. As an authorized participant in the DWSRF Program, the District will benefit substantially from the subsidized fixed rate loans made under the Program. Consequently, no other financing mechanism can provide a greater cost advantage than that offered by the DWSRF Program.

BND
Bank of North Dakota

PO BOX 5509, 1200 Memorial Hwy.
Bismarck, ND 58506-5509
800.472.2166
800.366.6888 TTY
701.328.5600
bnd.nd.gov

Memorandum

To: Industrial Commission

From: Kylee Merkel, Business Banker
Bank of North Dakota

Date: September 4, 2024

RE: All Seasons Water Users District
Drinking Water State Revolving Fund Program

ND Public Finance Authority has delivered to BND their memo which recommends approval of a $1,856,000 increase to an existing loan (from $1,738,000 to $3,594,000) to All Seasons Water Users District under the Drinking Water State Revolving Fund (DWSRF). This project is eligible for $1,285,733 of DWSRF loan forgiveness, making the net loan $2,308,267. The total cost of the project is $10,674,000, with $7,080,000 coming from a Department of Water Resources cost-share grant.

The project will connect an additional water source for portions of the system as well as expand the water treatment plant. The requested loan term is 30 years. The District will issue revenue bonds payable from user fees. The annual payment will average $97,177.

Debt Service Coverage:

	Audit	Unaudited		
	2021	2022	2023	Projected
Operating Revenue	1,850,650	1,823,706	1,992,808	1,992,808
Intended Rate Increase				37,968
Interest Revenue	2,737	1,930	3,383	3,383
Operating Expenses	-1,905,462	-1,938,961	-2,068,717	-2,068,717
Net Operating Revenue	-52,075	-113,325	-72,526	-34,558
Add: Depreciation	631,980	660,023	660,023	660,023
Adjusted Operating Income	579,905	546,698	587,497	625,465
Current Debt Service	345,698	328,549	333,300	333,300
Proposed Debt Service				97,177
Current Debt Service	345,698	328,549	333,300	430,477
Debt Service Coverage	167.75%	166.40%	176.27%	145.30%

Residential connections currently pay a monthly base rate of $40.00 or $48.00 depending on which portion of the system they are located. They also pay a volume charge of $7.50 per 1,000 gallons. Commercial connections currently pay a monthly base rate of $44.50 and a volume charge of $8.75 per 1,000 gallons. The District intends to raise the monthly base rate $2.00 per connection next year. The existing user fees, combined with the intended rate increase, will generate sufficient net operating revenues to service both the new and existing debt.

Outstanding Debt:

	Original Amount	**Amount Outstanding**
Revenue Bonds	$7,663,925	$3,864,303
Total Revenue Bonds	$7,663,925	$3,864,303

Average annual debt service requirements are estimated at $430,447, which is an average of $99.94 per resident of the District.

The system currently has 1,582 residential connections, 5 commercial connections and 5 bulk City connections. The District provides water services to Bottineau, McHenry, Towner and Benson Counties as well as the Cities of Rock Lake, Bisbee, Willow City and Upham. The District's estimated population served is 4,307.

Based upon the PFA recommendation and the benefits obtained with this project, BND concurs with their evaluation and support of the request.

Kylee Merkel
Business Banker

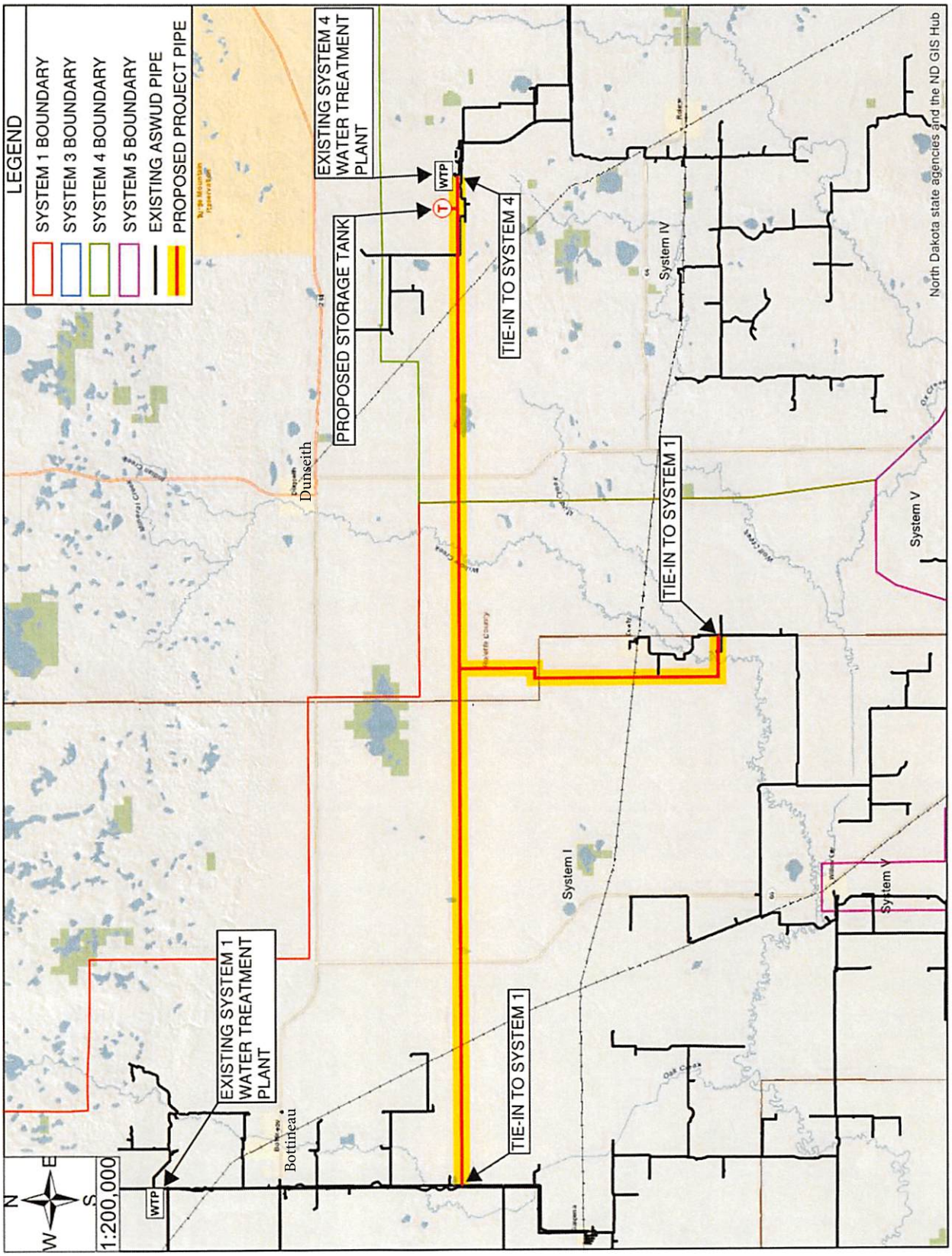

Figure 2 – ASWUD Project Planning Area

Industrial Commission
of North Dakota

Doug Burgum
GOVERNOR

Drew H. Wrigley
ATTORNEY GENERAL

Doug Goehring
AGRICULTURE COMMISSIONER

NORTH Dakota | Public Finance Authority
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Memorandum

To: Public Finance Authority Advisory Committee

From: DeAnn Ament, Executive Director

Date: September 5, 2024

Re: Dakota Rural Water District, Drinking Water State Revolving Fund

Purpose of the Project: Construct transmission lines to connect 500 new users to a clean and safe drinking water source.

Project Amount:

DWSRF Increase Request	$ 107,000
DWSRF Original Request	2,176,000
DWR Cost-Share	6,832,000
Project Total	$ 9,115,000

Population to Benefit from the Project: 500; $18,230/user
Population Served by the System: 2,618 and 6 bulk users which serve a population of 1,182

The requested term for the Drinking Water State Revolving Fund (DWSRF) loan is 30 years. Dakota Rural Water District (District) will issue revenue bonds payable with water user fees. The average annual payment for the revenue bonds will be $88,670. The reserve requirement will be $94,075 and the 110% coverage requirement will be $97,537.

The District currently provides water services in Griggs and Steele Counties and parts of Barnes, Cass, Grand Forks, Nelson and Traill Counties.

Water Connections:

	2020	2021	2022	2023	2024
Residential	937	1,010	1,047	1,097	1,147
Cities	6	6	6	6	6

The residential monthly base rate is $53 per user and the volume charge is $6.50/1,000 gallons. The District anticipates raising the monthly base rate $7 per connection on January 1, 2024, which would annually generate approximately $92,316.

Net Operating Coverage:

	2020	2021	2022	Unaudited 2023
Interest Revenue	$4,514	$2,035	$698	$6,527
Operating Revenue	984,773	1,096,250	1,111,028	1,332,033
Operating Expenses	1,065,683	1,113,079	1,278,541	925,205
Net Operating Revenue	-$76,396	-$14,794	-$166,815	$413,355
Depreciation	352,964	375,163	492,477	--
Adjusted Net Operating Revenue	$276,568	$360,369	$325,662	$413,355
P&I Requirements	$317,472	$306,877	$441,792	$495,909
Net Operating Coverage	87%	117%	74%	83%
Proforma Rate Increase Revenue	$92,316	$92,316	$92,316	$92,316
Proforma DW Payment [1]	$87,236	$35,736	$24,704	$13,105
Proforma Net Operating Coverage	91%	132%	90%	99%

[1] Average proforma DWSRF payment has been reduced by actual payments made that year.

After new management is hired, the District will evaluate net operating coverage mid-2025 and determine whether an additional rate increase will be necessary to meet the 110% requirement.

Summary of the total outstanding debt as of December 31, 2023:

	Original Debt	Outstanding Debt
Total Revenue Bond Debt*	$11,885,000	$6,421,682

*Payments have been made as agreed. The District has two DWSRF loans, including this original loan request, with $2,187,722 outstanding and reserves of $343,667.

The District's total average annual debt payment will be $446,490 which is $117 per connection.

District Population Served by the System:

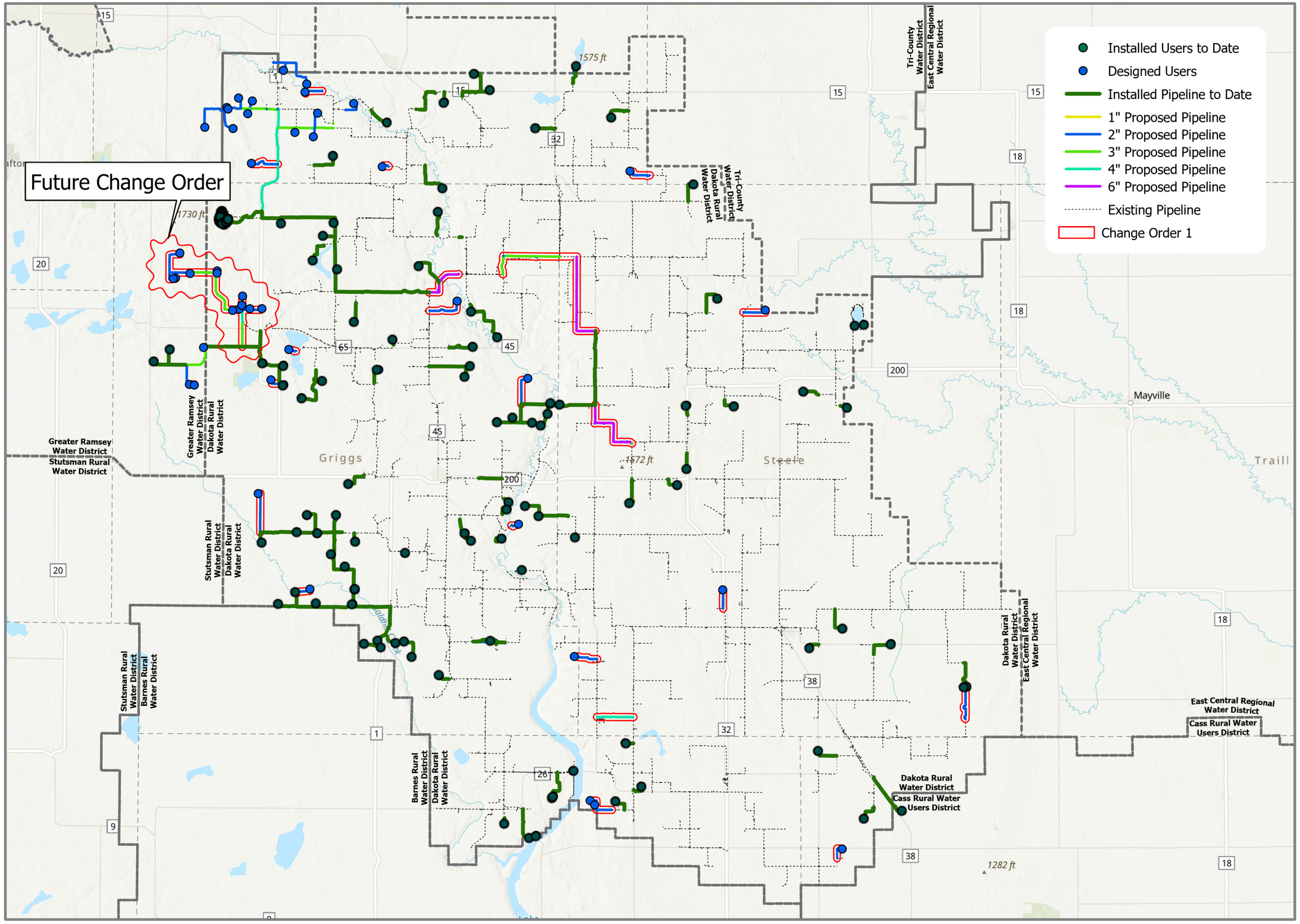
2020	2010
3,932	2,020

Major employers in the service area are Cooperstown Medical Center with 45 employees, Sheyenne Tooling employs 60 and Griggs County Nursing Home has 70 employees.

District-Wide School Enrollment for K-12:

2018-2019	2019-2020	2020-2021	2021-2022	2022-2023
657	657	656	684	680

www.ae2s.com | Advanced Engineering and Environmental Services, Inc.

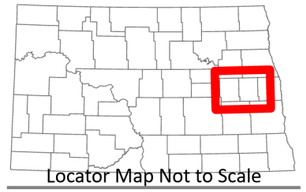


N

0 2.5 5

Miles

1 inch equals 5 miles



Locator Map Not to Scale

2022 CONSTRUCTION PROGRESS

USER EXPANSION

DAKOTA RURAL WATER DISTRICT

Date: 1/4/2022

Information depicted may include data unverified by AE2S. Any reliance upon such data is at the user's own risk. AE2S does not warrant this map or its features are either spatially or temporally accurate.

Coordinate System: NAD 1983 StatePlane North Dakota North FIPS 3301 Feet Intl | Edited by: cclauson | C:\Data\Nasuni\D\DRWD\00118-2017-001\GIS\DRWD User Expansion Preliminary Design - Engineering Staff - Stephen.aprx | DRWD User Expansion Progress Map

NORTH Dakota | Public Finance Authority
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Memorandum

To: Public Finance Authority Advisory Committee

From: DeAnn Ament, Executive Director

Date: September 11, 2024

Re: City of Wilton
Drinking Water State Revolving Fund Program Loan

Purpose of the Project: Replacement of water mains and related appurtenances.

Project Amount:

DWSRF Increase Request	$ 431,000
DWSRF Original Request	1,688,000
Total DWSRF	$ 2,119,000
CWSRF Increase Request	$ 201,000
CWSRF Original Request	1,319,000
Total CWSRF	$ 1,520,000

Total CWSRF and DWSRF	$3,639,000
DWR Cost-Share	3,136,800
Burleigh County ARPA Funds	770,025
USACE Sec 594 Grant	3,583,833
Local Funds	221,212
Project Total	$11,350,870

Population to Benefit from the Project: 808; $14,048/user
Population Served by the System: 808
Is the Project Area Within the Extraterritorial Jurisdiction of a City: No

The requested term is 30 years. The City will issue revenue bonds payable with water user fees. Accordingly, the annual payment to the Public Finance Authority will average approximately $86,652. The reserve requirement will be $91,450 and the 110% coverage requirement will be $95,317.

The City has 328 water connections which each pay a base rate of $11 per connection per month. The City will raise the base rate $12 per user per month to $23 which will generate $47,232 annually.

Water Fund:

				Unaudited
	2020	**2021**	**2022**	**2023**
Interest Revenue	$1,157	$525	$557	$1,130
Operating Revenue	265,151	281,206	239,534	275,379
Operating Expenses	232,782	269,583	212,965	174,785
Net Operating Revenue	$33,526	$12,148	$27,126	$101,724
Revenue Bond Payments	$14,020	$13,495	$13,120	$12,670
Net Operating Coverage	239%	90%	207%	803%
Proforma Revenue Increase	$23,616	$23,616	$23,616	$23,616
Proforma DW Bond Payment	$86,652	$86,652	$86,652	$86,652
Proforma Net Operating Coverage	57%	36%	51%	126%

[1] Using city sales tax funds paid off the water line loan portion of the monthly payment to South Central Water District and discontinued charging the related loan fee.
[2] Implemented a water improvement fee to cover anticipated DWSRF bond payments.

The existing net operating revenue coupled with the proposed rate increase will be sufficient to meet the 110% net operating coverage.

Outstanding Debt July 31, 2024:

	Original Amount	**Outstanding Amount**
Improvement Bonds	$2,030,000	$440,000
Water & Sewer Revenue Bonds	150,000	20,000
Total Bonds	$2,180,000	$460,000

The average annual payment of all debt will be $337,344 which is $418 per resident. In 2027, the average annual payments will be reduced to $148,795 when the current outstanding bonds are paid off.

The City of Wilton is located in Burleigh County 25 miles north of Bismarck on US Highway 83. Based on the 2020 census, the total population was 718; this is an increase of 7 from the 2010 census. The largest employers in the City are Farmers Union Oil (gas station) with 32 employees, Wilton Public Schools with 32 employees and The Union Bank with 10 employees.

School Enrollment:

				Projected
2021-2022	**2021-2022**	**2022-2023**	**2023-2024**	**2024-2025**
267	267	273	278	280

The City's 2023 taxable valuation was $2,549,861. This is an increase of $299,283 from the 2019 taxable valuation.

Property Taxes Levied & Collected 7/31/2024:

Levy Year	Dollar Amount of Levy	Amount Collected to Date of Application	Percentage Collected
2023	276,196	258,840	94%
2022	280,799	270,700	96%
2021	278,589	269,731	97%

Special Assessments Levied & Collected 7/31/2024:

Year	Dollar Amount	Amount Collected to Date of Application	Percentage Collected
2023	109,801	108,871	99%
2022	115,741	115,438	100%
2021	121,047	121,114	100%

City of Wilton Mill Levy History:

Burleigh County:

Year	City	School	Park District	State and County	Other	Total for Each Year
2023	76.35	134.36	10.66	42.17	19.76	283.30
2022	79.89	87.88	10.82	35.26	20.50	234.35
2021	82.11	87.38	10.34	35.40	17.06	232.29
2020	79.18	86.15	10.36	35.36	18.98	230.03
2019	77.73	85.84	9.90	36.30	19.83	229.60

McLean County:

Year	City	School	Park District	State and County	Other	Total for Each Year
2023	76.35	134.36	10.66	79.96	19.00	320.33
2022	79.89	87.88	10.82	81.36	19.80	279.75
2021	82.11	87.38	10.34	81.67	18.69	280.19
2020	79.18	86.15	10.36	83.82	17.59	277.10
2019	77.73	85.84	9.90	84.50	17.50	275.47

2022 STREET AND UTILITY IMPROVEMENTS
WILTON, NORTH DAKOTA

Created By: TJS Date Created: 06/10/21 Date Saved: 06/10/21 Date Plotted: NEVER Date Exported: 06/10/21
Plotted By: Tanner.Schmidt Parcel Date: N/A Aerial Image: 2020 County NAIP SIDS Elevation Data: Lidar
Horizontal Datum: NAD 1983 StatePlane North Dakota South FIPS 3302 Feet Vertical Datum: NAVD1988
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N W E S

moore engineering, inc.

Industrial Commission
of North Dakota

Doug Burgum
GOVERNOR

Drew H. Wrigley
ATTORNEY GENERAL

Doug Goehring
AGRICULTURE COMMISSIONER

NORTH Dakota | Public Finance Authority
Be Legendary.

Memorandum

To: Public Finance Authority Advisory Committee

From: DeAnn Ament, Executive Director

Date: September 11, 2024

Re: City of Wilton
Clean Water State Revolving Fund Program Loan

Purpose of the Project: Replacement of sewer mains and related appurtenances.

Project Amount:

CWSRF Increase Request	$ 201,000
CWSRF Original Request	1,319,000
Total CWSRF	$ 1,520,000
DWSRF Increase Request	$ 431,000
DWSRF Original Request	1,688,000
Total DWSRF	$ 2,119,000

Total CWSRF and DWSRF	$3,639,000
DWR Cost-Share	3,136,800
Burleigh County ARPA Funds	770,025
USACE Sec 594 Grant	3,583,833
Local Funds	221,212
Project Total	$11,350,870

Population to Benefit from the Project: 808; $14,048/user
Population Served by the System: 808
Is the Project Area Within the Extraterritorial Jurisdiction of a City: No

The requested term is 30 years. The City will issue revenue bonds payable with sewer user fees. Accordingly, the annual payment to the Public Finance Authority will average approximately $62,143. The reserve requirement will be $71,050 and the 110% coverage requirement will be $68,357.

The City has 328 sanitary sewer connections which each pay a base rate of $11 per connection per month. The City will raise the base rate $12 per user per month to $23 which will generate $47,232 annually.

Sewer Fund:

				Unaudited
	2020	**2021**	**2022**	**2023**
Operating Revenue	$48,796	$49,709	$50,001	$113,385[2]
Operating Expenses	37,889[1]	48,334[1]	18,120	16,435
Net Operating Revenue	$10,907	$1,375	$31,881	$96,950
Proforma Rate Increase	$47,232	$47,232	$47,232	$47,232
Proforma CW Bond Payment	$62,143	$62,143	$62,143	$62,143
Proforma Net Operating Coverage	94%	78%	127%	232%

[1] Large, one-time repairs were expensed.
[2] Implemented a sewer improvement fee to cover anticipated CWSRF bond payments.

The existing net operating revenue coupled with the proposed rate increase will be sufficient to meet the 110% net operating coverage.

Outstanding Debt July 31, 2024:

	Original Amount	**Outstanding Amount**
Improvement Bonds	$2,030,000	$440,000
Water & Sewer Revenue Bonds	150,000	20,000
Total Bonds	$2,180,000	$460,000

The average annual payment of all debt will be $337,344 which is $418 per resident. In 2027, the average annual payments will be reduced to $148,795 when the current outstanding bonds are paid off.

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2022 STREET AND UTILITY IMPROVEMENTS
WILTON, NORTH DAKOTA

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T:\Projects\21900\21998\21998_2021_Street_and_Utility_Improvements.mxd

N W E S

moore engineering, inc.

RENEWABLE ENERGY PROGRAM PROJECT MANAGEMENT REPORT

Reice Haase, Deputy Executive Director, NDIC

September 30, 2024

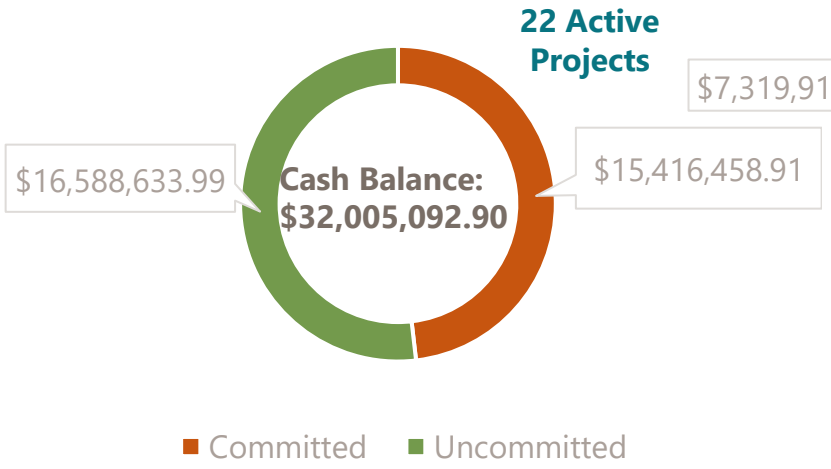
renewable ENERGY PROGRAM

NORTH Dakota

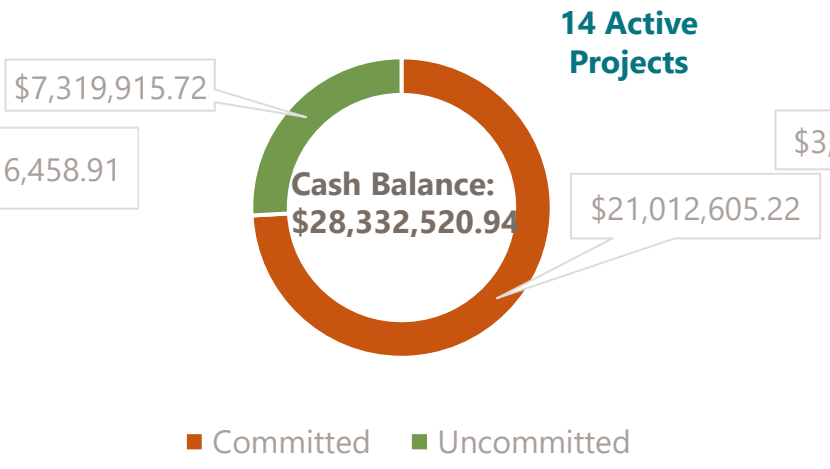
Be Legendary.™

INDUSTRIAL COMMISSION-MANAGED FUNDS

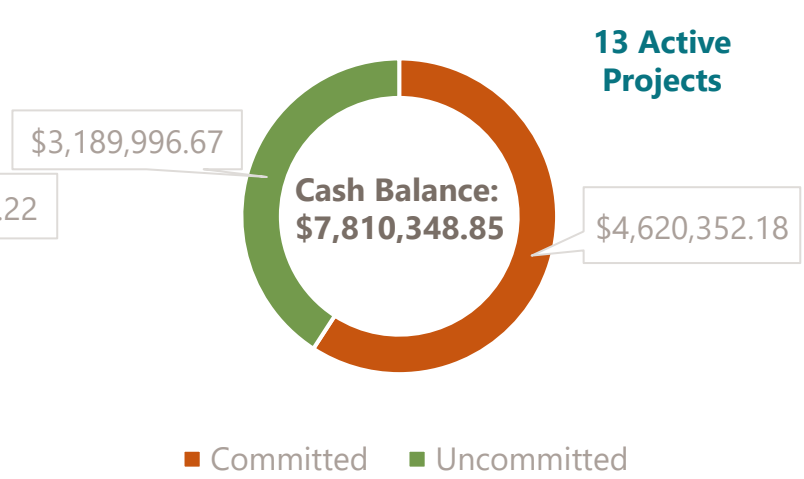
Lignite Research Fund



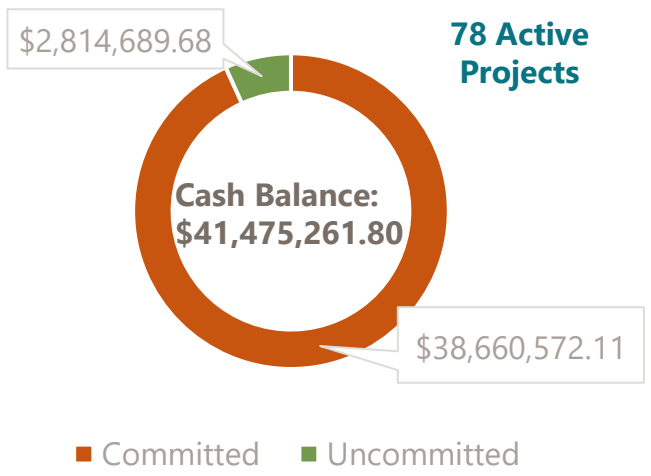
Oil and Gas Research Fund



Renewable Energy Fund

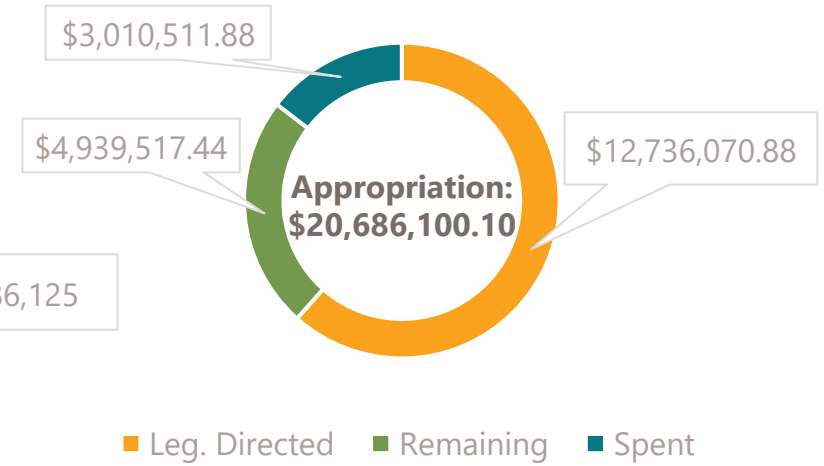


Outdoor Heritage Fund

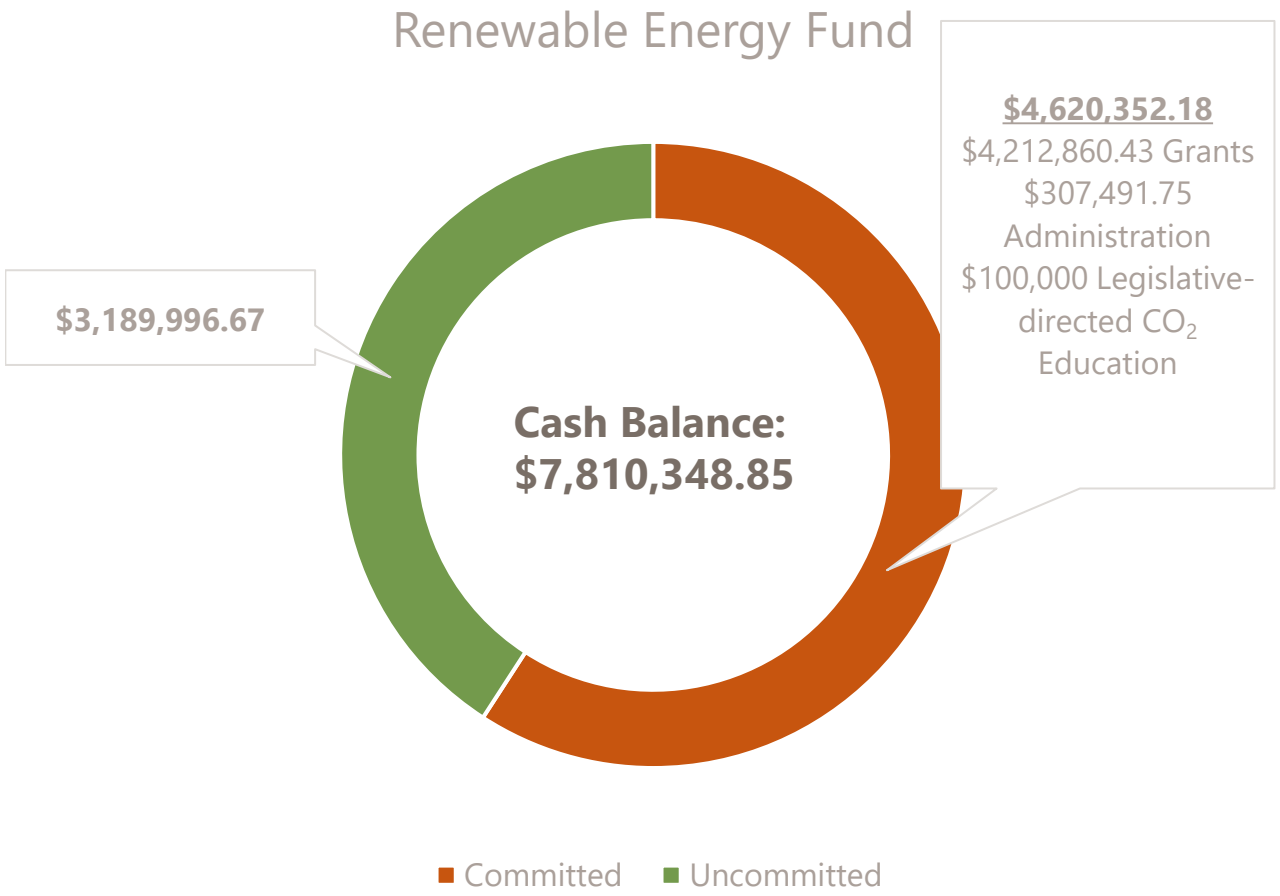


CSEA Fund*

SERC Fund



RENEWABLE ENERGY FUND BALANCE SEPTEMBER 30, 2024



Funding Source:
- **$3 million oil production taxes**

72 Cumulative Projects

13 Active Projects

Cumulative Value:
- **$24.5 million granted**
- **$163.7 million project value**

R-046-056: Electrostatic Lubrication Filtration of Wind Turbine Oil Reservoirs

- $286,234 awarded to UND June 2021
- Demonstrated new filtration technology which cleans and extends the life of wind turbine oil (10,000 gal reservoir)
- Over 90% reduction in size of equipment vs. previously-available technology
- Next Steps: Pursing commercialization

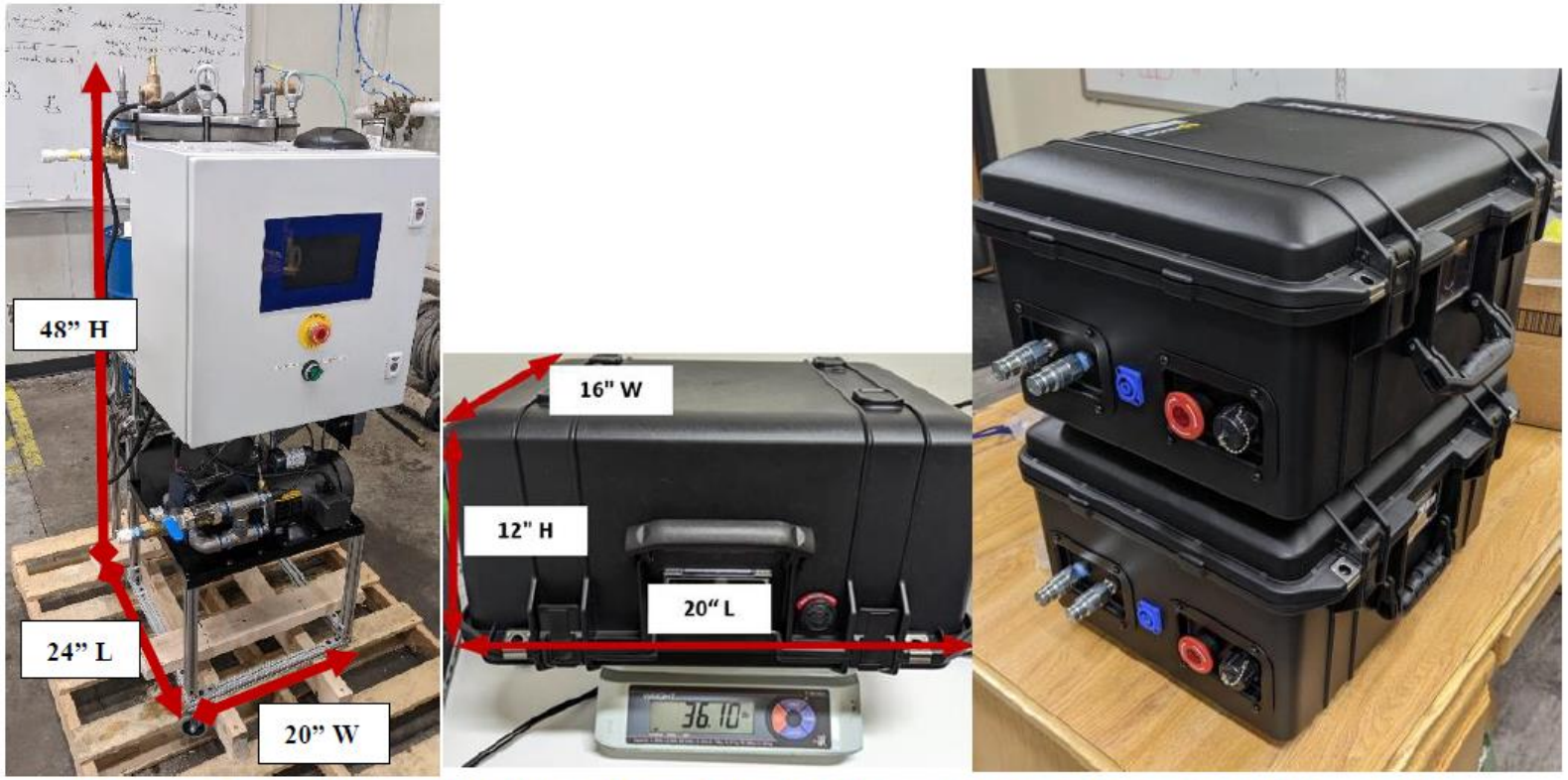


Figure 15: ELF Gen 1 (left) vs Gen 2 Scaled Down Pelican Case (middle, right)

R-050-067: Unlocking Lithium Extraction in Produced Water

- $500,000 awarded to Wellspring Hydro in September 2022
- Completed demonstration project for lithium extraction from oilfield produced water
- 40-100 mg/L of lithium in Bakken formation water
- Pilot plant: 9 gal/minute yielded 99% lithium recovery
- Next Steps: Field validation and commercialization

Field Data	
pH:	5.842
	mg/L
Bicarbonate (HCO3-):	155.873
aqueous CO2:	0
aquesous H2S:	0
Oil Carryover	413
Specific Gravity	g/mL
Measured:	
Calculated:	1.170061
Conductivity	units

Anions	mg/L
Chlorides (Cl-):	157003
Sulfates (SO42-):	287.34
Boron (B):	424.4
Phosphorous (P):	2.386
Analysis Values	
Calculated TDS:	261162.482
Cation/Anion Ratio:	0.003994698

Cations	mg/L
Sodium (Na+):	72300
Magnesium (Mg+):	1402
Potassium (K+):	6840
Calcium (Ca2+):	18970
Strontrium (Sr2+):	1521
Barium (Ba2+):	26.1
Iron (Fe2+):	126.8
Zinc (Zn2+):	28.07
Manganese (Mn2+):	19.04
Lead (Pb):	0.037
Copper (Cu2+):	0
Lithium (Li)	53.7

Pilot Plant Setup

Grant Round 54 Applications

Proposal Number	Applicant	Application Title	Amount Requested	Total Project Cost	Technical Review Score	Renewable Energy Council Vote
R-054-B	NewCarbon Feedstocks, LLC	ACS NewCarbon RNG Project	$455,000	$930,000	154/250	3-2
R-054-C	NewCarbon Feedstocks, LLC	VBD NewCarbon RNG Project	$455,000	$930,000	159/250	3-2
R-054-D	Singularity Energy Technologies	Accelerating the Waste-to-Fuels Commercialization for the Sandwich Gasifier	$486,950	$978,950	213.5/250	3-1 (1 abstain)
Total:			**$1,642,911**	$3,330,872		

INDUSTRIAL COMMISSION OF NORTH DAKOTA
RENEWABLE ENERGY PROGRAM

TECHNICAL REVIEWERS' RATING SUMMARY

R-054B
ACS NEWCARBON RNG PROJECT
Principal Investigator: Matthew Moshier
Request for $455,000; Total Project Costs $930,000

TECHNICAL REVIEWERS' RATING SUMMARY
R-054-B
ACS NEWCARBON FEEDSTOCKS, LLC
Principal Investigator: Matthew Moshier
Request for $455,000 Total Project Costs $930,000

		Technical Reviewer			
		1B	**2B**	**3B**	
Rating Category	**Weighting Factor**	**Rating**			**Average Weighted Score**
1. Objectives	9	4	4	2	30.00
2. Achievability	9	3	4	2	27.00
3. Methodology	7	3	4	3	23.33
4. Contribution	7	2	3	2	16.33
5. Awareness	5	3	3	2	13.33
6. Background	5	4	3	3	16.67
7. Project Management	2	3	3	3	6.00
8. Equipment Purchase	2	5	5	5	10.00
9. Facilities	2	3	3	3	6.00
10. Budget	2	3	2	3	5.33
Average Weighted Score		161	177	124	**154.00**
Maximum Weighted Score					250.00

1. The objectives or goals of the proposed project with respect to clarity and consistency with North Dakota Industrial Commission/Renewable Energy Council goals are: 1 – very unclear; 2 – unclear; 3 – clear; 4 – very clear; or 5 – exceptionally clear.

Reviewer 1B (Rating 4)

Produce RNG with sugar beet pulp & tailings at an industrial scale and prove-up technology to a commercially viable system using anerobic digestion. This application appears to aid in obtaining initial engineering and additional financing of the project, i.e. a pre-feed study.
This project is in alignment with the goals of the REC as it finds a beneficial use of an ag by-product to be used as an energy source.

Reviewer 2B (Rating 4)

This proposal aligns with all of the NDIC's goals. Contact with the beet plant have been made along with a tentative agreement.

Reviewer 3B (Rating 2)
The proposed work appears to this reviewer to be a marketing activity to show the value of a proposed project for American Crystal at their Hillsboro plant. It does not appear there is any new technology being developed which is the goal of the NDIC/Renewable Energy Council. Therefore, I am giving the low score noted.

2. **With the approach suggested and time and budget available, the objectives are: 1 – not achievable; 2 – possibly achievable; 3 – likely achievable; 4 – most likely achievable; or 5 – certainly achievable.**

Reviewer 1B (Rating 3)
The proposal lays out a time frame and budget that appear to be achievable. The NG interconnection timeframe is very optimistic unless the plan is to sell to ACS directly.

Reviewer 2B (Rating 4)
This proposal is for the investigation of feasibility. The requested funding is for the labor cost of deciphering how best to capture and market the methane from sugar beet processing waste.

Reviewer 3B (Rating 2)
There is limited data included in the budget. Without the number of hours and the individuals involved it is impossible to estimate the potential for success.

3. **The quality of the methodology displayed in the proposal is: 1 – well below average; 2 – below average; 3 – average; 4 – above average; or 5 – well above average.**

Reviewer 1B (Rating 3)
The project follows a typical venture capital start-up process. The process will work if the economics are viable. No mention of the inputs into the budget pro-forma. i.e. sales price and carbon credit price.

Reviewer 2B (Rating 4)
The proposed plan is very logical and covers all the bases.

Reviewer 3B (Rating 3)
The methodology noted is good but the lack of details, particularly in the budget and the lack of information identifying contractors is problematic.

4. **The scientific and/or technical contribution of the proposed work to specifically address North Dakota Industrial Commission/Renewable Energy Council goals will likely be: 1 – extremely small; 2 – small; 3 – significant; 4 – very significant; or 5 – extremely significant.**

Reviewer 1B (Rating 2)
There will be very little tech or science achieved with this project, as stated this is a project with a TRL of 9. Unless the team is planning on using a novel process, there is little to gain other than economic justification. Again, at this TRL, there should be some level of payback analysis including pricing and carbon credits.

Reviewer 2B (Rating 3)
Taking waste and producing markable gas may have a significant impact on the owner and surrounding community.

Reviewer 3B (Rating 2)
Since this reviewer does not see any "new" technology being developed I see the scientific or technical contribution as small. In addition, the proposal also states that all data generated will be held by New

Carbon which indicates the information would not be available to assist in development of additional North Dakota projects.

5. The principal investigator's awareness of current research activity and published literature as evidenced by literature referenced and its interpretation and by the reference to unpublished research related to the proposal is: 1 – very limited; 2 – limited; 3 – adequate; 4 – better than average; or 5 – exceptional.

Reviewer 1B (Rating 3)

The awareness of the PI and Co-PIs are adequate based on reference and backgrounds of key personnel. They appear to know that more specialized technical people need to be involved.

Reviewer 2B (Rating 3)

The PI appears to have a proven background in project management. However, based on his resume, he is prone to change jobs quite frequently. Consequently, project dedication would be a concern.

Reviewer 3B (Rating 2)

The proposal does not include any details on the technologies to be used or criteria for the selection of technology including vendors.

6. The background of the investigator(s) as related to the proposed work is: 1 – very limited; 2 – limited; 3 – adequate; 4 – better than average; or 5 – exceptional.

Reviewer 1B (Rating 4)

The PI and Co-PI's have the background to manage this project to their stated goal.

Reviewer 2B (Rating 3)

This project only involves the investigation of methane capture. I have over 40 years of providing and reviewing proposed industrial projects.

Reviewer 3B (Rating 3)

The assembled team includes well educated individuals with significant experience. I am concerned that the team as group has been together for less than a year and therefore has a limited track record in successfully completing similar projects.

7. The project management plan, including a well-defined milestone chart, schedule, financial plan, and plan for communications among the investigators and subcontractors, if any, is: 1 – very inadequate; 2 – inadequate; 3 – adequate; 4 – very good; or 5 – exceptionally good.

Reviewer 1B (Rating 3)

Good PM plan & milestone chart. Timetable has missing reference. No communication schedule found. No public final report issuance found.

Reviewer 2B (Rating 3)

The provided management plan appears to be very generic with very little specified (as it was in other proposals by this requestor). However, since this proposal is only for preliminary investigation, it should suffice.

Reviewer 3B (Rating 3)

No comments.

8. The proposed purchase of equipment is: 1 – extremely poorly justified; 2 – poorly justified; 3 – justified; 4 – well justified; or 5 – extremely well justified. (Circle 5 if no equipment is to be purchased.)

Reviewer 1B (Rating 5)
No equipment purchased

Reviewer 2B (Rating 5)
This proposal is only for investigation, so no new equipment is to be purchased.

Reviewer 3B (Rating 5)
No equipment is to be purchased.

9. The facilities and equipment available and to be purchased for the proposed research are: 1 – very inadequate; 2 – inadequate; 3 – adequate; 4 – notably good; or 5 – exceptionally good.

Reviewer 1B (Rating 3)
No facilities or equipment required other than land agreements that appear to be readily available. Services Only for this portion of the project. Does the team intend to have a ND based engineering firm or office?

Reviewer 2B (Rating 3)
The proposal is only for initial investigation and the existing facilities should be adequate.

Reviewer 3B (Rating 3)
The proposed work is strictly a paper study, and no equipment is to be purchased for this project.

10. The proposed budget "value"[1] relative to the outlined work and the financial commitment from other sources[2] is of: 1 – very low value; 2 – low value; 3 – average value; 4 – high value; or 5 – very high value. (See below)

Reviewer 1B (Rating 3)
Finding a means to economically produce RNG at various ag processing sites adds flexibility and resiliency to the facility operations. It will not fully replace NG. There is only an in-kind labor match from the applicants.

Reviewer 2B (Rating 2)
It is difficult to quantify "in-kind" value when it is presented as a lump sum without any detail as to how the dollar amount was determined.

Reviewer 3B (Rating 3)
The budget has limited details on the financial commitment from other sources. The proposal states that $475,000 in labor from the proposer is included. No information is given about specific individuals, their time commitments and the tasks they will be involved in. In addition, the main recipient of value besides the proposer is American Sugar and they are not contributing significantly to this effort.

Therefore, although I see value in the proposed activities, I believe the value flows do not match up with the requested funds.

Section C. Overall Comments and Recommendations:

Please comment in a general way about the merits and flaws of the proposed project and make a recommendation whether or not to fund.

Reviewer 1B

Good concept. Need to release economic findings for public use. To buy down the risk of a large enough project that is potentially economically feasible and meets the REC's goals is a good use of funds.

In reviewing R-54-B and R-54-C, these are 2 extremely similar projects. Individually I am recommending funding, however, I would only fund one of the projects and not both. There is not enough value to justify both. If I had to pick one, I'd fund R-54-C, even though 54-B is likely more economically viable due to the scale of the project. If there was a way for ACS to make money by digesting their beet pulp and tailings, they would already be doing it in my opinion.

Reviewer 2B

It is evident that this proposal was, in many places, a "cut and paste" process to fulfil the requirements necessary to request NDIC funding. This proposal could have great potential to utilize waste and make a renewable energy product with an economic benefit. However, as written, I cannot support funding this project due to the "in-kind" ambiguity. Once again, this proposal cited 10 line items as to how the NDIC's funding ($455,000) will be utilized. The budget cites the applicant's contribution as a lump sum ($475,000) with no breakdown on how this number is derived. It would appear that the "in-kind" contribution was selected to cover just over 50% of the total project cost to meet the minimum requirements for NDIC funding. Consequently, I **do not** support this proposal as written.

Reviewer 3B

This reviewer does not support funding of this project in its current form. Although I do believe there is value in the proposed work, The proposer needs to add additional details in the material provided in particular regarding the cost share including the number of hours in each of the tasks noted. Also, there are no letters of commitment from the contractors that would be used to complete the tasks, which includes commitments to complete the work outlines in the proposal. Finally, the proposal includes only general references to technology to be used. More information is required. Finally the proposal states that information generated will be held by New Carbon. In order for the value to flow to the State, access to at least some knowledge gained has to be publicly available.

NewCarbon Feedstocks, LLC
1057 Chadwick Ct.
Aurora, IL 60502
www.newcarbon.energy

July 31, 2024
Mr. Reice Haase
Deputy Executive Director
North Dakota Industrial Commission
State Capitol – 14th Floor
600 East Boulevard Avenue, Department 405
Bismarck, ND 58505-0840

Dear Mr. Haase:

Subject: ACS NewCarbon RNG Project

NewCarbon Feedstocks, LLC ("NewCarbon") is pleased to submit the subject proposal to the North Dakota Industrial Commission Renewable Energy Program.

NewCarbon, a clean energy infrastructure company who develops, owns and operates infrastructure that delivers lifecycle carbon intensity reduction for North America's top industrial, agricultural and energy companies, is collaborating with American Crystal Sugar on the development of a renewable natural gas (RNG) project to harvest biogas from byproducts of sugar beet refining via anerobic digestion, upgrade the gas, and deliver high-quality low-carbon RNG to end users. Successful execution of this Project will result in the creation of new renewable energy jobs, wealth and tax revenues for North Dakota. It will also decrease the carbon intensity of a major North Dakota agricultural cooperative and increase sustainability of a key North Dakota industry thereby preserving existing jobs and production levels.

NewCarbon is committed to completing the Project on schedule and within budget should the Commission approve the requested grant.

The $100 application fee for this proposal is provided through ACH Confirmation Number 503625600. If you have any questions, please contact me by telephone at (312) 718-9519 or by email at omar.khayum@newcarbon.energy.

Sincerely,

Omar Khayum, President
NewCarbon Feedstocks, LLC

Renewable Energy Program

North Dakota Industrial Commission

Application

Project Title: ACS NewCarbon RNG Project

Applicant: NewCarbon Feedstocks, LLC

Principal Investigator: Matthew Moshier

Date of Application: July 31, 2024

Amount of Request: $455,000

Total Amount of Proposed Project: $930,000

Duration of Project: 12 months

Point of Contact (POC): Omar Khayum

POC Telephone: (312) 718-9519

POC Email: omar.khayum@newcarbon.energy

POC Address: 1057 Chadwick Ct., Aurora, IL 60502

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ABSTRACT

NewCarbon, a clean energy infrastructure company who develops, owns and operates infrastructure that delivers lifecycle carbon intensity reduction for North America's top industrial, agricultural and energy companies, is collaborating with American Crystal Sugar Company on the development of a renewable natural gas (RNG) project to harvest biogas from byproducts of sugar beet refining via anerobic digestion, upgrade the gas, and deliver high-quality low-carbon RNG to end users.

Objective: The Project objective is to conduct planning and feasibility activities over 12 months that will study sizing and integration of a renewable natural gas (RNG) project with American Crystal Sugar's Hillsboro, North Dakota beet sugar processing facility. The scope of the planning and feasibility activities include market analysis, community outreach and engagement, pre-FEED engineering study, feasibility studies to determine the availability and cost of utility feedstocks, financial model development and pipeline routing due diligence. **Expected Results:** Successful execution of this Project will support the Renewable Energy Program's (REP's) mission to promote the growth of North Dakota's renewable energy industries through research, development, marketing, and education. Upon completion of the 12-month Project duration, NewCarbon will decide whether to progress to a FEED study and subsequent

development activities based upon meeting the following measurable criteria: (1) signed non-binding customer term sheets, (2) budgetary estimate from an EPC contractor based on the pre-FEED, (3) development of a community benefits plan, and (4) feasibility assessment of the technology achieving a TRL 9. Once operational, the proposed Project will result in the creation of new renewable energy jobs, wealth and tax revenues for North Dakota. It will also decrease the carbon intensity of a major North Dakota agricultural cooperative and increase sustainability of a key North Dakota industry thereby preserving existing jobs and production levels. When it is fully operational the ACS NewCarbon RNG Project will produce approximately 300,000 MMBTU per year of low carbon intensity RNG that will satisfy emerging Midwest low carbon fuel standards (LCFS) and provide for a value-added derivative biofuel suitable for commercial and industrial natural gas customers. The Project will create an estimated 50-75 temporary (12-18 months) construction, engineering, and fabrication jobs and 3-5 new permanent facility/operations jobs. The Project represents a novel integration of sugar beet refining, anaerobic digestion, biogas upgrading and gas delivery which can be replicated at other North Dakota agricultural feedstock and sugar beet processing operations. **Duration:** 12 months, with an anticipated start date of November 1, 2024. **Total Project Cost:** $930,000 with $455,000 from the North Dakota Industrial Commission Renewable Energy Program and $475,000 from NewCarbon Feedstocks, LLC. **Participants:** NewCarbon Feedstocks, LLC and American Crystal Sugar Company.

PROJECT DESCRIPTION

Objectives: The Project objective is to conduct planning and feasibility activities over 12 months that will study sizing and integration of a renewable natural gas (RNG) project with American Crystal Sugar's Hillsboro, North Dakota beet sugar processing facility. The scope of the planning and feasibility activities include market analysis, community outreach and engagement, pre-FEED engineering study, feasibility studies to determine the availability and cost of utility feedstocks, financial model development and pipeline routing due diligence. Particular emphasis will be placed on community outreach and public

engagement activities that will support improved understanding of stakeholder concerns, community attitudes, and public acceptance of RNG.

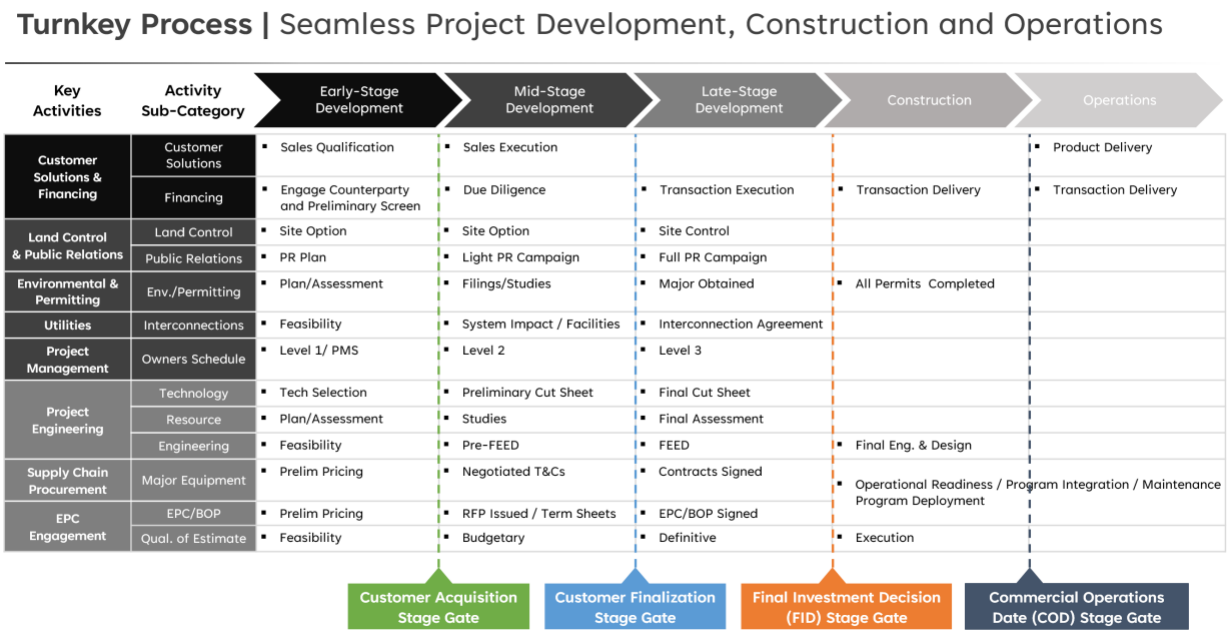
Sugar beet refining is the production of sugar (sucrose) from sugar beets. The process generates significant quantities of both solid and liquid organic byproducts. (Natalia Mioduszewska, 2018) Byproducts of the sugar beet refining process, including sugar beet pulp and sugar beet tailings, are currently used for cattle feed or land applied for beneficial use. This Project will evaluate the design of an industrial scale system to convert these byproducts into raw biogas using anaerobic digestion. The process of anaerobic digestion reduces the amount of methane released during the decomposition of the organic matter and does not reduce the nitrogen and phosphorus nutrient levels. The raw biogas is subsequently upgraded to natural gas pipeline specification which results in lower carbon intensity natural gas when compared to fossil fuel-derived natural gas (Francisco López, Lago Rodríguez, Faraji Abdolmaleki, Galera Martínez, & Bello Bugallo, 2024), hence the term renewable natural gas (RNG). This lower carbon intensity RNG is then delivered to customers either through existing natural gas pipelines or via trucked compressed natural gas. The residual organic matter from the anaerobic digestion process, digestate, is subsequently recycled for agricultural use as a fertilizer. Although sugar production is based on seasonal processing of beets, fresh input substrates can be stored and fed into digesters to maintain a year-round, consistent, biogas production. When it is fully operational the ACS NewCarbon RNG Project will produce approximately 300,000 MMBTU per year of low carbon intensity RNG. This Project will provide a clean energy source from agricultural byproducts and provide a pathway for low carbon competitive sugar production from sugar beets.

Methodology: The Project is organized into eight major tasks. NewCarbon will employ its turnkey project development process to ensure technical, development, and financial

feasibility (see **Error! Reference source not found.**). This process provides multiple stage gates to ensure the Project

follows a rigorous governance process to maximize project viability and risk reduction. During the 12-month duration of the Project, NewCarbon will complete all early-stage development activities and certain mid-stage development activities, such as the pre-FEED study, pursuant to the process in Figure 1 which are vital to producing realistic cost and schedule information and further validate feasibility of the proposed technology and project.

Figure 1: NewCarbon Turnkey Project Development Process



Task 1.0: Market Analysis. The objective of this task is to obtain signed, non-binding customer term sheets from customers for long-term offtake of the RNG product. In terms of market demand for RNG, North Dakota has in-state Biofuels and Sustainable Aviation Fuels facilities which require RNG low carbon feedstock such as RNG to achieve their carbon intensity targets. Many out of state entities are also seeking RNG to meet voluntary or compliance-driven sustainability targets. The scope for Task 1 includes sales and marketing efforts, financial analysis, and execution of commercial transactions. Activities involve developing sales strategies for Renewable Natural Gas (RNG), identifying and reaching

out to prospective customers, engaging with customers to discuss terms and conditions for long-term offtake of RNG and preparing and drafting commercial and legal documents to memorialize offtake agreements.

Task 2.0: Property Due Diligence. The goal of this task is to determine the legal and environmental suitability of the RNG plant site. The scope includes conducting a property title search and assessing the site for any legal or environmental issues that could affect the Project. The project team will optimize the equipment and general plant arrangement, installation, and interconnecting piping of the RNG processing facilities within the existing Hillsboro, North Dakota beet sugar processing facility while anticipating interconnection with utilities adjacent to the Project site.

Task 3.0: Community Outreach and Engagement. This task aims to deliver maximum value to the North Dakota community through effective engagement and communication. The community benefits plan will address community and labor engagement and discuss the creation of high-quality jobs and development of a skilled workforce. Activities include designing and implementing a community outreach strategy and engaging with local stakeholders to communicate Project benefits and gather stakeholder input.

Task 4.0: Engineering Services. The objective is to conduct preliminary front-end engineering and relevant studies to ensure the viability of the facility for RNG production. The scope includes pre-FEED Engineering Study, Lifecycle Assessment (LCA), Biogas Quality Study, Plant Permit Matrix, and Pipeline Permit Matrix. The project team will identify and quantify major material and energy inputs and outputs for a biogas production system. Design analysis includes pressed pulp and tailings reception and washing, size reduction requirements, and design requirements for anaerobic digestion based on high solids content.

Task 5.0: Developer Services. The goal is to perform feasibility studies to determine the availability and cost of utility feedstocks/inputs into the RNG project. The scope includes Electrical, Natural Gas, Wastewater, and Feedwater Interconnection Feasibility.

Task 6.0: Project Pro-Forma/Budget. This task aims to develop a pro-forma model to support offtake pricing and construction financing needs. The pro-forma will leverage the data from the pre-FEED study, biogas and methane production yields, interconnection, land, and financing costs.

Task 7.0: Site Acquisition Planning. The objective is to plan site acquisition for pipeline routing to the interstate pipeline interconnection location.

Task 8.0: Sourcing Project Funding. This task focuses on identifying other funding sources and federal, local, and state tax incentives for renewable natural gas.

Anticipated Results: Successful execution of this Project will support the Renewable Energy Program's (REP's) mission to promote the growth of North Dakota's renewable energy industries through research, development, marketing, and education. Upon completion of the 12-month Project duration, NewCarbon will decide whether to progress to a FEED study and subsequent development activities based upon meeting the following measurable criteria: (1) signed non-binding customer term sheets, (2) budgetary estimate from an EPC contractor based on the pre-FEED, (3) development of a community benefits plan, and (4) feasibility assessment of the technology achieving a TRL 9. Once operational, the proposed Project will result in the creation of new renewable energy jobs, wealth, and tax revenues for North Dakota. The proposed project will also decrease the carbon intensity of a major North Dakota agricultural cooperative and increase sustainability of a key North Dakota industry thereby preserving existing jobs and production levels. When it is fully operational the ACS NewCarbon RNG Project will produce approximately 300,000 MMBTU per year of low carbon intensity RNG that will satisfy emerging Midwest low carbon fuel standard (LCFS) and provide for a value-added derivative biofuel suitable for commercial and industrial natural gas customers. The Project will create an estimated 50-75 temporary

(12-18 months) construction, engineering, and fabrication jobs and 3-5 new permanent facility/operations jobs. The Project represents a novel integration of sugar beet refining, anaerobic digestion, biogas upgrading, and gas delivery which can be replicated at other North Dakota agricultural feedstock and sugar beet processing operations.

Facilities: NewCarbon will be working directly with a large-scale EPC contractor as well as other subcontractors with significant facilities and capabilities for scale up. The NewCarbon team has developed relationships across the energy, engineering, and construction sectors and will augment the NewCarbon capabilities as needed. Using lessons learned from similar pilot projects and analysis and design of the Project site, the project team will determine the feasibility of sugar beet pressed pulp and tailings as a substrate for anaerobic digestion at a commercial scale. During this Project, NewCarbon will be working directly with American Crystal Sugar Company to ensure clear and consistent communication between the two organizations.

Resources: No equipment is expected to be purchased during the initial 12-month planning and feasibility stage. The project participants control the Project and have effective control of the land.

Techniques to Be Used, Their Availability and Capability: The proposed team has committed to the Project and has ensured the availability of key personnel for the time frame of this Project. Any and all relevant publicly available data will be used for the Project. In addition to public resources, NewCarbon has engaged a technology licensor/ equipment provider that has completed and operates a similar project in the EU. The lessons learned from this project is expected to significantly improve the project outcomes.

Environmental and Economic Impacts while Project is Underway: There will be no environmental impact during the initial 12-month planning and feasibility stage. During operations, the RNG project will avoid methane emissions from decomposing sugar beet pulp and tailings while producing low carbon intensity fuel for industry in North Dakota and surrounding regions. Funding through NDIC will help

offset initial development costs of RNG projects in the North Dakota agricultural sector and help develop a potential roadmap for successful project execution of RNG projects at scale.

Ultimate Technological and Economic Impacts: The team believes that as more RNG projects are developed, the costs of the technologies employed will continue to fall and projects such as this will become more economically, socially, and environmentally beneficial. Sugar beet byproducts provide significant potential for RNG production due to high sucrose levels, stable yields across seasons, high dry matter yield, and strong substrate characteristics that stabilize the microbial conversion process. The Project represents a novel integration of sugar beet refining, anaerobic digestion, biogas upgrading and gas delivery which can be replicated at other North Dakota agricultural feedstock processing operations. The Project will create an estimated 50-75 temporary (12-18 months) construction, engineering, and fabrication jobs and 3-5 new permanent facility/operations jobs in North Dakota. The use of sugar beet byproducts for RNG production will contribute to the prosperity of sugar beet farmers and their communities in the North Dakota agricultural landscape.

Why the Project is Needed: This Project will be key to increasing momentum for RNG deployment in the North Dakota agricultural sector. North Dakota is the #2 producer of sugar beets in the United States (ND Department of Agriculture), and this Project is a critical enabler to preserving existing jobs and production levels in this industry while generating information and knowledge that will have the highest probability of bringing new renewable energy companies and industry investment to North Dakota. This Project will address a number of technical and stakeholder needs which can be replicated at other North Dakota agricultural feedstock and sugar beet processing operations. In the technical realm, there are questions about how sugar beet and other agricultural byproducts companies can integrate their operations with anaerobic digestion and subsequent gas upgrading. In the area of public perception, the concept of RNG deployment in North Dakota has been gaining traction and there is an opportunity to educate the public about the beneficial role that the government and private sector play in leveraging

RNG as a means of using our existing and robust natural gas infrastructure to decarbonize our local economy. The technical development and community benefits plan scope in our Project plan will be valuable to all stakeholders as North Dakota continues to pursue carbon reduction strategies and diversify its energy sector. Additionally, the proposed project creates a pathway for low carbon intensity agricultural products allowing North Dakota's agricultural sector to produce products that meet evolving consumer demand.

STANDARDS OF SUCCESS

Upon completion of the twelve-month Project duration, NewCarbon will decide whether to progress to a FEED study and subsequent development activities based upon meeting the following measurable criteria: (1) Signed non-binding customer term sheets, (2) budgetary estimate from an EPC contractor based on the pre-FEED, (3) development of a community benefits plan, and (4) feasibility assessment of the technology achieving a TRL 9. Successful execution of this Project will support the Renewable Energy Program's (REP's) mission to promote the growth of North Dakota's renewable energy industries through research, development, marketing, and education. The proposed Project will result in the creation of new renewable energy jobs, wealth and tax revenues for North Dakota. The project will also decrease the carbon intensity of a major North Dakota agricultural cooperative and increase sustainability of sugar beets, a key North Dakota and US industry, thereby growing existing jobs and production levels.

BACKGROUND/QUALIFICATIONS

NewCarbon will lead and oversee all proposed Project activities. The Principal Investigator (PI) is Matt Moshier (NewCarbon Head of Engineering) who has more than ten years of energy project execution and development experience across the conventional and clean energy sectors, and has completed over $3 billion in capital development, execution, and maintenance work at BP, Williams and TC Energy. The Business Point of Contact (POC) is Omar Khayum (NewCarbon Founder and CEO) who has over 15 years

of experience in the energy domain. Prior to founding NewCarbon, Omar served as the CEO of Annova LNG and held executive and leadership roles at TC Energy, Constellation Energy and Exelon Corporation.

NewCarbon develops, owns, and operates infrastructure that delivers lifecycle carbon intensity reduction. We do this through fit-for-purpose solutions that integrate seamlessly across our customers' value chains. NewCarbon's turnkey infrastructure process makes it easier for customers to reduce lifecycle carbon intensity so they can remain focused on their core businesses.

American Crystal Sugar Company is owned by nearly 2,800 shareholders who raise approximately one-third of the nation's sugar beet acreage in the Red River valley of Minnesota and North Dakota. As the largest beet sugar producer in the United States, the company utilizes innovative farming practices, low-cost production methods, and sales and marketing leadership to produce and sell about 15 percent of America's sugar.

MANAGEMENT

NewCarbon will oversee all tasks, schedule regular internal and external meetings with project participants and contractors and ensure that the Project is conducted using industry best practices in accordance with the project plan (budget, schedule, deliverables, and milestones) and is meeting quality objectives. NewCarbon will keep all partners informed of Project progress, coordinate activities as necessary for the execution of a successful project and will be responsible for timely submission of all project deliverables and transfer of data and products to the project team.

Key Roles:

NewCarbon Feedstocks, LLC: Provides Project director resources, manages the overall Project execution and oversees the contractors and will lead origination effort to sign non-binding term sheet(s) with customers for long-term sale of the RNG.

American Crystal Sugar Company: Provides site specific data and volume and composition of sugar beet byproducts that will feed the anaerobic digestion process.

Contractors: Community Benefits Consultant, Land Control, Environmental/Permitting Consultant, Life Cycle Assessment, Engineering/EPC, Electrical/Water/Pipeline Interconnect Consultant, Financial Modeling Consultant, and OEMs.

Project Duration (12-Month) Go/No-Go Evaluation Point: NewCarbon will decide whether to progress to FEED/Mid-Stage development phase based on the End of Project Goal (SMART).

End of Project Goal: Upon completion of the 12-month Project duration, NewCarbon will decide whether to progress to a FEED study and subsequent development activities based upon meeting the following measurable criteria: (1) Signed non-binding customer term sheets, (2) budgetary estimate from an EPC contractor based on the pre-FEED, (3) development of a community benefits plan, and (4) feasibility assessment of the technology achieving a TRL 9.

TIMETABLE

This Project is proposed to be performed over a 12-month period, with an anticipated start date of November 1, 2024. Quarterly progress reports will be submitted within 30 days after the end of each calendar quarter. **Error! Reference source not found.** depicts the proposed schedule.

Figure 2: ACS NewCarbon RNG Project Schedule

NewCarbon Feedstocks	Year	2024		2025										
ASC RNG Project	Quarters	Q4		Q1			Q2			Q3			Q4	
	# of Months	11	12	1	2	3	4	5	6	7	8	9	10	11
Mid- Stage Development		November	December	January	February	March	April	May	June	July	August	September	October	November
NDIC Grant Award		✓												
Sales Qualification														✓
Engage Fiancing Counterparty and preliminary screen														✓
Site Option														✓
Community Benefits Plan														✓
Pre-FEED Engineering													✓	
Life Cycle Analysis													✓	
Biogas Quality Study			✓											
Permit Matrix													✓	
Electrical Interconnection													✓	
Natural Gas Pipeline Interconnection													✓	
Water/Waste Water Interconnection													✓	
Proforma/ Budget														✓
Pipeline Routing Due Diligence													✓	

BUDGET

The total estimated cost for the proposed work is $930,000, as presented in Table 1. NewCarbon requests $455,000 from the North Dakota Industrial Commission Renewable Energy Program to be matched with $475,000 from NewCarbon Feedstocks, LLC. Budget notes can be found in Appendix D.

Table 1: ACS NewCarbon RNG Project Budget

Project Associated Expense	NDIC's Share	Applicant's Share (In-Kind)	Total Project
Labor (Salaries + Fringe Benefits)		$475,000	$475,000
Travel	$22,000		$22,000
Supplies	$5,000		$5,000
Task 1.0: Market Analysis	$25,000		$25,000
Task 2.0: Property Due Diligence	$5,000		$5,000
Task 3.0: Community Outreach and Engagement	$40,000		$40,000
Task 4.0: Engineering Services	$265,000		$265,000
Task 5.0: Developer Services	$33,000		$33,000
Task 6.0: Project Pro-Forma/Budget	$15,000		$15,000
Task 7.0: Site Acquisition Planning	$40,000		$40,000
Task 8.0: Sourcing Project Funding	$5,000		$5,000
Total	**$455,000**	**$475,000**	**$930,000**

CONFIDENTIAL INFORMATION

No confidential information is included in this proposal.

PATENTS/RIGHTS TO TECHNICAL DATA

It is not anticipated that any patents will be generated during this Project. The rights to data generated will be held NewCarbon Feedstocks, LLC and its affiliates.

STATE PROGRAMS AND INCENTIVES

NewCarbon Feedstocks, LLC has not participated in any programs or incentives from the State in the last 5 years.

APPENDIX A

LETTERS OF SUPPORT

American Crystal Sugar Company

101 North 3rd Street
Moorhead, MN 56560

North Dakota Industrial Commission
State Capitol 14th Floor
600 E. Boulevard Ave. Dept. 405

Bismarck, ND 58505-0840
Phone: (701) 328-3722
Attn: Reice Haase

July 31, 2024

Dear Mr. Haase

To Whom It May Concern,

I am writing this letter to express American Crystal Sugar Company's support of NewCarbon's proposed renewable natural gas (RNG) project at our beet sugar processing facility in Hillsboro, North Dakota.

NewCarbon's innovative food waste to energy project will serve the State of North Dakota and its residents by producing pipeline-grade renewable natural gas from feedstocks abundant in the Red River Valley. The project will allow American Crystal Sugar to convert byproducts of our sugar beet refining process – unprocessed pulp and tailings -- into a value-added advanced biofuel product.

We believe the project meets several stated objectives of the North Dakota Industrial Commission's Renewable Energy Program.

- Promoting efficient economic and environmentally sound development and use of the state's natural resources
- Creating construction and operations jobs in the agricultural/biofuels sector
- Growing the economy, enhancing economic stability and opportunity
- Technology development, innovation and ideation
- Supporting economic growth for agricultural producers

American Crystal Sugar Company generates significant quantities of sugar beet pulp and tailings per year. NewCarbon proposes to develop, construct, and operate an anaerobic digester to produce biogas on site, which will be upgraded to produce pipeline quality renewable natural gas. We support NewCarbon's application to secure grant funding from the North Dakota Industrial Commission Renewable Energy Development Program and other funding sources which will enable them to complete through Phase 1 planning and feasibility tasks of this clean energy project.

NewCarbon is a clean energy infrastructure company who develops, owns and operates infrastructure that delivers lifecycle carbon intensity reduction for North America's top industrial, agricultural and energy companies. Their turnkey infrastructure process makes it easier for partners like American Crystal Sugar Company to reduce lifecycle carbon intensity so we can

American Crystal Sugar Company

101 North 3rd Street
Moorhead, MN 56560

remain focused on what we do best. While delivering on a lower-carbon future, we can attest that NewCarbon takes a collaborative approach to maximizing economic benefits to the local communities in which they operate.

We at American Crystal Sugar are pleased to be collaborating with NewCarbon on this innovative project that creates value through environmentally sound and efficient use of an abundant North Dakota natural resource.

Please do not hesitate to reach out to me if you require any further information. I look forward to witnessing the progress and positive economic impact that NewCarbon will deliver

Thank you for considering my support.

Sincerely,

Josh Kamrud
Business Development and Economic Analysis Manager

APPENDIX B

RESUMES OF KEY PERSONNEL

OMAR KHALID KHAYUM
1057 Chadwick Ct., Aurora, IL 60502 | (312) 718-9519 | omar.khayum@gmail.com | linkedin.com/in/omarkhayum

EDUCATION

The University of Chicago Booth School of Business — **Chicago, IL**
MBA (Honors); Concentrations in Economics, Finance & Entrepreneurship — *September 2007 – June 2009*
- Beta Gamma Sigma

Purdue University — **West Lafayette, IN**
Bachelor of Science, Computer Science (Honors); Minors in Mathematics & Management — *August 2000 – May 2004*
- Phi Beta Kappa, Kappa Sigma, Alpha Kappa Psi

EXPERIENCE

NewCarbon, LLC — **Chicago, IL**
Founder and Chief Executive Officer — *November 2023 – Present*
- Founded a clean energy infrastructure company that delivers lifecycle carbon intensity reduction through fit-for-purpose infrastructure solutions that integrate seamlessly across customers' value chains

Cognitive Concierge, LLC — **Chicago, IL**
Founder and Board Member — *September 2019 – Present*
- Founded a health and wellness company that provides virtual services to families navigating cognitive conditions

MemoryCare Corporation — **Chicago, IL**
Founder and Board Member — *March 2010 – Present*
- Founded a healthcare company that provides Speech, Occupational and Physical Therapy to individuals with cognitive conditions

TC Energy — **Houston, TX**
Vice President – North American Low Carbon Origination and Development — *March 2021 – October 2023*
- Led customer origination for North American power, environmental, natural gas and hydrogen development and trading platform
- Led asset development for North American low carbon platform, including wind, solar, pumped hydro, renewable natural gas, green hydrogen production, blue hydrogen production and carbon capture
- Led asset financing for North American low carbon platform, including strategic equity, project debt and tax equity

Annova LNG — **Houston, TX**
Chief Executive Officer, Annova LNG — *October 2018 – March 2021*
- Led a 6.5 MTPA greenfield liquefied natural gas (LNG) export startup company in Texas
- Led development capital fundraising, project finance debt and equity fundraising and origination of long-term offtake contracts
- Led development activities resulting in FERC and DOE approvals to construct and operate the LNG export facility

Chief Operating Officer, Annova LNG — *September 2017 – September 2018*

Constellation Energy — **Baltimore, MD**
Managing Director – Origination, Constellation Energy — *September 2017 – March 2019*
- Led origination for Constellation's natural gas and LNG trading business

Managing Director – Strategic Projects, Constellation Energy — *January 2017 – August 2017*
- Led establishment of joint venture providing development services to new nuclear power stations in the UK and Japan

Exelon Corporation — **Chicago, IL**
Managing Director – Generation Development, Exelon Generation — *June 2015 – December 2016*
- Led greenfield development for utility scale power generation projects, resulting in financing and construction of over $3 billion of new assets, including over 2.5 GW of natural gas, wind, solar and battery storage capacity across the continental United States

Manager – Generation Development, Exelon Generation — *August 2014 – May 2015*
Manager – Wind Business Development, Exelon Generation — *June 2013 – July 2014*
Manager – Corporate Strategy, Exelon Business Services Company — *November 2012 – May 2013*
Principal Analyst – Corporate Strategy, Exelon Business Services Company — *February 2011 – October 2012*
Senior Analyst – Corporate Financial Planning & Analysis, Exelon Business Services Company — *August 2009 – January 2011*

Diamond Management & Technology Consultants — **Chicago, IL**
Associate and Analyst – Strategy & Marketing Competency — *June 2004 – June 2007*

Matthew William Moshier, MBA, P.E., P.M.P.

Email: mwm5221@gmail.com Phone: 724-825-8406

WORK EXPERIENCE

New Carbon **Chicago, IL**

Head of Engineering March 2024- Present

- Accountable for financial analysis, project management, and engineering for a variety of low carbon products to lower customers carbon intensity in the Midwest
- Submitted five DOE concept papers with customer engagement to EERE to obtain development funding for hard to abate emitters
- Developed financial models to support financing of RNG portfolio on a project and portfolio basis
- Engagement with customers across the carbon lifecycle- from feedstock development to product sale and financing
- Development of term sheets for potential offtake, feedstock supply, and investment

Strata Clean Energy **Chicago, IL**

Senior Director of Engineering October 2023- March 2024

- Led execution of pre-FEED study to determine viability of ammonia production with solid oxide electrolysis
- Served as the technical advisor for stage gated process to drive efficient capital deployment and accountability
- Conducted due diligence across portfolio of electrolysis and ammonia production vendors to determine vendor selection
- Developed siting and deployment strategy to identify potential deep-water ammonia shipping and staged capital deployment
- Led customer engagement in order to commercialize a portfolio of ammonia production facilities
- Created a technoeconomic analysis tool for the leadership team to determine the potential customer cost impact for variety of transportation methods

TCEnergy **Chicago, IL**

Senior Project Manager-Project Development April 2022- October 2023

- Directly managed three employees to meet overall corporate net zero ambitions and drive project development and execution
- Recruited, interviewed, onboarded, and managed multiple employees into the engineering and development group
- Project director for a confidential fully integrated, large scale biofuels facility, with full feedstock supply and offtake
- Managed over 1000 tonne per day (tpd) across 15 FEL studies in various levels of development to develop scope, schedule, and cost to meet customer needs for hydrogen and Carbon Capture Utilization and Storage (CCUS) projects
- Created hydrogen sales and purchase agreement (HSPA) and associated financial and pricing model
- Developed TCEnergy Chemours Joint venture to develop 20 tpd of electrolysis and DOE cost share agreement (Press Release)
- Managed development team to submit four DOE hub applications to receive over $2 Bn in DOE funding
- Executed option to purchase two, 30 tpd liquefaction trains from Plug to support safe harbor investment strategy (Press Release)
- Developed financial and pricing model for green and blue hydrogen as well as capital and operational costs to support
- Executed Life Cycle Analysis across the hubs in order to quantify Carbon Intensity and environmental impact
- Recipient of a DOE loan for $1.3 Bn from the Loans Program Office for Phoenix Hydrogen Hub (Press Release)
- Lead developer for Phoenix Hydrogen Hub (Nikola JV) and key member of due diligence and execution
- Managed multiple Joint Venture (JV) partners and customer engagement with varying levels of ownership
- Developed multiple hydrogen and CO2 pipeline routings and strategies to support hub development and potential offtake
- Negotiated CO2 CCUS sequestration agreement with third party to ensure project bankability
- Lead developer for offtake negotiations for potential biofuels, logistics, and other potential off takers
- Developed hydrogen offtake agreement and pricing structure for customer negotiations in conjunction with JV partners
- Directly involved with the commercial negotiations and financial model development for all projects to ensure engineering perspective is incorporated with main accountabilities for capital and operational expenditures
- Created updated governance structure to ensure viability of project financing and execution for hydrogen and CCUS projects
- Completed due diligence across the hydrogen technology portfolio, including operating and manufacturing site visits
- Developed scope, schedule, and cost for ammonia export terminals to advance hydrogen producing opportunities
- Designed of the metrics spreadsheet to more effectively allow engineering team to provide high level development design criteria to understand feasibility of potential projects for rapid RFP response
- Utilized existing and new data sources to provide recommendations for potential Long Term Supply Agreements for SMR, ATR, Electrolysis, Liquefaction, and biofuels production vendors
- Developed templates to help expedite EPC inputs into financial model, reducing time to pricing for market
- Interviewed and developed recommendation for potential Owners Engineer vendors

BP **Chicago, IL**

Project Manager December 2019 – April 2022

- Directly managed 40+ resources and $11 MM in contractor spend to conduct a 446-mile pipeline inspection- longest in BP history
- Managed a portfolio of $13MM and 60+ resources across the U.S. to complete a high-profile HDD, 65 ILI repairs, reactivation of an idled asset, three active line valve replacements, and multiple ILI inspections
- Conducted multiple FEL studies to shape BPs Net Zero initiative which included multiple confidential Carbon Capture, Utilization, and Storage (CCUS) projects as well as a nationwide DOE funded hydrogen transportation system; presented to senior leadership for investment level decision leading to additional due diligence to align with BP net zero ambitions
- Created financial model to analyze carbon capture projects within the business unit to determine carbon break even pricing
- Optimized in line inspection run to reduce the volume of nitrogen emitted and reduced project spend by $2 MM

- Collaborated with global procurement and leadership teams to develop and implement a change order tracking and feedback system to aggregate contractor non-conformance data for current and future negotiations, ~$1 MM/ year in refunds
- Achieved highest level of internal conformance by implementing a self-verification process to audit project execution and ensure alignment with BP's Stage Gate process and identified future opportunities for KPI development and process improvements
- Established a standardized process for managing projects for pipeline repairs key stakeholder communications
- Utilized Power BI to develop a tool which tracked third party encroachments into pipeline ROW to inform front line operations

Williams Companies Inc. **Pittsburgh, PA**

Project Developer Sr. April 2017 – December 2019

- Lead developer selected to analyze and execute over $2 B of capital projects: gas and condensate gathering, compression, FERC regulated pipelines, gas processing, and fractionation facilities in Ohio River Supply Hub (ORSH)
- Completed commercial deals across gathering and processing business resulting in over $2 B in incremental EBITDA
- Subject matter expert on Processing and Fractionation and expansion capital requirements for multiple M&A deals
- Managed FERC open season process, rate case development, and corporate structure for NGL pipelines
- Presented over $500 MM in proposed capital projects for FY 2017-2019 within capital funding (CAPEX) gated process to senior leadership, board members, and commercial teams to ensure projects meet long term growth strategy
- Developed discounted cash flow models for rate setting purposes for projects with CAPEX less than $150 MM
- Automated and streamlined forecasting model to include commercial scenarios, mitigating contractual risk, and reducing product over/undersell by 15%

Project Engineer III December 2013 – April 2017

- Completed over $650 MM in large capital projects from front end engineering and design (FEED), detailed design, construction support, operations turnover, and post project support
- Managed over $5 MM in engineering contactors, resulting in engineering costs 10% below budget on average
- Provided engineering assistance for construction, including requests for information, commissioning and start-up support, and project deliverable turnover
- Designed, constructed, and commissioned the startup of multiple facilities, including compression, interconnects, pipelines, turbo expander, de-ethanizers, slug catcher, flare, stabilization, frac train, rail bays, and storage tanks
- Developed and ensured efficient execution of multiple company standards for engineering design reviews, Process Hazard Analysis, Layers of Protection Analysis, Management of Changes, Process Safety Startup Review, Alarm Rationalization, Factory Acceptance Tests, and Process Safety Management
- Member of steering committee that developed and implemented companywide standard for API 12F tanks

Pinnacle Asset Integrity Services (PinnacleAIS) **Pasadena, TX**

Project Lead May 2012 – November 2013

- Directly supervised and trained a team of seven consultants on NCRA site-specific procedures in multiple locations
- Oversaw the completion and project reporting of a Mechanical Integrity and Risk Based Inspection program at the National Cooperative Refinery Association (NCRA) Refinery in McPherson, KS
- Managed a total of four project budgets with a gross revenue of $2 MM and gathered data for future proposal bids
- Implemented a companywide best practice for integration of PinnacleAIS Inspection Services with PinnacleAIS Services department for turnaround planning purposes

EDUCATION

Indiana University Bloomington, IN
The Kelley School of Business, MBA, Finance Major August 2023

The Pennsylvania State University University Park, PA
The College of Engineering, Bachelor of Science in Chemical Engineering May 2012

JUSTIN GUTKNECHT
Head of Solutions
NewCarbon LLC
1648 W Division Street, Unit 709, Chicago, IL 60622
312.576.8004 (phone), Justin.Gutknecht@newcarbon.energy

Education and Training

M.B.A., Accounting, Finance, and Strategy, Booth School of Business University of Chicago, 2017.
B.S. Finance, University of Illinois at Urbana-Champaign, 2004.
Chartered Financial Analyst (CFA), 2013–present.

Research and Professional Experience

- Lead structuring of clean energy infrastructure utilizing low carbon feedstocks, fuels and carbon capture technologies by providing commercial guidance to the project development, origination, engineering, and capital markets teams.
- Develop a near and long-term customer-focused decarbonization strategy by deploying energy infrastructure and technologies to achieve lifecycle carbon intensity reduction in manufacturing and production processes.
- Oversee a strategic execution plan incorporating an entire project lifecycle, from conception to commissioning. Include risk mitigation, managing commercial relationships, safety, scheduling, budgeting, and project finance transactional activities.
- Coordinate financing activities, including tax equity and debt financing, provide guidance on financial models, identify risks within contracts, and manage relationships with third-party financiers.

2021–2023: Director, Energy Origination and Development, TC Energy.

- Managed TCE Energy's origination and development of utility-scale renewable power projects and low-carbon infrastructure projects in the United States.
- Supervised a U.S. Origination and Development team covering structured origination, mid-marketing, development, interconnection, permitting and land management functions.
- Led commercial negotiations, development, and execution efforts to establish a U.S. portfolio of wind, solar, hydrogen, clean fuels and carbon capture, transportation and sequestration projects.
- Led Federal and State Hydrogen and Carbon Capture funding opportunities totaling $1 billion, receiving DOE grant awards for projects within the Heartland and ARCH2 Regional Hydrogen Hubs.

2017–2021: Senior Vice President, Finance and Development, Annova LNG.

- Led due diligence, development and execution efforts in multi-phase equity financings with joint venture partners and construction capital fundraising.
- Managed financial advisor, insurance advisor, and outside counsel engagements to support the bankability of terms and conditions of various project contracts and provided structuring advice.
- Led project development activities, including electrical interconnection, wholesale power procurement, dredging, local and state tax incentive negotiations, accounting and tax matters.

2015–2017: Principal, Generation Development Analytics, Exelon Corporation.

- Led financial evaluation and transaction execution support for acquisition and greenfield development of utility scale wind, solar and battery storage generation projects.
- Led development activities for battery storage, including site control, permitting, interconnection, engineering, technology evaluation, and offtake.

2011–2015: Manager, Financial Planning and Analysis, Evraz North America.

- Supervised on-site mill financial managers in monthly forecasting and annual budget processes and consolidated the financial results of the Tubular Product Division.
- Obtained approvals for capital investment projects and provided technical financial support and recommendations on the evaluation of potential alliances, acquisitions, capital investments, and other issues affecting operations.

2004–2011: Senior Financial Analyst, Corporate Development, Telephone and Data Systems Inc.

- Performed valuations for the acquisitions of wireless spectrum and acquisitions.
- Prepared presentations to bond-rating agencies, reviewed credit metric ratios based on rating agency methodologies, and analyzed strategic and financial initiatives to improve capital structure.

Professional Activities

Member, CFA Society of Chicago, 2013–present.

PHILLIP FRANSHAW

4205 Dickson Street, Houston, TX 77007 | (713)253-0690 | phillip.franshaw@newcarbon.energy

EXPERIENCE

NewCarbon—Houston, TX
Co-Founder & Head of Customer Engagement *November 2023—Present*

- Co-founded a clean energy infrastructure company that delivers lifecycle carbon intensity reduction through fit-for-purpose solutions that integrate across customers' value chains
- Lead deal structuring and contract negotiations while working collaboratively with legal, finance, engineering, and construction leads to optimize project economics and mitigate risk

TC Energy Corporation—Houston, TX
Origination Specialist, Power & Energy Solutions *April 2021—November 2023*

- Led customer origination for United States low carbon platform including wind, solar, renewable natural gas, green hydrogen, and sustainable aviation fuel production
- Led deal structuring, negotiations, and execution of contracts to secure mutually beneficial agreements with equity partners, customers, and other project stakeholders

Exelon Corporation—Houston, TX
Senior Vice President & Co-Founder, Annova LNG, LLC *October 2012—March 2021*

- Co-founded a 6.5 MTPA greenfield liquefied natural gas (LNG) export company
- Led origination, structuring, and negotiation of long-term offtake contracts

713 Capital Partners—Houston, TX
Co-Founder & Principal *September 2007—March 2014*

- Co-founded municipal real estate consulting practice providing advisory and development management services

Cockrell Interests Inc.—Houston, TX
Managing Director *September 2003—September 2007*

- Managed a diversified real estate portfolio for a family office
- Led structuring, negotiation, and execution in a portfolio of direct and indirect investments including wholly owned properties, joint ventures, and commingled funds

Hines Interest Limited Partnership—Houston, TX
Project Manager *June 2000—September 2001*

- Managed a global diversified real estate portfolio totaling $2.1billion

The Coca-Cola Company—Atlanta, GA
Business Development Consultant—Houston, TX *September 2001—September 2003*

- Led acquisition structuring, negotiation, and execution of premium juice drink company

Business Development Manager—Atlanta, GA *August 1995—February 1998*

- Led acquisition structuring, negotiation, and execution of bottling assets totaling $2.4 billion

Principal Financial Analyst—Houston, TX *August 1992-August 1995*

- Led restructuring of $2.0 billion operating division

Merrill Lynch Capital Markets—New York City, NY
Equity Trader *August 1986—August 1988*

EDUCATION

The University of Texas at Austin
Master of Business Administration, Finance & International Business *August 1992*

Georgetown University
Bachelor of Arts, English *May 1986*

Brian Lammers
2437 Girard Avenue South
Minneapolis, MN 55405
(612) 518-3798
brian.lammers@newcarbon.energy

Experience

Brian has more than 20 years of experience developing utility-scale renewable power, energy storage and HVDC transmission infrastructure in the United States and Canada. Brian held leadership positions at Exelon, EDP North America and RES Americas. During his career Brian has led origination, development and financing initiatives resulting in investment of more than $6 Billion in low carbon power and energy solutions.

NewCarbon, Chicago, IL
Head of Feedstocks
January 2024 - Present
Founding partner of NewCarbon, a developer, owner and operator of fit-for-purpose solutions for agricultural and industrial customers to lower the lifecycle carbon intensity of their operations.

Advanced Generation Development, Minneapolis, MN
President and Founder
March 2017 – Present

- Originated, developed, and sold a 700 MW wind generation development portfolio to a leading US independent power producer
- Closed 850 MW of wind and solar power purchase agreements for midstream energy client, organized buy-side solicitation, evaluated proposals, led contract negotiations
- Led integration and development of 400 MW solar generation portfolio for power client
- Advisor for site identification and early-stage development of hydrogen production projects, two of which received $1.85 billion in DOE Grant awards
- Led commercial offtake and development efforts for a private equity-backed 2100 MW merchant HVDC transmission project

Renewable Energy Systems, Minneapolis, MN
Vice President, Development
October 2017 – December 2018

- Closed power purchase agreements for 400 MW of wind and solar generation
- Held P&L responsibility for regional origination and development office
- Managed joint venture with leading US IPP resulting in construction of 1 GW of new wind and solar generation

Exelon Generation, Chicago, IL
Managing Director, Renewables and Technology Development
November 2011 - March 2017

- Led development and acquisition of 2 GW of wind and solar generation and battery storage, deploying ~$3 billion in CapEx, and doubling the size of Exelon's renewable generation fleet

EDP Renewables N.A., Minneapolis, MN
Director of Development, Upper Midwest and Northeast U.S.
March 2008 – November 2011

- Completed development of more than 750 MW (~ $1.5 billion) of wind generation
- Responsible for two regional development teams, fifteen staff, a 3 GW project pipeline and $10 million annual budget in the Midwest and Northeastern U.S.

John Deere Finance, Johnston, IA
October 2006 – March 2008

- Led development of 500 MW (~ $1 billion) of U.S. wind power generation projects
- Spearheaded transition from distributed-scale to utility-scale wind generation
- Developed and closed financing for the first multi-megawatt wind farm in Michigan

Gamesa Energy, Philadelphia, PA
September 2004 – October 2006

- Led development of more than 500 MW (~ $1 billion) of US wind generation projects including the largest wind generation project constructed in Pennsylvania
- Opened and managed regional development office

Navitas Energy, Minneapolis, MN
November 1998 – September 2004

- Led origination, development, and completion of 250 MW (~ $500 million) of wind generation
- Supported successful M&A efforts with U.S. and European IPPs

Education

University of Minnesota - Minneapolis, MN
MBA

University of Wisconsin – Madison, WI
Bachelor of Science

Community Involvement

American Red Cross, Twin Cities Chapter – Minneapolis, MN
Board of Directors
June 2023 - Present

City of Lakes Waldorf School, Minneapolis, MN
Secretary, Board of Trustees
Chair, Development Committee
2019 – Present

Clean Grid Alliance (fka Wind on the Wires), Saint Paul, MN
Treasurer and Board Member
2010 – 2021

APPENDIX C

TAX LIABILITY STATEMENT

Industrial Commission

Tax Liability Statement

Applicant:

NewCarbon Feedstocks, LLC

Application Title:

ACS NewCarbon RNG Project

Program:

- ☐ Lignite Research, Development and Marketing Program
- ☑ Renewable Energy Program
- ☐ Oil & Gas Research Program
- ☐ Clean Sustainable Energy Authority

Certification:

I hereby certify that the applicant listed above does not have any outstanding tax liability owed to the State of North Dakota or any of its political subdivisions.

_____

Signature

President

_____

Title

July 31, 2024

_____

Date

APPENDIX D

CITATIONS AND BUDGET NOTES

CITATIONS

ND Department of Agriculture, D. G. (n.d.). Retrieved from https://www.ndda.nd.gov/sites/www/files/documents/files/2023%20ND%20Ag%20brochure.pdf

Natalia Mioduszewska, M. A. (2018). The usefulness of sugar beets for biogas production in relations of the storage time and sugar content. *E3S Web of Conferences*.

Francisco López, A., Lago Rodríguez, T., Faraji Abdolmaleki, S., Galera Martínez, M., & Bello Bugallo, P. (2024). *From Biogas to Biomethane: An In-Depth Review of Upgrading Technologies That Enhance Sustainability and Reduce Greenhouse Gas Emissions*. Retrieved from https://www.mdpi.com/2076-3417/14/6/2342.

BUDGET NOTES

Salaries: Salary estimates are based on the scope of work and prior experience on projects of similar scope. The labor rate used for specifically identified personnel is the current hourly rate for that individual.

Fringe Benefits: Fringe benefits is calculated as 11.6% of gross salary which is calculated as the total of: 6.2% for Employer Social Security Withholding, 1.45% for Employer Medicare Withholding, 0.6% for Employer Federal Unemployment Tax Withholding (FUTA), 0.85% for Employer State Unemployment Tax Withholding (SUI), 2.5% for Paid Leave for All Workers.

Travel: Travel may include site visits, fieldwork, meetings, and conferences. Travel costs are estimated and paid in accordance with OMB Uniform Guidance 2 CFR 200, Section 474. Daily meal rates are based on U.S. General Services Administration (GSA) rates. Other estimates such as airfare, lodging, ground transportation, and miscellaneous costs are based on a combination of historical costs and current market prices. Miscellaneous travel costs may include parking fees, Internet charges, long-distance phone, copies, faxes, shipping, and postage.

Supplies: Supplies include items and materials that are necessary for the research project and can be

directly identified to the project. Supply and material estimates are based on prior experience with similar projects. Examples of supply items are chemicals, gases, glassware, nuts, bolts, piping, data storage, paper, memory, software, toner cartridges, maps, sample containers, minor equipment (value less than $5000), signage, safety items, subscriptions, books, reference materials. General purpose office supplies (pencils, pens, paper clips, staples, Post-it notes, etc.) are included in the Supplies cost.

Communications: Telephone, cell phone, and fax line charges are included in the Supplies cost; however, direct project costs may include line charges at remote locations, long-distance telephone charges, postage, and other data or document transportation costs that can be directly identified to a project. Estimated costs are based on prior experience with similar projects.

INDUSTRIAL COMMISSION OF NORTH DAKOTA
RENEWABLE ENERGY PROGRAM

TECHNICAL REVIEWERS' RATING SUMMARY

R-054-C
VBD NEWCARBON RNG PROJECT
Principal Investigator: Matthew Moshier
Request for $455,000; Total Project Costs $930,000

TECHNICAL REVIEWERS' RATING SUMMARY
R-054-C
VBD NEWCARBON RNG PROJECT
Principal Investigator: Matthew Moshier
Request for $455,000 Total Project Costs $930,000

Rating Category	Weighting Factor	Technical Reviewer Rating 1C	2C	3C	Average Weighted Score
1. Objectives	9	3	4	4	33.00
2. Achievability	9	5	4	3	36.00
3. Methodology	7	2	4	2	18.67
4. Contribution	7	1	3	2	14.00
5. Awareness	5	1	3	3	11.67
6. Background	5	4	3	4	18.33
7. Project Management	2	3	3	3	6.00
8. Equipment Purchase	2	5	5	5	10.00
9. Facilities	2	5	3	3	7.33
10. Budget	2	1	2	3	4.00
Average Weighted Score		146	177	154	**159.00**
Maximum Weighted Score					250.00

1. **The objectives or goals of the proposed project with respect to clarity and consistency with North Dakota Industrial Commission/Renewable Energy Council goals are: 1 – very unclear; 2 – unclear; 3 – clear; 4 – very clear; or 5 – exceptionally clear.**

Reviewer 1C (Rating 3)

The proposed project seems to be focused on community outreach, engagement, pre-FEED and feasibility studies, but doesn't mention anything regarding the process or the necessary equipment to collect, transport, filter, clean, and compress the methane.

Reviewer 2C (Rating 4)

This proposal aligns with all of the NDIC's goals.

Reviewer 3C (Rating 4)
Produce RNG from livestock manure using anerobic digestion and gas cleaning procedures. Also produce reusable bedding for livestock and soil amendments. Develop "standard" digestion units. This project meet the goals of a beneficial use of an ag wast to provide a beneficial renewable product, RNG.

2. With the approach suggested and time and budget available, the objectives are: 1 – not achievable; 2 – possibly achievable; 3 – likely achievable; 4 – most likely achievable; or 5 – certainly achievable.

Reviewer 1C (Rating 5)
Additional information should have been provided regarding the pre-FEED and feasibility studies in order to determine how achievable the studies will be. However, the community outreach and studies for the availability and cost of utility feedstocks is certainly achievable.

Reviewer 2C (Rating 4)
This proposal is for the investigation of feasibility. The requested funding is for the labor cost of deciphering how best to capture and market the methane from dairy cow manure.

Reviewer 3C (Rating 3)
The proposal is achievable given the timeframe and budget. The NG interconnection time frame may be optimistic, but an agreement could be reached.

3. The quality of the methodology displayed in the proposal is: 1 – well below average; 2 – below average; 3 – average; 4 – above average; or 5 – well above average.

Reviewer 1C (Rating 2)
A more detailed scope of the engineering studies (pre-FEED and feasibility) should have been provided.

Reviewer 2C (Rating 4)
The proposed plan is very logical and covers all the bases.

Reviewer 3C (Rating 2)
The project does not layout identifying the attributes of the manure that produces a greater quantity or quality of RNG. As a development project, it follows a typical venture capital process.

4. The scientific and/or technical contribution of the proposed work to specifically address North Dakota Industrial Commission/Renewable Energy Council goals will likely be: 1 – extremely small; 2 – small; 3 – significant; 4 – very significant; or 5 – extremely significant.

Reviewer 1C (Rating 1)
This is a commodity dependent project. And with natural gas at $1.55/MMBtu, spending $930,000 for community outreach, assessing feedstock availability, and a couple engineering studies seems excessive. Especially when it does not include any pilot projects or equipment. And if/when this project is fully operational only collects 56,000 MMBtu per year, it's equivalent to only $86,800/year at today's natural gas prices. That's 11 years just to cover this portion of the project and doesn't include the costs for any FEED study, pilot projects, or commercial equipment. Plus it sounds like they need natural gas for the "high heat pasteurization" which could be more than the 56,000 MMBtu/yr they would produce.

Therefore, this project does not promote efficient or economic use of North Dakotas renewable resources, create highest potential to create jobs, nor will it add wealth to landowners or agriculture producers.

Reviewer 2C (Rating 3)
Taking waste and producing markable gas may have a significant impact on the owner and surrounding community.

Reviewer 3C (Rating 2)
Some knowledge will be gained on the solids separation and cleaning. However, the process is a proven technology. The economic analysis is the key to the project success if it includes pricing and carbon credits.

5. The principal investigator's awareness of current research activity and published literature as evidenced by literature referenced and its interpretation and by the reference to unpublished research related to the proposal is: 1 – very limited; 2 – limited; 3 – adequate; 4 – better than average; or 5 – exceptional.

Reviewer 1C (Rating 1)
Very few research or published literature references were provided.

Reviewer 2C (Rating 3)
The PI appears to have a proven background in project management. However, based on his resume, he is prone to change jobs quite frequently. Consequently, project dedication would be a concern.

Reviewer 3C (Rating 3)
The awareness of the PI and Co-PI's are adequate based on references and backgrounds. The developers appear to acknowledge that outside technical specialists need to be involved.

6. The background of the investigator(s) as related to the proposed work is: 1 – very limited; 2 – limited; 3 – adequate; 4 – better than average; or 5 – exceptional.

Reviewer 1C (Rating 4)
All parties have very thorough and impressive resumes in a considerable quantity of endeavors. Not sure if this is a good sign or not.

Reviewer 2C (Rating 3)
This project only involves the investigation of methane capture. I have over 40 years of providing and reviewing proposed industrial projects.

Reviewer 3C (Rating 4)
The developers have the background to manage the project to meet their stated goal.

7. The project management plan, including a well-defined milestone chart, schedule, financial plan, and plan for communications among the investigators and subcontractors, if any, is: 1 – very inadequate; 2 – inadequate; 3 – adequate; 4 – very good; or 5 – exceptionally good.

Reviewer 1C (Rating 3)
Not overly impressed with the limited details in the project schedule.

Reviewer 2C (Rating 3)
The provided management plan appears to be very generic with very little specified. However, since this proposal is only for preliminary investigation, it should suffice.

Reviewer 3C (Rating 3)
Good PM plan & milestone goals. Financial feasibility has a missing reference. No communication plan found.

8. The proposed purchase of equipment is: 1 – extremely poorly justified; 2 – poorly justified; 3 – justified; 4 – well justified; or 5 – extremely well justified. (Circle 5 if no equipment is to be purchased.)

Reviewer 1C (Rating 5)
There is no equipment to be purchased for this project.

Reviewer 2C (Rating 5)
This proposal is only for investigation, so no new equipment is to be purchased.

Reviewer 3C (Rating 5)
No equipment purchased

9. The facilities and equipment available and to be purchased for the proposed research are: 1 – very inadequate; 2 – inadequate; 3 – adequate; 4 – notably good; or 5 – exceptionally good.

Reviewer 1C (Rating 5)
The project is collaborating with the facility, VanBedaf Dairy LLP, so will most likely be available. No additional equipment is to be purchased as part of this project.

Reviewer 2C (Rating 3)
The proposal is only for initial investigation and the existing facilities should be adequate.

Reviewer 3C (Rating 3)
No facilities or equipment required other than land agreements that appear to be readily available. Services Only for this portion of the project.

10. The proposed budget "value"[1] relative to the outlined work and the financial commitment from other sources[2] is of: 1 – very low value; 2 – low value; 3 – average value; 4 – high value; or 5 – very high value. (See below)

Reviewer 1C (Rating 1)
For this single site alone (VanBedaf Dairy), research, engineering, pilot projects, land acquisition, utility access, equipment, construction, commissioning, operations, maintenance, utilities (natural gas, water, electricity), etc. will cost several if not tens of millions of dollars – just to generate maybe $90,000 of equivalent natural gas per year. Unless natural gas prices skyrocket, or RNG can sell for $20-$30/MMBtu – this project will not prove to efficient or economic.

Reviewer 2C (Rating 2)
It is difficult to quantify "in-kind" value when it is presented as a lump sum without any detail as to how the dollar amount was determined.

Reviewer 3C (Rating 3)
Proving that RNG can be produced economically from small to mid sized ag centers is attractive. The NDIC/REC assistance buys down risk and accelerates the development of these project types.

Section C. Overall Comments and Recommendations:

Please comment in a general way about the merits and flaws of the proposed project and make a recommendation whether or not to fund.

Reviewer 1C

In current commodity market, natural gas is extremely inexpensive for the foreseeable future and these types of projects are extremely difficult to justify – even for environmental reasons as methane produced from dairy farms is just ~4.5% of total amount of methane released to the atmosphere.

The benefits just don't outweigh the costs (as outlined in Comment 4 and Comment 10).

Recommendation: Not to fund.

Reviewer 2C

This proposal could have great potential to utilize waste and make a renewable energy product with an economic benefit. However, as written, I cannot support funding this project due to the "in-kind" ambiguity. The proposal cited 10 line items as to how the NDIC's funding ($455,000) will be utilized. The budget cites the applicant's contribution as a lump sum ($475,000) with no breakdown on how this number is derived. It would appear that the "in-kind" contribution was selected to cover just over 50% of the total project cost to meet the minimum requirements for NDIC funding. Consequently, I **do not** support this proposal as written.

Reviewer 3C

Good concept. Need to release economic findings for public use. This project meets the NDIC/REC's goals of advancing renewable energy derived from ag waste by buying down the risk for project developers.

In reviewing R-54-B and R-54-C, these are 2 extremely similar projects. Individually I am recommending funding, however, I would only fund one of the projects and not both. There is not enough value to justify both. If I had to pick one, I'd fund R-54-C, even though 54-B is likely more economically viable due to the scale of the project. If there was a way for ACS to make money by digesting their beet pulp and tailings, they would already be doing it in my opinion.

NewCarbon Feedstocks, LLC
1057 Chadwick Ct.
Aurora, IL 60502
www.newcarbon.energy

July 31, 2024

Mr. Reice Haase
Deputy Executive Director
North Dakota Industrial Commission
State Capitol – 14th Floor
600 East Boulevard Avenue, Department 405
Bismarck, ND 58505-0840

Dear Mr. Haase:

Subject: VBD NewCarbon RNG Project

NewCarbon Feedstocks, LLC ("NewCarbon") is pleased to submit the subject proposal to the North Dakota Industrial Commission Renewable Energy Program.

NewCarbon, a clean energy infrastructure company who develops, owns and operates infrastructure that delivers lifecycle carbon intensity reduction for North America's top industrial, agricultural and energy companies, is collaborating with VanBedaf Dairy LLP on the development of a renewable natural gas (RNG) project to harvest biogas from dairy manure via anerobic digestion, upgrade the gas, and deliver high-quality negative carbon intensity RNG to end users. Successful execution of this Project will add wealth for landowners and agriculture producers to build and maintain a robust rural economy in North Dakota. It will also decrease the carbon intensity of a family-owned farm in North Dakota which will generate information and knowledge that will increase the probability of bringing new renewable energy companies and industry investment to North Dakota's agricultural producers.

NewCarbon is committed to completing the project on schedule and within budget should the Commission approve the requested grant.

The $100 application fee for this proposal is provided through ACH Transaction Number 503625864. If you have any questions, please contact me by telephone at (312) 718-9519 or by email at omar.khayum@newcarbon.energy.

Sincerely,

Omar Khayum, President
NewCarbon Feedstocks, LLC

Renewable Energy Program

North Dakota Industrial Commission

Application

Project Title: VBD NewCarbon RNG Project

Applicant: NewCarbon Feedstocks, LLC

Principal Investigator: Matthew Moshier

Date of Application: July 31, 2024

Amount of Request: $455,000

Total Amount of Proposed Project: $930,000

Duration of Project: 12 months

Point of Contact (POC): Omar Khayum

POC Telephone: (312) 718-9519

POC Email: omar.khayum@newcarbon.energy

POC Address: 1057 Chadwick Ct., Aurora, IL 60502

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ABSTRACT

NewCarbon, a clean energy infrastructure company who develops, owns and operates infrastructure that delivers lifecycle carbon intensity reduction for North America's top industrial, agricultural and energy companies, is collaborating with VanBedaf Dairy LLP on the development of a renewable natural gas (RNG) project to harvest biogas from dairy manure via anerobic digestion, upgrade the gas, and deliver high-quality low-carbon RNG to end users. VanBedaf Dairy is a family-owned farm established in Carrington, North Dakota in 2008 with a focus on providing quality food for as many as possible while maintaining natural resources and minimizing their footprint. The dairy farm manages over 2,300 cows, milking, dry and heifer, and delivers milk to Cass Clay Creamery in Fargo for further processing into dairy products to service North Dakota and the surrounding region. The cow meals at VanBedaf Dairy are community-oriented and primarily consist of haylage, silage, and byproducts like canola meal, corn distillers, wheat middlings, and sugar beet pulp from local manufacturers. VanBedaf Dairy has also made significant investments in cow care, including high-tech ear tag sensors that make regular wireless contact with computers to ensure cow health and safety. **Objective:** The project objective is to conduct planning and feasibility activities over 12 months that will study sizing and integration of a renewable

natural gas (RNG) project with VanBedaf Dairy's Carrington, North Dakota dairy farm. The scope of the planning and feasibility activities include market analysis, community outreach and engagement, pre-FEED engineering study, and feasibility studies to determine the availability and cost of utility feedstocks, financial model development and pipeline routing due diligence. **Expected Results:** Successful execution of this Project will support the Renewable Energy Program's (REP's) mission to promote the growth of North Dakota's renewable energy industries through research, development, marketing, and education. Upon completion of the 12-month Project duration, NewCarbon will decide whether to progress to a FEED study and subsequent development activities based upon meeting the following measurable criteria: (1) signed non-binding customer term sheets, (2) budgetary estimate from an EPC contractor based on the pre-FEED, (3) development of a community benefits plan, and (4) feasibility assessment of the technology achieving a TRL 9. Once operational, the proposed Project will add wealth for landowners and agriculture producers to build and maintain a robust rural economy in North Dakota. The project will also decrease the carbon intensity of a family-owned farm in North Dakota which will generate information and knowledge that will increase the probability of bringing new renewable energy companies and industry investment to North Dakota's agricultural producers. Methane produced from dairy farms is accountable for 4.5% of the total amount of methane released to the atmosphere (Diane Mayerfeld, n.d.). The project will bring the immediate advantage of reducing regional methane from the dairy industry, capturing biogas as a source of renewable fuel, and producing digestate byproducts as a nutrient-rich fertilizer. Additionally, due to the regional importance of the VanBedaf Dairy facility, the project will help support the REP's goals of helping to educate residents of the potential benefit of renewable products and begin stimulating growth in the renewable energy sector. RNG processing facilities will improve manure management and operations on the site that will benefit the surrounding Carrington community. When the project is fully operational the VanBedaf Dairy NewCarbon RNG Project will process approximately 26 million gallons of liquid manure to produce an

estimated 56,000 MMBTU per year of negative carbon intensity RNG that will satisfy emerging Midwest low carbon fuel standards (LCFS) and provide for a value-added derivative biofuel suitable for commercial and industrial natural gas customers (Francisco López, Lago Rodríguez, Faraji Abdolmaleki, Galera Martínez, & Bello Bugallo, 2024). The Project will create an estimated 40-65 temporary (12-18 months) construction, engineering, and fabrication jobs and 3-5 new permanent facility/operations jobs. The majority of Midwest Dairy RNG operating projects have focused on facilities with greater than 5,000 cows. NewCarbon plans to evaluate new turnkey standardized biogas system configurations for dairy farms with animal units between 1,000 to 3,000 cows, which will increase sustainability and economic viability for small to medium sized dairy producers and other Concentrated Animal Feeding Operations (CAFOs), which are more prevalent in North Dakota. Small CAFOs, where resources and space are limited, face unique challenges for manure storage and management. RNG production improves on-farm manure management, significantly reduces greenhouse gas (GHG) emissions in agriculture, provides a new revenue stream, and advances environmental stewardship. The project represents a novel integration of dairy manure handling, anaerobic digestion, biogas upgrading and gas delivery which can be replicated at other North Dakota dairy operations. This project paves a pathway for other dairy operators to begin to implement RNG projects at their own facilities, creating additional revenue streams and helping take a step towards a clean energy economy. **Duration:** 12 months, with an anticipated start date of November 1, 2024. **Total Project Cost:** $930,000 with $455,000 from the North Dakota Industrial Commission Renewable Energy Program and $475,000 from NewCarbon Feedstocks, LLC. **Participants:** NewCarbon Feedstocks, LLC and VanBedaf Dairy LLP.

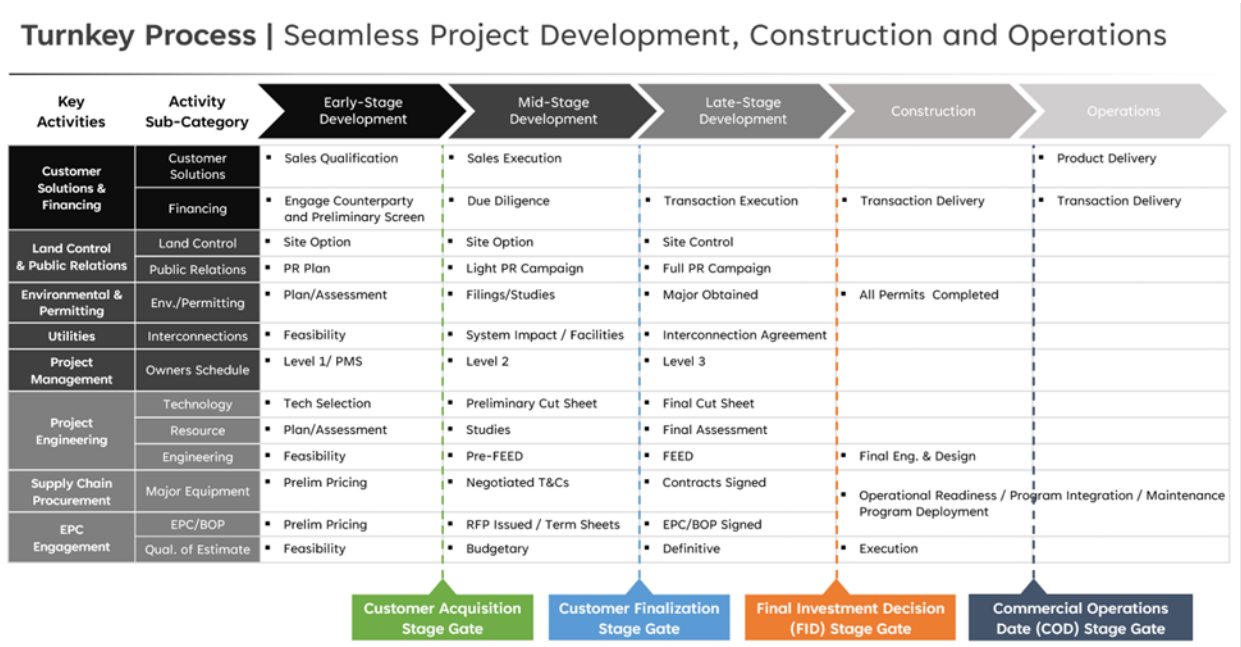
PROJECT DESCRIPTION

Objectives: The project objective is to conduct planning and feasibility activities over 12 months that will study the sizing and integration of a renewable natural gas (RNG) project with the existing dairy to reduce emissions of fugitive methane from manure management at the VanBedaf Dairy farm in

Carrington, North Dakota. The scope of the planning and feasibility activities include market analysis, community outreach and engagement, pre-FEED engineering study, feasibility studies to determine the availability and cost of utility feedstocks, financial model development and pipeline routing due diligence. Particular emphasis will be placed on community outreach and public engagement activities that will support improved understanding of stakeholder concerns, community attitudes, and public acceptance of RNG. The biomethane potential of livestock manure depends on factors such as type of livestock, manure management practices, and the composition of waste. NewCarbon will analyze the consistency of feedstock, moisture content, nutrient content, and other characteristics to improve the efficiency and performance of the conversion process. Manure at VanBedaf Dairy is currently stored in lagoons, where it naturally starts decomposing and releasing methane into the atmosphere, until it can be applied as a fertilizer. The Project will design an RNG processing facility to capture large quantities of manure in anaerobic digesters and use microbial communities to break down the manure into raw biogas. The digesters process and store manure for an average of 25 days, during which time high heat pasteurizes the slurry killing the majority of pathogens. The raw biogas is subsequently upgraded to natural gas pipeline specification which results in negative carbon intensity natural gas when compared to fossil fuel-derived natural gas. This negative carbon intensity RNG is then delivered to customers either through existing natural gas pipelines or via trucked compressed natural gas. A pump system will move the residual organic matter, digestate, from the anaerobic digestion process to a manure solids separator which divides the waste stream into solid and liquid components. The resulting liquid effluent can be pumped through standard irrigation systems for direct application to field crops. The dairy farms will be able to reclaim and recycle the water, thereby improving conservation efforts. When it is fully operational the Project will process approximately 26 million gallons of liquid manure to produce an estimated 56,000 MMBTU per year of negative carbon intensity RNG. The development of a standardized biogas system configuration for small to medium sized CAFOs will improve the

sustainability of North Dakota livestock operations and convert decomposing manure into a valuable product. Anaerobic digestion of dairy manure also reduces odors compared to uncovered manure storage and decreases the risk of nutrient runoff into waterways (Francisco López, Lago Rodríguez, Faraji Abdolmaleki, Galera Martínez, & Bello Bugallo, 2024). **Methodology:** The Project is organized into eight major tasks. NewCarbon will employ its turnkey project development process to ensure technical, development, and financial feasibility (see **Error! Reference source not found.**). This process provides multiple stage gates to ensure the Project follows a rigorous governance process to maximize project viability and risk reduction. During the 12-month duration of the Project, NewCarbon will complete all early-stage development activities and certain mid-stage development activities, such as the pre-FEED study, pursuant to the process in Figure 1 which are vital to producing realistic cost and schedule information and further validate feasibility of the proposed technology and project.

Figure 1: NewCarbon Turnkey Project Development Process



Task 1.0: Market Analysis. The objective of this task is to obtain signed, non-binding customer term sheets from customers for long-term offtake of the RNG product. In terms of market demand for RNG, North Dakota has in-state Biofuels and Sustainable Aviation Fuels facilities which require RNG as a low

carbon feedstock to achieve their carbon intensity targets. Many out of state entities are also seeking RNG to meet voluntary or compliance-driven sustainability targets. The scope for Task 1 includes sales and marketing efforts, financial analysis, and execution of commercial transactions. Activities involve developing sales strategies for Renewable Natural Gas (RNG), identifying and reaching out to prospective customers, engaging with customers to discuss terms and conditions for long-term offtake of RNG and preparing and drafting commercial and legal documents to memorialize offtake agreements.

Task 2.0: Property Due Diligence. The goal of this task is to determine the legal and environmental suitability of the RNG plant site. The scope includes conducting a property title search and assessing the site for any legal or environmental issues that could affect the project. The dairy farm uses sand bedding and separates manure solids mechanically. This process would need to be moved to the digester location and take place after manure has gone through the digester. Sand bedding has caused manure handling challenges for anaerobic digestion as sand can settle in tanks and cause equipment wear. Small amounts of bypass sand can be problematic for effective operations of anaerobic digestion systems. NewCarbon will evaluate mechanical sand-manure separation equipment as anaerobic digestion pre-treatment to recover up to 98% of the sand for reuse, which will improve the dairy operation and increase the total organic solids going into the digester. RNG production can also be affected by technical challenges such as impurities and moisture in the feedstock. NewCarbon will evaluate new technologies to improve the efficiency and effectiveness of RNG production and implement quality control processes in the design basis. The project team will optimize the equipment and general plant arrangement, installation, and interconnecting piping of the RNG processing facilities with the existing Carrington, North Dakota dairy farm.

Task 3.0: Community Outreach and Engagement. This task aims to deliver maximum value to the North Dakota community through effective engagement and communication. The community benefits plan will address community and labor engagement and discuss the creation of high-quality jobs and

development of a skilled workforce. Activities include designing and implementing a community outreach strategy and engaging with local stakeholders to communicate Project benefits and gather stakeholder input.

Task 4.0: Engineering Services. The goal is to conduct preliminary front-end engineering and relevant studies to ensure the facility's viability for RNG production. The scope includes pre-FEED Engineering Study, Lifecycle Assessment (LCA), Biogas Quality Study, Plant Permit Matrix, and Pipeline Permit Matrix. Project team will identify and quantify major material and energy inputs and outputs for a biogas production system. The design analysis will include a closed-loop sand-manure separation system that will rely on minimal water addition to achieve separation and reduce the volume of water fed into the digester. The sand-manure separation system will follow industry best practices in engineering and design to ensure a consistent system operation, and handle manure in an environmentally friendly way.

Task 5.0: Developer Services. The goal is to perform feasibility studies to determine the availability and cost of utility feedstocks/inputs into the RNG project. The scope includes Electrical, Natural Gas, Wastewater, and Feedwater Interconnection Feasibility.

Task 6.0: Project Pro-Forma/Budget. This task aims to develop a pro-forma model to support offtake pricing and construction financing needs. The pro-forma will leverage the data from the pre-FEED study, estimated carbon intensity based on existing dairy operations and proposed equipment installations, interconnection, land, and financing costs.

Task 7.0: Site Acquisition Planning. The objective is to plan site acquisition for pipeline routing to the interconnection location. NewCarbon will design an upgrading system to meet required pipeline specifications and develop a planned pipeline route that will meet safety and regulatory requirements.

Task 8.0: Sourcing Project Funding. This task focuses on identifying other funding sources and federal, local, and state tax incentives for renewable natural gas.

Anticipated Results: Successful execution of this Project will support the Renewable Energy Program's (REP's) mission to promote the growth of North Dakota's renewable energy industries through research, development, marketing, and education. Upon completion of the 12-month Project duration, NewCarbon will decide whether to progress to a FEED study and subsequent development activities based upon meeting the following measurable criteria: (1) signed non-binding customer term sheets, (2) budgetary estimate from an EPC contractor based on the pre-FEED, (3) development of a community benefits plan, and (4) feasibility assessment of the technology achieving a TRL 9. Once operational, the proposed Project will add wealth for landowners and agriculture producers to build and maintain a robust rural economy in North Dakota. The project will also decrease the carbon intensity of a family-owned farm in North Dakota which will generate information and knowledge that will increase the probability of bringing new renewable energy companies and industry investment to North Dakota's agricultural producers. The proposed project will also reduce environmental impacts of dairy feedlot operations while producing a value-added derivative biofuel suitable for commercial and industrial natural gas customers. Processing agricultural waste, such as animal manure, into RNG has significant potential in North Dakota as one of the largest agricultural producers in the United States. When the project is fully operational the VanBedaf Dairy NewCarbon RNG Project will produce approximately 56,000 MMBTU per year of negative carbon intensity RNG that will satisfy emerging Midwest low carbon fuel standards (LCFS) and provide for a value-added derivative biofuel suitable for commercial and industrial natural gas customers. The Project will create an estimated 40-65 temporary (12-18 months) construction, engineering, and fabrication jobs and 3-5 new permanent facility/operations jobs.

Facilities: NewCarbon will be working directly with a large-scale EPC contractor as well as other subcontractors with significant facilities and capabilities in the execution animal waste RNG projects. NewCarbon will be working with contractors who are able to apply best practices for dairy farms using sand bedding with anaerobic digestion systems, which are particularly susceptible to sand settling and

equipment wear, to avoid the design pitfalls from earlier implementations and improve overall system performance. The NewCarbon team has developed relationships across the energy, engineering, and construction sectors and will augment the NewCarbon capabilities as needed. During the course of this Project, NewCarbon will be working directly with VanBedaf Dairy to ensure clear and consistent communication between the two organizations.

Resources: No equipment is expected to be purchased during the initial 12-month planning and feasibility stage. The project participants control the Project and have effective control of the land.

Techniques to Be Used, Their Availability and Capability: The proposed team has committed to the project and has ensured the availability of key personnel for the time frame of this project. Any and all relevant publicly available data will be used for the project.

Environmental and Economic Impacts while Project is Underway: There will be no environmental impact during the initial 12-month planning and feasibility stage. During operations, the RNG project will avoid methane emissions from decomposing dairy manure while producing negative carbon intensity fuel for industry in North Dakota and surrounding regions. Funding through NDIC will help offset initial development costs of RNG projects in the North Dakota dairy sector and help develop a potential roadmap for successful project execution of RNG projects at scale.

Ultimate Technological and Economic Impacts: The team believes that as more RNG projects are developed, the costs of the technologies employed will continue to fall and projects such as this will become more economically, socially and environmentally beneficial. The project represents a novel integration of dairy manure handling, anaerobic digestion, biogas upgrading and gas delivery which can be replicated at other North Dakota agricultural feedstock and dairy operations. The Project will create an estimated 40-65 temporary (12-18 months) construction, engineering, and fabrication jobs and 3-5 new permanent facility/operations jobs in North Dakota. The use of manure for RNG production can

provide a valuable contribution for increasing the prosperity of dairy farmers and their communities in the North Dakota agricultural landscape.

Why the Project is Needed: This Project will be key to increasing momentum for RNG deployment in the North Dakota agricultural sector. Agriculture is one of North Dakota's leading industries, with its dairies producing milk for 593 million 8-ounce servings United States (ND Department of Agriculture). The proposed Project is a critical enabler to growing the low carbon dairy industry and creating energy transition jobs in North Dakota. The design, development and implementation of an anaerobic digestion facility adjacent to VanBedaf Dairy using its manure as a feedstock will capture and beneficially reuse biogenic methane for use in the region. Small and medium sized dairies lack the financial resources to invest in sophisticated manure management systems like anaerobic digestion and biogas upgrading, but the growing demand and value of negative carbon intensity RNG can financially underpin a project with proper engineering and design factoring in best practices for operations. The feasibility study will support the innovation and implementation of biogas production at small to medium sized CAFOs, explore ways to reduce waste, improve sustainable practices in livestock operations in North Dakota, and provide an additional revenue stream for dairy farm operations.

STANDARDS OF SUCCESS

Upon completion of the 12-month project duration, NewCarbon will decide whether to progress to a FEED study and subsequent development activities based upon meeting the following measurable criteria: (1) Signed non-binding customer term sheets, (2) budgetary estimate from an EPC contractor based on the pre-FEED, (3) development of a benefits plan, and (4) feasibility assessment of the technology achieving a TRL 9. Successful execution of this Project will support the Renewable Energy Program's (REP's) mission to promote the growth of North Dakota's renewable energy industries through research, development, marketing, and education. The proposed Project will add wealth for landowners and agriculture producers to build and maintain a robust rural economy in North Dakota.

The proposed Project will also decrease the carbon intensity of a family-owned dairy farm in North Dakota which will generate information and knowledge on innovative ways to handle manure management that will increase the probability of bringing new renewable energy companies and industry investment to North Dakota's dairy industry and other livestock operations.

BACKGROUND/QUALIFICIATIONS

NewCarbon will lead and oversee all proposed project activities. The Principal Investigator (PI) is Matt Moshier (NewCarbon Head of Engineering) who has more than ten years of energy project execution and development experience across the conventional and clean energy sectors, and has completed over $3 billion in capital development, execution, and maintenance work at BP, Williams and TC Energy. The Business Point of Contact (POC) is Omar Khayum (NewCarbon Founder and CEO) who has over 15 years of experience in the energy domain. Prior to founding NewCarbon, Omar served as the CEO of Annova LNG and held executive and leadership roles at TC Energy, Constellation Energy and Exelon Corporation. NewCarbon develops, owns and operates infrastructure that delivers lifecycle carbon intensity reduction. We do this through fit-for-purpose solutions that integrate seamlessly across our customers' value chains. NewCarbon's turnkey infrastructure process makes it easier for customers to reduce lifecycle carbon intensity so they can remain focused on their core businesses. VanBedaf Dairy is a family-owned farm established in Carrington, North Dakota in 2008.

MANAGEMENT

NewCarbon will oversee all tasks, schedule regular internal and external meetings with project participants and contractors and ensure that the project is conducted using industry best practices in accordance with the project plan (budget, schedule, deliverables, and milestones) and is meeting quality objectives. NewCarbon will keep all partners informed of project progress, coordinate activities as necessary for the execution of a successful project and will be responsible for timely submission of all project deliverables and transfer of data and products to the project team.

Key Roles: NewCarbon Feedstocks, LLC: Provides project director resources, manages the overall project execution and oversees the contractors and will lead origination effort to sign non-binding term sheet(s) with customers for long-term sale of the RNG. VanBedaf Dairy LLP: Provides site specific data and volume and composition of dairy manure that will feed the anaerobic digestion process.

Contractors: Community Benefits Consultant, Land Control, Environmental/Permitting Consultant, Life Cycle Assessment, Engineering/EPC, Electrical/Water/Pipeline Interconnect Consultant, Financial Modeling Consultant, and OEMs.

Project Duration (12-Month) Go/No-Go Evaluation Point: NewCarbon will decide whether to progress to FEED/Mid-Stage development phase based on the End of Project Goal (SMART).

End of Project Goal: Upon completion of the 12-month Project duration, NewCarbon will decide whether to progress to a FEED study and subsequent development activities based upon meeting the following measurable criteria: (1) Signed non-binding customer term sheets, (2) budgetary estimate from an EPC contractor based on the pre-FEED, (3) development of a benefits plan, and (4) feasibility assessment of the technology achieving a TRL 9.

TIMETABLE

This Project is proposed to be performed over a 12-month period, with an anticipated start date of November 1, 2024. Quarterly progress reports will be submitted within 30 days after the end of each calendar quarter. **Error! Reference source not found.** depicts the proposed schedule.

Figure 2: VBD NewCarbon RNG Project Schedule

NewCarbon Feedstocks	Year	2024		2025										
ASC RNG Project	Quarters	Q4		Q1			Q2			Q3			Q4	
	# of Months	11	12	1	2	3	4	5	6	7	8	9	10	11
Mid- Stage Development		November	December	January	February	March	April	May	June	July	August	September	October	November
NDIC Grant Award		✓												
Sales Qualification														✓
Engage Fiancing Counterparty and preliminary screen														✓
Site Option														✓
Community Benefits Plan														✓
Pre-FEED Engineering													✓	
Life Cycle Analysis													✓	
Biogas Quality Study			✓											
Permit Matrix													✓	
Electrical Interconnection													✓	
Natural Gas Pipeline Interconnection													✓	
Water/Waste Water Interconnection													✓	
Proforma/ Budget														✓
Pipeline Routing Due Diligence													✓	

BUDGET

The total estimated cost for the proposed work is $930,000, as presented in Table 1. NewCarbon requests $455,000 from the North Dakota Industrial Commission Renewable Energy Program to be matched with $475,000 from NewCarbon Feedstocks, LLC. Budget notes can be found in Appendix D.

Table 1: VBD NewCarbon RNG Project Budget

Project Associated Expense	NDIC's Share	Applicant's Share (In-Kind)	Total Project
Labor (Salaries + Fringe Benefits)		$475,000	$475,000
Travel	$22,000		$22,000
Supplies	$5,000		$5,000
Task 1.0: Market Analysis	$25,000		$25,000
Task 2.0: Property Due Diligence	$5,000		$5,000
Task 3.0: Community Outreach and Engagement	$40,000		$40,000
Task 4.0: Engineering Services	$265,000		$265,000
Task 5.0: Developer Services	$33,000		$33,000
Task 6.0: Project Pro-Forma/Budget	$15,000		$15,000
Task 7.0: Site Acquisition Planning	$40,000		$40,000
Task 8.0: Sourcing Project Funding	$5,000		$5,000
Total	**$455,000**	**$475,000**	**$930,000**

CONFIDENTIAL INFORMATION

No confidential information is included in this proposal.

PATENTS/RIGHTS TO TECHNICAL DATA

It is not anticipated that any patents will be generated during this Project. The rights to data generated will be held NewCarbon Feedstocks, LLC and its affiliates.

STATE PROGRAMS AND INCENTIVES

NewCarbon Feedstocks, LLC has not participated in any programs or incentives from the State in the last 5 years.

APPENDIX A

LETTERS OF SUPPORT

VanBedaf Dairy

6959 2nd Street NE
Carrington, ND 58421

[DATE] 7/25/24

To Whom It May Concern,

I am writing this letter to express VanBedaf Dairy's support of NewCarbon's proposed renewable natural gas (RNG) project at our dairy and the corresponding issues it will address.

VanBedaf Dairy produces approximately 26 million gallons of animal waste per year. NewCarbon proposes a manure management project with anaerobic digestion on site. This manure management project will collect and treat the manure producing approximately 56,000 MMBtu per annum of pipeline quality renewable natural gas. We support NewCarbon's application to secure grant funding from the North Dakota Industrial Commission Renewable Energy Development Program and other funding sources which will enable them to advance through Phase 1 planning and feasibility tasks of this clean energy project.

NewCarbon's proposed project would serve the State of North Dakota and its residents by promoting environmental sustainability. By capturing and upgrading biogas, the project reduces greenhouse gas emissions, avoids watershed contamination, and reliance on fossil fuels, aligning with environmental regulations and improving air quality. This holistic approach reflects a commitment to sustainable development and responsible resource utilization.

NewCarbon is a clean energy infrastructure company who develops, owns and operates infrastructure that delivers lifecycle carbon intensity reduction for North America's top industrial, agricultural and energy companies. Their turnkey infrastructure process makes it easier for partners like VanBedaf Dairy to reduce lifecycle carbon intensity so we can remain focused on what we do best. While delivering on a lower-carbon future, we can attest that NewCarbon takes a collaborative approach to maximizing economic benefits to the local communities in which they operate.

Please do not hesitate to reach out to me if you require any further information. I look forward to witnessing the progress and positive economic impact that NewCarbon will deliver.

Thank you for considering my support.

Sincerely,

Piet van Bedaf
Owner

APPENDIX B

RESUMES OF KEY PERSONNEL

OMAR KHALID KHAYUM
1057 Chadwick Ct., Aurora, IL 60502 | (312) 718-9519 | omar.khayum@gmail.com | linkedin.com/in/omarkhayum

EDUCATION

The University of Chicago Booth School of Business — **Chicago, IL**
MBA (Honors); Concentrations in Economics, Finance & Entrepreneurship — *September 2007 – June 2009*
- Beta Gamma Sigma

Purdue University — **West Lafayette, IN**
Bachelor of Science, Computer Science (Honors); Minors in Mathematics & Management — *August 2000 – May 2004*
- Phi Beta Kappa, Kappa Sigma, Alpha Kappa Psi

EXPERIENCE

NewCarbon, LLC — **Chicago, IL**
Founder and Chief Executive Officer — *November 2023 – Present*
- Founded a clean energy infrastructure company that delivers lifecycle carbon intensity reduction through fit-for-purpose infrastructure solutions that integrate seamlessly across customers' value chains

Cognitive Concierge, LLC — **Chicago, IL**
Founder and Board Member — *September 2019 – Present*
- Founded a health and wellness company that provides virtual services to families navigating cognitive conditions

MemoryCare Corporation — **Chicago, IL**
Founder and Board Member — *March 2010 – Present*
- Founded a healthcare company that provides Speech, Occupational and Physical Therapy to individuals with cognitive conditions

TC Energy — **Houston, TX**
Vice President – North American Low Carbon Origination and Development — *March 2021 – October 2023*
- Led customer origination for North American power, environmental, natural gas and hydrogen development and trading platform
- Led asset development for North American low carbon platform, including wind, solar, pumped hydro, renewable natural gas, green hydrogen production, blue hydrogen production and carbon capture
- Led asset financing for North American low carbon platform, including strategic equity, project debt and tax equity

Annova LNG — **Houston, TX**
Chief Executive Officer, Annova LNG — *October 2018 – March 2021*
- Led a 6.5 MTPA greenfield liquefied natural gas (LNG) export startup company in Texas
- Led development capital fundraising, project finance debt and equity fundraising and origination of long-term offtake contracts
- Led development activities resulting in FERC and DOE approvals to construct and operate the LNG export facility

Chief Operating Officer, Annova LNG — *September 2017 – September 2018*

Constellation Energy — **Baltimore, MD**
Managing Director – Origination, Constellation Energy — *September 2017 – March 2019*
- Led origination for Constellation's natural gas and LNG trading business

Managing Director – Strategic Projects, Constellation Energy — *January 2017 – August 2017*
- Led establishment of joint venture providing development services to new nuclear power stations in the UK and Japan

Exelon Corporation — **Chicago, IL**
Managing Director – Generation Development, Exelon Generation — *June 2015 – December 2016*
- Led greenfield development for utility scale power generation projects, resulting in financing and construction of over $3 billion of new assets, including over 2.5 GW of natural gas, wind, solar and battery storage capacity across the continental United States

Manager – Generation Development, Exelon Generation — *August 2014 – May 2015*
Manager – Wind Business Development, Exelon Generation — *June 2013 – July 2014*
Manager – Corporate Strategy, Exelon Business Services Company — *November 2012 – May 2013*
Principal Analyst – Corporate Strategy, Exelon Business Services Company — *February 2011 – October 2012*
Senior Analyst – Corporate Financial Planning & Analysis, Exelon Business Services Company — *August 2009 – January 2011*

Diamond Management & Technology Consultants — **Chicago, IL**
Associate and Analyst – Strategy & Marketing Competency — *June 2004 – June 2007*

Matthew William Moshier, MBA, P.E., P.M.P.

Email: mwm5221@gmail.com Phone: 724-825-8406

WORK EXPERIENCE

New Carbon **Chicago, IL**

Head of Engineering March 2024- Present

- Accountable for financial analysis, project management, and engineering for a variety of low carbon products to lower customers carbon intensity in the Midwest
- Submitted five DOE concept papers with customer engagement to EERE to obtain development funding for hard to abate emitters
- Developed financial models to support financing of RNG portfolio on a project and portfolio basis
- Engagement with customers across the carbon lifecycle- from feedstock development to product sale and financing
- Development of term sheets for potential offtake, feedstock supply, and investment

Strata Clean Energy **Chicago, IL**

Senior Director of Engineering October 2023- March 2024

- Led execution of pre-FEED study to determine viability of ammonia production with solid oxide electrolysis
- Served as the technical advisor for stage gated process to drive efficient capital deployment and accountability
- Conducted due diligence across portfolio of electrolysis and ammonia production vendors to determine vendor selection
- Developed siting and deployment strategy to identify potential deep-water ammonia shipping and staged capital deployment
- Led customer engagement in order to commercialize a portfolio of ammonia production facilities
- Created a technoeconomic analysis tool for the leadership team to determine the potential customer cost impact for variety of transportation methods

TCEnergy **Chicago, IL**

Senior Project Manager-Project Development April 2022- October 2023

- Directly managed three employees to meet overall corporate net zero ambitions and drive project development and execution
- Recruited, interviewed, onboarded, and managed multiple employees into the engineering and development group
- Project director for a confidential fully integrated, large scale biofuels facility, with full feedstock supply and offtake
- Managed over 1000 tonne per day (tpd) across 15 FEL studies in various levels of development to develop scope, schedule, and cost to meet customer needs for hydrogen and Carbon Capture Utilization and Storage (CCUS) projects
- Created hydrogen sales and purchase agreement (HSPA) and associated financial and pricing model
- Developed TCEnergy Chemours Joint venture to develop 20 tpd of electrolysis and DOE cost share agreement (Press Release)
- Managed development team to submit four DOE hub applications to receive over $2 Bn in DOE funding
- Executed option to purchase two, 30 tpd liquefaction trains from Plug to support safe harbor investment strategy (Press Release)
- Developed financial and pricing model for green and blue hydrogen as well as capital and operational costs to support
- Executed Life Cycle Analysis across the hubs in order to quantify Carbon Intensity and environmental impact
- Recipient of a DOE loan for $1.3 Bn from the Loans Program Office for Phoenix Hydrogen Hub (Press Release)
- Lead developer for Phoenix Hydrogen Hub (Nikola JV) and key member of due diligence and execution
- Managed multiple Joint Venture (JV) partners and customer engagement with varying levels of ownership
- Developed multiple hydrogen and CO2 pipeline routings and strategies to support hub development and potential offtake
- Negotiated CO2 CCUS sequestration agreement with third party to ensure project bankability
- Lead developer for offtake negotiations for potential biofuels, logistics, and other potential off takers
- Developed hydrogen offtake agreement and pricing structure for customer negotiations in conjunction with JV partners
- Directly involved with the commercial negotiations and financial model development for all projects to ensure engineering perspective is incorporated with main accountabilities for capital and operational expenditures
- Created updated governance structure to ensure viability of project financing and execution for hydrogen and CCUS projects
- Completed due diligence across the hydrogen technology portfolio, including operating and manufacturing site visits
- Developed scope, schedule, and cost for ammonia export terminals to advance hydrogen producing opportunities
- Designed of the metrics spreadsheet to more effectively allow engineering team to provide high level development design criteria to understand feasibility of potential projects for rapid RFP response
- Utilized existing and new data sources to provide recommendations for potential Long Term Supply Agreements for SMR, ATR, Electrolysis, Liquefaction, and biofuels production vendors
- Developed templates to help expedite EPC inputs into financial model, reducing time to pricing for market
- Interviewed and developed recommendation for potential Owners Engineer vendors

BP **Chicago, IL**

Project Manager December 2019 – April 2022

- Directly managed 40+ resources and $11 MM in contractor spend to conduct a 446-mile pipeline inspection- longest in BP history
- Managed a portfolio of $13MM and 60+ resources across the U.S. to complete a high-profile HDD, 65 ILI repairs, reactivation of an idled asset, three active line valve replacements, and multiple ILI inspections
- Conducted multiple FEL studies to shape BPs Net Zero initiative which included multiple confidential Carbon Capture, Utilization, and Storage (CCUS) projects as well as a nationwide DOE funded hydrogen transportation system; presented to senior leadership for investment level decision leading to additional due diligence to align with BP net zero ambitions
- Created financial model to analyze carbon capture projects within the business unit to determine carbon break even pricing
- Optimized in line inspection run to reduce the volume of nitrogen emitted and reduced project spend by $2 MM

- Collaborated with global procurement and leadership teams to develop and implement a change order tracking and feedback system to aggregate contractor non-conformance data for current and future negotiations, ~$1 MM/ year in refunds
- Achieved highest level of internal conformance by implementing a self-verification process to audit project execution and ensure alignment with BP's Stage Gate process and identified future opportunities for KPI development and process improvements
- Established a standardized process for managing projects for pipeline repairs key stakeholder communications
- Utilized Power BI to develop a tool which tracked third party encroachments into pipeline ROW to inform front line operations

Williams Companies Inc. **Pittsburgh, PA**

Project Developer Sr. April 2017 – December 2019

- Lead developer selected to analyze and execute over $2 B of capital projects: gas and condensate gathering, compression, FERC regulated pipelines, gas processing, and fractionation facilities in Ohio River Supply Hub (ORSH)
- Completed commercial deals across gathering and processing business resulting in over $2 B in incremental EBITDA
- Subject matter expert on Processing and Fractionation and expansion capital requirements for multiple M&A deals
- Managed FERC open season process, rate case development, and corporate structure for NGL pipelines
- Presented over $500 MM in proposed capital projects for FY 2017-2019 within capital funding (CAPEX) gated process to senior leadership, board members, and commercial teams to ensure projects meet long term growth strategy
- Developed discounted cash flow models for rate setting purposes for projects with CAPEX less than $150 MM
- Automated and streamlined forecasting model to include commercial scenarios, mitigating contractual risk, and reducing product over/undersell by 15%

Project Engineer III December 2013 – April 2017

- Completed over $650 MM in large capital projects from front end engineering and design (FEED), detailed design, construction support, operations turnover, and post project support
- Managed over $5 MM in engineering contactors, resulting in engineering costs 10% below budget on average
- Provided engineering assistance for construction, including requests for information, commissioning and start-up support, and project deliverable turnover
- Designed, constructed, and commissioned the startup of multiple facilities, including compression, interconnects, pipelines, turbo expander, de-ethanizers, slug catcher, flare, stabilization, frac train, rail bays, and storage tanks
- Developed and ensured efficient execution of multiple company standards for engineering design reviews, Process Hazard Analysis, Layers of Protection Analysis, Management of Changes, Process Safety Startup Review, Alarm Rationalization, Factory Acceptance Tests, and Process Safety Management
- Member of steering committee that developed and implemented companywide standard for API 12F tanks

Pinnacle Asset Integrity Services (PinnacleAIS) **Pasadena, TX**

Project Lead May 2012 – November 2013

- Directly supervised and trained a team of seven consultants on NCRA site-specific procedures in multiple locations
- Oversaw the completion and project reporting of a Mechanical Integrity and Risk Based Inspection program at the National Cooperative Refinery Association (NCRA) Refinery in McPherson, KS
- Managed a total of four project budgets with a gross revenue of $2 MM and gathered data for future proposal bids
- Implemented a companywide best practice for integration of PinnacleAIS Inspection Services with PinnacleAIS Services department for turnaround planning purposes

EDUCATION

Indiana University Bloomington, IN
The Kelley School of Business, MBA, Finance Major August 2023

The Pennsylvania State University University Park, PA
The College of Engineering, Bachelor of Science in Chemical Engineering May 2012

JUSTIN GUTKNECHT
Head of Solutions
NewCarbon LLC
1648 W Division Street, Unit 709, Chicago, IL 60622
312.576.8004 (phone), Justin.Gutknecht@newcarbon.energy

Education and Training

M.B.A., Accounting, Finance, and Strategy, Booth School of Business University of Chicago, 2017.
B.S. Finance, University of Illinois at Urbana-Champaign, 2004.
Chartered Financial Analyst (CFA), 2013–present.

Research and Professional Experience

- Lead structuring of clean energy infrastructure utilizing low carbon feedstocks, fuels and carbon capture technologies by providing commercial guidance to the project development, origination, engineering, and capital markets teams.
- Develop a near and long-term customer-focused decarbonization strategy by deploying energy infrastructure and technologies to achieve lifecycle carbon intensity reduction in manufacturing and production processes.
- Oversee a strategic execution plan incorporating an entire project lifecycle, from conception to commissioning. Include risk mitigation, managing commercial relationships, safety, scheduling, budgeting, and project finance transactional activities.
- Coordinate financing activities, including tax equity and debt financing, provide guidance on financial models, identify risks within contracts, and manage relationships with third-party financiers.

2021–2023: Director, Energy Origination and Development, TC Energy.

- Managed TCE Energy's origination and development of utility-scale renewable power projects and low-carbon infrastructure projects in the United States.
- Supervised a U.S. Origination and Development team covering structured origination, mid-marketing, development, interconnection, permitting and land management functions.
- Led commercial negotiations, development, and execution efforts to establish a U.S. portfolio of wind, solar, hydrogen, clean fuels and carbon capture, transportation and sequestration projects.
- Led Federal and State Hydrogen and Carbon Capture funding opportunities totaling $1 billion, receiving DOE grant awards for projects within the Heartland and ARCH2 Regional Hydrogen Hubs.

2017–2021: Senior Vice President, Finance and Development, Annova LNG.

- Led due diligence, development and execution efforts in multi-phase equity financings with joint venture partners and construction capital fundraising.
- Managed financial advisor, insurance advisor, and outside counsel engagements to support the bankability of terms and conditions of various project contracts and provided structuring advice.
- Led project development activities, including electrical interconnection, wholesale power procurement, dredging, local and state tax incentive negotiations, accounting and tax matters.

2015–2017: Principal, Generation Development Analytics, Exelon Corporation.

- Led financial evaluation and transaction execution support for acquisition and greenfield development of utility scale wind, solar and battery storage generation projects.
- Led development activities for battery storage, including site control, permitting, interconnection, engineering, technology evaluation, and offtake.

2011–2015: Manager, Financial Planning and Analysis, Evraz North America.

- Supervised on-site mill financial managers in monthly forecasting and annual budget processes and consolidated the financial results of the Tubular Product Division.
- Obtained approvals for capital investment projects and provided technical financial support and recommendations on the evaluation of potential alliances, acquisitions, capital investments, and other issues affecting operations.

2004–2011: Senior Financial Analyst, Corporate Development, Telephone and Data Systems Inc.

- Performed valuations for the acquisitions of wireless spectrum and acquisitions.
- Prepared presentations to bond-rating agencies, reviewed credit metric ratios based on rating agency methodologies, and analyzed strategic and financial initiatives to improve capital structure.

Professional Activities

Member, CFA Society of Chicago, 2013–present.

PHILLIP FRANSHAW

4205 Dickson Street, Houston, TX 77007 | (713)253-0690 | phillip.franshaw@newcarbon.energy

EXPERIENCE

NewCarbon—Houston, TX
Co-Founder & Head of Customer Engagement *November 2023—Present*

- Co-founded a clean energy infrastructure company that delivers lifecycle carbon intensity reduction through fit-for-purpose solutions that integrate across customers' value chains
- Lead deal structuring and contract negotiations while working collaboratively with legal, finance, engineering, and construction leads to optimize project economics and mitigate risk

TC Energy Corporation—Houston, TX
Origination Specialist, Power & Energy Solutions *April 2021—November 2023*

- Led customer origination for United States low carbon platform including wind, solar, renewable natural gas, green hydrogen, and sustainable aviation fuel production
- Led deal structuring, negotiations, and execution of contracts to secure mutually beneficial agreements with equity partners, customers, and other project stakeholders

Exelon Corporation—Houston, TX
Senior Vice President & Co-Founder, Annova LNG, LLC *October 2012—March 2021*

- Co-founded a 6.5 MTPA greenfield liquefied natural gas (LNG) export company
- Led origination, structuring, and negotiation of long-term offtake contracts

713 Capital Partners—Houston, TX
Co-Founder & Principal *September 2007—March 2014*

- Co-founded municipal real estate consulting practice providing advisory and development management services

Cockrell Interests Inc.—Houston, TX
Managing Director *September 2003—September 2007*

- Managed a diversified real estate portfolio for a family office
- Led structuring, negotiation, and execution in a portfolio of direct and indirect investments including wholly owned properties, joint ventures, and commingled funds

Hines Interest Limited Partnership—Houston, TX
Project Manager *June 2000—September 2001*

- Managed a global diversified real estate portfolio totaling $2.1billion

The Coca-Cola Company—Atlanta, GA
Business Development Consultant—Houston, TX *September 2001—September 2003*

- Led acquisition structuring, negotiation, and execution of premium juice drink company

Business Development Manager—Atlanta, GA *August 1995—February 1998*

- Led acquisition structuring, negotiation, and execution of bottling assets totaling $2.4 billion

Principal Financial Analyst—Houston, TX *August 1992-August 1995*

- Led restructuring of $2.0 billion operating division

Merrill Lynch Capital Markets—New York City, NY
Equity Trader *August 1986—August 1988*

EDUCATION

The University of Texas at Austin
Master of Business Administration, Finance & International Business *August 1992*

Georgetown University
Bachelor of Arts, English *May 1986*

Brian Lammers
2437 Girard Avenue South
Minneapolis, MN 55405
(612) 518-3798
brian.lammers@newcarbon.energy

Experience

Brian has more than 20 years of experience developing utility-scale renewable power, energy storage and HVDC transmission infrastructure in the United States and Canada. Brian held leadership positions at Exelon, EDP North America and RES Americas. During his career Brian has led origination, development and financing initiatives resulting in investment of more than $6 Billion in low carbon power and energy solutions.

NewCarbon, Chicago, IL
Head of Feedstocks
January 2024 - Present
Founding partner of NewCarbon, a developer, owner and operator of fit-for-purpose solutions for agricultural and industrial customers to lower the lifecycle carbon intensity of their operations.

Advanced Generation Development, Minneapolis, MN
President and Founder
March 2017 – Present

- Originated, developed, and sold a 700 MW wind generation development portfolio to a leading US independent power producer
- Closed 850 MW of wind and solar power purchase agreements for midstream energy client, organized buy-side solicitation, evaluated proposals, led contract negotiations
- Led integration and development of 400 MW solar generation portfolio for power client
- Advisor for site identification and early-stage development of hydrogen production projects, two of which received $1.85 billion in DOE Grant awards
- Led commercial offtake and development efforts for a private equity-backed 2100 MW merchant HVDC transmission project

Renewable Energy Systems, Minneapolis, MN
Vice President, Development
October 2017 – December 2018

- Closed power purchase agreements for 400 MW of wind and solar generation
- Held P&L responsibility for regional origination and development office
- Managed joint venture with leading US IPP resulting in construction of 1 GW of new wind and solar generation

Exelon Generation, Chicago, IL
Managing Director, Renewables and Technology Development
November 2011 - March 2017

- Led development and acquisition of 2 GW of wind and solar generation and battery storage, deploying ~$3 billion in CapEx, and doubling the size of Exelon's renewable generation fleet

EDP Renewables N.A., Minneapolis, MN
Director of Development, Upper Midwest and Northeast U.S.
March 2008 – November 2011

- Completed development of more than 750 MW (~ $1.5 billion) of wind generation
- Responsible for two regional development teams, fifteen staff, a 3 GW project pipeline and $10 million annual budget in the Midwest and Northeastern U.S.

John Deere Finance, Johnston, IA
October 2006 – March 2008

- Led development of 500 MW (~ $1 billion) of U.S. wind power generation projects
- Spearheaded transition from distributed-scale to utility-scale wind generation
- Developed and closed financing for the first multi-megawatt wind farm in Michigan

Gamesa Energy, Philadelphia, PA
September 2004 – October 2006

- Led development of more than 500 MW (~ $1 billion) of US wind generation projects including the largest wind generation project constructed in Pennsylvania
- Opened and managed regional development office

Navitas Energy, Minneapolis, MN
November 1998 – September 2004

- Led origination, development, and completion of 250 MW (~ $500 million) of wind generation
- Supported successful M&A efforts with U.S. and European IPPs

Education

University of Minnesota - Minneapolis, MN
MBA

University of Wisconsin – Madison, WI
Bachelor of Science

Community Involvement

American Red Cross, Twin Cities Chapter – Minneapolis, MN
Board of Directors
June 2023 - Present

City of Lakes Waldorf School, Minneapolis, MN
Secretary, Board of Trustees
Chair, Development Committee
2019 – Present

Clean Grid Alliance (fka Wind on the Wires), Saint Paul, MN
Treasurer and Board Member
2010 – 2021

APPENDIX C

TAX LIABILITY STATEMENT

Industrial Commission

Tax Liability Statement

Applicant:

NewCarbon Feedstocks, LLC

Application Title:

ACS NewCarbon RNG Project

Program:

- ☐ Lignite Research, Development and Marketing Program
- ☑ Renewable Energy Program
- ☐ Oil & Gas Research Program
- ☐ Clean Sustainable Energy Authority

Certification:

I hereby certify that the applicant listed above does not have any outstanding tax liability owed to the State of North Dakota or any of its political subdivisions.

_____

Signature

President

_____

Title

July 31, 2024

_____

Date

APPENDIX D

CITATIONS AND BUDGET NOTES

CITATIONS

Francisco López, A., Lago Rodríguez, T., Faraji Abdolmaleki, S., Galera Martínez, M., & Bello Bugallo, P. (2024). *From Biogas to Biomethane: An In-Depth Review of Upgrading Technologies That Enhance Sustainability and Reduce Greenhouse Gas Emissions*. Retrieved from https://www.mdpi.com/2076-3417/14/6/2342.

ND Department of Agriculture, D. G. (n.d.). Retrieved from https://www.ndda.nd.gov/sites/www/files/documents/files/2023%20ND%20Ag%20brochure.pdf

Diane Mayerfeld, W. F. (n.d.). *Methane emissions from livestock and climate change*. Retrieved from University of Wisconsin- Madison: https://cropsandsoils.extension.wisc.edu/articles/methane-emissions-from-livestock-and-climate-change/

USDA. (2023). *2023 STATE AGRICULTURE OVERVIEW*. Retrieved from https://www.nass.usda.gov/Quick_Stats/Ag_Overview/stateOverview.php?state=north%20dakota

BUDGET NOTES

Salaries: Salary estimates are based on the scope of work and prior experience on projects of similar scope. The labor rate used for specifically identified personnel is the current hourly rate for that individual.

Fringe Benefits: Fringe benefits is calculated as 11.6% of gross salary which is calculated as the total of: 6.2% for Employer Social Security Withholding, 1.45% for Employer Medicare Withholding, 0.6% for Employer Federal Unemployment Tax Withholding (FUTA), 0.85% for Employer State Unemployment Tax Withholding (SUI), 2.5% for Paid Leave for All Workers.

Travel: Travel may include site visits, fieldwork, meetings, and conferences. Travel costs are estimated

and paid in accordance with OMB Uniform Guidance 2 CFR 200, Section 474. Daily meal rates are based on U.S. General Services Administration (GSA) rates. Other estimates such as airfare, lodging, ground transportation, and miscellaneous costs are based on a combination of historical costs and current market prices. Miscellaneous travel costs may include parking fees, Internet charges, long-distance phone, copies, faxes, shipping, and postage.

Supplies: Supplies include items and materials that are necessary for the research project and can be directly identified to the project. Supply and material estimates are based on prior experience with similar projects. Examples of supply items are chemicals, gases, glassware, nuts, bolts, piping, data storage, paper, memory, software, toner cartridges, maps, sample containers, minor equipment (value less than $5000), signage, safety items, subscriptions, books, reference materials. General purpose office supplies (pencils, pens, paper clips, staples, Post-it notes, etc.) are included in the Supplies cost.

Communications: Telephone, cell phone, and fax line charges are included in the Supplies cost; however, direct project costs may include line charges at remote locations, long-distance telephone charges, postage, and other data or document transportation costs that can be directly identified to a project. Estimated costs are based on prior experience with similar projects.

INDUSTRIAL COMMISSION OF NORTH DAKOTA
RENEWABLE ENERGY PROGRAM

TECHNICAL REVIEWERS' RATING SUMMARY

R-054-D
ACCELERATING THE WASTE-TO-FUELS COMMERCIALIZATION FOR THE SANDWICH GASIFIER

Principal Investigator: Dr. Nikhi Patel

Request for $486,950; Total Project Costs $978,950

TECHNICAL REVIEWERS' RATING SUMMARY
R-054-D
ACCELERATING THE WASTE-TO-FUELS COMMERCIALIZATION FOR THE SANDWICH GASIFIER
Principal Investigator: Dr. Nikhi Patel
Request for $486,950 Total Project Costs $978,950

		Technical Reviewer				
		1D	2D	3D	4D	
Rating Category	Weighting Factor	Rating				Average Weighted Score
1. Objectives	9	4	4	4	5	38.25
2. Achievability	9	4	4	4	5	38.25
3. Methodology	7	4	4	4	5	29.75
4. Contribution	7	3	4	5	4	28.00
5. Awareness	5	4	4	5	5	22.50
6. Background	5	5	5	4	5	23.75
7. Project Management	2	4	4	4	5	8.50
8. Equipment Purchase	2	4	4	3	5	8.00
9. Facilities	2	4	4	4	5	8.50
10. Budget	2	3	4	4	5	8.00
Average Weighted Score		196	205	210	243	**213.50**
Maximum Weighted Score						250.00

1. The objectives or goals of the proposed project with respect to clarity and consistency with North Dakota Industrial Commission/Renewable Energy Council goals are: 1 – very unclear; 2 – unclear; 3 – clear; 4 – very clear; or 5 – exceptionally clear.

Reviewer 1D (Rating 4)

Intention to make clean syngas for subsequent synthetic fuels and/or hydrogen from ND biomasses or wastes, commercialization of the technology, and job creation.

Note that a primary challenge may be economic viability at a relatively small scale that could be limited by feedstock availability at a given location. Voting members of the council may ask for a response to this concern as part of the proposal presentation.

Reviewer 2D (Rating 4)
The proposed project will confirm the performance of the Sandwich Gasifier and integrated systems with multiple waste feedstocks to produce to produce clean and composition-balanced syngas under self-sustained steady-state operation. They will validate the integrated technology and improvement in techno-economics of producing low-cost syngas suitable for direct conversion into sustainable liquid fuels, renewable natural gas, and/or green hydrogen. This is consistent with the goals of the ND Industrial Commission/Renewable Energy Councils goals.

Reviewer 3D (Rating 4)
This proposal outlined quite well how this project would closely follow the NDIC's stated goals.

Reviewer 4D (Rating 5)
The project proposal is exceptionally well written and the objective is stated clearly, precisely, and concisely in the very first sentence. The objective of this proposal is in accordance with the goals and purposes of the NDIC Renewable Energy Council.

2. With the approach suggested and time and budget available, the objectives are: 1 – not achievable; 2 – possibly achievable; 3 – likely achievable; 4 – most likely achievable; or 5 – certainly achievable.

Reviewer 1D (Rating 4)
Most of the equipment is available and proven, so two years and a budget of $978,950 should be adequate to make the project achievable as planned.

Reviewer 2D (Rating 4)
The proposal has justified the time and budget requested. I believe the approach noted is most likely appropriate to expect the objectives to be achieved.

Reviewer 3D (Rating 4)
The timeline appears to be realistic and achievable. The budget appears to be reasonable.

Reviewer 4D (Rating 5)
Two years to relocate and demonstrate the capabilities of the Sandwich Gasifier is certainly achievable with the suggested approach, schedule, and budget.

3. The quality of the methodology displayed in the proposal is: 1 – well below average; 2 – below average; 3 – average; 4 – above average; or 5 – well above average.

Reviewer 1D (Rating 4)
The concept and methodology are very sound. Achieving economic viability is the question.

Reviewer 2D (Rating 4)
The methodology noted is well thought out and leads this reviewer to anticipate a positive outcome.

Reviewer 3D (Rating 4)
The methodology certainly appears to be a logical way to accomplish the final objective.

Reviewer 4D (Rating 5)
As stated previously, this proposal is well written and the methodology is clear and concise.

4. The scientific and/or technical contribution of the proposed work to specifically address North Dakota Industrial Commission/Renewable Energy Council goals will likely be: 1 – extremely small; 2 – small; 3 – significant; 4 – very significant; or 5 – extremely significant.

Reviewer 1D (Rating 3)

Significant, but the proposal states the system has been proven on many of the target feedstocks in previous tests. Some of the unique targets of this effort include longer duration runs, tailoring the syngas to enable subsequent synthetic fuels production, system integration to improve the process and economics …

Reviewer 2D (Rating 4)

The proposer notes several waste streams that they have identified that could be used as feedstocks for the Sandwich Gasifier. These materials represent a significant environmental challenge and the ability to convert these materials to useful products in an environmentally acceptable manor would be a significant contribution to achieving the goals of the NDIC/Renewable Energy Council.

Reviewer 3D (Rating 5)

This proposal is to take waste products and convert it to energy products in an economical manner.

Reviewer 4D (Rating 4)

Distance (shipping costs) is the single most significant factor to utilizing biomass. If the Sandwich gasifier could be modular, trailer mounted, or truck mounted as the existing prototype – the reactor could be moved to the biomass instead of moving biomass to the reactor. Additionally, small co-ops could be created to pool financial resources and share the CAPEX and operating costs of a centralized processing site.

This proposal ticks nearly all of the check boxes for the NDIC Renewable Energy Council's goal, purposes, and objectives.

5. The principal investigator's awareness of current research activity and published literature as evidenced by literature referenced and its interpretation and by the reference to unpublished research related to the proposal is: 1 – very limited; 2 – limited; 3 – adequate; 4 – better than average; or 5 – exceptional.

Reviewer 1D (Rating 4)

Over two decades at the EERC with a focus on biomass conversion systems. Additional awareness shown by paper and references in Appendix E.

Reviewer 2D (Rating 4)

The team assembled is aware of current research activities and the published literature as demonstrated by the information cited in the proposal.

Reviewer 3D (Rating 5)

Dr. Patel (PI) holds the patent on the sandwich gasifier and has authored several papers on as such.

Reviewer 4D (Rating 5)

The principal investigator invented the technology and has patents and IP rights. Working with the EERC, the investigator has considerable knowledge of current research.

6. The background of the investigator(s) as related to the proposed work is: 1 – very limited; 2 – limited; 3 – adequate; 4 – better than average; or 5 – exceptional.

Reviewer 1D (Rating 5)
The Principal Investigator is the patent holder for the technology with over 18 years of experience with this technology and over two decades of related experience at the EERC. Also supported by a strong team including members that have been involved in significant past R&D projects for North Dakota.

Reviewer 2D (Rating 5)
The assembled team is very well qualified to complete the proposed research.

Reviewer 3D (Rating 4)
I am aware of the gasification process and have provided and reviewed proposed industrial projects for over 40 years.

Reviewer 4D (Rating 5)
The investigator background related to the proposed work is exceptional as they developed the technology. It is this reviewer's opinion that the project participants are well suited to completed the proposed objective.

7. The project management plan, including a well-defined milestone chart, schedule, financial plan, and plan for communications among the investigators and subcontractors, if any, is: 1 – very inadequate; 2 – inadequate; 3 – adequate; 4 – very good; or 5 – exceptionally good.

Reviewer 1D (Rating 4)
Good timeline with milestones and Mike Mann is supporting the project management and communication efforts.

Reviewer 2D (Rating 4)
The proposal lays out a set of milestones that should allow the sponsors to follow the progress of the proposed work. I would suggest a change to include a meeting with the sponsors to review and approve the selected equipment prior to purchase. This group should include the technical lead for the Industrial Commission.

Reviewer 3D (Rating 4)
Potential risks have been identified and project responsibilities have been cited in this proposal.

Reviewer 4D (Rating 5)
The layout of this proposal is exceptional and all attributes like milestone chart, schedule, financial plan, qualifications, and mitigations strategies, are clear and well organized.

8. The proposed purchase of equipment is: 1 – extremely poorly justified; 2 – poorly justified; 3 – justified; 4 – well justified; or 5 – extremely well justified. (Circle 5 if no equipment is to be purchased.)

Reviewer 1D (Rating 4)
The primary equipment additions are needed to support the system upgrades for cleaning and tailoring the syngas composition for future synthetic fuels production.

Reviewer 2D (Rating 4)
The proposal includes information that justifies the need to purchase the equipment noted. I believe once the selection process is complete it makes sense to have a meeting of the team to confirm the selections made are appropriate.

Reviewer 3D (Rating 3)
The exact equipment required is ambiguous due to the nature of the project.

Reviewer 4D (Rating 5)
There is not a considerable amount of equipment to be purchased as the majority of the equipment has already been acquired. The $220,000 total for equipment is well justified. The greatest risk to the proposed equipment budget is implementing a CO_2 capture system.

9. The facilities and equipment available and to be purchased for the proposed research are: 1 – very inadequate; 2 – inadequate; 3 – adequate; 4 – notably good; or 5 – exceptionally good.

Reviewer 1D (Rating 4)
The project focuses on use of the existing 5 ton per day system with upgrades mainly associated with the backend syngas equipment.

Reviewer 2D (Rating 4)
With the purchases noted in the proposal the facilities and equipment for use in the proposed work are very good.

Reviewer 3D (Rating 4)
Facilities have been arranged for and the initially, required equipment has been overhauled for project use.

Reviewer 4D (Rating 5)
The facilities already exist and just need to be relocated and integrated with syngas cleanup systems and CO_2 capture.

10. The proposed budget "value"[1] relative to the outlined work and the financial commitment from other sources[2] is of: 1 – very low value; 2 – low value; 3 – average value; 4 – high value; or 5 – very high value. (See below)

Reviewer 1D (Rating 3)
Just over 50 percent cost share, with a mix of cash and in-kind. Additional funding is expected by the team that would also support the effort but is not shown as cost share in the budget, so the leveraging of State funding could be higher. The budget seems to be in line with the proposed scope of work.

NDIC will need to review the budget details including the equipment rental value.

Reviewer 2D (Rating 4)
The proposed work includes cost share of 50% for the work outlined in the proposal. The proposer also notes that a second project already funded from a Bioscience Innovation Grant of $150,000 plus cost share of $75,000 has some overlap and was not counted as cost share as was the waving of rent from the Grand Forks landfill of $71,820 per year. These added costs covered with other funds raises the effective cost to ~60%. This results in more cost-effective use of the State funds committed to the Renewable Energy Council's funds.

Reviewer 3D (Rating 4)
The value of this proposal is very good as is the financial committment. The expressed interest of outside municipalities indicates that this process could provide an exceptional renewable energy project that fulfils all of the NDIC's goals.

Reviewer 4D (Rating 5)
It is this reviewer's opinion that the proposal has a very high value relative to the previous work and financial commitment from the Applicant, Xcel, and Tri-Steel. This proposal also has high value to enhance and encourage energy and agricultural development for the State of North Dakota.

Section C. Overall Comments and Recommendations:

Please comment in a general way about the merits and flaws of the proposed project and make a recommendation whether or not to fund.

Reviewer 1D
As a reviewer I feel the technology and the project plan are sound and am supportive of the proposed effort. The project has a strong project team with very good expertise.

Note that a primary challenge may be economic viability at a relatively small scale that could be limited by feedstock availability at a given location. Voting members of the council may ask for a response to this concern as part of the proposal presentation.

Reviewer 2D
Overall, I believe the proposed project represents good value and success in completing this activity offers significant value to the State by working to further the goals of the NDIC/Renewable Energy Council. Therefore, I would recommend this project be funded based on accepting the changes suggested with the milestones noted. In addition, the proposer needs to demonstrate that funding from Xcel Energy is made available and a change is made to their milestone 6 to state the final report is for The NDIC not the Department of Energy.

Reviewer 3D
As written, I **do not** recommend funding this project. This proposal aligns with all the goals stated in the NDIC's mission statement. I believe it is a very worthwhile renewable energy project. This proposal is to upscale a 5 tpd (tons per day) process to a 25 and possibly 50 tpd process which would make the sandwich gasifier (SG) a markable, economical renewable energy process for municipalities. The reason I do not recommend this project as submitted is this:
Dr. Patel has submitted this proposal and holds the patents for the sandwich gasifier. Dr. Patel is currently employed by UND and the EERC. If this upscaling project is successful, Dr. Patel and his companies would realize substantial financial gain (estimated net sales were reported as $30 - $40 million). However, for Dr. Patel to orchestrate his own project, the proposal states that he would be compensated $148,000 (28.2% of the project request) over two years as a consultant (to his own project) regardless of project outcome by the NDIC. This compensation needs to be deleted from this proposal. I do not believe that Dr. Patel should be compensated for his time by the NDIC in making his own product markable. Other than this one issue, this project has great potential as a renewable energy source for the state of North Dakota and would come with my highest recommendation.

Reviewer 4D

This proposal is thorough, well organized, concise and easy to read and understand. The objective is clearly defined and achievable and the potential results are in accordance with the stated goals, purposes, and objectives of NDIC's Renewable Energy Council.

Recommendation: This reviewer recommends funding this proposal

Renewable Energy Program

North Dakota Industrial Commission

Application

Project Title: Accelerating the Waste-to-Fuels Commercialization for the Sandwich Gasifier

Applicant: Singularity Energy Technologies

Principal Investigator: Dr. Nikhil Patel

Date of Application: August 1, 2024

Amount of Request: $486,950

Total Amount of Proposed Project: $978,950

Duration of Project: 24 months

Point of Contact (POC): Dr. Nikhil Patel

POC Telephone: 701-739-8720

POC Email: npatel@singularet.com

POC Address: Center of Innovation
4200 James Ray Drive
Grand Forks, ND 58202

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ABSTRACT

Objective:

The primary objective of this project is to demonstrate and prove the capabilities of the Sandwich Gasifier and integrated systems to produce clean and composition-balanced syngas under self-sustained steady-state operation. We will validate the integrated technology and improvement in techno-economics of producing low-cost syngas suitable for direct conversion into sustainable liquid fuels, renewable natural gas, and/or green hydrogen. The scale-up and integrated operation will fast-track our plan to develop a viable customer base and build future commercial-scale facilities. The Sandwich gasification technology has been proven to produce clean syngas from challenging waste streams with net carbon dioxide equivalent emission reduction, and therefore our integrated setup will provide a marketable waste-to-fuels technology using North Dakota biomass, agriculture/animal wastes and MSW. Job creation and training of a future workforce to support the industry are also important goals.

Expected Results:

This project seeks to generate tangible evidence, data, and insights that will inform decision-making processes regarding the adoption and implementation of the gasifier technology. Ultimately, the goal is to contribute to the development of a more sustainable and environmentally friendly energy sector by enabling the utilization of locally available biomass resources for clean and renewable biofuel and bio-material production. In achieving these goals, this project will demonstrate the performance and efficiency of the Sandwich gasifier in converting North Dakota biomass feedstocks (agricultural waste, manure, municipal solid waste, etc.) into syngas of suitable quality for production of sustainable liquid fuels, renewable natural gas, or green hydrogen. It will provide valuable insights and recommendations for improving the overall efficiency, cost-effectiveness, and sustainability of biomass-to-syngas conversion. This project will contribute to the advancement of renewable energy technologies by showcasing the potential of the Sandwich gasifier in utilizing diverse biomass feedstocks for biofuel production, and advancing the technology towards commercialization. Finally, this project will facilitate the transition towards a more sustainable energy sector by promoting the use of locally available biomass resources for clean and renewable fuel production.

Duration:

Twenty-four months (Suggested: January 1, 2025 – December 26, 2026)

Total Project Cost:

$486,950 is requested from NDIC of the $978,950 total project cost.

Participants:

Dakota Green Power (DGP), Singularity Energy Technologies, LLC (SET), Tri-Steel Manufacturing, Sage Green N.R.G. LLC, MDM Energy Consulting, LLC, Dr. Edwin Olson

PROJECT DESCRIPTION

The primary objective of this project is to demonstrate and prove the capabilities of the Sandwich Gasifier (SG) and integrated systems to produce clean and composition-balanced syngas under self-sustained steady-state operation by a clinker-free system producing gas-to-liquid (GTL), renewable natural gas (RNG) and hydrogen (H_2) quality syngas. Singularity Energy Technology's (SET) Sandwich gasifier has been proven to operate on a range of complex feedstocks, including municipal solid waste (MSW), biodigester waste, high moisture forestry and agricultural wastes including poultry and livestock manure, railroad ties, tires, and other difficult to process waste materials. SET's technology is viable at 25 tons/day, making it ideal for localized use for feedstocks traditionally difficult and expensive to transport. The unique design of the Sandwich gasifier allows clinker-free operation on difficult feedstocks while producing a syngas low in tar. Our strategy for the production of GTL/RNG/H_2-ready syngas includes the use of off-the-shelf sorbents, solvents and technologies and their optimized combinations, thereby minimizing the required development time and improving the overall economics of the system. Understanding the unique characteristics of each feedstock allows tweaking of the gasifier operating conditions and optimization of the backend scrubbing system to obtain the required syngas purity at the lowest cost. The ability to reinject waste streams makes this a near-zero discharge gasifier, including low to negative carbon emissions. Figure 1 provides an overview of the integrated technology, which comprises a waste processing unit, the Sandwich Gasifier, a syngas processing unit and a renewable liquid synthesis system.

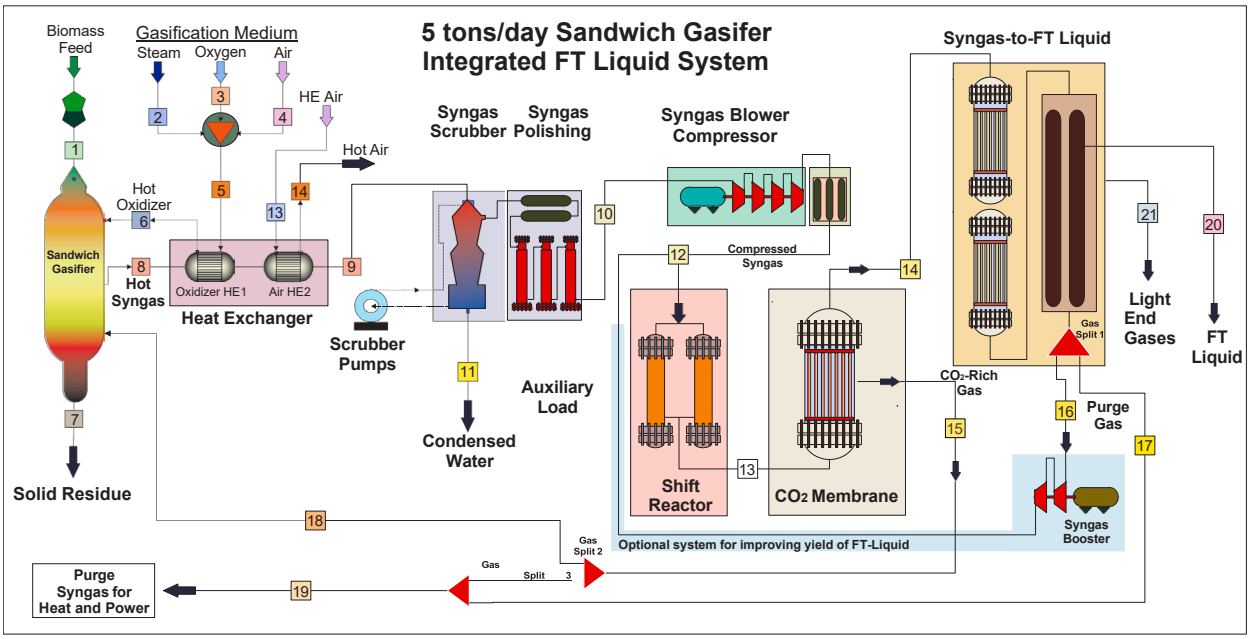


Figure 1: High-Level Process Flow Diagram the integrated Sandwich gasification system

Objectives:

The primary objective of this project is to demonstrate and prove the capabilities of the Sandwich Gasifier (SG) and integrated systems to produce clean and composition-balanced syngas under self-sustained steady-state operation by a clinker-free system producing GTL/RNG/H_2-ready quality syngas. We will validate the integrated technology to meet the stringent syngas purity and composition standards and demonstrate an improvement in techno-economics of producing low-cost GTL/RNG/H_2-ready syngas. Our team's major strength is our ability to integrate additional components into the gasification architecture

at different scales to achieve high-quality liquid-based fuels and intermediates for lubricants and chemicals. Our target is the integration of technically and economically viable gas cleanup technology with the Sandwich gasifier to produce syngas suitable for commercial and near-commercial GTL/RNG/H_2 systems.

The scale-up and integrated operation will fast-track our plan to build future commercial-scale facilities. Our integrated setup will provide a marketable waste-to-fuels technology. The SG technology has been proven to produce clean syngas from challenging waste streams with net carbon dioxide equivalent emission reduction.

Methodology:

Overview: The key technical risk is integrating the Sandwich Gasifier (SG) with a GTL/RNG/H_2 system and associated subsystems. Specifically, our proposed project is designed to address the need for a narrow range of H_2/CO, with near zero concentrations of trace contaminants in syngas for achieving desired conversion, and ensuring high yields and adequate catalyst performance/longevity when using distributed low energy-dense and complex composition feedstocks. The gasifier design philosophy is based on the production of clean syngas with high fuel conversion efficiency while achieving near-zero-effluent discharge from the overall system. Clean syngas is produced by converting complex organics into energy-rich gaseous forms in the hot zones of the gasifier. The near-zero-effluent discharge is achieved by recycling the small fraction of unconverted organics in the syngas into the gasifier hot zones, to ensure production of favorable syngas compositions. One of the main features of the Sandwich gasifier is the unique gas–solid distribution afforded by the second oxidation zone that creates uniformly high-temperatures throughout the reaction chamber. This ensures a higher level of in situ tar and carbon conversion, thereby eliminating the need for secondary carbon/char converters, large syngas scrubbers, waste disposal systems, and extensive syngas processing. When operated according to specifications, downdraft gasifiers (including the first stage of the Sandwich gasifier) produce clean syngas with very low (on the order of 1 g/Nm^3) tar loading.[(1)] The production of low amounts of tar in the downdraft gasifier is due to the long residence time of high-molecular-weight devolatilized gases in a uniform high-temperature zone, which results in thermal conversion to simple short-chain hydrocarbons. SG's second oxidation zone enhances tar reduction and carbon conversion.

Several strategies are utilized to obtain the gas purity and the optimal H_2/CO ratio for liquid-to-gas production. Low temperature and pressure tar removal and acid gas removal is accomplished using conventional scrubbing technology. Tar recycling in the gasifier increases yields and reduces environmental harm from tar disposal. Effluent streams from wet scrubbing filtered through enhanced surface area char produced within the gasifier which are then recycled back into the gasifier, thus minimizing generation of solid as well as liquid waste. The trace impurities removal in packed beds of low temperature sorbent prior to syngas balance allows low pressure operation thus offering low capital cost and ease of operation. Conventional water-gas-shift catalysts further maximize overall yields and produce a syngas with a H_2/CO ratio in the range needed for GTL/RNG/H_2 production. The H_2/CO ratio is fine-tuned by incorporating a bypass and recycle loop in the system. Prior to the GTL/RNG/H_2 processing, CO_2 can be removed from the system via several different commercially available technologies including solvent-based and membrane-based approaches, both of which will be tested during this project. We also propose to recycle a portion of the CO_2 back into the gasifier to be used to help moderate gasifier temperatures

[1] Graham, R.G.; Bain, R. *Biomass Gasification: Hot-Gas Clean-Up*; International Energy Agency, Biomass Gasification Working Group, Dec 21, **1993**; 33–44.

while simultaneously serving to reform a portion of the CO_2 into CO, thereby increasing liquid fuel yields while reducing CO_2 emissions.

The variable compositions of the various waste materials to be tested during this project (and others which are of interest to our commercial clients), and in particular their effects on the Sandwich gasifier's ability to minimize tar and char formation represents a significant challenge. The SG has successfully converted mixed wastes containing plastic waste materials and modifications to the truck-mounted system incorporate design changes suggested from that earlier work. Captured tars are recycled into the gasifier to maintain the near-zero discharge attribute and additional tar removal equipment can be added if needed. Low-cost commercially available gas cleanup systems are available that can be readily integrated into the Sandwich gasification island for the production of GTL-ready syngas.

Innovation and Impacts: The Sandwich Gasifier has overcome two important barriers: cost (figure 2) and reliability (Appendix A). The Sandwich Gasifier design has high heat transfer, isothermicity, scalability, enhanced control over operating conditions, good gas-solid contact, and high specific capacity. The Sandwich Gasifier design is fully scalable, relying on single or multiple modules to accommodate both rural and urban requirements for converting feedstocks to heat, chemicals, and power. The scalable feature of the system allows sizing of the commercial Sandwich gasification technology such that it can be located at or near the feedstock source, enabling zero to near-zero feedstock transportation cost. The system is capable of converting waste on an "as-received" basis without requiring feed densification. The heat integration capability allows the system to tolerate moisture variation while minimizing or completely eliminating energy-intensive feed preparation.

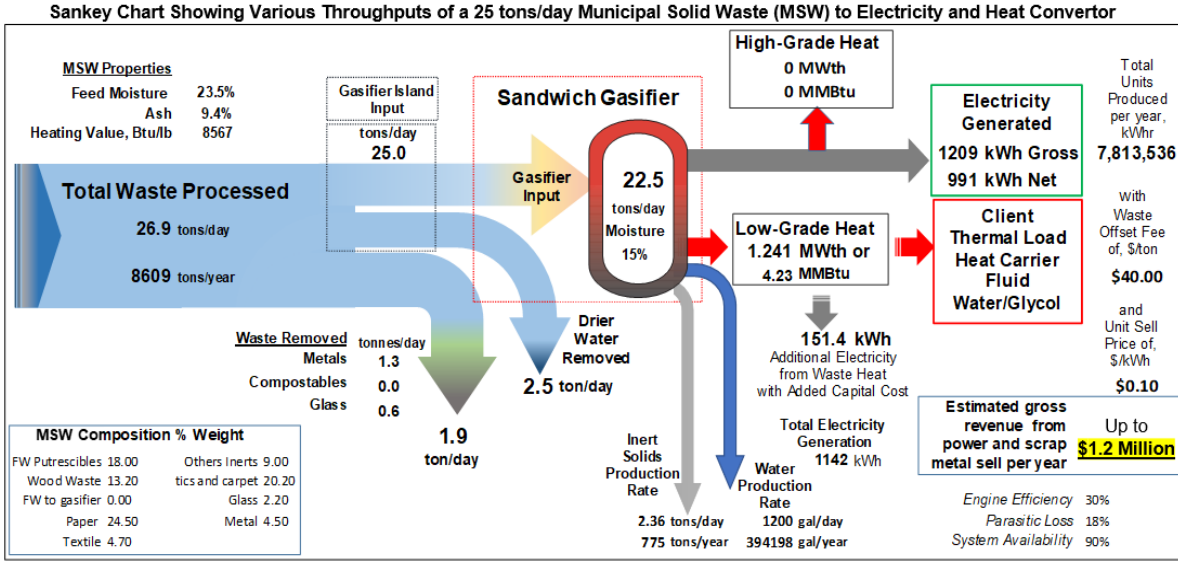


Figure 2. High level material and energy balance showing economic viability of SG technology.

This optimized gasifier significantly reduces the demands on the downstream cleanup system, thereby allowing for significant simplification of the required gas purification equipment. The tar condenser and wet scrubber are effective in removing soluble tars, alkalis, and gas-phase chlorine not captured in the inorganics associated with the ash. The staged low- and high-pressure sorbent removal as presented above operates at low temperature and take advantage of the abilities of newer water-gas-shift catalyst

and CO_2 capture solvents in removal of trace contaminants providing synergies in syngas composition balance and cleaning. Stage two cleaning is also critical in capturing secondary release of sorbent-captured species and aerosols escaping the demister from upstream solvent scrubber. This approach supports cost reduction, ease of operation and GTL/RNG/H_2 catalyst protection goals.

Additionally, we propose to tailor the downstream equipment based upon the specific characteristics of each feedstock, thereby ensuring the necessary equipment is present to produce the desired quality syngas, but not including extra and un-necessary equipment (avoiding the one size fits all feedstock approach), thereby minimizing overall capital and operating costs. Based upon previous studies at the EERC and vendor assurances, we are confident that commercially available sorbents and solvents are available which allows rapid deployment of the integrated system. The high-quality syngas produced from the Sandwich gasifier can be upcycled using Fischer-Tropsch technology.

Anticipated Results:

The outcome of the proposed project will be an optimized and simple waste-to-fuels platform that provides economic GTL/RNG/H_2-ready syngas production from a variety of negative cost (tipping fee generating) wastes that pose significant environmental challenges. SET will work with team member organizations to streamline integration of the SG technology with available commercial or near-commercial subsystems that include:

- Syngas cleanup system to remove trace contaminants detrimental to catalysts such as tar and particulate matter, trace gaseous contaminants including species of sulfur (H_2S, COS and mercaptans), nitrogen (NH_3 and HCN), halogen (HCl), volatile alkali, Si (silane) arsenic and trace volatile organic compounds (VOC's).
    - Condensation of tars by gas cooling followed by wet scrubbing
    - Wet scrubbing for removing tars and soluble inorganic contaminants using conventional and non-conventional solvents that provide recycling options
    - Activated carbon, iron- and zinc-based polishing sorbents for removal of sulfur
    - Zocarbs sorbents to adsorb impurities including sulfur, nitrogen, and trace VOC
- Syngas composition balance by demonstration of integrated water-gas-shift reactor to optimize the H_2/CO ratio.
- CO_2 capture with recycle and H_2 separation technologies to optimize the H_2/CO ratio for increasing yield of fuel production.

Facilities:

The Sandwich gasifier was invented at the Energy and Environmental Research Center (EERC) in Grand Forks, ND by Dr. Nikhil Patel in 2006 (Dr. Patel is the President of SET). The technology's research and deployment efforts have gone through extensive peer review and has benefited from the EERC's long experience and expertise in gasifier development. The EERC Foundation transferred the technology to SET which is the sole owner and licensor of the technologies. Dakota Green Power, of which Dr. Patel is the CEO, is the licensee of the technology with rights to manufacture, commission, and sell these systems to clients. Figure 3 provides a history of the technology development and commercialization efforts for the Sandwich gasifier.

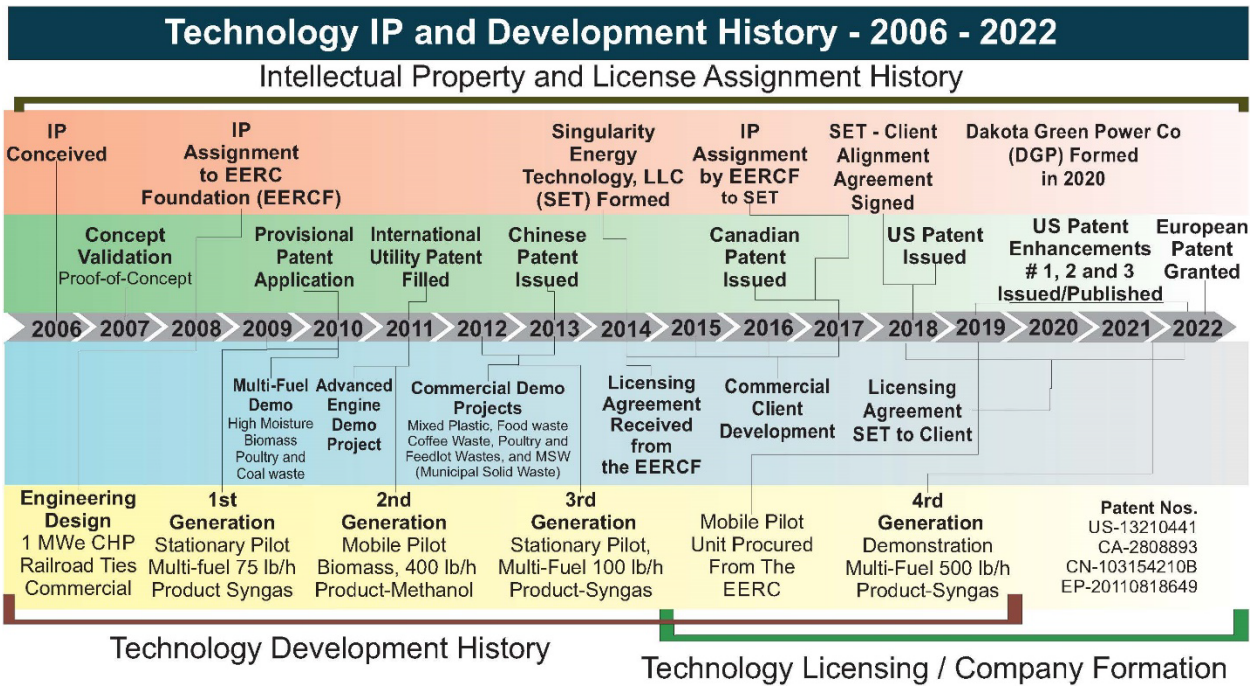


Figure 3. Technology and Intellectual Property Development for the Sandwich Gasifier

The Sandwich gasifier is at a technology readiness level (TRL) of 5. Development has progressed through several scales, including a 2 lb/hr laboratory system operated by the University of North Dakota Institute for Energy Studies (IES), a 70 lb/hr pilot-scale system operated by the EERC, and a 5 ton per day truck mounted system shown in Figure 4, originally built at the EERC and currently owned by Tri-Steel Manufacturing. Many tests, the longest of which was 5 days of continuous steady-state operation, have been performed on a variety of feedstock, including turkey litter, manure, railroad ties, and coffee roaster's waste, including plastic and food processing waste and wet wood on the 70 lb/hr bench-scale system. The 5 TPD truck mounted system has successfully processed railroad ties, shredded tree trimmings, and high-moisture wood waste and produced both electricity and methanol. Various gas cleanup strategies have been employed at these different scales. These tests have illustrated the benefits of the Sandwich gasification concept on challenging feedstocks and led to the enhancements necessary to further optimize the system performance and enable continuous steady-state operation over long periods of time (>10 days). Results from previous testing and justification of the proposed approach are discussed in Appendix A.

Figure 4. Five ton/day truck mounted Sandwich gasifier currently located at Tri-Steel Manufacturing.

Resources:

The current 5 ton/day truck mounted gasifier (see figure 3) owned by Tri-Steel Manufacturing will be relocated to the Grand Forks City Landfill. This system was originally conceived by Dr. Patel while he worked at the EERC. Funding for the original gasifier was provided primarily by the U.S. Department of Energy and Xcel Energy. The unit was mothballed in 2011 due to difficulties in developing sponsors to commercialize the technology. Patents for the technology were transferred to SET and its owner, Dr. Patel. Tri-Steel Manufacturing purchased the truck mounted system from the EERC and invested approximately $1,500,000 to refurbish and enhance the system to its current operating condition. The truck mounted system has been successfully operated on railroad ties, shredded tree trimmings, and high-moisture wood waste. Tri-Steel will provide access to the truck-mounted system to SET for this program and will perform necessary modifications. Steffes Manufacturing, a Grand Forks, North Dakota company can provide ASME stamped pressure vessels. In addition, the EERC has a pilot-scale system and the UND Engineering has a bench-scale system that can be used to support the development efforts if needed. SET/DGE has a three-year, rent-free lease from the City of Grand Forks to use the building that housed the former bailing facility for this and other projects focused on developing and commercializing the Sandwich Gasifier technology.

Techniques to Be Used, Their Availability and Capability:

This project aims to demonstrate the capabilities of the Sandwich Gasifier (SG) and integrated systems in producing uninterrupted, high-quality syngas suitable for gas-to-liquid (GTL) production. The project will integrate a cost-effective gas cleanup technology and assess the techno-economic improvements in producing low-cost GTL/RNG/H_2-ready syngas. By showcasing the potential of the SG system, this project seeks to advance efficient and economically viable GTL/RNG/H_2 production.

In this project, the SET Sandwich Gasifier will be integrated with existing or nearly commercial subsystems, including:

- Syngas cleanup system: Removes harmful contaminants like tar, particulate matter, sulfur species (H_2S, COS, mercaptans), nitrogen species (NH_3, HCN), halogen (HCl), volatile alkali, silane, arsenic, an d trace volatile organic compounds (VOCs). This is achieved through tar condensation by gas cooling, wet scrubbing using conventional and non-conventional solvents, activated carbon, iron- and zinc-based sorbents for sulfur removal, and Zeocarb sorbents for impurity adsorption.
- Syngas composition balance: Demonstrates the use of an integrated water-gas-shift reactor to optimize the ratio of H_2 to CO in the syngas.
- CO_2 capture with recycle and H_2 separation technologies: Utilizes methods to capture CO_2 and separate H_2, aiming to optimize the H_2/CO ratio for increased yield of liquid fuel production.

The following provided details of the five tasks proposed to meet the project objectives.

Task 1: Feedstock Selection and Analysis

MSW will be used as the primary feedstock based upon interest from SET's potential clients (see letters of support in Appendix). Other suitable feedstocks will be identified based on their availability and market demand for disposal and with input from the ND Department of Commerce and Xcel Energy. SET will procure the biomass feedstocks locally and/or from other localities with potential interest to serve as a site(s) for the commercial installation(s). Small representative samples will be subjected to fuel analysis such as proximate, ultimate, dynamic, and differential thermal analysis (TG/DTA) and inorganic analysis. Selected samples will be gasified using a laboratory gasifier. Ash composition analysis will include bulk species and trace metals in the feed material. Data will supplement a request for an extension to the current temporary environmental permit.

Milestone 1: Feedstocks procured and analyzed. Supplemental permit request filed.

Task 2: Syngas Composition Balance Equipment Design, Vendor Selection and Procurement

Task 2 focuses on designing, selecting vendors and procuring equipment that will enable us to achieve syngas composition balance to meet with third-party GTL/RNG vendor syngas specification. This involves selection of the Shift Reactor and catalyst for conversion for achieving targeted H_2/CO ratio in the syngas and a CO_2 Removal System. The sorbents and solvents are selected based upon results from work performed at the Energy and Environmental Research Center (EERC) in conjunction with DOE. The train tested included WGS and removal of sulfur, chlorine, and trace metals (including mercury). The technologies utilized are considered either commercial or near-commercial.[2] An example configuration tested included Johnson Matthey's KATALCO® K8-11 sour shift catalyst, fixed beds for sulfur capture (hydrogen sulfide and carbonyl sulfide) with a regenerable adsorbent (RVS-1, a regenerable zinc oxide-based adsorbent developed by DOE NETL and manufactured by RTI for Süd-Chemie (now Clariant)). High purity (95%+) CO_2 is obtained via the Selexol process using NETL-recommended solvents including ARG2[3].

Included in Task 2 is the procurement and testing of analytical equipment necessary for measuring the primary syngas components and trace concentrations of sulfur and nitrogen species. The procured analytical equipment will be integrated into the syngas production system, ensuring proper connectivity and functionality. Compatibility with existing control systems and data acquisition systems is considered to enable seamless integration and data exchange. The performance of the analytical equipment is evaluated through comprehensive testing and validation.

Upon completion of Task 2 we will have a well-designed and balanced syngas composition system, with the necessary equipment and safeguards in place. This will enable us to achieve our project goals of producing syngas with the desired composition of clean syngas. The efficacy of the process and sorbent will help determine cost effective option for production of syngas of desired composition.

Milestone 2: Syngas cleanup and compositional balancing equipment selected and procured. A HAZOP for system integration completed.

Task 3: 5 TPD System Modification and Commissioning

Task 3 will involve the modification and commissioning of the 5 TPD system at the Grand Forks City Landfill. Data from the feedstock analysis and estimated performance will be used in obtaining necessary permits and drive a thorough HAZOPS review to identify and address any potential hazards. The equipment identified and procured in Task 2 will be installed and commissioned. This includes ensuring proper installation, connectivity, and functionality of the equipment within the syngas production and cleanup system. A commissioning test will be conducted using the baseline feedstock to assess the system's functionality and identify any potential issues or areas for improvement. A set of preidentified sorbents will be utilized during the preliminary commissioning. The necessary preparations will be made for contaminant sampling, including system upgrades, commissioning, and testing. This will ensure accurate and reliable sampling of trace gas contaminants and will enable effective detection and analysis of contaminants in the syngas produced. This task will include optimizing the system for efficient on-site sampling and analysis of trace contaminants in a third-party lab. All prescribed quality control protocols will be adhered to during the sampling. By completing Task 3, the 5 TPD system will undergo necessary modifications and upgrades, ensuring its compatibility with the selected feedstocks and operability of the added syngas balance and cleanup equipment. Preliminary commissioning tests will help verify the

[2] Subtask 2.1 – Pathway to Low-Carbon Lignite Utilization, Topical Report for the Period September 15, 2015 through May 31, 2017. Cooperative Agreement Number DE-FE0024233. May 17, 2017

[3] Biomass Cofiring with Precombustion Carbon Capture Baseline Testing at UND EERC, Final Report. Dec 2021.

system's performance, and the sampling system will be optimized for accurate contaminant sampling. These efforts will contribute to the overall success and efficiency of the syngas production process.

Milestone 3: Syngas cleanup equipment fully integrated and operational on the 5 TPD system. System ready for clean syngas production.

Task 4: Clean Syngas Production with Composition Balance

In Task 4, gasification tests with syngas and measurement of scrubber water contaminants will be conducted in the 5 TPD system. Baseline testing will establish the initial performance and characteristics of the syngas produced. Contaminant sampling and analysis will be carried out to identify and quantify any trace contaminants present in the syngas. The scrubber water generated during the gasification process will undergo treatment using gasifier char or activated carbon to remove contaminants from the water and improve its quality before disposal or reuse, while reinjecting the spent sorbent into the gasifier. Baseline testing provides a comprehensive understanding of the syngas composition and contaminant levels will be obtained through baseline testing and analysis. Additionally, the treatment of scrubber water with gasifier char or activated carbon will help ensure the efficient management of water contaminants, contributing to environmental sustainability and process optimization.

Once the baseline testing is complete, clean syngas production with composition balance will be achieved using the selected feedstocks; Municipal Solid Waste (MSW) and/or a Municipal/Industrial Wood Waste mix; and potentially forestry wastes, poultry waste; and/or biosolids. Gasification tests will involve at least one 8-hour shift and continuous operation for 24 hours for each feedstock. Additionally, a 5-day continuous operation will be performed on a feedstock selected by the client to support commercialization goals. During the tests on the 5 TPD system, the syngas composition will be continuously monitored. This will include the implementation of appropriate sampling methodologies and colorimetric trace-gas detection techniques to ensure accurate measurement and analysis of the syngas composition. By completing Task 4, clean syngas production with composition balance will be achieved for various feedstocks. The gasification tests and continuous monitoring will provide valuable data on the syngas composition, enabling optimization of the process and supporting the commercialization objectives of the project.

Milestone 4: Baseline testing with selected feedstock completed and optimal configuration and operation of syngas equipment determined.

Milestone 5: Clean syngas produced from selected feedstocks for 8-, 24-, and 100- hours operation using the selected feedstocks.

Task 5: Final Report Preparation

In Task 5, the project team will undertake the preparation of the final report and the submission to the North Dakota Industrial Commission (NDIC) and Xcel Energy. The report will encompass the data collected, data analysis, and recommendations for future studies. Additionally, it will feature a technoeconomic of the feedstock-specific technology implementation at a selected location. By completing Task 5, the project team will provide a valuable resource for future studies, providing insights and guidance for further advancements in the field. Additionally, the submission of the final report will signify the successful conclusion of the project and the fulfillment of all obligations.

In addition to the final report, SET will submit quarterly progress reports to the NDIC and Xcel Energy for assessment. These reports will provide updates on the project's progress, outlining the milestones achieved, challenges encountered, and future plans. The progress reports will serve as a means to ensure alignment with the project goals and objectives. Through regular reporting, SET aims to maintain

transparency and accountability in project execution and foster effective communication with both the NDIC and Xcel Energy regarding the project's advancement.

Milestone 6: Final report submitted to and accepted by DOE.

Environmental and Economic Impacts while Project is Underway:

We do not anticipate any significant environmental impacts while the project is underway. The Sandwich gasifier achieves near-zero effluent discharge by injecting the condensed tar and particulate matter (PM) along with a small fraction of water into the reactor hot bed such that the thermodynamics of the reactor temperature profile are not affected. The inert inorganic ash residue removed from the gasifier is the only disposable material generated from the system and will be disposed of at the City Landfill. The produced syngas will be oxidized via a thermal oxidizer or flare and/or used for heating or electricity generation while the project is underway. Solid, liquid, and gaseous effluents will be collected and analyzed before being disposed of in compliance with the environmental permits that will be obtained for this project as a standard procedure. The data generated will be used for reporting and other permit application purposes.

Approximately one hundred tons of biomass will be processed during the testing phase of the project. The volume reduction of the waste coupled with the "green" electricity and fuels produced represent a positive environmental impact of the project.

Ultimate Technological and Economic Impacts:

The technological impact of the Sandwich gasifier is vested in its ability to promote complete waste conversion to produce clean syngas. The robust operational flexibility of the technology means that it can drive down costs for valuable fuel production in rural and urban areas. The system has the potential for higher revenues due to its higher conversion efficiency and improved quality of syngas produced. The Sandwich gasifier's net production is ~850 kWh/ton compared to 500 – 617 kWh/ton for 4 different competing technologies, and 500 kWh/ton for existing combustion-based waste-to-energy plants when using municipal solid waste (MSW) as a comparison.[4]

The Sandwich Gasifier design has high heat transfer, isothermicity, scalability, good control over operating conditions, good gas-solid contact, and high specific capacity. The scalable feature of the system allows the sizing of the commercial Sandwich gasification technology such that it can be located at or near the feedstock source, thus requiring zero to near-zero transportation cost. This feature makes it ideal for remote locations that require low-cost biomass and plastic waste processing systems for valuable fuels production.

Once the technology's commercial operation is demonstrated, DGP is projecting they can manufacture and sell initially up to five systems per year resulting in annual net sales of $30,000,000 - 40,000,000 and development of up to 35-40 high paying jobs. Manufacturing will occur in Grand Forks, ND. Even during the initial growth phase it is anticipated that DGP will generate 24 jobs in its 4th year.

Why the Project is Needed:

[4] Ducharme, C.; "Technical and Economic Analysis of Plasma-Assisted Waste-to-Energy Process", Columbia University, 2010.

The Sandwich gasifier has the potential to provide consistent-quality biomass-derived air-blown and enriched-oxygen/air-blown syngas for liquid fuels production. However, technical risks remain because of a lack of experience for long-term continuous operation and the performance challenges associated with challenging feedstocks that possess elevated and variable moisture, ash, and inorganic content. Further, the strict purity requirements for downstream GTL/RNG/H_2 systems are economically difficult to meet at a small scale for most gasification systems. These risks prevent commercial investment. Potential clients are interested in seeing the operation of a fully integrated system before investing in the technology (see letters of support).

NDIC funding will allow this project team to make the necessary system modifications, achieve step-change improvements to system performance and cost-effectiveness, full integration of the gasifier with gas cleanup systems and demonstrate longer-duration operation. With these three accomplishments, the project team will have the information needed to secure commercial investment to take the next step of scale-up design and fabrication of a first-generation commercial Sandwich gasifier suitable for integration with GTL/RNG/H_2 conversion systems.

The funding provided by NDIC through this grant, coupled with funding that will be raised as cost share commitments will facilitate the market expansion of gasification technologies.

STANDARDS OF SUCCESS

The end of project goal is a technically and economically viable gas cleanup technology integrated with the Sandwich gasifier capable of producing syngas suitable for commercial and near-commercial GTL/RNG/H_2 systems. In accomplishing this goal, this project will produce a gasification system that is fully scalable, relying on single or multiple modules to accommodate both rural and urban requirements for converting feedstocks to heat, chemicals, and power. The sizing of the commercial Sandwich gasification technology is such that it can be located at or near the feedstock source, enabling zero to near-zero feedstock transportation cost. Further, the system will be capable of converting waste on an “as-received” basis without requiring feed densification or drying, minimizing, or completely eliminating energy-intensive feed preparation.

This project will assess the technical and economic viability of the Sandwich gasifier as a reliable and efficient method for converting diverse North Dakota biomass sources, such as municipal solid waste, agricultural and forestry waste, and manure, into high-quality syngas suitable for biofuel synthesis and production of bio-materials. The project seeks to generate tangible evidence, data, and insights that will inform decision-making processes regarding the adoption and implementation of the gasifier technology. Ultimately, the goal is to contribute to the development of a more sustainable and environmentally friendly energy sector by enabling the utilization of locally available biomass resources for clean and renewable biofuel and bio-material production. To meet this broader goal, the following individual goals will have been met.

1. Demonstrate the performance and efficiency of the Sandwich gasifier in converting North Dakota biomass feedstocks (municipal solid waste, agricultural and forestry waste, manure, etc.) into syngas of suitable quality for production of sustainable liquid fuels, renewable natural gas, or green hydrogen.

2. Optimize the operation of the Sandwich gasifier to maximize the conversion efficiency and overall performance.

3. Generate comprehensive data supporting an engineering feasibility study for implementing the gasifier technology.

4. Develop a technoeconomic cost model to assess the economic viability and potential commercialization of the gasification process.

5. Provide valuable insights and recommendations for improving the overall efficiency, cost-effectiveness, and sustainability of biomass-to-syngas conversion.

6. Contribute to the advancement of renewable energy technologies by showcasing the potential of the Sandwich gasifier in utilizing diverse biomass feedstocks for biofuel production.

7. Facilitate the transition towards a more sustainable energy sector by promoting the use of locally available biomass resources for clean and renewable fuel production.

BACKGROUND/QUALIFICIATIONS

The team members and their primary roles of the team are summarized in Table 1. Resumes of key personnel are included in Appendix B.

Table 1. Primary Roles of Project Participants

Team Member	Role
Singularity Energy Technologies LLC	Prime contractor and project lead. Owner of patents. License patent rights to DGP. Input into long-term potential projects.
Dakota Green Power (DGP)	Manufactures Sandwich gasifier systems in partnership with SET and Tri-Steel Manufacturing. Will provide engineering support.
Tri-Steel Manufacturing	Manufacturer of gasifier components through established relationship with DGP and SET. Will provide operations support and perform system modifications.
Sage Green N.R.G.	Provide support for permitting, marketing, and communications
MDM Energy Consulting	Provide support for project management, design, and reporting
Dr. Ed Olson	Develop and implement advanced analytical techniques

Singularity Energy Technologies, LLC (SET) – Dr. Nikhil Patel, founder and President of SET, is the inventor and patent holder for the technology. He will lead the project, serving as the Primary Investigator (PI) to direct the technical and scientific aspects, managing resources, scheduling, and budgets. He will be the point of contact between the EERE and other project participants/sponsors. He has over 25 years of research, development, and technology commercialization experience in waste-to-energy conversion using thermochemical processes involving combustion and partial oxidation or gasification of biomass, coal, and unconventional, difficult-to-burn liquid and solid, industrial, and municipal solid wastes. He spent 23 years working with the Energy and Environmental Research Center (EERC) where he focused on inventing and advancing gasification-based conversion technologies.

Tri-Steel Manufacturing – Mr. Scott Homstad is the Manager/Secretary Treasurer at Tri-Steel Manufacturing Co. Tri-Steel will provide manufacturing services for the required modifications to the system. Tri-Steel will rent the 5 TPD gasifier to the project as in-kind cost share to the project. The company, located in Grand Forks, ND was established in 1962 and serves the upper Midwest as a manufacturer and supplier of agriculture equipment. In an effort led by Mr. Homstad, Tri-Steel procured the current truck-mounted Sandwich gasifier from EERC and has invested into refurbishing and updating the previously mothballed system into a fully operational system.

Dakota Green Power (DGP) - Mr. Scott Homstad serves as the President of Dakota Green Power. Mr. Scott Homstad will assist the PI in the development of the commercialization strategy and identification of potential customers for the integrated biofuels production system. Mr. Homstad and Dr. Patel co-founded Dakota Green Power. Their goal is to serve as a manufacturer of 25, and 50 ton/day Sandwich Gasifier integrated waste-to-energy systems. They have established an engineering team who is responsible for preparing initial piping, instrumentation, and manufacturing drawings and will provide similar engineering support to the project.

Sage Green N.R.G., LLC – Dr. Nicholas Ralston, Director of Sage Green NRG, provides advice and support in business considerations, marketing, networking, and outreach presentations, publications, and communications. He will work performed to comply with environmental permits. Dr. Ralston will also use his expertise to help develop a long-term customer base and establish relationships with potential buyers of the Sandwich gasifier. Dr. Ralston has over 40 years of experience in applied research and has particular expertise in environmental aspects related to energy production.

MDM Energy Consulting LLC – Dr. Michael Mann, founder of MDM Energy Consulting, will provide assistance in design review, developing test plans, meeting project-reporting requirements, and will provide input into the development of commercialization plans and developing the end-user marketing material. He has extensive experience in management of large multi-organizational projects of similar scale and scope during his 40+ years' work in the energy field. While at the University of North Dakota, he served as the principal investigator on a three-phase $12 million project to extract rare earth elements and other critical materials from North Dakota lignite, including the design, construction, and operation of a 12 ton per day pilot plant located in Grand Forks. Previously while at the EERC, he was responsible for the design and installation of their 1-MW transport gasifier and associated hot-gas cleanup unit.

Dr. Edwin Olson – Dr. Edwin Olson, Consultant, will assist in developing comprehensive analytical techniques to measure performance of the gas cleanup modules. He will assist in training personnel in proper sampling techniques and with sample collection during testing. Dr. Olson, an organic chemist by training, spent 16 years in the academic arena before joining the EERC. While at the EERC, he has conducted extensive research programs in the development of novel methods for CO_2 capture and has developed and patented a novel levulinate biorefinery, an algae-to-fuels and chemicals biorefinery, a dual fermentation biorefinery, a biomass pyrolysis biorefinery, a method for preparing polyamines from biomass pyrolysis products.

MANAGEMENT

The team brings together the expertise required to advance our waste-to-fuels technology to commercialization. The project structure is designed to facilitate management of the project by task. Dr. Nikhil Patel, SET President and CEO for DGP will lead the project, serving to direct the technical and scientific aspects, managing resources, scheduling, and budgets, and will be the point of contact between the DOE Project Officer and other project participants/sponsors. SET/DGP will utilize current accounting personnel from Tri-Steel Manufacturing to assist in the cost management of the project, including tracking all costs for each of the project tasks.

Nicholas Ralston, Michael Mann, and Ed Olson have been working with SET, the technology licenser since its inception. For this project, Dr. Ralston will take the lead on maintaining permits. Michael Mann will use his many years of experience in developing and managing large research, development, and demonstration projects to help keep the proposed work on schedule and within budget. Dr. Mann will provide assistance in design review, developing test plans, meeting project reporting requirements. Dr. Olson will use his extensive experience in developing and applying complex analytical techniques to ensure accurate gas analysis around each unit operation.

Project meetings and conference calls with the core project management team will be held, at least, on a biweekly basis to conduct project activities, review project timelines, upcoming milestones/deliverables, costs, and challenges associated with the completion of the project tasks. Microsoft Project management tools will be utilized. Review meetings with sponsors (NDIC and Xcel Energy) will be held quarterly to ensure communication and discussion of accomplishments, plans and management of project risks. Intellectual property management and discussions have been initiated. During the course of the project, any new findings will be promptly documented and patent applications to protect the intellectual property filed as necessary. Discussions with potential commercial sponsors have been initiated regarding further development and scale-up of the technology and will be continued on a semi-annual basis as the project progresses.

A preliminary list of the perceived risks associated with completing the project is summarized in Table 2. Project risks will be continuously analyzed, and appropriate measures taken to address and mitigate said risks. A risk analysis will be included as an agenda item for the monthly project management team meetings and updated during the course of the project. Deviations and corrective actions will be discussed in quarterly reports.

Table 2. Perceived Risks and Mitigation Strategies

Perceived Risk	Risk Rating			Mitigation/Response Strategy
	Probability	Impact	Overall	
	(Low, Med, High)			
Cost/Schedule Risks:				
Plant construction costs exceed budget	Low	Med	Low	Vendor quotes have been obtained for major pieces of equipment. Installation costs based on previous experience. Used equipment can be purchased to help control costs.
Equipment delivery delayed	Low	Med	Med	Long lead times will be identified during design. Extra "flex" time built into schedule. Alternate vendors will be identified.
A crucial activity unexpectedly requires substantial additional funds	Low	Med	Low	Project and task managers will evaluate modifications to reduce cost and still meet project objectives. Additional funding will be sought if necessary. The City of Grand Forks, Grand Forks Regional Economic Development and the State of North Dakota offer programs to provide bridge funding.
Technical/Scope Risks:				
Integration of back-end processing equipment	Low	High	Med	Product gas specifications for various down-stream applications have been reviewed. Current design indicates good compatibility. The gasifier island can be tailored with additional gas cleanup, process recycling, and additional reactors/catalysts added to impact gas quality as needed.
Gas cleanup system not performing to vendor specifications	Med	High	Med	For lower cost sorbents/solvents, residence times will be increased and polishing steps added. If this is not effective, other more expensive (but still commercially available) materials will be tested, followed by the use of near-commercial materials.
Management, Planning, and Oversight Risks:				

Personnel availability	Low	High	Low	Explore options with EERC for a subcontract to supply operators and technicians. Utilize wide range of personnel expertise available at UND including students. Offer competitive internships to upper-level engineering students. Key personnel identified are committed and available at their specified labor hours.
Equipment availability	Low	High	Med	System design maximizes the use of off-the-shelf equipment. Work with engineering firms to identify preferred vendors. Identify long-lead items early in the design effort and initiate ordering. Coordinate manufacturing schedule with Tri-Steel Manufacturing to ensure their schedule can accommodate project needs.
Cost tracking	Low	High	Low	SET/DGP will utilize the accounting services of Tri-Steel Manufacturing's CPA to assist the project manager in tracking costs. Utilization of Project cost tracking system.
ES&H Risks:				
Organic emissions	Moderate	Low	Low	The temperature regime in the Sandwich gasifier is designed to minimize the formation of tars and other organic compounds. Recycle options are available to capture and reprocess organics in the gasifier (capture on activated carbon followed by gasification for example). Additional backend polishing systems will be added if needed.
Fugitive emissions related to feedstock storage	Low	Moderate	Moderate	Facility is located outside the city limits adjacent to the city landfill. Dust control measures such as water spray of storage piles used as needed. Feedstocks stored and fed from truck and or similarly designed feed bin. Train all personnel on the proper handling and use of feed equipment.

TIMETABLE

Table 3 presents an overview of the project schedule and major milestones.

Table 3. Project Schedule and Major Deliverables

	Task	Milestone	Milestone Description	Milestone Verification Process (What, How, Who, Where)	Duration / Months from Start of the Project
1	Feedstock Selection and Analysis	M1	Feedstocks procured and analyzed. Supplemental permit request filed.	Test results submitted to NDIC and summarized in quarterly progress reports	0 - 3
2	Syngas composition balance equipment design and procurement	M2	Syngas cleanup and compositional balancing equipment selected and procured. A HAZOP for system integration completed	Equipment procured and HAZOP of integrated system completed. Final design summarized in quarterly progress reports	0 - 12
3	5 TPD System Modification and Commissioning	M3	Syngas cleanup and composition balance equipment fully integrated on the 5 TPD system	Test results submitted to NDIC and summarized in quarterly progress reports	7 - 14
4	Clean Syngas Production with Composition Balance	M4	Baseline testing with selected feedstock completed and optimal configuration and operation of syngas equipment determined.	Test results submitted to NDIC and summarized in quarterly progress reports	14 - 16
		M5	Clean syngas produced from selected feedstocks for 8-, 24-, and 100- hours operation.	Test results submitted to NDIC and summarized in Final Report	17 - 22
5	Final Report Preparation and Submission	M6	Final report submitted to and accepted by NDIC.	Final report which includes updated economic models, and plant performance (inputs, outputs, yields, etc.) as defined in the deliverable requirements	22 - 24

BUDGET

Project Associated Expense	NDIC's Share	Applicant's Share (Cash)	Applicant's Share (In-Kind)	Xcel Energy Share
Personnel	$249,400	$189,000	$0	$86,250
Equipment	$157,000		$0	$63,000
Supplies	$46,250		$0	$20,500
Contractual	$30,250		$0	$19,750
Other Direct	$4,050		$108,000	$5,500
Total	$486,950	$189,000	$108,000	$195,000

Direct salaries are for a portion of Nikhil Patel, engineers' and the operations/technician salaries required to complete the proposed project. Fringe benefits are included in the personnel costs. The salaries shown as cost share will be contributed by Tri-Steel Manufacturing and SET.

Equipment will be purchased to clean the raw syngas from the gasifier to the purity and composition required to directly convert the syngas to bio-based fuels. This includes a shift reactor, CO_2 removal, solvent and sorbent gas cleanup systems. Analytical equipment to allow measurement and control of the syngas quality will be purchased through a $150,000 grant from the North Dakota Department of Agriculture Bioscience Innovation Grant Program (this $150,000 is not shown on the budget as it is not allowed as cost share towards this application).

Small parts, piping, electrical wiring, etc. is required to support the modifications and upgrades to the system. Supply dollars will be used to procure and ship the various feedstocks to be tested as a part of the program. These dollars are also required to replace the consumables used during proposed tests.

SET has a small work force and relies on consultants to provide expertise needed to support their project. These include Tri-Steel Manufacturing, MDM Energy Consulting LLC, and Sage Green NRG.

Oher direct costs provide analytical support required to obtain detailed characterization of all streams (solid, liquid, and gaseous). This information will be required by potential customers to evaluate our technology and apply for permits. An independent certified laboratory will be used for all critical analysis. Rental of the 5 ton/day gasifier from Tri-Steel Manufacturing is also included in the budget and shown as a part of the cost share. The DOE approved rental rate is $20,000/month. It is estimated that the gasifier would need to be committed to this project for approximately 30% of the time, and therefore the rent was prorated to $6,000/month (30% of $20,000)

No indirect costs are included in this budget.

The applicants share of budget includes salaries paid by Singularity Energy Technologies and Tri-Steel Manufacturing. Xcel Energy has included this project as a part of their Natural Gas Innovation Act (NGIA) filing at a value of $195,000. Final approval from the Commission is expected soon. As noted in the equipment section, SET has received an award for $150,000 from the Bioscience Innovation Grant program. These funds, in addition to the required $75,000 match will be used in support of this project as the goals of the two projects overlap. These dollars are not included in the budget shown above and are not counted as cost share towards this project. This budget also does not include the estimated

value ($71,820/yr) of the lease agreement with the City of Grand Forks. When these costs are included in the budget, NDIC's share of the total project costs are 38%.

A detailed budget is presented in the appendix.

TAX LIABILITY

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

CONFIDENTIAL INFORMATION

No confidential information is presented in this application.

PATENTS/RIGHTS TO TECHNICAL DATA

The patented Sandwich gasification technology is owned by SET. The technology was invented at UND's Energy & Environmental Research Center (EERC) by Dr. Patel (founder of SET), and the IP rights were transferred to his company. DGP has permission to use the patented technology and associated technical/design information for the execution of the proposed project. In certain cases, our unique understanding that we would gain from our testing efforts will lead to new procedure design/operation for which we will file domestic and foreign patent applications as necessary. Finally, the performance data and experience we develop with increasing deployment of our technology will represent a competitive advantage and a barrier for new entrants. Patents in the SET portfolio include:

U.S. Patent No. 10,011,792. Date of Patent: July 3, 2018.U.S.

U.S. Patent No. 10,550,343 B2. Date of Patent: February 4, 2020.

U.S. Patent No. 11,220,641. Date of Patent: January 11, 2022.

U.S. Patent No. 11,702,604 B2. Date of Patent: July 18, 2023

Canada Patent No. 2808893. Date of Patent: June 5, 2018.

China Patent No. CN103154210, (issued 2015)

European Patent No. EP2606105, Published on 26th October 2022

European Patent Application, 22199757.0. Divisional from 11818649.3.

STATE PROGRAMS AND INCENTIVES

Title: Support for the Commercialization of the Sandwich Gasifier; 3/2020 – 6/2021; $237,000 (North Dakota Department of Commerce Research ND), $474,000 (Total Project).
Title: Biofuel and Biomaterial Production from North Dakota Biomass using the Sandwich Gasifier; 10/2023 – 6/2025; North Dakota Bioscience Innovation Grant, $150,000 with a $75,000 match.

Transmittal Letter

SINGULARITY ENERGY TECHNOLOGIES, LLC
WASTE TO ENERGY

Dr. Nikhil Patel
Founder and CEO

Suite 201, 4200 James Ray Dr.
Grand Forks, ND 58202
Cell Phone: 701-739-8720
https://www.singularet.com

July 31, 2024

North Dakota Industrial Commission
Attention: Renewable Energy Program
State Capitol – 14th Floor
600 East Boulevard Ave Dept 405
Bismarck, ND 58505-0840

Subject: Singularity Energy Technologies proposal entitled "Accelerating the Waste-to-Fuels Commercialization for the Sandwich Gasifier"

Enclosed, please find an electronic copy of the subject proposal entitled " Accelerating the Waste-to-Fuels Commercialization for the Sandwich Gasifier", which is being submitted to the NDIC Renewable Energy Program.

This proposal seeks to test technology and devise improvements, enabling reliable gasification of renewable feedstocks to produce sustainable liquid fuels, renewable natural gas, and green hydrogen in a reduced carbon emissions context. The proposed work's main benefit is in developing a production technology that is modular giving it the ability to be located in rural or urban settings, close to the feedstock source. The Sandwich gasifier technology can provide flexibility to operations as it can accommodate various feedstocks without pre-blending, which is an important consideration when using biomass and waste materials with changing availability due to seasonal variations.

Successful completion of this project will greatly expand the understanding of how to utilize North Dakota's vast biomass resources, including municipal solid wastes, to produce sustainable liquid fuels, renewable natural gas, and green hydrogen. This will provide the State with options to reduce carbon emissions through renewable feedstock utilization.

If you have any questions, please contact me by telephone at (701) 739-8720 or by e-mail at npatel@singularET.com

Sincerely,

Nikhil Patel
CEO
Singularity Energy Technologies, LLC

Industrial Commission

Tax Liability Statement

Applicant:

NewCarbon Feedstocks, LLC

Application Title:

ACS NewCarbon RNG Project

Program:

- ☐ Lignite Research, Development and Marketing Program
- ☑ Renewable Energy Program
- ☐ Oil & Gas Research Program
- ☐ Clean Sustainable Energy Authority

Certification:

I hereby certify that the applicant listed above does not have any outstanding tax liability owed to the State of North Dakota or any of its political subdivisions.

_____

Signature

President

_____

Title

July 31, 2024

_____

Date

Accelerating the Waste-to-Fuels Commercialization for the Sandwich Gasifier

Application to the NDIC Renewable Energy Program

Appendices

Appendix A – Rationale for Proposed Approach

Appendix B – Resumes of Key Personnel

Appendix C – Letters of Support

Appendix D – Projected Economic Performance of Sandwich Gasification Technology on Various Feedstocks: Customer Acceptance

Appendix E – Example Life Cycle Assessment

Appendix F – Detailed Budget

APPENDIX A

RATIONALE FOR PROPOSED APPROACH

RATIONALE FOR PROPOSED APPROACH

The following subsections first present details on the Sandwich gasifier itself, which is critical to fully meeting the goals of this proposal. Secondly, results from previous testing demonstrating the potential of the integrated system to meet the required specifications while still obtaining near-zero effluent/emissions will be presented.

Gasifier Island: Unlike typical gasifiers which can only maintain gasification temperatures in limited zones, the unique configuration of the Sandwich Gasifier enables it to process feedstocks of varying compositions and moistures while maintaining optimal temperatures for higher syngas qualities and quantities. The Sandwich configuration (see Figure A1) incorporates an endothermic reduction zone sandwiched between two high-temperature oxidation zones, thus maintaining uniform gasification temperatures throughout extended reaction zones. This enables complete gasification of the material, maximizing syngas production while preventing formation of tar residues.

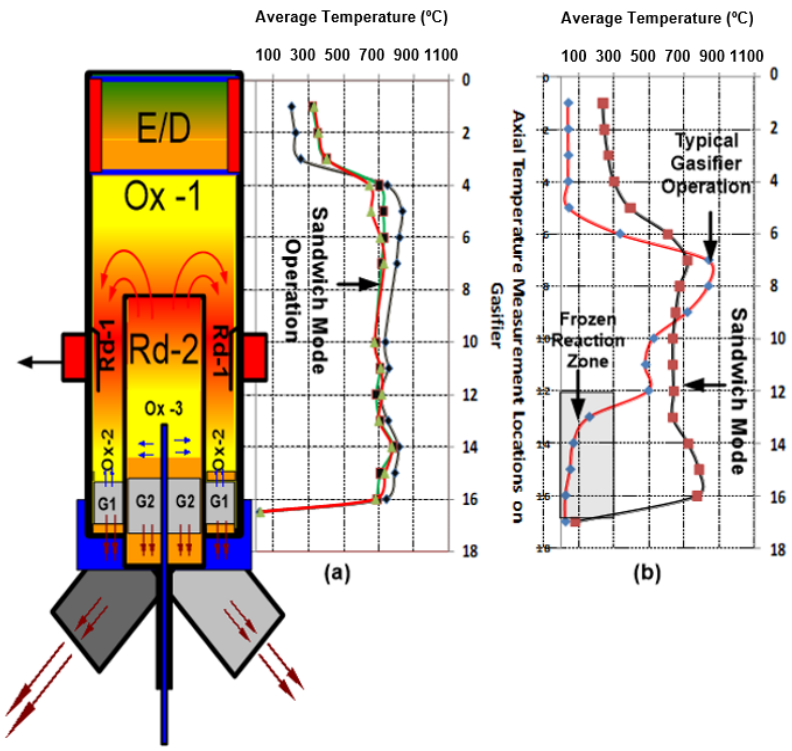


Figure A1. Schematic of the Sandwich Gasifier and its interior temperature profile showing oxidation (Ox) zones where limited combustion occurs and reduction (Rd) zones where syngas forms (gasification) and is extracted. The crucial aspect of the Sandwich Gasifier design is its ability to maintain uniform high temperature zones which increase syngas production efficiency, composition control, and diminishes production of tar and char materials. As seen in (a), this enables the Sandwich Gasifier to process multiple feedstocks with different compositions. As seen in (b) although processing identical fuels, a downdraft gasifier cannot maintain the temperatures required to produce clean syngas. This results in partial gasification and formation of excessive char and tar, degrading efficiency and increasing syngas production costs.
(US PTO 13210441)

The project team has tested a wide variety of fuels at a variety of scales, including the 2 lb/hr laboratory-scale system, the 70 lb/hr bench-scale system, and the 5 ton/day truck-mounted system, with moisture content of the feedstocks tested ranging from 5.6% to 47% and the volatile-to-fixed carbon ratios ranging from 0.26 to 7.9. This shows the ability of the Sandwich gasifier to accommodate feedstocks with a wide and variable range of properties. Figure A2 shows results from the nominal 14-hour tests, demonstrating the uniform temperature distribution in the gasifier and the quality of the syngas produced.

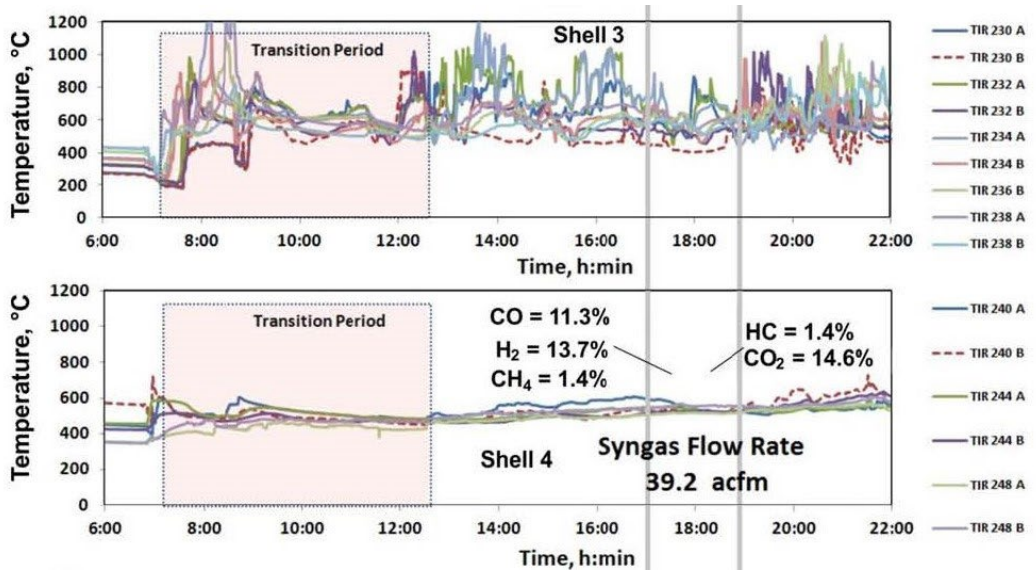


Figure A2. Temperature and syngas compositions for testing with high-moisture white spruce chips

Gas and Effluent Cleanup: To maintain distributed scale operation within the constraints of low capital and operating cost the gasification and the bulk of the syngas cleaning occurs at atmospheric pressure and low-temperature which allows use of conventional carbon-based sorbents. As stated previously, the Sandwich gasifier inherently produces a low-level of tar (<1 g/Nm^3), simplifying the steps required to meet tar specifications. The proposed wet scrubber removes the water-soluble tar species and a portion of the non-water solubles. Results from tar sampling performed during gasification testing of railroad ties show virtually no water-soluble tars with a total tar level in the effluent from the scrubber at approximately 0.2 g/m^3 (~25 ppmv). While this is low, additional tar removal will be necessary to meet the GTL/RNG/H_2 specifications. As discussed in the work scope, this will be accomplished via condensation in a syngas cooler. This cooler (heat exchanger) is designed to accommodate tar buildup on its surfaces. Tar removal will be accomplished via a solvent wash. Two heat exchangers in parallel allows taking one exchanger off line for "tar washing" without disrupting the operation of the system.

Final polishing of the syngas to meet the stringent guidelines for GTL/RNG/H_2 production occurs in two stages, **the first stage** uses a series of sorbent filled packed beds and or solvent columns at room temperature and at close to atmospheric pressure. Since a prior study revealed difficulty in capturing Hg in hot (>200 F) beds, the proposed strategy helps address some of the prior limitations in hot-syngas cleanup. The sorbents and any solvents used will be selected based upon the expected syngas impurities (determined for each feedstock via screening tests). The **second-stage** polishing will occur post syngas-shift and CO_2 scrubbing processes at GTL/RNG/H_2 system operating pressure, prior to syngas preheating. This will allow the system to be optimized choosing only those systems that necessary for the feedstock, but at the same time sufficient to meet the targeted gas composition. For example, arsenate is expected to be a concern for some but not all feedstocks. Likewise, PFAS may be a concern of biosolids and MSW, but not for other biomass feedstocks. Therefore, the recommended treatment system will be optimized for each feedstock to minimize overall cost while still obtaining the required overall removals.

As an example, work has been performed at the Energy and Environmental Research Center (EERC) in conjunction with DOE to develop methods to remove contaminants from syngas to levels suitable for a

hydrogen separation membrane. The warm-gas cleanup train is capable of removing sulfur, particulate, chlorine, and trace metals including mercury at temperatures above 400°F. All of the technologies utilized are considered either commercial or near-commercial in development.[1] The warm-gas cleanup train tested at the EERC can provide WGS reactions and/or removal of sulfur, chlorine, and trace metals (including mercury) at temperatures above 204°C (400°F). The basic principle of the warm gas cleanup train is the utilization of solid catalysts and sorbents in fixed beds at elevated temperature to shift composition of the syngas and remove unwanted contaminants. An example configuration tested included Fixed Beds 1 and 2 loaded with Johnson Matthey's KATALCO® K8-11 sour shift catalyst to provide WGS reactions. Fixed Beds 3 and 4 were used for sulfur capture (hydrogen sulfide and carbonyl sulfide) with a regenerable adsorbent (RVS-1, a regenerable zinc oxide-based adsorbent developed by DOE NETL and manufactured by RTI for Süd-Chemie (now Clariant)). In prior testing, RVS-1 has been demonstrated to reduce sulfur to single-digit ppm levels in the syngas. Fixed Bed 5 is a sulfur polishing bed and was loaded with Clariant ActiSorb® S 2. The two-stage sulfur removal process has been demonstrated to produce H_2S levels below our detection limits of 10 ppb.

CO_2 removal is also an important and can be accomplished using a variety of technologies. We propose to evaluate two approaches, conventional CO_2 scrubbing using NETL recommended solvents such as ARG2[2] and newer membrane separation techniques such as the developed by Membrane Technology and Research LLC.[3] The CO_2 captured can be recycled back into the gasifier where it will be thermally reformed, serving to both increase the yield of liquid product from the GTL conversion and to reduce overall CO_2 emissions. This also has the advantage of better control of the temperature allowing the gasifier to operation at optimal temperature.

Near-Zero Emissions: An important goal of the system is near-zero emissions. Testing has determined the feasibility of organic removal from gasifier condensate water using adsorption on chars produced during gasification of biomass feedstock: two types of char produced in the Sandwich gasifier were investigated.[4] Isotherm data verify that the char produced in the Sandwich gasifier is an effective sorbent for phenolics and other organics in gasifier condensate water present at initially relatively high concentration with final effluent levels <3 mg/L. Other organics (cyclic ketones) are also adsorbed, except for some highly volatile components that may be stripped by air sparging. Further sorption kinetics data are needed to determine the size and optimal configuration of the sorbent beds. These studies are planned as part of the proposed effort.

Testing has also demonstrated that the direct injection of char and tars into the gasifier is a viable method to eliminate the need for secondary treatment and/or disposal of these materials. Reinjection of these materials as a part of the overall process eliminates the production of effluents that could potentially be classified as hazardous wastes, with a favorable result of increased hydrogen yield. The Stage 1 process of syngas production can, thus, attain near-zero effluent discharge, an important benefit of this technology.

[1] Subtask 2.1 – Pathway to Low-Carbon Lignite Utilization, Topical Report for the Period September 15, 2015 through May 31, 2017. Cooperative Agreement Number DE-FE0024233. May 17, 2017

[2] Biomass Cofiring with Precombustion Carbon Capture Baseline Testing at UND EERC, Final Report. December 2021.

[3] Kniep, J.; Bench-Scale Development of a Transformative Membrane Process for Pre-Combustion CO2 Capture; Final Report for DE-FE0031623, July 27, 2022.

[4] Reference tar-water study

Appendix B – Resumes of Key Personnel

Nikhil Patel

Michael Mann

Nichalos Ralston

Ed Olson

DR. NIKHIL PATEL
Founder & CEO

Suite 201, 4200 James Ray
Dr. Grand Forks, ND 58202
Cell Phone: 701-739-8720
https://www.singularet.com

Principal Area of Expertise

Dr. Patel has 25 years of research and technology development experience in the combustion and gasification of biomass, coal, and unconventional, difficult-to-burn liquid and solid industrial and municipal solid wastes. Dr. Patel currently leads efforts to commercialize mobile truck-mounted and stationary waste conversion technologies. These technologies utilize the patented Sandwich™ gasification process he invented while working at the Energy & Environmental Research Center (EERC).

Dr. Patel joined EERC in 2002 and focused efforts on inventing, developing, and commercializing innovative gasification technologies for distributed energy and Fischer–Tropsch (FT) liquid fuel production. As a research manager and research scientist at the EERC, he led the design, construction, and project management team responsible for implementing gasification-based demonstration and commercialization projects.

Dr. Patel founded Singularity Energy Technologies, LLC, in 2014 to commercialize the Sandwich gasification technology. SET uses the Sandwich gasification technology it owns as a core technology for waste conversion to electricity and FT liquids and chemicals. In 2020 he co-founded and led as CEO of Dakota Green Power Co (DGP), an operating company for manufacturing and deploying SET's Sandwich Gasification technology.

Qualifications

Ph.D. (2001), Aerospace Engineering, Indian Institute of Science, Bangalore,
M.S. (1993) and B.E. (1991), Mechanical Engineering, University of Baroda, Baroda.

Professional Experience

2020–Present: Co-founder & CEO, Dakota Green Power Co (DGP)
2014–Present: Founder & CEO, Singularity Energy Technologies, LLC (SET)
2005–Present: Adjunct Professor, Institute of Energy Studies (IES), Department of Chemical Engineering, UND.
2015–Present: Research Engineer Lead, Distributed Energy Technologies, EERC, UND.
2012–2015: Research Manager, EERC, UND.
2002–2012: Research Scientist, EERC, UND.
2002: Visiting Researcher, EERC, UND.
2000–2002: CSIR Research Associate, Indian Institute of Science, Bangalore, India.
1994–2001: Research Scholar, Indian Institute of Science, Aerospace Engineering Department, Bangalore, India.
1993–1994: Lecturer, University of Baroda, Baroda, India.
1991–1992: Research Assistant, University of Baroda, Baroda, India.
1989: Engineer Trainee, Mukund (Iron and Steel) Ltd., Bombay, India.

Publications and Presentations

Has authored and/or coauthored more than 35 publications and holds four patents, including; IP07-013 – Sandwich Gasification Process for High-Efficiency Conversion of Carbonaceous Fuels to Clean Syngas with Zero Residual Carbon. U.S. Patent No. 10,011,792 (issued 2018), 10,550,343 (issued 2020), US 11,220,641 B2 (Issued 2021), US 17/570,448 (Filed 2021) Canada Patent No. 2808893 (issued 2018), China Patent No. CN103154210, (issued 2015), European Patent Application No. 11818649.3 (Grant fees paid February 2021)

mdm energy consulting, llc

701.215.2900 • mike.mann@mdmenergy.net • thompson, nd

MICHAEL D. MANN, Principal

Principal Areas of Interest and Expertise:

Dr. Michael Mann is the founder and Principal of MDM Energy Consulting LLC. His company was founded in 2015 to provide clients with design services, economic assessments and feasibility studies, formulation and execution of research and development projects, and project management support. He has been working in the energy field since 1981 where he has been involved in developing a wide range of technologies, including energy production from combustion and gasification, wind, and geothermal resources along with energy storage options. He has experience with the extraction of rare earth and other critical materials from coal, brines, and spent catalysts, and has explored options to add value biomass, lignite, and other low-grade carbonaceous materials. Much of his activity focuses on system integration and the development of energy strategies coupling thermodynamics with political, social, and economic factors. Dr. Mann has over 215 publications and has secured over $35 million in research funding during his career.

Qualifications:

Mayville State University	Chemistry, Mathematics	B.A., 1979
University of North Dakota	Chemical Engineering	M.S., 1981
University of North Dakota	Business Administration	M.B.A.,
University of North Dakota	Energy Engineering	Ph.D., 1997

Dr. Mann's ability to develop and manage large research projects while juggling a wide range of other activities was recognized when he was awarded UND's highest honor, the Chester Fritz Distinguished Professorship. He has been awarded UND's highest award for Excellence in Research and the UND Foundation Faculty Scholar Award, recognizing his combined excellence and contributions in teaching, research and service to the university. Dr. Mann helped develop major research centers at UND including SUNRISE, a faculty driven sustainable energy center and the Petroleum Research Education and Entrepreneurship Center of Excellence (PREEC). He was recognized for these efforts when he received UND's Interdisciplinary Collaborative Research Award. He was a primary player in the development of the Institute for Energy Studies.

Professional Experience

2015 – Present: Principal, MDM Energy Consulting, LLC:

Provide support in all phases of client's energy and chemical processing projects. Available to support design of pilot and demonstration systems, develop and implement experimental test plans, analyze data to optimize system design and operation, assist in writing proposals to funding agencies, performing techno-economic analysis and life-cycle analysis, and providing project management support. Technical areas of expertise include integration of energy systems, combustion and gasification technologies, geothermal energy, air pollution control, waste-to-energy systems, and chemical processes.

2009 - 2022: College of Engineering (Associate Dean 2013-14; Associate Dean for Research

2009-13; 2018-2022), University of North Dakota (UND):

Provided advice and support to the Dean in issues related research and development within the college and support academic affairs. Responsible for the implementing the college's major research goals, promoting a culture of research in the college, enhancing research opportunities for faculty and students, and providing administrative oversight for proposal submittal and grant accounting.

2014 –2021: Executive Director, Institute for Energy Studies:

Helped realize the Institute's goal of developing UND into a premier "Energy University" that "inspires the creation of new knowledge to enable the development of revolutionary energy technologies, train the next generation of energy experts, and establish advanced industries required to make affordable emissions free energy technologies a reality". Responsibilities included identifying key technical and economic barriers to the development of secure, affordable, and reliable energy production technologies; identifying proposal opportunities and develops new relationships with potential partners; and drawing from resources across campus building teams to deliver the research, education, and outreach required to meet the needs of public and private partners. Highlights include directing over $12 million in research in rare earth elements resulting in the design and construction of a 12 ton/day pilot processing facility and developing the IES into a go-to research support unit for emerging small businesses.

1999 – 2022: UND Department of Chemical Engineering (Professor, 2006-2022; Chair 2005-13; Associate Professor, 1999-2006):

Developed a reputation as an engaging teacher, excellent researcher, and inspirational leader. Awarded UND's highest honor, the Chester Fritz Distinguished Professorship in 2009 in recognition for his accomplishments in research, teaching, and service. Led the Department to UND's top departmental awards for Excellence in Research in 2005 and 2011 and Excellence in Teaching in 2007. Co-founder of the SUstainable eNergy Research, Infrastructure, and Supporting Education (SUNRISE) group in 2004. SUNRISE now has over 30 faculty participants from 12 different departments and 4 North Dakota Universities with over $20 million in research grants. Served as the primary research advisor for over 30 PhD students and 40 Master's students.

1981-99: UND Energy & Environmental Research Center (Sr. Research Mgr, Advanced Processes and Technologies 1994-99; Research Mgr, Combustion Systems 1985-94; Research Engineer 1981-85):

Activities evolved from hands on research to the development and marketing of ideas and technology. Involved in a wide range of technology development, including energy production from combustion and gasification, wind, and geothermal resources. Highlights include management of over $15 million in research projects; design, installation, and operation of a 1 MWth CFBC; design, installation, and operation of a 250 lb/hr gasifier; development of small power systems for Alaskan villages; and the development of a small-modular fluid-bed combustion system (0.5 to 5 MW)

Nicholas V.C. Ralston
Ph.D. Biomedical Research

Environmental Health Emphasis Area:
My team is working to deploy Smart Waste Converters which use the recently patented Sandwich Gasifier technology. Through a growing network of interested individuals, companies, and government agencies, we are promoting development of projects and proposals to support funding and investment in these crucial additions to commercial and community infrastructure.

Public Health Emphasis Area:
I also lead international efforts to update scientific understanding of the effects of maternal consumption of seafood on child health outcomes. This has grown to include consideration of a broader range of exposures which may affect public health.

Current and Former Positions:

2014-Present; Director, Sage Green NRG (See our website at https://www.sagegreennrg.com/)
Our work increasingly involves deployment of Smart Waste Converter Systems. These systems were patented by Dr. Nikhil Patel, Founder and Director of Singularity Energy Technologies (SET). His advanced approach to gasification minimizes problems which prevented previous technologies from profitably converting mixed wastes into electrical power and/or liquid fuels. His Sandwich gasification technology is the least expensive and most efficient option available to diminish pollution of the land, sea, and air. Sage Green NRG has contributed to major proposals in this area and we are developing regional, nation-wide and international relationships in preparation for deployment of these systems.

My group provides Nutrition Research Guidance as well as Natural Resource Guidance (the origin of the "NRG" in the name of our company). Our public health emphasis is on improving reliability of risk assessments by applying biochemical perspectives to more accurately predict the health effects of nutrients present in ocean fish. Increased maternal intakes of these nutrients are responsible for the ~7.7 point increases in the IQ's of their children. We were funded by the US EPA to develop a more reliably accurate seafood safery criterion which is known as the Health Benefit Value (HBV). Consumption of seafoods and fish with positive HBV's will improve maternal and fetal health while those with negative HBV's would be predicted to put it at risk. To continue our work on the EPA, NOAA, and seafood industry funded projects performed to establish the HBV criterion, we are advising the FAO and WHO organization as well as regulatory agencies of various nations on the importance of adopting this criteria.

2015-Present; Adjunct Faculty, Earth Systems Science & Policy, University of North Dakota
I continue to advise on nutrition in health assessments of risks vs. benefits of maternal fish consumption in studies that have been performed in the Seychelles, Hawaii, Saudi Arabia, Peru, and regularly provide invited keynotes at major meetings. I am developing a Toxicology Forum on selenium-mercury issues and recently authored an invited review, 3 book chapters, and am writing a book that contrasts the risks formerly believed to be associated with mercury exposures from eating certain varieties seafood vs. the notable beneficial effects that have instead been observed among children whose mothers eat ocean fish.

2013-2019; Faculty, Masters in Public Health Program, University of North Dakota
I developed the environmental health core curriculum for the MPH program and taught Environmental Health courses. I obtained funding for and led the "Sustainable Cities Initiative" for multidisciplinary studies involving UND students and faculty interacting with city, state, and federal agencies.

2012-Present; Faculty, Undergraduate Nutrition courses at Grand Forks Air Force Base
Along with other work, I provide nutrition courses to members of the military and their families at the Grand Forks Air Force Base. Many students from UND commonly choose attend these courses.

2005–2016; Health Effects Program Leader, EERC, University of North Dakota
I led research health/environment research groups, advised on mercury studies worldwide and served on EPA Science Advisory Boards as a Mercury Review Panel Member and coordinated/chaired a series of "International Symposia on Selenium-Mercury Interactions" conferences.

2002–2016; Biomedical Research Scientist, EERC, University of North Dakota
My training background in the molecular basis of disease enabled me to identify the biochemical causes and fully define the pathophysiology of mercury toxicity. This led to the "Health Benefit Value" (HBV) criterion which reliably indicates neonatal mercury exposure risks vs. nutritional benefits of maternal fish consumption.

1998–2002; GS-12 Biochemist, Grand Forks Human Nutrition Research Center, USDA
I led the methods development group that created research and laboratory protocols to examine boron and selenium biochemistry/physiology and developed novel methods to quantify molecular binding interactions and examine the significance of selenium in brain metabolism, inflammation, and neurodevelopment.

Education and Training:

1974-1978; Biology, Chemistry, & Earth Science, Mayville State University, Mayville, ND.
Graduated with a B.S. composite major in biology with dual minors in chemistry and earth science.

1989–1995; Fellow, Biomedical Research, Mayo Clinic Graduate School, Rochester MN.
I joined the molecular pathology program at the Mayo Medical Center (Rochester, MN) with rotations in hematology, coagulation, molecular biology, and laser fluorescence spectroscopy prior to my research in thoracic disease. I developed novel methods to quantify inflammatory mediators and characterize the molecular etiology and biochemical pathways which result in the pathogenesis of Byssinosis, an acquired pulmonary disorder.

1995–1998; Fellow, Bowman Gray Medical School, Wake Forest University, Winston-Salem NC.
I discovered the biosynthetic pathway of bis(monoacyl-glyerol) phosphate (BMP), a lysosomal phospholipid that avoids degradation due to its unique sn1:sn1' structure. My work provided stereospecifically tritiated substrates for laboratories around the world and identified the crucial reactions of the biosynthetic pathway that forms BMP.

Publications:
My work has resulted in 2 books, 12 book chapters, >12 documentaries, websites, or online interviews, >80 additional publications, (~40 in research journals, the rest as annual and final project reports for government agencies and other sponsors), >100 platform presentations (>50 were invited keynotes) and I have coordinated and chaired 14 international meetings on the updated understanding of the mercury issue. My group recently finished a book titled "Smart Waste Converters" which describes Sandwich gasifier applications in solving public and environmental health issues. This will be used as a marketing tool and provide background for commercial partner organizations as well as in training seminars to support development and commercial expansion efforts.

Achievements:
As Principal Investigator in public and environmental health studies, I performed >$5,000,000 in research for the US EPA, NOAA, DOE, and industry partners in projects that has dramatically changed how US and international regulatory agencies perceive mercury exposures from maternal seafood and freshwater fish consumption.

My group established a new paradigm for the biochemical mechanisms of toxicity of entire classes of toxic agents and created the Health Benefit Value (HBV) criterion which is the most reliable index of the risks associated with exposures to mercury vs. benefits of nutrient intakes from eating typical varieties of seafoods and freshwater fish.

I currently advise international and national health agencies and most recently gave an invited presentation for the Queen of Spain who has been appointed as FAO's special ambassador for Nutrition to the United Nations.

I provided the keynote presentation "Smart Waste Converters: The Sustainable Solution" for >2,000 attendees at the Karnataka Assocham GEM Chapter meeting: "Towards a Technological and Sustainable Built Environment."

DR. EDWIN S. OLSON
Consultant
223 Circle Hills Dr.
Grand Forks, North Dakota 58201
(701) 772-5403, eolson@gra.midco.net

Education B.A., Chemistry, magna cum laude, St. Olaf College, 1959.
Ph.D., Chemistry and Physics, California Institute of Technology, 1964.
Postdoctoral, University of California, Los Angeles, Laboratory of Nuclear Medicine and Radiation Biology.1964.

Professional Experience
2014 to present" Consultant on energy and environmental issues for ME2C (mercury emissions) and SET (gasification effluents).
2013: Part time work at EERC, UND, following retirement. Provided consultation and analytical services.
1994–2012: Senior Research Advisor, EERC, UND. Conducted extensive research programs in the following areas: 1) Developed new models for mercury-carbon-flue gas interactions and mercury sorption on carbon, resulting in a number of patented mercury control methods for power plant emissions. 2) Developed novel methods for carbon dioxide capture with magnesium and amine reagents4. 3) Developed and patented novel levulinate biorefinery, an algae-to-fuels and chemicals biorefinery, a dual fermentation biorefinery, a biomass pyrolysis biorefinery, a method for preparing polyamines from biomass pyrolysis products. In addition to these research activities, Dr. Olson served as in house consultant to engineers in gasification, pyrolysis, and liquefaction projects.
1988–2002: President, Universal Fuel Development Associates, Inc., Grand Forks, North Dakota. Dr. Olson served as Project Manager for Phase I and II Small Business Innovation Research (SBIR) projects involving water purification, nonaqueous enzymatic solubilization of coal materials, fuel oxygenate synthesis from agricultural materials, and fine-particle catalysts for coal liquefaction.. Also he was project manager for a large U.S. DOE contract involving geotechnical and analytical characterizations of many US power utility byproducts (ash and solid wastes).
1983–1994: Research Supervisor, Process Chemistry and Development, EERC, UND. Dr. Olson performed hydrotreating and catalyst research, coal liquefaction, and gasification research, and analytical methods development.
1980–1983: Research Chemist, Grand Forks Energy Technology Center, DOE, Grand Forks, North Dakota. Dr. Olson developed analytical methods for coal gasification and coal liquefaction products and byproducts in air, water, and fly ash by GC, MS, HPLC, and NMR.
1968–1980: Professor of Chemistry, South Dakota State University. Dr. Olson taught graduate and undergraduate courses in organic, biochemistry, and instrumental analysis. Research projects involved catalyst development, synthesis of antimicrobial heterocyclic compounds, amino acids, and fatty acids.
1977: Professor, University of Notre Dame, South Bend, Indiana. Summer faculty appointment.
1972–1976 summers: Visiting Staff Member, Los Alamos Scientific Laboratory, Los Alamos, New Mexico. Dr. Olson performed synthesis and biosynthesis of labeled amino acids and heterocyclics.
1964-1968: Assistant Professor, Idaho State University Department of Chemistry.

Synergistic Activities: Dr. Olson is past-chair of the American Chemical Society Division of Fuel Chemistry.

Publications: Dr. Olson has over 250 publications and papers and over 25 patents.

Appendix C – Letters of Commitment and Support

Public Works Department
724 North 47th Street
PO Box 5200
Grand Forks, ND 58206-5200

CITY OF GRAND FORKS NORTH DAKOTA

SHARON LIPSH
PUBLIC WORKS DIRECTOR
(701) 738-8740

April 15, 2024

Singularity Energy Technologies
Dr. Nikhil Patel, President
4200 James Ray Drive
Grand Forks, ND 58202

RE: Letter of Support for the Singularity Energy Technologies proposal to the U.S. Department of Energy DE-FOA-0003082

Dear Dr. Patel,

The City has entered into a three-year lease agreement with Dakota Green Power for Phase I, which encompasses a 5 ton/day pilot demonstration of your gasification technology, with the potential of a Phase II expansion to 25 ton/day unit. The City recognizes the potential benefits of your project, particularly in mitigating waste going into the city's landfill and fostering the development of new manufacturing ventures within Grand Forks.

The City Council has approved a three-year lease of space at the City of Grand Forks Landfill, utilizing the building that formerly housed our baling facility. The lease agreement grants you access to 10,260 sq. ft. of space, with a nominal annual lease value of $71,820, provided to you at a token lease rate of $1.00.

We are willing to supporting your project by supplying approved solid waste types for conversion upon request, contingent upon your acquisition of an approved Solid Waste Permit from the North Dakota Department of Environmental Quality. Notably, we recognize your interest in utilizing forestry/tree trimming/wood wastes, which are readily available at the City's inert landfill and will be furnished upon your request.

Furthermore, we are prepared to collaborate with you and Nodak Electric, the local electric cooperative serving the City Landfill, to facilitate the establishment of net-metering arrangements for the produced electricity back into the system.

The City of Grand Forks eagerly anticipates the commencement of your demonstration project.

Sincerely,

Sharon Lipsh
Public Works Director

Xcel Energy®
RESPONSIBLE BY NATURE™

July 29th, 2024

Dr. Nikhil Patel
President, Singularity Energy Technologies, LLC
4200 James Ray Drive
Grand Forks, ND 58202

Subject: Xcel Energy Letter of Support for the Singularity Energy Technologies LLC (SET) proposal to North Dakota Renewable Energy Council

Dear Dr. Patel,

Thank you for sharing your intentions to submit a proposal for a 5 ton/day pilot-scale system to the North Dakota Renewable Energy Council. The work you are proposing aligns with the proposed R&D project within Xcel Energy's Natural Gas Innovation Act (NGIA) filing, which was filed in December 2023 and is currently going through Commission review and approval. Xcel Energy supports SET's proposal which will enable funding to further research technologies that may be able to help support the energy transition towards carbon free resources such as renewable natural gas, bio-methanol and hydrogen which are also of interest to Xcel Energy.

Xcel Energy is a clean and renewable energy leader and was the first utility to establish a goal to provide its customers with carbon-free electricity by 2050 and Net-Zero emissions in the natural gas local distribution company ("LDC") by 2050. For the reviewers of your proposal, Xcel Energy through the NGIA funding plans to support SET's gasification technology advancements. This R&D project will assess the technical and economic viability of the Sandwich gasifier as a reliable and efficient method for converting Minnesota's diverse biomass resources into high-quality syngas suitable for production of renewable natural gas or hydrogen as well as useful biomaterials such as biochar. Xcel Energy supports the North Dakota Renewable Energy Council funding to help advance SET's technology as having the potential to help Xcel Energy lead the clean energy transition and meet the company's long-term carbon free 2050 goals.

We wish you luck with your submission to the Renewable Energy Council and are looking forward to working with you on the first phase of our NGIA project after commission review and approval.

Sincerely,

Kathryn Valdez
AVP, Corporate Planning & Carbon Free Technology
Xcel Energy

Tristeel Manufacturing Company
3001 N Washington St
Grand Forks, ND 58208
1-800-279-2689
www.tristeelmfg.com

July 29, 2024

Dr. Nikhil Patel
President, Singularity Energy Technologies
4200 James Ray Drive
Grand Forks, ND 58202

Subject: Letter of Commitment for the Singularity Energy Technologies proposal to the ND Renewable Energy Program

Dear Dr. Patel,

I am happy to provide support for your proposed project to Singularity Energy Technologies' proposal to North Dakota's Renewable Energy Program. As one of Grand Forks' major farm equipment manufacturers and the owner of the 5-ton/day truck-mounted system, we can assist in all aspects of your project. We will provide labor to help complete your proposed project goals. Based upon your input, we will provide approximately $115,000 in labor towards your project as a mix of engineers, technicians, and operators to best meet the needs of your project. Tri-Steel Manufacturing is committing this amount as an in-kind cost share towards the NDIC cost-share requirements. We will also provide full rent-free access to the 5 TPD truck-mounted system as an in kind cost share equivalent to $108,000.

Sincerely,

Scott Homstad

Tristeel Manufacturing Co.

Grand Forks Region ECONOMIC DEVELOPMENT

April 4, 2024

Dr. Nikhil Patel
President, Singularity Energy Technologies
4200 James Ray Drive
Grand Forks, ND 58202

Subject: Letter of Support for the Singularity Energy Technologies proposal to the U.S. Department of Energy DE-FOA-0003082

Dear Dr. Patel,

The Grand Forks Region Economic Development Corporation (Grand Forks Region EDC) would like to express its strong interest and support for your proposal to the U.S. Department of Energy to build a 25 ton/day pilot facility demonstrating your Smart Gasifier technology. The Grand Forks Region EDC's mission is to expand economic opportunity through industry growth and diversification. Energy and environment is one of our key targeted sectors when prioritizing business development, along with the programmatic opportunities defined by our partners at the University of North Dakota. In result, our organization actively explores state and local opportunities that can be resourceful for the improvement of waste disposal concerns while simultaneously creating economic opportunities for the community. We are aware of the potential tax credits that may be generated using your technology. The ability to see a fully integrated pilot-scale system in operation producing electricity and liquid fuels would provide confidence from key state and local stakeholders to invest in this fascinating technology you have demonstrated with us through your company.

We hope you are successful in obtaining funding for this important demonstration and look forward to continuing to work with you as you fully commercialize your exciting technology.

Sincerely,

Kevin S Hatcher

Kevin Hatcher
Business Development Manager
Grand Forks Region Economic Development Corporation

HydroCarb1

04/14/2024

Dr. Nikhil Patel
President, Singularity Energy Technologies
4200 James Ray Drive
Grand Forks, ND 58202

Subject: Letter of Support for the Singularity Energy Technologies proposal to the U.S. Department of Energy DE-FOA-0003082

Dear Dr. Patel,

HydroCarb1would like to express its strong interest in and support for your proposal to the U.S. Department of Energy to build a 25 ton/day pilot facility demonstrating your Smart gasification technology. As you know from our discussions, HydroCarb1 is exploring opportunities that can deal with plastic waste disposal concerns in our area while simultaneously creating economic opportunities for the community. As we discussed, we are considering a facility to process 25-75 tons/day of plastic waste to produce electricity and fuels. The facility would be located in the St Cloud, MN area and operated by HydroCarb1. We are also aware of the potential tax credits that may be generated using your technology. The ability to see a fully integrated pilot-scale system in operation producing electricity and liquid fuels would provide us with the confidence needed to invest in your technology.

We hope you are successful in obtaining funding for this important demonstration and look forward to continuing to work with you as you fully commercialize your exciting technology.

Sincerely,

Jeff Grunenwald
CEO HydroCarb1
612-224-1004

ALAKAHI GLOBAL

Date April 3, 2024

Dr. Nikhil Patel
President, Singularity Energy Technologies
4200 James Ray Drive
Grand Forks, ND 58202

Subject: Letter of Support for the Singularity Energy Technologies proposal to the U.S. Department of Energy DE-FOA-0003082

Dear Dr. Patel,

Alakahi Globlal Inc would like to express our strong interest in and support for your proposal to the U.S. Department of Energy to build a 25 ton/day pilot facility demonstrating the ability of Smart gasification technology to produce methanol and hydrogen from a wide range of waste materials and biomass. As you know from our discussions, *Alakahi Global Inc* is exploring opportunities to deal with waste disposal concerns in our area while simultaneously creating economic opportunities and reducing greenhouse gas emissions. As we discussed, we are considering a facility to process *25* tons/day of *disposable waste* to produce *electricity* and talking with additional parties located in Maui Hawaii, Oahu Hawaii, and Africa that are interested in Smart gasification as a solution to their waste and energy issues. The first facility we are interested in developing would be located in *Kahalui, Maui* and operated by *Alakahi Global Inc.* We are also aware of the potential tax credits that may be generated using your technology. The ability to see a fully integrated commercial-scale system producing electricity and liquid fuels from various forms of biomass and waste materials would certainly enhance the confidence of future investors in your technology.

We hope you are successful in obtaining funding for this important demonstration project and look forward to continuing to work with you and your exciting technology.

Sincerely,

Dr. Nate Makaiwi
President and CEO of Alakahi Global Inc.
Las Vegas, NV
drnate@civilityglobal.com

Dr. Stacen Makaiwi
Vice President and COO of Alakahi Global Inc.
Las Vegas, NV
drstacen@civilityglobal.com

CITY OF
Belle
Fourche
SOUTH DAKOTA

April 8, 2024

Dr. Nikhil Patel
President, Singularity Energy Technologies
4200 James Ray Drive
Grand Forks, ND 58202

Subject: Letter of Support for the Singularity Energy Technologies proposal to the U.S. Department of Energy DE-FOA-0003082

Dear Dr. Patel,

The City of Belle Fourche would like to express its strong interest in and support for your proposal to the U.S. Department of Energy to build a 25 ton/day pilot facility demonstrating your Smart gasification technology. As you know from our discussions, The City of Belle Fourche is exploring opportunities that can deal with waste disposal concerns in our area while simultaneously creating economic opportunities for the community. As we discussed, we are considering a facility to process 125 tons/day of sorted municipal solid waste to produce heat, electricity, and sustainable methanol. The facility would be located in Belle Fourche, South Dakota and operated by the City. We are also aware of the potential tax credits that may be generated using your technology. The ability to see a fully integrated pilot-scale system in operation producing electricity and liquid fuels would provide us with the confidence needed to invest in your technology.

We hope you are successful in obtaining funding for this important demonstration and look forward to continuing to work with you as you fully commercialize your exciting technology.

Sincerely

Ryan Reeves
Landfill Superintendent
SWANA Certified MOLO
City of Belle Fourche

ENVIRA
SMART ENERGY

03 April 2024

Dr. Nikhil Patel
President, Singularity Energy Technologies
4200 James Ray Drive
Grand Forks, ND 58202

Subject: Letter of Support for the Singularity Energy Technologies proposal to the U.S. Department of Energy DE-FOA-0003082

Dear Dr. Patel,

Envira Smart Energy would like to express our strong interest in and support for your proposal to the U.S. Department of Energy to build a 25 ton/day pilot facility demonstrating the ability of Smart gasification technology to produce methanol and hydrogen from a wide range of waste materials and biomass.

As you know from our discussions, Envira Smart Energy is exploring opportunities to deal with waste disposal concerns in our area while simultaneously creating economic opportunities and reducing greenhouse gas emissions. As we discussed, we are considering a facility to process 50 tons/day of Municipal Solid Waste to produce Electricity/Methanol. Meanwhile we are talking with parties located in New Mexico and Antigua and Barbuda that are interested in Smart gasification as a solution to their waste and energy issues. The first facility we are interested in developing would be in The City of Rio Communities, NM.

We are also aware of the potential tax credits that may be generated using your technology. The ability to see a fully integrated commercial-scale system producing electricity and liquid fuels from various forms of biomass and waste materials would certainly enhance the confidence of future investors in your technology.

We hope you are successful in obtaining funding for this important demonstration project and look forward to continuing to work with you and your exciting technology.

Sincerely,

Hafiz Hassan
Co-founder
ENVIRA
SMART ENERGY
Hafiz@EnviraSmart.com
www.EnviraSmart.com

THE CITY OF Fargo FAR MORE

Division of Solid Waste

2301 8th Avenue North
Fargo, North Dakota 58102
Phone: 701-241-1449
Fax: 701-241-8109

April 5, 2024

Dr. Nikhil Patel
President, Singularity Energy Technologies
4200 James Ray Drive
Grand Forks, ND 58202

Subject: Letter of Support for the Singularity Energy Technologies proposal to the U.S. Department of Energy DE-FOA-0003082

Dear Dr. Patel,

The City of Fargo, North Dakota Solid Waste Department would like to express its strong interest and support in your proposal to the U.S. Department of Energy to build a 25 ton/day pilot facility demonstrating your Smart gasification technology. As you know from our previous discussions, The City is exploring opportunities that can assist with waste disposal concerns in our area while simultaneously creating economic opportunities for the community. As we discussed, we are considering a facility to process 700 tons/day of sorted municipal solid waste to produce a beneficial byproduct such as process heat, electricity, or other sustainable fuels. The facility would be located in Fargo, North Dakota and operated by the City. We are also aware of the potential tax credits that may be generated using your technology. The ability to see a fully integrated pilot-scale system in operation producing electricity and liquid fuels would assist in building the confidence needed to potentially invest in your technology.

We hope you are successful in obtaining funding for this important demonstration and look forward to continuing to work with you as you fully commercialize your exciting technology.

Sincerely

Scott Olson, PE
Solid Waste Utility Director
City of Fargo

Solid Waste Facilities

Incinerator
708 8th Street NW
PO Box 179
Fosston, Minnesota 56542
(218) 435-6501 Telephone
(218) 435-6619 Fax
ESA: jon.steiner@co.polk.mn.us
Facility Mgr: ron.larson@co.polk.mn.us

Landfill
Located: Gentilly, Minnesota
PO Box 179
Fosston, Minnesota 56542
(218) 281-5419
Accountant: julie.mathison@co.polk.mn.us
Secretary: debbie.kappedal@co.polk.mn.us

April 4, 2024

Dr. Nikhil Patel
President, Singularity Energy Technologies
4200 James Ray Drive
Grand Forks, ND 58202

Subject:: Singularity Energy Technologies
DoE Proposal - DE-FOA-0003082
Letter of Support

Dear Dr. Patel,

The Polk County (MN) Resource Recovery Facility (Polk RRF) located in Fosston, MN strongly supports your proposal to the U.S. Department of Energy (DoE) to build a 25 ton/day pilot facility demonstrating your Smart gasification technology. As you may be aware, the MN legislature – and various activist groups – are currently attempting to force the pre-mature closure of the Hennepin Energy Recovery Center (HERC) in Minneapolis, MN. The HERC is the largest MSW waste-to-energy (WTE) facility in MN. This development has all WTE facilities in the state, including Polk RRF, closely monitoring the outcome of that initiative and any ramifications to other WTE's. As a result, all WTE's are evaluating possible alternatives should that effort expand.

Polk RRF currently utilizes an advanced Material Recovery Facility (MRF) which processes both MSW and Single Stream Recyclables from the region. The MRF processes the MSW to provide a clean fuel for the WTE portion of the Plant. Polk RRF has had numerous conversations with you regarding the MRF and its potential impact upon your system. The continued evaluation of both a MRF on your system and demonstration of your system's potential to be incorporated into a system such as Polk RRF's provides benefits to both interests. As a result, we have a keen interest in furthering that evaluation process.

Polk RRF hopes that your effort to attain the DoE support will be realized as it would be of benefit to Polk and other MN-based WTE's in determining if a system such as yours would be a viable alternative to our current integrated waste management systems. Please keep us informed as your project moves forward.

Sincerely

Jon D. Steiner
Env. Svs. Admin.
Polk County, MN

John Deere Intelligent Solutions Group
4101 19th Avenue North
Fargo, ND 58102

Brij N. Singh, Ph.D., IEEE Fellow
John Deere Technical Fellow - Power Electronics Engineeirng
John Deere Region 4 Manager External Relationships
SinghBrijN@JohnDeere.com

June 15, 2023

Dr. Nikhil Patel
President, Singularity Energy Technologies, LLC
Suite 201, 4200 James Ray Dr, Grand Forks, ND 58202

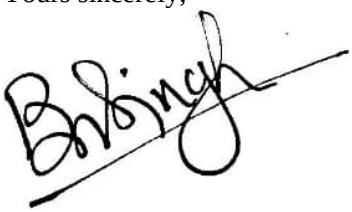
RE: Letter of Interest - Integration of John Deere Technology with Sandwich Gasifier for Biofuel and Biomaterial Production in North Dakota's Farming Community

Dear Dr. Patel,
We sincerely appreciate your introduction of Dakota Green Power and Singularity Energy Technologies, LLC's Sandwich gasification technology. After carefully reviewing your technology and considering its potential application to our customer base in the agriculture sector, we recognize the strong synergy between your gasification technology and our mission. Specifically, we acknowledge its capability to effectively process a wide range of agricultural waste, including manure, and harvesting residues. Moreover, the generation of gaseous and liquid fuels from these waste streams, which can be used to fuel generator sets, aligns with end-use requirements for equipment manufactured by the John Deere. Additionally, your technology offers an attractive pathway for our customers to reduce their carbon footprint, granting us a significant marketing advantage over existing commonly used alternatives.

John Deere would like to express keen interest in the commercial implementation of Sandwich Gasification technology. We fully support your application to the Bioscience Innovation Grant Program (BIG) administered by the North Dakota Department of Agriculture, as this project will facilitate client demonstrations of the technology. Establishing a demonstration facility in Grand Forks would provide us with an ideal platform to develop and test our engine technology using fuels derived from actual waste products at a commercial scale. As part of the project team in capacity of advisory role, which amounts to in-kind support with no cost and resource commitments, we intend to provide engineering know-how for assessment of quality of the biofuels and their suitability for internal combustion engines. Our expertise can guide the process optimization of your system, maximizing the benefits in terms of output fuel quality. Subject to budgetary constraints and resource availability, we may consider donating an engine to the project for direct integration with your system. Furthermore, we envision utilizing your facility as a host site for future research endeavors.

Please do not hesitate to contact me at 701-552-8516 or SinghBrijN@JohnDeere.com if you have any questions or require further information. We look forward to continuing our support to your project.

Yours sincerely,



Brij N. Singh, Ph.D., IEEE Fellow
John Deere Technical Fellow - Power Electronics Engineeirng
Region 4 Manager External Relationships

Sage Green N.R.G.

October 1, 2023

Dr. Nikhil Patel
President, Singularity Energy Technologies
4200 James Ray Drive
Grand Forks, ND 58202

Subject: Letter of Commitment for the Singularity Energy Technologies proposal to the ND Renewable Energy Program

Dear Dr. Patel,

I am happy to provide support for your proposed project to Singularity Energy Technologies' proposal to North Dakota's Renewable Energy Program. I will use my connections and expertise to procure the required biomass for the proposed work, provide support in developing analytical protocols, analyzing data and report writing, and in using my connections to help develop long-term relationships with customers and identifying potential buyers of your technology.

I am committing 100 hours of my time at a fee of $150 per hour ($15,000 total). I have reviewed your proposal and detailed budget and agree with the allocation of my time between tasks and the roles as described in the Project Management Plan.

Sincerely,

Nicholas Ralston
Director, Sage Green NRG

mdm energy consulting, llc

701.215.2900 • mike.mann@mdmenergy.net • thompson, nd

October 1, 2023

Dr. Nikhil Patel
President, Singularity Energy Technologies
4200 James Ray Drive
Grand Forks, ND 58202

Subject: Letter of Commitment for the Singularity Energy Technologies proposal to the ND Renewable Energy Program

Dear Dr. Patel,

I am happy to provide support for your proposed project to Singularity Energy Technologies' proposal to North Dakota's Renewable Energy Program. I feel the experience I gained during my 18 years working with the Energy & Environmental Research Center and the 23 years with the College of Engineering and Mines provide me with an excellent background to assist you with the overall project management of your proposed efforts, including input into your final design, providing oversight for the construction of your system, and developing and executing your testing campaign.

I am committing 133 hours of me time at a fee of $150 per hour ($20,000 total). I have reviewed your proposal and detailed budget and agree with the allocation of my time between tasks and the roles as described in the Project Management Plan.

Sincerely

Michael D. Mann

Michael D. Mann
Principal
MDM Energy Consulting LLC

Dr. Edwin S. Olson
Principal Scientific Advisor

Phone: 701 330 2522
Email: eolson@gra.midco.net

October 1, 2023
Dr. Nikhil Patel
President, Singularity Energy Technologies
4200 James Ray Drive
Grand Forks, ND 58202

Subject: Letter of Commitment for the Singularity Energy Technologies proposal to the ND Renewable Energy Program

Dear Dr. Patel,

I am happy to provide support for your proposed project to Singularity Energy Technologies' proposal to North Dakota's Renewable Energy Program. I feel the experience I gained during my many years working with the Energy & Environmental Research Center provide me with an excellent background to assist you with development and implementation of a strong analytical plan.

I am committing 133 hours of my time at a fee of $150 per hour ($20,000 total). I have reviewed your proposal and detailed budget and agree with the allocation of my time between tasks and the roles as described in the Project Management Plan.

Sincerely

Edwin Olson

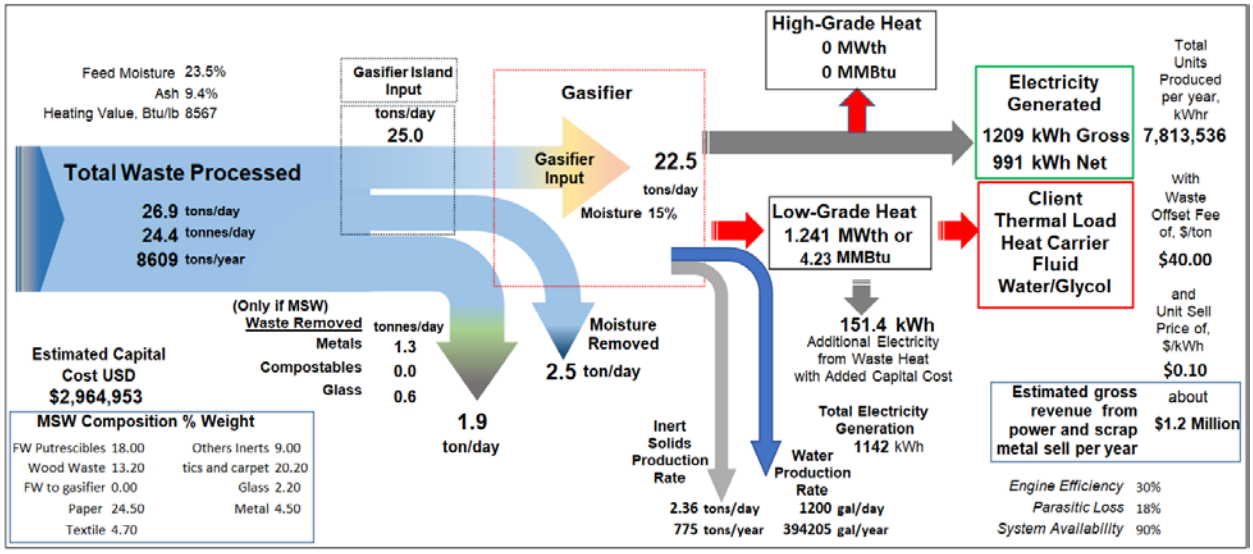
Edwin S. Olson
Principal Scientific Advisor
Singularity Energy Technologies, LLC

Appendix – Projected Economic Performance of Sandwich Gasification Technology on Various Feedstocks: Customer Acceptance

SET and DGP have developed a set of models to estimate the economic performance of the Sandwich Gasifier for various fuels and end-use applications. The model allows projections to be made based upon the characteristics of the fuel and economic factors including tipping fees, electricity and fuel prices, and other major cost/revenue streams. The examples are provided here to show that the Sandwich gasifier has good economic potential and hence the ability to generate a client base.

The Sankey Chart below is an example prepared for an interested client.

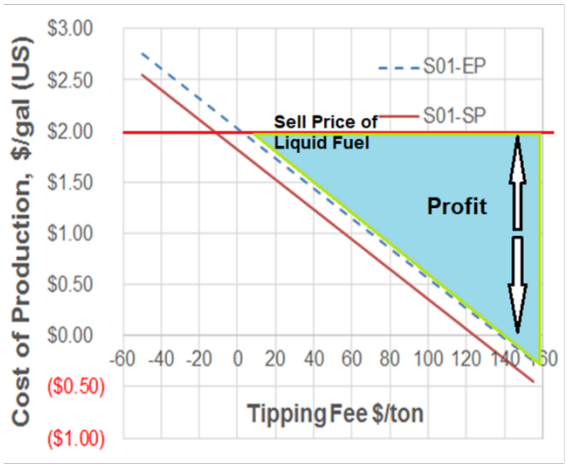
Sankey Chart Showing Various Throughputs of a 25 tons/day MSW to Electricity and Heat Convertor



SET also shows clients the potential areas of profit based upon the primary variables of interest. In the example below, the profitable region for production of crude diesel fuel versus tipping fee, and including the benefit of generating electricity on-site is shown.

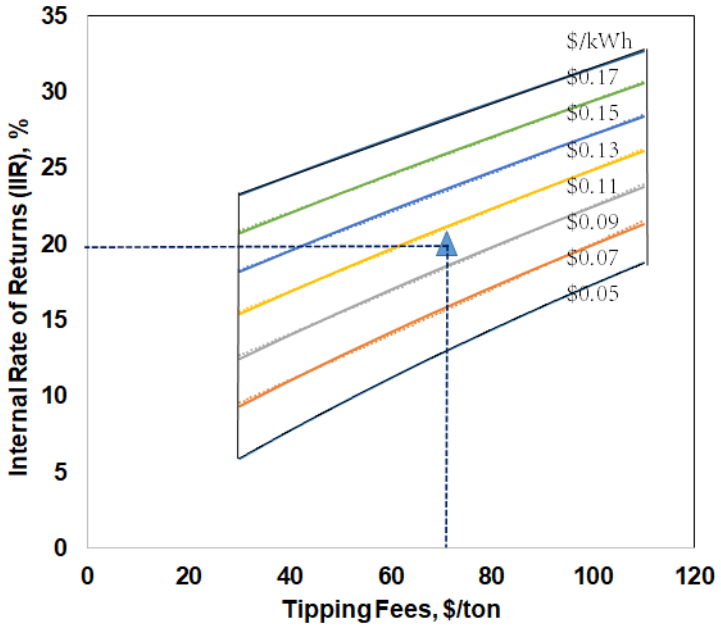
Capital Cost and Revenue Generation Opportunity
Stationary System 20 tons/day MSW-to-Crude Diesel Fuel
(an example for discussion purposes only)

SET Technology Model	S01-EP	S01-SP
	Electricity Purchased	Self-Sustained Operation
System Capital Cost, $	$3,194,165	$3,549,519
Direct Operating, $/year	$413,016	$277,971
Cost of Debt		
Interest Rate for Borrowing Capital	6.50%	6.50%
Debt Loading (10 yr), $/year	$444,323	$493,755
Revenue from Tipping Fees		
Tipping Fee Rate ($/ton)	35	35
Tipping Fee Revenue , $/year	$217,175	$217,175
Production, gal/year		
Crude Diesel Production	424,422	424,422
Production Cost, $		
Zero Debt	$0.97	$0.65
Gallon Debt-Loaded (first 10yr)	$2.02	$1.82
Debt Loaded With Tipping Fee	$1.51	$1.31



SET SINGULARITY ENERGY TECHNOLOGIES, LLC
WASTE TO ENERGY

SET also provides an indication of the potential return on investment for its clients. As an example, the plot below shows a positive internal return on investment even at tipping fees as low as $20/ton at an electricity selling price of $0.05/kWh. This particular customer was receiving a $70/ton tipping fee with an electricity selling price of $0.10/kWh, showing a potential IRR of 20%.



The table below shows potential gross revenues for a variety of different feedstocks of interest to potential clients.

Feedstock Type	MSW # 2	MSW # 1	RR Ties #3	RR Ties #2	Turkey Litter # 1
Gasifier Island Input tons/day	25.0	25.0	25.0	25.0	25.0
Total Waste Processed, tons/day	29.5	26.9	25.0	25.0	25.0
Feed Composition and Energy Content					
Feed Moisture	34%	23%	17%	32%	33%
Ash	6%	9%	2%	2%	17%
Heating Value, Btu/lb	8171	8567	7786	6790	4114
Pre-Gasification Product Removed					
Metals, tons/day	1.1	1.3	0.0	0.0	0.0
Glass, tons/day	3.4	0.6	0.0	0.0	0.0
Post-Gasification Inert Solids and Water Production					
Inert Solids, tons/day	1.45	2.36	0.46	0.44	4.32
Water Production Rate, gal/day	1069	1200	1458	1186	887
Energy Production					
Gross Electricity, kWh	1153	1209	1098	958	580
Net Electricity, kWh	945	991	901	786	476
Low Grade Heat, MMBtu	4.04	4.23	3.85	3.36	2.03
Estimated Annual Gross Revenue from Sell of Electricity and Byproducts					
$/annum	$ 1,188,322	$ 1,196,282	$ 1,038,633	$ 947,792	$ 845,800
Earning Rate: Electricity = $ 0.1/kWh, Tipping Fees= $40/ton, Metal = $150/ton, Fertilizer = $100/ton					

Also of importance is the quality of the liquid that can be produced from the syngas. The table below presents a fuel specification for a fuel generated from syngas using the technology provided by BGTL, Inc. Based upon the syngas compositions generated from testing on the EERC pilot-scale system and on testing performed at Tri-Steel on the 5-ton/day system we expect a fuel of similar quality will be produced.

Sample ID	FISCHER TROPSH REACTOR
Sample Type	Fuel
Report Date	2/6/2018

U.S. OilChek®
Fuel Oil Report

US Lubricants

179946-0001

Labcode	*Sample Date*	*Receipt Date*	*Oil Type*	*Vis @ 40 / 100C*	*Degrees F*		*Percent*		*Particulate*	*Microbe*	*Color*	*API*	*Distillation Data Degrees F*												*BTU/gal*
					VI	*Cloud*	*Water*	*Sulfur*																	
					Flash	*Pour*	*Solids*	*Ash*	*Halogens*	*Stability*	*AF*	*Lb/gal*	*IBP*	*5%*	*10%*	*20%*	*30%*	*40%*	*50%*	*60%*	*70%*	*80%*	*90%*	*95%*	*EP*	*Cetane*
				2.4		-12						35.4														
2048315	1/30/2018	2/5/2018			135							7.059	267	364	397	433	459	479	499	518	539	565	598	627	646	46.0

Sample Date	*Wear Metals (ppm)*										*Contaminant Metals (ppm)*				*Additive Metals (ppm)*					
	Iron	*Aluminum*	*Chrome*	*Copper*	*Lead*	*Tin*	*Cadmium*	*Silver*	*Nickel*	*Titanium*	*Silicon*	*Sodium*	*Boron*	*Potassium*	*Barium*	*Calcium*	*Magnesium*	*Molybdenum*	*Phosphorus*	*Zinc*
1/30/2018																				

Comment:

Specific Gravity 0.8478
Copper Corrosion 1a
Fuel tested within expected ranges for parameters analyzed.

Report To:

ZHIJUN JIA
COMPREX LLC
1740 EISENHOWER DR
DE PERE, WI 54115

Results may now be viewed electronically on our website

www.usoilchek.com

Or sent via email

U.S. OilChek
422 S Washington St
Kimberly, Wi. 54136
Phone 920-831-8839 / 800-490-4903 Fax 920-788-0102

Appendix E – Example Life Cycle Assessment

The Singularity Energy Technology (SET) Sandwich Gasification Process for Manure-to-Energy Conversion:

A Comparative Understanding of CO2e Equivalent Emissions

One of the main features of the Sandwich gasifier is the gas-solid distribution that creates a larger and more uniform high-temperature zone in the gasifier (see Figure 1). This feature ensures a higher level of in situ tar and carbon conversion, thereby eliminating the need for secondary carbon/char converters, large syngas scrubbers and waste disposal systems, and extensive syngas processing. When used to process waste materials into energy, the Sandwich gasifier provides a substantial CO_{2e} reduction/credit as compared to competing technologies. This report provides data showing net CO_{2e} emissions of negative (-) 768 kg CO_2 per ton of manure gasified. Analysis of other potential feedstocks shows net CO_{2e} emission reductions in a similar range.

1. A typical Sandwich configuration consists of at least one **endothermic reduction zone** sandwiched between two high-temperature **oxidation zones.**
2. The reduction zone in the gasifier produces and extracts the syngas. This is an endothermic reaction zone requiring heat transfer from the higher-temperature zones of the gasifier.
3. The patented configuration ensures near-complete waste conversion and augments reduction zone temperature to promote clean syngas production with high efficiency.

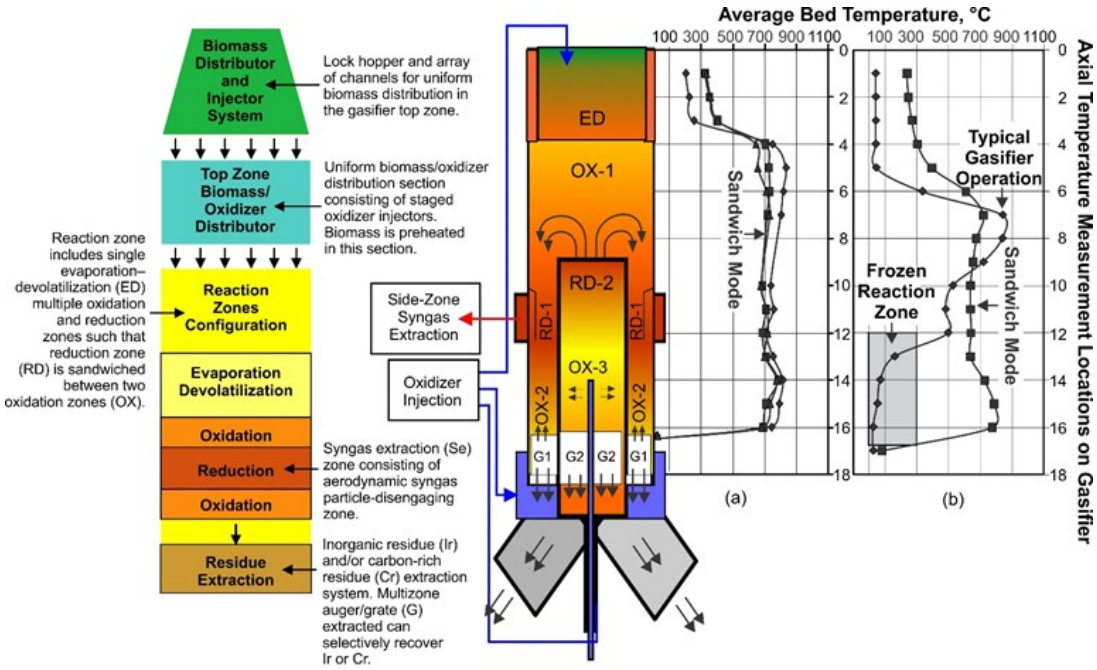


Figure 1. Sandwich gasifier, showing oxidation and reduction zones and the advantage of a uniform axial temperature profile versus the low-conversion “frozen reaction zone” present in typical downdraft gasifiers (oxidation is shown as OX and reduction as RD).

Innovation and Impacts

Current State of the Art – Gasification Processes

For processing residues such as wet manure, competitors of the Sandwich gasifier take two forms: biological methods, such as composting facilities and waste digesters that currently use manure to generate methane as a direct-use fuel or for electricity generation, and thermal methods, such as gasifiers that convert manure to a synthesis gas fuel.[1] Composting facilities and digesters are commercially available and familiar; however, each has significant challenges. Digesters are biological systems that can be negatively impacted by environmental conditions such as cold weather. Additionally, they achieve relatively poor conversion efficiencies compared to gasification, and the waste biosolids generated from digesters add to their overall cost and life cycle impacts.[2] Composting and land application are simple processes, but face limitations to their widespread use due to excessive nutrient runoff and negative impacts on water quality. In the Mid-Atlantic region, such water quality issues have resulted in prohibiting land application of animal waste. Gasifiers represent an emerging technology for power generation from manure that—when compared to biological methods—more quickly treat waste; are more compact; reduce odors, biological oxygen demand, remove pharmaceutical compounds; and eliminate sludge.[3] Several companies claim to market gasifiers that process manure for energy production, such as Ecoremedy® for heat and steam generation[4]; Mavitec Green Energy, which advertises a gasifier to produce steam, electricity, hot water, or hot air but appears to currently demonstrate only heating and drying applications[5]; and BGP International, which also claims heat, steam, or electricity generation but does not disclose any commercial application on its website.[6] As explained earlier, the advanced-design Sandwich gasifier confers performance advantages in manure-to-power applications when compared with other gasifier designs.

A schematic of the Sandwich gasifier and two variations of typical downdraft gasifiers depicting the location of reaction zones with respect to the fuel feed (from the top) and syngas discharge (from the bottom) are illustrated in Figure 2. These gasifiers—Imbert, stratified downdraft gasifier, and Sandwich gasifier – are differentiated based on the distinct temperature profiles achieved as a result of their respective design and operating features. In all three, the pyrolysis zone is located upstream of the oxidation zone, and the reduction zone is located downstream of the oxidation zone. The devolatilized products leaving the pyrolysis zone pass through a high-temperature zone

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[1] eXtension. Treatment Technologies for Livestock and Poultry Manure, 2015. http://articles.extension.org/pages/8855/treatment-technologies-for-livestock-and-poultry-manure (accessed June 2018).

[2] Gonzaga, J.A.; Biona, J.B.M.M. Application of Energy Return on Investment (EROI) Analysis to Biogas Production. Presented at the DLSU Research Congress, De La Salle University, Manila, Philippines, Mar. 6–8, 2014.

[3] Cantrell, K.; Ro, K.; Mahajan, D.; Anjom, M.; Hunt, P.G. Role of Thermochemical Conversion in Livestock Waste-to-Energy Treatments: Obstacles and Opportunities. *Ind. Eng. Chem. Res*. **2007**, *46*, 8918–8927.

[4] Ecoremedy, LLC. Agricultural Waste to Energy, Biochar, and Nutrients, 2017. http://ecoremedyllc.com/agricultural-waste-to-energy-biochar-and-nutrients/ (accessed June 2018).

[5] Mavitec Green Energy. Gasification. www.mavitecgreenenergy.com/gasifications/ (accessed June 2018).

[6] BGP International. About BGP International. www.bgpint.com/about.1/ (accessed June 2018).

formed by the partial oxidation of devolatilized products and char. The products of combustion and unconverted devolatilized hydrocarbons leaving the oxidation zone react with unconverted char in the reduction zone located downstream of the oxidation zone.

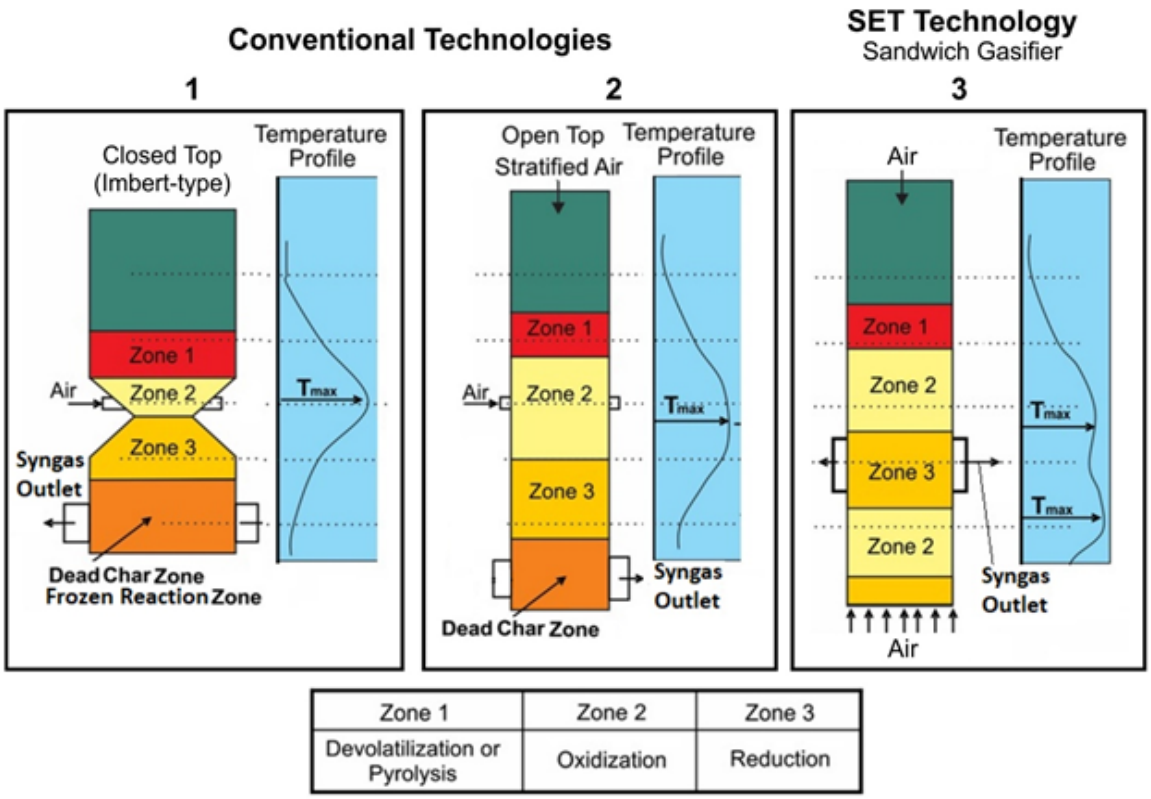


Figure 2. Schematic of downdraft gasifier: 1) Imbert-type, 2) classical stratified, and 3) Sandwich gasifier.

The Imbert downdraft gasifier (Figure 2) has a characteristic constriction near the oxidation zone which limits particle size and fuel ash content. High-ash feedstock, such as railroad ties, tested by the EERC in a commercially purchased downdraft gasifier of this type, failed in operation due to clinker formation near the constriction[7]. This constriction provides the oxidation zone stability and prevents movement. This is a World War II-era technology that was commonly used for powering automobiles during that time. It was therefore designed to utilize quality dry wood, which was affordable at the time. The stratified downdraft has no constriction; however, zone stability is established by maintaining specific oxidizer (air) and fuel throughput. The single oxidation zone achieves a narrow peak temperature, resulting in smaller but similar challenges with high-ash feedstock as was demonstrated in the Imbert-type gasifier.

Competitive Advantage of Sandwich Gasifier

As shown in Figure 2, the conventional downdraft gasifiers are unable to maintain adequate heat transfer to the reduction zone, particularly if the moisture content of the feedstock increases. This

causes the temperatures in conventional systems to diminish and waste conversion ceases. In contrast, the reduction zone temperature in the Sandwich gasifier is maintained by heat transfer from the additional oxidation zone located after the reduction zone and before the residue extraction zone. This configuration promotes complete waste conversion, produces clean syngas with an improved composition, and tolerates variations in moisture and energy content of the waste feedstocks, including nonreactive or poorly-reactive feedstocks that can be problematic in conventional gasifiers.

Air, oxygen-enriched air, pure oxygen, or steam mixed with air or oxygen are potential oxidizers that can be used in all downdraft gasifiers to achieve self-sustained gasification. However, if the exothermic heat profile is not achieved because of insufficient exothermic oxidation, possibly due to high moisture or a high fraction of inert material in the fuel, the reduction zone temperature can drop, reducing the carbon conversion rate and adversely impacting syngas composition and flow rate. The additional oxidation zone in the Sandwich gasifier depicted in Figure 5, and the direct heat transfer from both the top and bottom of the reduction zone augments the reduction zone temperature, thus improving syngas composition, flow rate, carbon conversion, and overall efficiency of the gasifier.

In a Sandwich gasifier, as shown in Figure 2, with solids moving from top to bottom, the characteristic second oxidation zone located near the bottom converts energy-dense dry solids (char) into additional heat for the reduction zone. This is the reason the sandwiched reduction zone achieves higher temperature and is less prone to variations in feed moisture that cause conversion challenges in conventional gasifiers. Figure 3 is a comparison of published heating value and tar concentration data from clean, low-ash wood in a conventional downdraft gasifier vs. results from a more difficult manure gasification test in a Sandwich gasifier. These graphs show that a much-higher-heating-value syngas was produced with low tar concentration (sampled prior to performing any tar scrubbing unit operations), compared to the conventional downdraft gasifier concentrations after their syngas had been processed through a scrubber system. The tar concentrations observed in the Sandwich gasifier were not as severely impacted by the higher moisture in the manure feedstock.

Sandwich Gasifier as GHG Emission Mitigation Technology

The main greenhouse gases which absorb heat and contribute to climate change and are methane (CH_4), nitrous oxide (N_2O) and carbon dioxide (CO_2). Biomass CO_2 emissions are considered climate-neutral, so the gasification of any compostable biomass (which might otherwise have released CH_4) into syngas or liquid fuels which release CO_2 would accomplish net reductions in greenhouse gases.

The high nitrogen (N), phosphorous (P), and potassium (K) contents of poultry litter make it desirable for fertilizer as the production of these nutrients is energy-intensive and consumes considerable resources. However, the traditional disposal pathway of direct land application of

poultry litter has large environmental footprint due to issues such as eutrophication, spreading of pathogens, antibiotic residue accumulation, and greenhouse gas (GHG) emissions among others.

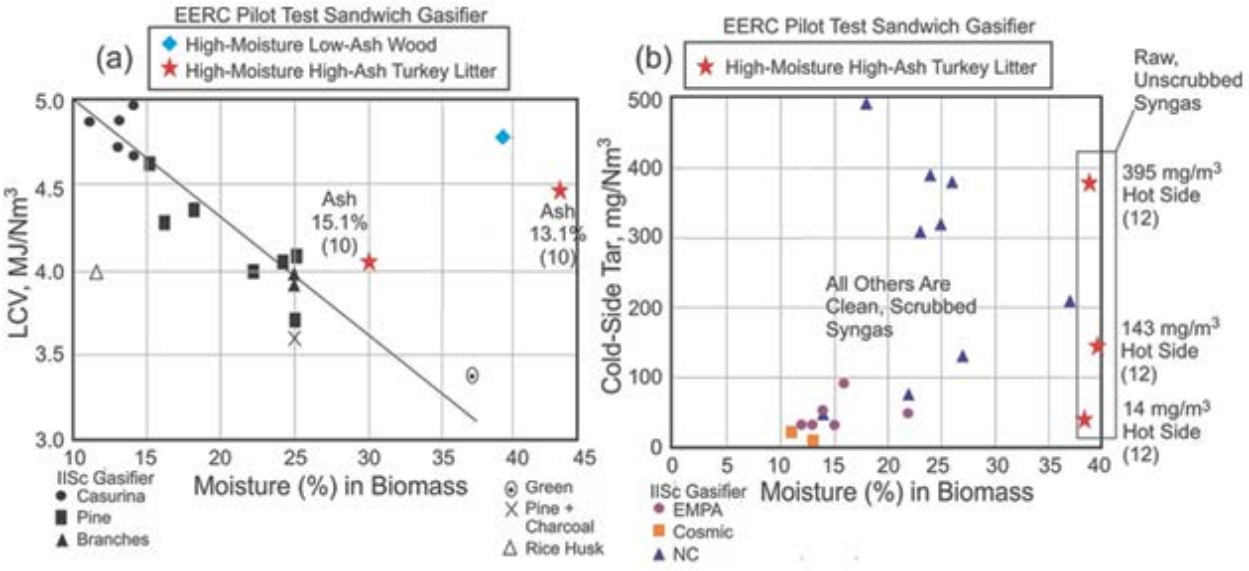


Figure 3. Comparison of Sandwich gasifier syngas heating value (a) and sampled outlet tar concentrations (b) to other commercially available downdraft gasifiers (figure modified from the Indian Institute of Science [IISc] LCV [lower caloric value]; EMPA, cosmic, and NC are other gasifier companies.)[7,8,9,10,11]

Production of N_2O during manure storage and treatment requires nitrification-denitrification of ammonia nitrogen that forms or is present in the wastes. For N_2O to be produced, it must be in an aerobic system where ammonia is converted to nitrites (nitrification). If these nitrites enter an anaerobic decomposition period (become saturated or deeply buried), they can be converted to N_2O (denitrification). This occurs in dry manure management systems which will initially provide aerobic conditions that can be followed by saturation to create the anaerobic conditions necessary

[7] Patel, N.M. *Advances in Gasification for DH Production: Year 3 – Activity 1.6 –Development of a National Center for Hydrogen Technology®*; Topical Report for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No.DE-FC26-05NT42465; Energy & Environmental Research Center: Grand Forks, ND, May 2011.

[8] Patel, N.M. *Pilot-Scale Demonstration of Heat and Power Production from High-Moisture Biomass*; Final Report U.S. Army Construction Engineering Research Laboratories (CERL) under Cooperative Agreement W9132T-08-2-0014, Phase III, Task 2.3 Development of Modular Systems for Distributed Fuels and Energy, Jan 2012.

[9] Uniqueness of IISc Biomass Gasification Technology. http://cgpl.iisc.ac.in/site/Portals/0/Main%20Page/UniquenessOfIIScGasificationTechnology.pdf (accessed May 10, 2019).

[10] Dasappa1, S.; Paul, P.J.; Mukunda, H.S.; Rajan, N.K.S.; Sridhar, G.; Sridhar, H.V. Biomass gasification technology – a route to meet energy needs, Special Section: Application of S&T to Rural Areas Current Science, vol. 87, no. 7, 10 Oct. 2004.

[11] Zygarlicke, C.J.; Hurley, J.P.; Aulich, T.R.; Folkedahl, B.C.; Strege, J.R.; Patel, N.M.; Swanson, M.L.; Martin, C.L.; Olson, E.S.; Oster, B.G.; Stanislowski, J.J.; Nyberg, C.M.; Wocken, C.A.; Pansegrau, P.D. *EERC Center for Biomass Utilization® 2008–2010: Phases I–III*; Final Technical Report for U.S. Department of Energy Cooperative Agreement No. DE-FG36-08GO88054; EERC Publication 2015-EERC-08-02; Energy & Environmental Research Center: Grand Forks, ND, Aug 2015.

for N_2O production and emissions to occur. The amounts of N_2O released will depend on the duration of exposure to aerobic and anaerobic conditions in the system used, whether wet-dry cycling occurs, and how long each aerobic/anaerobic encounters last. In the case of a Sandwich gasifier, the manure can be converted without requiring an extended period of storage thus preventing uncontrolled and undesired decomposition of organic matter. Both CH_4 and N_2O releases to the environment can be significantly reduced or prevented using a Sandwich gasifier. The temperature-controlled conversion of manure into clean syngas and high-efficiency removal of ammonia in the wet scrubber prevents nitrogen emission. The captured ammonia is converted as sellable liquid fertilizer such as ammonium sulfate in an integrated process. Other valuable inorganics such as phosphorous and potassium can also be reacquired from the process for their reuse as recovered fertilizer. The clean syngas is devoid of any sulfur and other trace gases after the syngas is passed through the sorbent beds. When the syngas is used in an internal combustion engine generator, the NOx is reduced by an order of magnitude as compared to when fed with hydrocarbon fuels. This extends the duration of catalytic NOx converters used to treat the engine exhaust. Since the syngas engine exhaust is relatively clean, there is an opportunity to utilize low-cost CO_2 capture technology. The small-scale CO_2 production can support its local use. Thus, the process can become a sink for GHG emissions.

For a comparative understanding of GHG emissions from the Sandwich gasifier with competing processes utilizing manure, a side-by-side comparison of their GHG emissions is provided in Figure 4. Table 1 provides the calculated emission numbers based on previously observed test data and manure composition used in the Sandwich gasifier. As shown in Table 1, the net CO_2 emission is negative (-) 786 kg/ton of manure processed using gasification. The dry matter (DM) including combustible organics and inorganics or ash is 0.735. Since the data for the competing methods reported in reference 12 considered manure with a DM of 0.6, the Sandwich gasifier emission data was recalculated for a DM value of 0.6 for presentation in the plot.

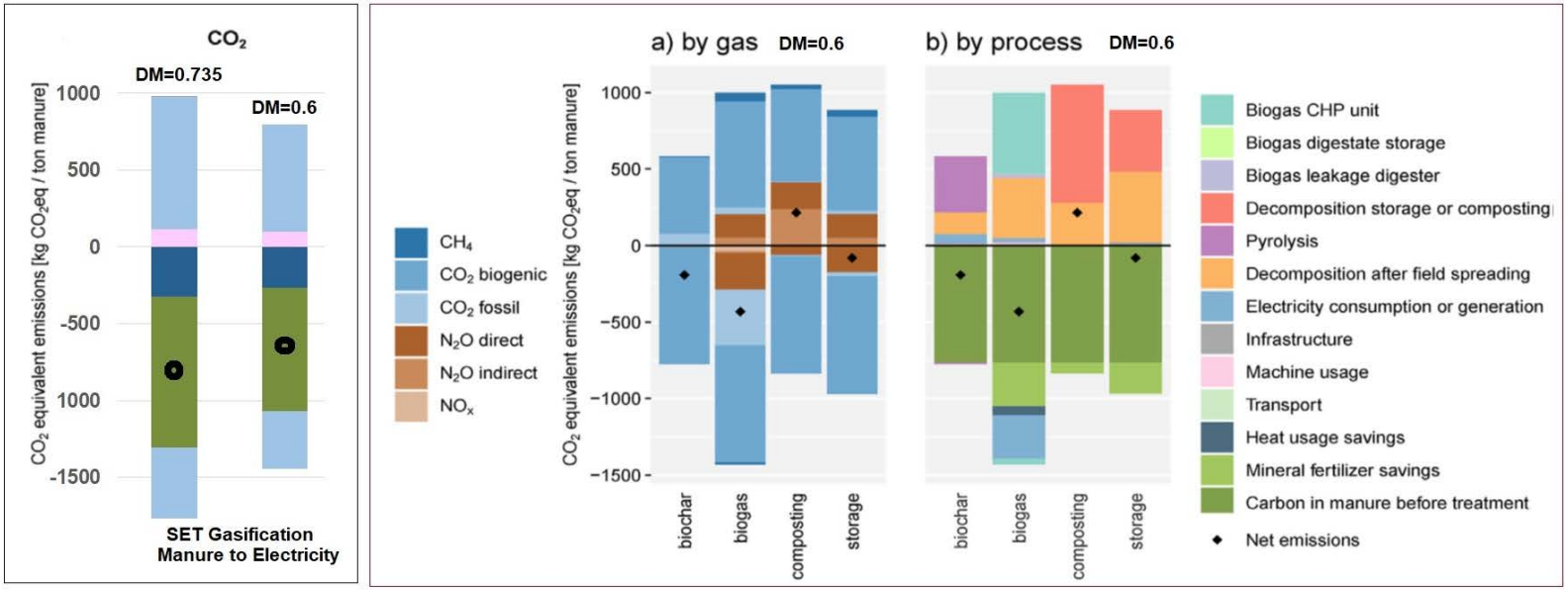
The main assumptions in the SET gasifier emission data calculations are.

1. The category “Carbon in Manure before Gasification” accounts for the organic carbon bound in the manure, which has previously been removed from the atmosphere through plant photosynthesis as in reference 12.
2. The nitrogen in the manure is converted to NH_3 and is removed in the high-efficiency wet scrubber. Therefore, the contribution of the fuel N_2O is neglected in the calculation. The data however includes thermal NOx equivalent CO_2 is included in the data based on previous engine generator NOx emission.
3. The emission from the closed manure storage bin is diverted to the wet scrubber and is fully captured. The holding period is short and therefore fugitive N emission is negligibly small.
4. The net electricity produced offsets the CO_2 equivalent and is considered to have a negative contribution.

5. The low-grade heat is used in the farm which offsets the use of propane and thus equivalent CO_2 emission reductions are accounted.
6. The emission offset accomplished due to the recovered fertilizer is not considered for lack of data. However, the effect on emissions would be negative and contribute to the GHG sink.
7. The embedded energy in steel usage in the 25 tons/day system is estimated to be 2.66 kWe for stainless steel usage of 50 tons. The CO_2e is estimated to be 2 kg/ton of manure.
8. The composition of the manure in reference 12 is similar at an equivalent DM.
9. The CH_4 emission is not considered since organic matter decomposition is prevented by the Sandwich gasification process.
10. Pre-combustion and/or post-combustion CO_2 capture are plausible options using Sandwich gasifiers and CO_2e would be greatly reduced by the implementation of CO_2 capture technology.

Table 1: GHG Emissions from SET Gasification Process

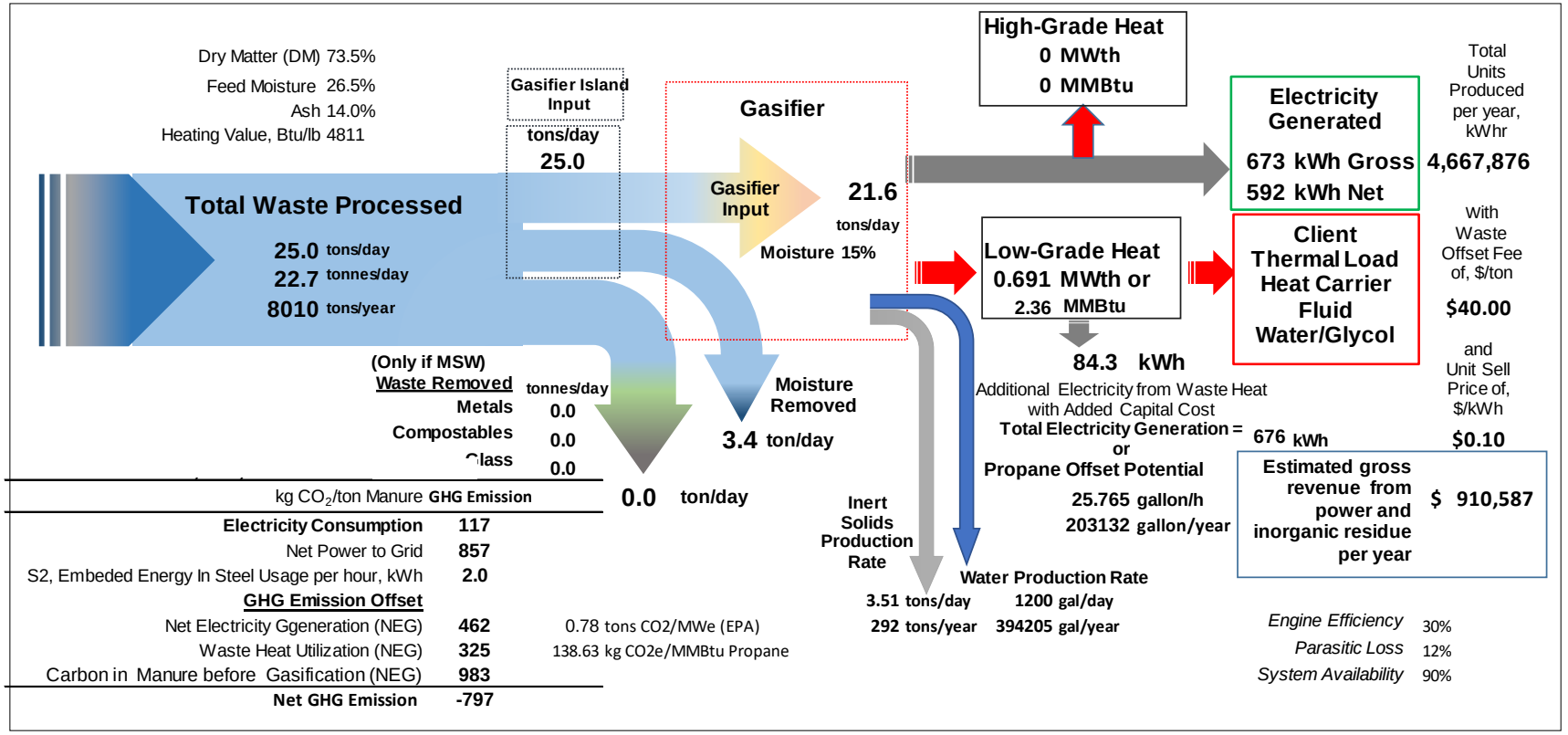
kg CO_2/ton Manure	**GHG Emission**	
Electricity Consumption	**117**	
Net Power to Grid	**857**	
S2, Embeded Energy In Steel Usage per hour, kWh	**2.0**	
Thermal Nox -engine exhaust with catalytic convertor	**8.8**	
GHG Emission Offset		
Net Electricity Ggeneration (NEG)	**462**	0.78 tons CO2/MWe (EPA)
Waste Heat Utilization (NEG)	**325**	138.63 kg CO2e/MMBtu Propane
Carbon in Manure before Gasification (NEG)	**983**	
Net GHG Emission	**-786**	



12. Kreidenweis, U,; Breier, J.; Herrmann, C,; Libra J,; Prochnow, A. *Greenhouse gas emissions from broiler manure treatment options are lowest in well-managed biogas production*, Journal of Cleaner Production 280. p. 124969, 2021.

Figure 4: Emissions for the SET poultry manure gasification process and the four competing treatment options differentiated according to the process causing the emissions provided Kreidenweis et. al.

Sankey Chart Showing
Various Throughputs of a 25 tons/day Turkey Manure to Electricity and Heat Convertor



Unconverted Carbon (Char)	0.92%
% Carbon in Residue	1.90%
% Carbon as per Analysis,	1.89%

Mineral Fertilizer kg/h	132.7		
K	27.8	Total Nitrogen, kg/h	33.2
P	30.7	NH3 (Max) kg/h	40.3614
Mg	12.1	(NH4)2SO4, kg/h	156.578
Ca	49.0	K2SO4, kg/h	61.9849

2NH3 + H2SO4 = (NH4)2SO4
2K + H2SO4 = K2SO4 + H2

Approximate weight of steel used in the system =	50	tonnes
S2, Embeded Energy In Steel Usage per hour =	2.66	kWh
(DOE requirement of EORI is 5) EROI (Q/(S1+S2) =	8.068	
S1 = 673 EROI (Q1/(S1+S2) =	9.078	
GHG - gCO2 e /kWh Gross =	1508	g/kWe
GHG - gCO2 e/kWh Net =	1714	g/kWe
GHG - gCO2 e /kWh Gross MAX =	1340	g/kWe
GHG - gCO2 e/kWh Net MAX =	1500	g/kWe

Energy Return on Investment (EROI)

The EROI value exceeds DOE's requirements of a minimum value of 5. The scalable feature of the system allows the sizing of the Sandwich gasification technology such that it can be located at the feedstock source requiring zero to near-zero transportation cost. This is a big advantage over larger systems where biomass transportation costs negatively impact project economics. The system is capable of converting waste on an "as-received" basis, without requiring feed densification. Also. the ability of the system to tolerate moisture variation besides heat integration capability minimizes completely any energy-intensive feed preparation. The embodied energy cost for the system (S2) therefore, is minimal for the system and is assumed to be restricted only to the energy expenditure considered for the stainless steel (or steel) used in the technology. For the scaled 25-tpd Sandwich gasifier, S2, is conservatively estimated to be 2.66 kWh. (see Table 2) This value was derived by using embedded energy values for steel extracted from Argonne National Lab's GREET model, an estimate of 50 tonnes of steel in a commercial gasification system, and the calculation methodology described by the University of Michigan[13] The electricity consumption in the process is estimated to be less than 12% of the gross electricity production. These preliminary EROI values based on high-level information are already greater than 5, with values ranging from 8.1 to 9.1 (See Table 3)

Table: 2: Embedded Energy in Steel Usage in 25 TPD system

S2, Embedded Energy In Steel Usage per hour, kWh	**2.66**
Embeded Energy in Stainless Steel Used in the Commercial System	
Approximate Weight of Steel Used in the System, tonnes	50
*Energy Consumption in New Stainless Steel, MJ/tonne	35309
*Energy Consumption in Stainless Steel Conversion, MJ/tonne	30187
Total Energy Consumption, MJ/tones	65496
Energy Offset End Life Recovery (Same as New Steel), MJ/tonnes	35309
Net Consumption of Energy in Steel, MJ/tonnes	30187
Total Embeded Energy in the Steel of the Commercial System, MJ	**1509350**
Total Duration of System Operation	
Useful Life of the System, years	20
Operation per Year (Availability), %	90%
Total Duration of Operation, h	157680

Table 3: Energy Return on Investment for 25-TPD high- moisture and high-ash feedstock (manure) conversion System

Energy Return On Investment (EROI)	
Q Gross Electricity Output, kWh e	672.8
Q1 Gross Electricity from Waste heat	757.1
S1 conversion energy input into the process, kWh e	80.74
S2, Embodied Energy, KWh e	2.66
EROI (Q/(S1+S2) =	**8.1**
EROI (Q1/(S1+S2) =	**9.1**

Definitions

(e.g., less than or equal to five dry tons of feedstock/day). Applicants must develop technologies that reduce the levelized cost of energy (LCOE) by at least 25% and provide a justified benchmark for the state-of-the-art as part of their application.

Helpful Equations:
LCOE:

$$LCOE = \frac{Total\ Life\ Cycle\ Costs}{\sum_{t=1}^{N} \frac{System\ Energy\ Output}{(1+i)^t}} = \frac{\sum_{t=1}^{N} \frac{After\ Tax\ Cash\ Flow}{(1+i)^t}}{\sum_{t=1}^{N} \frac{System\ Energy\ Output}{(1+i)^t}} = \frac{\$}{kWh\ \ or\ MMBtu}$$

In addition, by the end of the project, technologies must be capable of exceeding an Energy Return on Investment (EROI) of 5.

EROI:

$$EROI = \frac{Energy\ Output}{Energy\ Input} = \frac{Q}{S_1 + S_2}$$

Where:
Q = rate of energy output (kWh/analysis period) for the entire energy production system
S_1 = the conversion energy input into the process (kWh/analysis period)
S_2 = is the embodied energy in the various items the energy production system uses (kWh/analysis period)
i = the discount rate
t = the year
N = the system lifetime in years

Appendix F – Detailed Budget

Instructions and Summary

OMB Control Number: 1910-5162
Expiration Date: 04/30/2025

Award Number:
Award Recipient: Singularity Energy Technologies

Date of Submission: 1-Aug-24
Form submitted by: Singularity Energy Technologies
(May be award recipient or sub-recipient)

Please read the instructions on each worksheet tab before starting. If you have any questions, please ask your EERE contact!
Do not modify this template or any cells or formulas!

1. If using this form for award application, negotiation, or budget revision, fill out the blank white cells in workbook tabs a. through j. with total project costs.
2. Blue colored cells contain instructions, headers, or summary calculations and should not be modified. Only blank white cells should be populated.
3. Enter detailed support for the project costs identified for each Category line item within each worksheet tab to autopopulate the summary tab.
4. The total budget presented on tabs a. through i. must include both Federal (DOE) and Non-Federal (cost share) portions.
5. All costs incurred by the preparer's sub-recipients, contractors, and Federal Research and Development Centers (FFRDCs), should be entered only in section f. Contractual. All other sections are for the costs of the preparer only.
6. Ensure all entered costs are allowable, allocable, and reasonable in accordance with the administrative requirements prescribed in 2 CFR 200, and the applicable cost principles for each entity type: FAR Part 31 for For-Profit entities; and 2 CFR Part 200 Subpart E - Cost Principles for all other non-federal entities.
7. Add rows as needed throughout tabs a. through j. If rows are added, formulas/calculations may need to be adjusted by the preparer. Do not add rows to the Instructions and Summary tab. If your project contains more than three budget periods, consult your EERE contact before adding additional budget period rows or columns.
8. ALL budget period cost categories are rounded to the nearest dollar.

BURDEN DISCLOSURE STATEMENT

Public reporting burden for this collection of information is estimated to average 24 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Office of Information Resources Management Policy, Plans, and Oversight, AD-241-2 - GTN, Paperwork Reduction Project (1910-5162), U.S. Department of Energy 1000 Independence Avenue, S.W., Washington, DC 20585; and to the Office of Management and Budget, Paperwork Reduction Project (1910-5162), Washington, DC 20503.

SUMMARY OF BUDGET CATEGORY COSTS PROPOSED

The values in this summary table are from entries made in subsequent tabs, only blank white cells require data entry

Section A - Budget Summary

	Federal	Cost Share	Total Costs	Cost Share %	Proposed Budget Period Dates
Budget Period 1	$313,000	$321,000	$634,000	50.63%	1/01/2025-12/31/2025
Budget Period 2	$173,950	$171,000	$344,950	49.57%	01/01/2026-12/31/2026
Budget Period 3	$0	$0	$0	0.00%	
Total	$486,950	$492,000	$978,950	50.26%	

Section B - Budget Categories

CATEGORY	Budget Period 1	Budget Period 2	Budget Period 3	Total Costs	% of Project	**Comments** (as needed)
a. Personnel	$308,000	$216,650	$0	$524,650	53.59%	
b. Fringe Benefits	$0	$0	$0	$0	0.00%	
c. Travel	$0	$0	$0	$0	0.00%	
d. Equipment	$220,000	$0	$0	$220,000	22.47%	
e. Supplies	$42,500	$24,250	$0	$66,750	6.82%	
f. Contractual						
Sub-recipient	$0	$0	$0	$0	0.00%	
Contractor	$27,500	$22,500	$0	$50,000	5.11%	
FFRDC	$0	$0	$0	$0	0.00%	
Total Contractual	$27,500	$22,500	$0	$50,000	5.11%	
g. Construction	$0	$0	$0	$0	0.00%	
h. Other Direct Costs	$36,000	$81,550	$0	$117,550	12.01%	
Total Direct Costs	$634,000	$344,950	$0	$978,950	100.00%	
i. Indirect Charges	$0	$0	$0	$0	0.00%	
Total Costs	$634,000	$344,950	$0	$978,950	100.00%	

Additional Explanation (as needed):

a. Personnel

INSTRUCTIONS - PLEASE READ!!!

1. List project costs solely for employees of the entity completing this form. All personnel costs for subrecipients and contractors must be included under f. Contractual.
2. All personnel should be identified by position title and not employee name. Enter the amount of time (e.g., hours or % of time) and the base hourly rate and the total direct personnel compensation will automatically calculate. Rate basis (e.g., rate negotiated for each hour worked on the project, labor distribution report, state civil service rates, etc.) must also be identified.
3. If loaded labor rates are utilized, a description of the costs the loaded rate is comprised of must be included in the Additional Explanation section below. DOE must review all components of the loaded labor rate for reasonableness and unallowable costs (e.g. fee or profit).
4. If a position and hours are attributed to multiple employees (e.g. Technician working 4000 hours) the number of employees for that position title must be identified.
5. Each budget period is rounded to the nearest dollar.

SOPO Task #	Position Title	Budget Period 1			Budget Period 2			Budget Period 3			Project Total Hours	Project Total Dollars	Rate Basis
		Time (Hrs)	Hourly Rate ($/Hr)	Total Budget Period 1	Time (Hrs)	Hourly Rate ($/Hr)	Total Budget Period 2	Time (Hrs)	Hourly Rate ($/Hr)	Total Budget Period 3			
1	Sr. Engineer **(EXAMPLE!!!)**	2000	$85.00	$170,000	200	$50.00	$10,000	200	$50.00	$10,000	2400	$190,000	
2	Technicians (2)	4000	$20.00	$80,000	0	$0.00	$0	0	$0.00	$0	4000	$80,000	
				$0			$0			$0	0	$0	
1	Patel	80	$200.00	$16,000			$0			$0	80	$16,000	Standard conuslting rate
	Engineer	0	$57.50	$0			$0			$0	0	$0	Standard conuslting rate
	Technicians/Operators	120	$50.00	$6,000			$0			$0	120	$6,000	Standard conuslting rate
				$0			$0			$0	0	$0	
2	Patel	160	$200.00	$32,000			$0			$0	160	$32,000	Standard conuslting rate
	Engineer	600	$57.50	$34,500			$0			$0	600	$34,500	Standard conuslting rate
	Technicians/Operators	600	$50.00	$30,000			$0			$0	600	$30,000	Standard conuslting rate
				$0			$0			$0	0	$0	
3	Patel	160	$200.00	$32,000	80	$200.00	$16,000			$0	240	$48,000	Standard conuslting rate
	Engineer	1000	$57.50	$57,500	400	$57.50	$23,000			$0	1400	$80,500	Standard conuslting rate
	Technicians/Operators	2000	$50.00	$100,000	800	$50.00	$40,000			$0	2800	$140,000	Standard conuslting rate
				$0			$0			$0	0	$0	
4	Patel			$0	160	$200.00	$32,000			$0	160	$32,000	Standard conuslting rate
	Engineer			$0	500	$57.50	$28,750			$0	500	$28,750	Standard conuslting rate
	Technicians/Operators			$0	1000	$50.00	$50,000			$0	1000	$50,000	Standard conuslting rate
				$0			$0			$0	0	$0	
5	Patel			$0	100	$200.00	$20,000			$0	100	$20,000	Standard conuslting rate
	Engineer			$0	120	$57.50	$6,900			$0	120	$6,900	Standard conuslting rate
	Technicians/Operators			$0	0	$50.00	$0			$0	0	$0	Standard conuslting rate
				$0			$0			$0	0	$0	
				$0			$0			$0	0	$0	
				$0			$0			$0	0	$0	
				$0			$0			$0	0	$0	
	TOTAL PERSONNEL	**4720**		**$308,000**	**3160**		**$216,650**	**0**		**$0**	**7880**	**$524,650**	

Additional Explanation (as needed): The labor rates include fringe benefits. Personnel used for the project will be a combination of SET and Tri-Steel Manufacturing employees.

b. Fringe Benefits

INSTRUCTIONS - PLEASE READ!!!

1. Fill out the table below by position title. If all employees receive the same fringe benefits, you can show "Total Personnel" in the Labor Type column instead of listing out all position titles.
2. The rates and how they are applied should not be averaged to get one fringe cost percentage. Complex calculations should be described/provided in the Additional Explanation section below.
3. The fringe benefit rates should be applied to all positions, regardless of whether those funds will be supported by Federal Share or Recipient Cost Share.
4. Each budget period is rounded to the nearest dollar.

Labor Type	Budget Period 1			Budget Period 2			Budget Period 3			Total Project
	Personnel Costs	Rate	Total	Personnel Costs	Rate	Total	Personnel Costs	Rate	Total	
EXAMPLE!!! Sr. Engineer	$170,000	20%	$34,000	$10,000	20%	$2,000	$10,000	20%	$2,000	$38,000
			$0			$0			$0	$0
			$0			$0			$0	$0
			$0			$0			$0	$0
			$0			$0			$0	$0
			$0			$0			$0	$0
TOTAL FRINGE	**$0**		**$0**	**$0**		**$0**	**$0**		**$0**	**$0**

A federally approved fringe benefit rate agreement, or a proposed rate supported and agreed upon by DOE for estimating purposes is required at the time of award negotiation if reimbursement for fringe benefits is requested. Please check (X) one of the options below and provide the requested information if not previously submitted.

_____ A fringe benefit rate has been negotiated with, or approved by, a federal government agency. A copy of the latest rate agreement is/was included with the project application.*

___X___ There is not a current federally approved rate agreement negotiated and available.**

*Unless the organization has submitted an indirect rate proposal which encompasses the fringe pool of costs, please provide the organization's benefit package and/or a list of the components/elements that comprise the fringe pool and the cost or percentage of each component/element allocated to the labor costs identified in the Budget Justification.

**When this option is checked, the entity preparing this form shall submit an indirect rate proposal in the format provided in the Sample Rate Proposal at https://www.energy.gov/eere/funding/downloads/sample-indirect-rate-proposal-and-profit-compliance-audit, or a format that provides the same level of information and which will support the rates being proposed for use in the performance of the proposed project.

Additional Explanation (as necessary): Please use this box (or an attachment) to list the elements that comprise your fringe benefits and how they are applied to your base (e.g. Personnel) to arrive at your fringe benefit rate. SET does not have an approved fringe benefit rate. Fringe benefits are therefore not included as a cost item.

c. Travel

INSTRUCTIONS - PLEASE READ!!!

1. Identify Foreign and Domestic Travel as separate items. Examples of Purpose of Travel are subrecipient site visits, DOE meetings, project mgmt. meetings, etc. Examples of Basis for Estimating Costs are past trips, travel quotes, GSA rates, etc.
2. All listed travel must be necessary for performance of the Statement of Project Objectives.
3. Only travel that is directly associated with this award should be included as a direct travel cost to the award.
4. Federal travel regulations are contained within the applicable cost principles for all entity types.
5. Travel costs should remain consistent with travel costs incurred by an organization during normal business operations as a result of the organizations written travel policy. In absence of a written travel policy, organizations must follow the regulations prescribed by the General Services Administration.
6. **Columns G, H, I, J, and K are total per trip per traveler.**
7. The number of days is inclusive of day of departure and day of return.
8. Recipients should enter City and State (or City and Country for International travel) in the Depart from and Destination fields.
9. Each budget period is rounded to the nearest dollar.

SOPO Task #	Purpose of Travel	Depart From	Destination	No. of Days	No. of Travelers	Lodging per Traveler	Flight per Traveler	Vehicle per Traveler	Per Diem Per Traveler	Cost per Trip	Basis for Estimating Costs
	Domestic Travel	**Budget Period 1**									
1	**EXAMPLE!!!** Visit to PV manufacturer			2	2	$250	$500	$100	$80	$1,860	Current GSA rates
										$0	
										$0	
										$0	
										$0	
	International Travel										
										$0	
	Budget Period 1 Total									**$0**	
	Domestic Travel	**Budget Period 2**									
										$0	
										$0	
										$0	
										$0	
	International Travel										
										$0	
	Budget Period 2 Total									**$0**	
	Domestic Travel	**Budget Period 3**									
										$0	
										$0	
										$0	
										$0	
	International Travel										
										$0	
	Budget Period 3 Total									**$0**	
	TOTAL TRAVEL									**$0**	

Additional Explanation (as needed): The gasification component of this work is an important piece to the overall success of the project. It is unique from the other components and would require personnel from SET to fully discuss the applicaiton of the gasification component to windmill blades and to answer any substantive questions regarding the technology

d. Equipment

INSTRUCTIONS - PLEASE READ!!!

1. Equipment means tangible personal property (including information technology systems) having a useful life of more than one year and a per-unit acquisition cost which equals or exceeds the lesser of the capitalization level established by the non-Federal entity for financial statement purposes, or $5,000. Please refer to the applicable Federal regulations in 2 CFR 200 for specific equipment definitions and treatment.

2. List all equipment below, providing a basis of cost (e.g. contractor quotes, catalog prices, prior invoices, etc.). Briefly justify items as they apply to the Statement of Project Objectives. If it is existing equipment, provide logical support for the estimated value shown.

3. During award negotiations, provide a contractor quote for all equipment items over $50,000 in price. If the contractor quote is not an exact price match, provide an explanation in the additional explanation section below. If a contractor quote is not practical, such as for a piece of equipment that is purpose-built, first of its kind, or otherwise not available off the shelf, provide a detailed engineering estimate for how the cost estimate was derived.

4. Each budget period is rounded to the nearest dollar.

SOPO Task #	Equipment Item	Qty	Unit Cost	Total Cost	Basis of Cost	Justification of need
Budget Period 1						
3,4,5	**EXAMPLE!!!** Thermal shock chamber	2	$70,000	$140,000	Contractor Quote - Attached	Reliability testing of PV modules- Task 4.3
2	Compressor and tank	1	$50,000	$50,000		Compressed gas storage during system operation
2	Shift reactor and catalyst	1	$65,000	$65,000		
2	CO2 system and solvent	1	$60,000	$60,000		
2	Heat exchangers	3	$5,000	$15,000		
2	Pumps	4	$2,500	$10,000		
2	Misc parts and shipping	1	$20,000	$20,000		
	Budget Period 1 Total			$220,000		
Budget Period 2						
				$0		
				$0		
				$0		
				$0		
				$0		
				$0		
	Budget Period 2 Total			$0		
Budget Period 3						
				$0		
				$0		
				$0		
				$0		
				$0		
				$0		
	Budget Period 3 Total			$0		
	TOTAL EQUIPMENT			**$220,000**		

Additional Explanation (as needed):

e. Supplies

INSTRUCTIONS - PLEASE READ!!!

1. Supplies are generally defined as an item with an acquisition cost of $5,000 or less and a useful life expectancy of less than one year. Supplies are generally consumed during the project performance. Please refer to the applicable Federal regulations in 2 CFR 200 for specific supplies definitions and treatment. A computing device is a supply if the acquisition cost is less than the lesser of the capitalization level established by the non-Federal entity for financial statement purposes or $5,000, regardless of the length of its useful life.

2. List all proposed supplies below, providing a basis of costs (e.g. contractor quotes, catalog prices, prior invoices, etc.). Briefly justify the need for the Supplies as they apply to the Statement of Project Objectives. Note that Supply items must be direct costs to the project at this budget category, and not duplicative of supply costs included in the indirect pool that is the basis of the indirect rate applied for this project.

3. Multiple supply items valued at $5,000 or less used to assemble an equipment item with a value greater than $5,000 with a useful life of more than one year should be included on the equipment tab. If supply items and costs are ambiguous in nature, contact your DOE representative for proper categorization.

4. Add rows as needed. If rows are added, formulas/calculations may need to be adjusted by the preparer.

5. Each budget period is rounded to the nearest dollar.

SOPO Task #	General Category of Supplies	Qty	Unit Cost	Total Cost	Basis of Cost	Justification of need
Budget Period 1						
4,6	**EXAMPLE!!!** Wireless DAS components	10	$360.00	$3,600	Catalog price	For Alpha prototype - Task 2.4
				$0		
3	Feedstock procurement and transport	1	$2,500.00	$2,500	Past experience and verbal quotes	Provides the required feedstock for testing as proposed
2,3	Piping, fittings, electrical, misc supplies to prepare site and to make modifications to the 5 TPD system	1	$14,000.00	$14,000	Past experience, catalog prices	Modificaitons are required to the current 5 TPD system to allow the addition and installation of the various gas cleeanup systems including rerouting piping, electrical and controls
2,3	Piping, tubing, fittings, electrical, insulation, heat tape, misc supplies to install syngas balance equipment and gas analyzers	1	$20,000.00	$20,000	Past experience, catalog prices	This includes all materials required to install the CO2 solvent system and shift reactor.
3	Hand held gas analyzers	4	$250.00	$1,000	Catalog price	Safety
3	Initial charges of solvents/sorbents/catalysts	1	$5,000.00	$5,000	Estimated based upon current price and quantities required	Provides the initial charge of materials for the syngas cleanup train, shirt reactor, and CO2 removal system.
				$0		
	Budget Period 1 Total			**$42,500**		
Budget Period 2						
4	Feedstock procurement and transport	2	$2,500.00	$5,000	Past experience and verbal quotes	Provides the required feedstock for testing as proposed
3,4	Consumable supplies(glassware, solvents, sorbents, fittings, etc.) and repair/replacement parts	1	$10,000.00	$10,000	Experience / Catalog	Materials consumed during the testing are replaced. It is expected that minor repairs and replacment will be needed.
				$0		
3,4	Calibration and purge gases	4	$750.00	$3,000	Calibration and purge gases	Required for calibrating on-line gas analyzers
3,4	55 gallon drums	10	$250.00	$2,500	Estimate	Intermediate storage of various products and wastes
3,4	Charcoal	1	$2,500.00	$2,500	Estimate	Required for cold startup
3,4	Bottled gases	1	$1,250.00	$1,250	Estimate	Required for purge, calibration, and batch tests
3,4	Rental / Truck Mounted System11	0	$5,000.00	$0		
	Budget Period 2 Total			$24,250		
Budget Period 3						
				$0		
				$0		
				$0		
				$0		
				$0		
				$0		
				$0		
				$0		
	Budget Period 3 Total			$0		
	TOTAL SUPPLIES			**$66,750**		

Additional Explanation (as needed):

f. Contractual

INSTRUCTIONS - PLEASE READ!!!

1. The entity completing this form must provide all costs related to subrecipients, contractors, and FFRDC partners in the applicable boxes below.

2. Subrecipients (partners, sub-awardees): Subrecipients shall submit a Budget Justification describing all project costs and calculations when their total proposed budget exceeds either (1) $250,000 or (2) 25% of total award costs. These subrecipient forms may be completed by either the subrecipients themselves or by the preparer of this form. The budget totals on the subrecipient's forms must match the subrecipient entries below. A subrecipient is a legal entity to which a subaward is made, who has performance measured against whether the objectives of the Federal program are met, is responsible for programmatic decision making, must adhere to applicable Federal program compliance requirements, and uses the Federal funds to carry out a program of the organization. All characteristics may not be present and judgment must be used to determine subrecipient vs. contractor status.

3. Contractors: List all contractors supplying commercial supplies or services used to support the project. For each Contractor cost with total project costs of $250,000 or more, a Contractor quote must be provided. A contractor is a legal entity contracted to provide goods and services within normal business operations, provides similar goods or services to many different purchasers, operates in a competitive environment, provides goods or services that are ancillary to the operation of the Federal program, and is not subject to compliance requirements of the Federal program. All characteristics may not be present and judgment must be used to determine subrecipient vs. contractor status.

4. Federal Funded Research and Development Centers (FFRDCs): FFRDCs must submit a signed Field Work Proposal during award application. The award recipient may allow the FFRDC to provide this information directly to DOE, however project costs must also be provided below.

5. Each budget period is rounded to the nearest dollar.

SOPO Task #	Subrecipient Name/Organization	Subrecipient Unique Entity Identifier (UEI)	Purpose and Basis of Cost	Budget Period 1	Budget Period 2	Budget Period 3	Project Total
2,4	**EXAMPLE!!!** XYZ Corp.		Partner to develop optimal lens for Gen 2 product. Cost estimate based on personnel hours.	$48,000	$32,000	$16,000	**$96,000**
							$0
							$0
							$0
							$0
							$0
							$0
			Sub-total	**$0**	**$0**	**$0**	**$0**

SOPO Task #	Contractor Name/Organization	Purpose and Basis of Cost	Budget Period 1	Budget Period 2	Budget Period 3	Project Total
6	**EXAMPLE!!!** ABC Corp.	Contractor for developing robotics to perform lens inspection. Estimate provided by contractor.	$32,900	$86,500	$0	**$119,400**
1-5	Sage Green LLC	Feedstock procurement, support in developing analytical protocols, analyzing data and report writing	$7,500	$7,500		**$15,000**
1-5	MDM Energy Consulting LLC	Support in developing test plans, interpreting data, and report writing	$10,000	$10,000		**$20,000**
2,3,4	Electrical Contractor	Grid connection, wiring equiment	$10,000	$5,000		**$15,000**
						$0
						$0
		Sub-total	**$27,500**	**$22,500**	**$0**	**$50,000**

SOPO Task #	FFRDC Name/Organization	Purpose and Basis of Cost	Budget Period 1	Budget Period 2	Budget Period 3	Project Total
						$0
						$0
		Sub-total	**$0**	**$0**	**$0**	**$0**

TOTAL CONTRACTUAL	**$27,500**	**$22,500**	**$0**	**$50,000**

Additional Explanation (as needed): SET does not have a dedicated engineering staff. Tri-Steel Manufacturing will provide eningeering support on an as-needed basis at a loaded rate of $80/hr. It is estimated that SET will require 300 hours of engineergin time for Task 1 to support operation of the bench-scale system; 700 hours for Task 2 to for operation of the bench-scale system and to support the shakedown and commissioning of the truck-mounted system; and 1750

g. Construction

PLEASE READ!!!

1. Construction, for the purpose of budgeting, is defined as all types of work done on a particular building, including erecting, altering, or remodeling. Construction conducted by the award recipient is entered on this page. Any construction work that is performed by a contractor or subrecipient should be entered under f. Contractual.

2. List all proposed construction below, providing a basis of cost such as engineering estimates, prior construction, etc., and briefly justify its need as it applies to the Statement of Project Objectives.

3. Each budget period is rounded to the nearest dollar.

Overall description of construction activities: Example Only!!! - Build wind turbine platform

SOPO Task #	General Description	Cost	Basis of Cost	Justification of need
Budget Period 1				
3	EXAMPLE ONLY!!! Three days of excavation for platform site	$28,000	Engineering estimate	Site must be prepared for construction of platform.
	Budget Period 1 Total	**$0**		
Budget Period 2				
	Budget Period 2 Total	$0		
Budget Period 3				
	Budget Period 3 Total	$0		
	TOTAL CONSTRUCTION	**$0**		

Additional Explanation (as needed):

h. Other Direct Costs

INSTRUCTIONS - PLEASE READ!!!

1. Other direct costs are direct cost items required for the project which do not fit clearly into other categories. These direct costs must not be included in the indirect costs (for which the indirect rate is being applied for this project). Examples are: tuition, printing costs, etc. which can be directly charged to the project and are not duplicated in indirect costs (overhead costs).

2. Basis of cost are items such as contractor quotes, prior purchases of similar or like items, published price list, etc.

3. Each budget period is rounded to the nearest dollar.

SOPO Task #	General Description and SOPO Task #	Cost	Basis of Cost	Justification of need
			Budget Period 1	
5	**EXAMPLE!!!** Grad student tuition - tasks 1-3	$16,000	Established UCD costs	Support of graduate students working on project
3	Rental charge for 5 TPD truck-mounted system	$36,000	6 months rent at $6,000/month (30% of the nominal rental rate)	SET will require the use of the truck-mounted system to perform the propsed work. It is estimated that SET will use the system for approximately 30% of its availability, and therefore the rate charged is 30% of the normal rate of $20,000/month.
	Budget Period 1 Total	$36,000		
			Budget Period 2	
3,4	Rental charge for 5 TPD truck-mounted system	$72,000	12 months rent at $6,000/month (30% of the nominal rental rate)	SET will require the use of the truck-mounted system to perform the propsed work. It is estimated that SET will use the system for approximately 30% of its availability, and therefore the rate charged is 30% of the normal rate of $20,000/month.
3,4	Ultimate, proxiimate, ash analysis	$1,000	4 samples at $250	Analysis of feedstock
3,4	Fuel, Tar, and Residual Anlaysis	$1,500	10 samples at $150/sample	Determine concentrations for baseline tests / assist with process optimization
3,4	Certifed Analysis of Process Streams	$2,000	10 samples at $200/sample	Determine concentrations for baseline tests / assist with process optimization / support permitting requirements
3,4	TCLP analysis	$2,000	2 samples at $1000 each	Verify solid wastes are non-hazardous
3,4	RCRA metals analysis	$2,000	2 samples at $1000 each	Verify solid wastes are non-hazardous
3,4	Wastewater analysis	$1,050	3 samples at $350 each	Generate data for wastewater disposal
	Budget Period 2 Total	$81,550		
			Budget Period 3	
	Budget Period 3 Total	$0		
	TOTAL OTHER DIRECT COSTS	**$117,550**		

Additional Explanation (as needed):

i. Indirect Costs

INSTRUCTIONS - PLEASE READ!!!

1. Fill out the table below to indicate how your indirect costs are calculated. Use the box below to provide additional explanation regarding your indirect rate calculation.

2. The rates and how they are applied should not be averaged to get one indirect cost percentage. Complex calculations or rates that do not do not correspond to the below categories should be described/provided in the Additional Explanation section below. If questions exist, consult with your DOE contact before filling out this section.

3. The indirect rate should be applied to both the Federal Share and Recipient Cost Share.

4. NOTE: A Recipient who elects to employ the 10% de minimis Indirect Cost rate **cannot claim resulting costs as a Cost Share contribution, nor can the Recipient claim "unrecovered indirect costs" as a Cost Share contribution.** Neither of these costs can be reflected as actual indirect cost rates realized by the organization, and therefore are not verifiable in the Recipient records as required by Federal Regulation (§200.306(b)(1)).

5. Each budget period is rounded to the nearest dollar.

	Budget Period 1	Budget Period 2	Budget Period 3	Total	Explanation of BASE
Provide ONLY Applicable Rates:					
Overhead Rate	0.00%	0.00%	0.00%		*Example: Labor + Fringe*
General & Administrative (G&A)	0.00%	0.00%	0.00%		*MTDC*
FCCM Rate, if applicable	0.00%	0.00%	0.00%		
OTHER Indirect Rate	0.00%	0.00%	0.00%		
Indirect Costs (As Applicable):					
Overhead Costs				**$0**	
G&A Costs	$0	$0	$0	**$0**	
FCCM Costs, if applicable				**$0**	
OTHER Indirect Costs				**$0**	
Total Indirect Costs Requested:	**$0**	**$0**	**$0**	**$0**	

	BP1	BP2	BP3
Personel	308000	216650	0
Fringe	0	0	0
Travel	0	0	0
Supplies	42500	24250	0
Contract1	7500	7500	0
Contract2	10000	10000	0
Contract3	10000	5000	0
Contract4	0	0	0
SubRecip1	0	0	0
Other	36000	81550	0
MTDC	414000	344950	0

A federally approved indirect rate agreement, or rate proposed (supported and agreed upon by DOE for estimating purposes) is required if reimbursement of indirect costs is requested. Please check (X) one of the options below and provide the requested information if it has not already been provided as requested, or has changed.

_____ An indirect rate has been approved or negotiated with a federal government agency. A copy of the latest rate agreement is included with this application and will be provided electronically to the Contracting Officer for this project.

_____ The organization does not have a current, federally approved indirect cost rate agreement and has provided an indirect rate proposal in support of the proposed costs.

__X____ This organization has elected to apply a 10% de minimis rate in accordance with 2 CFR 200.414(f).

Provide an explanation of how your indirect cost rate was applied.

*Additional Explanation (as needed): *IMPORTANT: Please use this box (or an attachment) to further explain how your total indirect costs were calculated. If the total indirect costs are a cumulative amount of more than one calculation or rate application, the explanation and calculations should identify all rates used, along with the base they were applied to (and how the base was derived), and a total for each (along with grand total).*

Cost Share

PLEASE READ!!!

1. A detailed presentation of the cash or cash value of all cost share proposed must be provided in the table below. All items in the chart below must be identified within the applicable cost category tabs a. through i. in addition to the detailed presentation of the cash or cash value of all cost share proposed provided in the table below. Identify the source organization & amount of each cost share item proposed in the award.

2. Cash Cost Share - encompasses all contributions to the project made by the recipient, subrecipient, or third party (an entity that does not have a role in performing the scope of work) for costs incurred and paid for during the project. This includes when an organization pays for personnel, supplies, equipment, etc. for their own company with organizational resources. If the item or service is reimbursed for, it is cash cost share. All cost share items must be necessary to the performance of the project. **Contractors may not provide cost share.** Any partial donation of goods or services is considered a discount and is not allowable.

3. In Kind Cost Share - encompasses all contributions to the project made by the recipient, subrecipient, or third party (an entity that does not have a role in performing the scope of work) where a value of the contribution can be readily determined, verified and justified but where no actual cash is transacted in securing the good or service comprising the contribution. In Kind cost share items include volunteer personnel hours, the donation of space or use of equipment, etc. The cash value and calculations thereof for all In Kind cost share items must be justified and explained in the Cost Share Item section below. All cost share items must be necessary to the performance of the project. If questions exist, consult your DOE contact before filling out In Kind cost share in this section. Contractors may not provide cost share. Any partial donation of goods or services is considered a discount and is not allowable.

4. Funds from other Federal sources MAY NOT be counted as cost share. This prohibition includes FFRDC sub-recipients. Non-Federal sources include any source not originally derived from Federal funds. Cost sharing commitment letters from subrecipients and third parties must be provided with the original application.

5. Fee or profit, including foregone fee or profit, **are not allowable** as project costs (including cost share) under any resulting award. The project may only incur those costs that are allowable and allocable to the project (including cost share) as determined in accordance with the applicable cost principles prescribed in FAR Part 31 for For-Profit entities and 2 CFR Part 200 Subpart E - Cost Principles for all other non-federal entities.

6. NOTE: A Recipient who elects to employ the 10% de minimis Indirect Cost rate **cannot claim the resulting indirect costs as a Cost Share contribution.**

7. NOTE: A Recipient **cannot claim "unrecovered indirect costs"** as a Cost Share contribution, **without prior approval.**

8. Each budget period is rounded to the nearest dollar.

Organization/Source	Type (Cash or In Kind)	Cost Share Item	Budget Period 1	Budget Period 2	Budget Period 3	Total Project Cost Share
ABC Company **EXAMPLE!!!**	Cash	Project partner ABC Company will provide 20 PV modules for product development at the price of $680 per module	$13,600			**$13,600**
						$0
						$0
Tri-Steel Manufacturing	In-Kind	Rental for 5-ton/day truck mounted system	$36,000	$72,000		**$108,000**
Xcel Energy	Cash	Support provided through Xcel Energy's Natural Gas Innovation Act (NGIA) filing,	$195,000	$0	$0	**$195,000**
SET	Cash	Salary	$40,000	$34,000		**$74,000**
Tri-Steel Manufacturing	Cash	Salary	$50,000	$65,000		**$115,000**
						$0
						$0
						$0
						$0
		TOTAL COST SHARE	**$321,000**	**$171,000**	**$0**	**$492,000**
		Cost Share Percentage per Budget Period	**50.6%**	**49.6%**	**0.0%**	

Total Project Cost: $978,950 **Total Project Cost Share Percent: 50.3%**

Additional Explanation (as needed):