INDUSTRIAL COMMISSION OF NORTH DAKOTA
CLEAN SUSTAINABLE ENERGY AUTHORITY

Governor
Doug Burgum
Attorney General
Drew H. Wrigley
Agriculture Commissioner
Doug Goehring

Clean Sustainable Energy Authority Technical Review Committee
January 16, 2024 9:00 AM
Bank of North Dakota Missouri River Conference Room
1200 Memorial Highway, Bismarck, ND
Or Microsoft Teams
Click here to join the meeting
Or call in (audio only)
+1 701-328-0950,,651696858#

(approximately 9:00 am)
I. Call to Order and Determination of Quorum and Opening Comments – *Rep. Glenn Bosch and Sen. Dale Patten, Co-Chairs*
  a. Updates from Industrial Commission and Introduction of New Staff – *Reice Haase*

(approximately 9:15 am)
II. **Consideration of July 18th, 2023 Technical Review Committee Meeting Minutes** (Attachment 1)

(approximately 9:20 am)
III. Project Management and Financial Report – *Reice Haase* (Attachment 2)
  a. Project C-01-02 Cerilon Final Report (Attachment 2a)
  b. Project C-01-03 Wellspring Hydro Final Report (Attachment 2b)

IV. Summary of Project Infrastructure Needs (Attachment 3)

(approximately 9:30 am)
V. Presentation from Department of Water Resources – *Andrea Travnicek* (Attachment 4)

(approximately 9:50 am)
VI. Presentation from North Dakota Pipeline Authority – *Justin Kringstad* (Attachment 5)

(approximately 10:10 am)
VII. Presentation from North Dakota Transmission Authority – *Claire Vigesaa* (Attachment 6)

(approximately 10:30 am)
VIII. **Declaration/Consideration of Conflicts of Interest** (Attachment 8)

(approximately 10:40 am)
IX. Review of Grant Round 5 Applications
  a. C-05-A – Clean H_2 and N-fertilizer Production Facility; Submitted by Prairie Horizon Energy Solutions LLC; Total Project Costs: $2,200,000,000; Amount Requested: $125,000,000 fertilizer loan (Attachment 9)
  b. C-05-B – Spiritwood Fertilizer Project; Submitted by NextEra Energy Resources Development, LLC; Total Project Costs: $1,293,000,000; Amount Requested: $125,000,000 fertilizer loan (Attachment 10)

c. C-05-C – "Green" Pig Iron Production Facility; Submitted by Scranton Holding Company/North American Iron, Inc.; Total Project Costs: $2,000,000,000; Amount Requested: $12,000,000 grant (Attachment 11)
d. C-05-D – Unlocking the Full Potential of Produced Water (3rd Ask); Submitted by Wellspring Hydro; Total Project Costs: $324,730,000; Amount Requested: $5,000,000 grant, $25,000,000 loan (Attachment 12)
e. C-05-E – Blue Ammonia Facility; Submitted by Catalyst Midstream (USA) LLC; Total Project Costs: $960,000,000; Amount Requested: $10,000,000 grant (Attachment 13)
f. C-05-G – Dickinson Renewable Fuel Facility Expansion; Submitted by EERC; Total Project Costs: $21,761,930; Amount Requested: $10,000,000 grant (Attachment 14)
g. C-05-H – Energy Storage Technology for Lithium-Ion Batteries; Submitted by Dakota Lithium Materials; Total Project Costs: $10,250,000; Amount Requested: $4,000,000 grant (Attachment 15)
h. C-05-I – Grand Power North Dakota Battery Manufacturing Plant; Submitted by Packet Digital; Total Project Costs: $56,558,592; Amount Requested: $10,000,000 grant, $17,355,992 loan (Attachment 16)
i. C-05-J – Carbon Convert Prototype; Submitted by Carbon Convert; Total Project Costs: $4,500,000; Amount Requested: $500,000 grant (Attachment 17)
j. C-05-K – Cerilon GTL (2nd Ask); Submitted by Cerilon; Total Project Costs: $3,600,000,000; Amount Requested: $20,000,000 grant, $80,000,000 loan (Attachment 18)
k. C-05-L – NDeV Flare Gas Mitigation Project; Submitted by ND Energy Ventures; Total Project Costs: $30,000,000; Amount Requested: $3,000,000 grant, $10,000,000 loan (Attachment 19)

(approximately 12:00 pm)

Consideration of motion to enter Executive Session pursuant to N.D.C.C. 54-63.1-06 and 44-04-19.2

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l. *Review of Confidential Information* (Confidential Attachments 9-19)

X. Report on Economic Review Results– *Kelvin Hullet* (Confidential Attachment 20)

XI. Discussion and Completion of Scoring Sheets

(approximately 1:00 pm)

Meeting Returns to Open Session

XII. **Vote on Feasibility Recommendations and any Potential Conditions**

XIII. Review of January 23rd, 2024 Clean Sustainable Energy Authority Meeting Agenda (Attachment 21)

XIV. Other Business

XV. Adjournment

***Bold items require Committee action.**

Minutes of a Meeting of the Clean Sustainable Energy Authority Technical Review Committee

Held on July 18th, 2023 at 9:00 a.m.

BND Missouri River Conference Room, 1200 Memorial Highway, Bismarck, ND

Present: Rep. Glenn Bosch, Chair
Sen. Dale Patten
Rachel Retterath
Josh Teigen
Dave Glatt
Lynn Helms
Justin Kringstad
John Weeda
Charles Gorecki
Todd Steinwand
Rich Garman
Tom Oakland
Clair Vigesaa
Courtney Heiser
Al Christianson
Kelvin Hullet
Reice Haase
Brenna Jessen

Also Present: Not all attendees are known as this meeting was held through Microsoft Teams.

Rep. Glenn Bosch called the meeting of the Clean Sustainable Energy Authority Technical Review Committee to order at 9:02 a.m.

Rep. Bosch mentioned that there is a quorum present in this meeting.

Mr. Reice Haase, Industrial Commission Deputy Executive Director, provided the committee with a report on Industrial Commission activities and a summary of the 2023 legislative session actions which relate to the Clean Sustainable Energy Authority.

Mr. Haase provided a financial summary as follows:

There are currently 10 active projects. $44.3 million in grant dollars have been awarded, $15.6M of that has been paid to date, with the exception of the Bakken Energy de-obligation/ hydrogen bucket. Cash available for grants is $30.4 million.

Mr. Haase also provided a project highlight of the Valence project, which was funded by CSEA, that reduced over 155,000 tons of CO_2 emissions and generated $31.3 million in additional tax revenue to the state. It was noted that the amount of tax revenue surpassed the available grant dollars in the program currently.

Rep. Bosch requested the members to declare any conflicts of interest, to which Todd Steinwand and Charles Gorecki responded. Mr. Steinwand declared that Bank of North Dakota currently has loans with Bushel, Inc., and Rainbow Energy Center. Mr. Gorecki stated that his agency works closely with Minnkota Power Cooperative and HydroStrat GP.

It was moved by Sen. Patten and seconded by Lynn Helms to allow a vote from Bank of North Dakota representative Todd Steinwand and SERC Designee Charles Gorecki.

On a roll call vote Rachel Retterath, Josh Teigen, Dave Glatt, Lynn Helms, Justin Kringstad, John Weeda, Charlie Gorecki, and Todd Steinwand all voted aye. The motion carried unanimously.

The review of applications began: There were nine applications in total, and all had positive technical reviews.

C-04-A Bushel Farm Traceability Dashboard

- $5.529 million grant request
- Mr. John Weeda expressed support for the Ag community but questioned if this really fit the description of "technology to reduce emissions".
- Mr. Dave Glatt shared concerns about work already being done on this area through other companies.
- Mr. Lynn Helms asked about staff being from North Dakota, and if not, where would they be housed? He concurred that this seems to be more of an ag production project than an energy production project.
- Mr. Todd Steinwand mentioned that this is an "add-on" for ag producers to effectively track and measure their CO_2 emissions reduction. To Mr. Helms' point, he offered that agriculture is going to be playing a larger role on the energy stage when it comes to CO_2 emissions reduction.
- Ms. Courtney Heiser added that the applicant currently has 184 employees total and 2/3 of them live in North Dakota. They are headquartered out of Fargo, and they are going to be utilizing their current staff for this project.
- Ms. Retterath stated that this would be an added cost to the farmers.
- Mr. Teigen shared that he believes this project could unlock a lot of private investment. He stated that there is some hesitation due to Carbon intensity and this could help validate it so institutional capital investment can start flowing.

C-04-B SAFuels X

- $5 million grant and $25 million loan request
- The technical reviewers' comments were mostly positive and believe the proposal to be a great opportunity for North Dakota.
- The risks that were noted were the use of CSEA grant dollars to design a natural gas pipeline when there are other technologies to produce hydrogen with significantly less environmental impact.
- Mr. Weeda asked is this had been brought before the committee previously.
- Mr. Haase explained that they applied in the 2nd grant round and withdrew after the technical review to work on some management team, engineering and permitting issues. They have now addressed those concerns.
- Ms. Retterath asked if the applicant was able to accommodate the timeline set forth with the financing they've secured so far.
- Mr. Haase mentioned he would flag that for the presentation next week.

C-04-C Smart Well Hub

- $705,000 grant request
- Two technical reviewers rated this project as questionable.
- The concerns noted were a lack of details to evaluate the potential of the project to be technically sound, as well as barriers to adoption of the technology and how they would approach those challenges.
- Mr. Helms stated that several oil & gas operators are already doing this, and he'd like to see some letters of industry support to show that this would actually make a difference for them.
- Mr. Weeda agreed with Mr. Helms.
- Mr. Steinwand added that he believes this to be a game-changing technology that is really going to move the needle.
- Mr. Helms reiterated that Marathon and Conoco-Phillips are already converting their facilities with automated methane-leak scanning technology. He suggested that the Oil & Gas Research Program might be a better fit for this type of project.

C-04-D Project Tundra

- $150 million loan request
- All three technical reviewers rated this project as favorable.
- One reviewer requested more information regarding how previous CSEA funding has been used as well as how the additional funding will be used.
- Mr. Weeda commented that the applicant seems to still be figuring things out and doesn't quite know what direction they want to go with this project.
- Mr. Steinwand addressed Mr. Weeda's concerns and explained that they're going to be doing a final review and making a final decision in late 2023 or early 2024.
- Mr. Helms commented that the capture side of things is still in question. He believes the Carbon storage side of the project is secure as they have 4 storage facilities approved.
- Mr. Steinwand said he believes they've assembled the right partners for the project.
- Mr. Gorecki expanded on Mr. Steinwand's comment by explaining that Mitsubishi, the partner for the carbon capture side of things, is the only team whose done capture on this scale. He stated that its all about financing at this point for Minnkota.

C-04-E Project Phoenix

- $150 million loan request
- One technical reviewer rated this project as favorable, and one reviewer rated the project as questionable.
- The risks that were noted were climate concerns as well as procurement/marketing distances may prove to be a restrictive issue.
- It was mentioned that the demand for this product is strong, and it really fits the CSEA program.
- Mr. Kelvin Hullet explained that the applicant is experiencing some permitting issues with their facility in OHIO, but that they already have the product, this is really about

commercialization at this point.

- Mr. Steinwand added that they are planning on moving forward with this project in North Dakota, whether they move forward in OHIO or not. Their plan is to have projects in both states.
- Mr. Helms reiterated that Marathon and Conoco-Phillips are already converting their facilities with automated methane-leak scanning technology. He suggested that the Oil & Gas Research Program might be a better fit for this type of project.
- Mr. Helms commented there's synergy with the location of another project and it fits the clean & sustainable criteria. He'd like to see the loan broken up into phases.
- There was continued discussion on how to break up the funding.

C-04-F Lignite Combustion Product Enhancements

- $42.5 million loan request
- All three technical reviewers rated this project as favorable.
- There was discussion that this project has received funds from the Lignite Council for feasibility studies.
- John Weeda stated that he is excited for this project because it contributes to- rather than being a burden to- our economy.

C-04-G Unlocking the Full Potential of Produced Water

- $5 million grant and $50 million loan request
- There was only one technical reviewer for this application, who rated this project as favorable.
- The risks that were noted were permitting considerations for Class 2 well versus a Class 1 well.
- Mr. Glatt expressed concern over the significant waste that produced water produces and how they intend to deal with that.
- Mr. Helms agreed but noted there is synergy with the site location and other projects and ultimately this is a good thing, long term.
- There was some discussion about class 1 wells versus class 2 wells. Mr. Helms explained that anything related to Oil & Gas is going to use a class 2 well as they have an aquifer exemption and less expensive to construct and operate/maintain.

C-04-H Enhancement of Energy Infrastructure

- $10 million grant request
- There was only one technical reviewer for this application, who rated this project as questionable.
- The reviewer noted that while the project could be a valuable asset to the state, they are not sure that it meets the goals of CSEA.
- Mr. Weeda stated that this seems like an overly ambitious proposal, and that he didn't have quite enough of an understanding of the project to make a decision.
- Mr. Helms agreed there is too much to look at all together and suggested breaking it down and only funding partially.

C-04-J Project CAN

- $5 million grant request
- One technical reviewer rated this project as favorable, and one reviewer rated the project as questionable.
- A concern was noted that this proposal has no identified location in the State of North Dakota.
- Mr. Teigen stated that the Commerce has some involvement in this project, and he is super excited about this because it's clear that Minnesota isn't going to permit an industrial project like this. Currently, 100% of the nation's pig iron comes from Russia, China, and Brazil so North Dakota has an opportunity now to be the 1st and only producer of this type of steel in the country. He also noted that contrary to the technical reviewer's comments, the team working on this is highly experienced.
- Mr. Steinwand commented that this application was late, and there is no way to judge the economic feasibility because no financial information was included.

Rep. Bosch asked for a motion to be made to enter into executive session to discuss confidential information.

A motion was made by Mr. Weeda and seconded by Ms. Retterath that under the authority of the N.D.C.C. 54-63.1-06 and 44-04-19.2.1 that the Clean Sustainable Authority Technical Review Committee enter into an executive session for the purpose of considering Clean Sustainable Energy confidential information.

On a roll call vote Rachel Retterath, Josh Teigen, Dave Glatt, Lynn Helms, John Weeda, Charles Gorecki and Todd Steinwand all voted aye. The motion carried unanimously.

Rep. Bosch stated that the Clean Sustainable Energy Authority Technical Committee is entering into executive session to discuss confidential information. He stated that only CSEA members and ND Industrial Commission staff will be present during executive session. Any formal action will be taken in open session. Rep. Bosch reminded those present that the discussion must be limited to the announced purpose which is projected to last approximately 1 hour.

The executive session began at 10:45 a.m.

The Meeting Closed to the Public for Executive Session Pursuant to NDCC 54-63.1-06 and 44-04-19.2.1.

CLEAN SUSTAINABLE ENERGY AUTHORITY TECH COMMITTEE EXECUTIVE SESSION

Present:
Rep. Glenn Bosch
Sen. Dale Patten
Todd Steinwand
Courtney Heiser
Justin Kringstad
Dave Glatt

Lynn Helms
Rachel Retterath
Al Christianson
John Weeda
Josh Teigen
Charles Gorecki
Clair Vigesaa
Reice Haase
Brenna Jessen

Executive session ended at 12:01 p.m. and reconvened in open session.

Voting results are as follows:

C-04-A:

- Average 32.625, feasible with conditions
- Mr. Weeda stated his condition that it is to be determined by CSEA to be in alignment with their criteria.

A motion was made by Mr. Weeda and seconded by Ms. Retterath to recommend funding the C-04-0A Bushel Farm Traceability Dashboard with the added condition for the $5.529 million grant request.

On a roll vote Rachel Retterath, Josh Teigen, Dave Glatt, Lynn Helms, Justin Kringstad, John Weeda, Charlie Gorecki, and Todd Steinwand all voted aye. Motion carried unanimously.

C-04-B:

- Average 38.625, feasible

A motion was made by Mr. Steinwand and seconded by Mr. Weeda to recommend fully funding C-04-B SAFuels X for the $5 million grant and $25 million loan request.

On a roll vote Rachel Retterath, Josh Teigen, Dave Glatt, Lynn Helms, Justin Kringstad, John Weeda, Charlie Gorecki, and Todd Steinwand all voted aye. Motion carried unanimously.

C-04-C:

- Average 28, not feasible
- Mr. Justin Kringstad stated his issue with this is that they don't have an industry partner.
- Mr. Gorecki stated that was his same concern.

A motion was made by Mr. Helms and seconded by Ms. Retterath to recommend funding the C-04-C Smart Well Hub with the condition that they secure an industry partner before contracting.

On a roll vote Rachel Retterath, Josh Teigen, Dave Glatt, Lynn Helms, Justin Kringstad, John Weeda, Charlie Gorecki, and Todd Steinwand all voted aye. Motion carried unanimously.

C-04-D:

- Average 45.75, feasible

A motion was made by Mr. Steinwand and seconded by Mr. Kringstad to recommend fully funding C-04-D Project Tundra for the $150M loan request.

On a roll vote Rachel Retterath, Josh Teigen, Dave Glatt, Lynn Helms, Justin Kringstad, John Weeda, Charlie Gorecki, and Todd Steinwand all voted aye. Motion carried unanimously.

C-04-E:

- Average 42.875, feasible with conditions
- Mr. Helms stated that he would like to see a condition to only fund an approximate amount for Phase 1 of this project.

A motion was made by Mr. Helms and seconded by Mr. Steinwand to recommend partial funding C-04-E Project Phoenix, with the added condition.

On a roll vote Rachel Retterath, Josh Teigen, Dave Glatt, Lynn Helms, Justin Kringstad, John Weeda, Charlie Gorecki, and Todd Steinwand all voted aye. Motion carried unanimously.

C-04-F:

- Average 43.25, feasible

A motion was made by Ms. Retterath and seconded by Mr. Kringstad to recommend fully funding C-04-F Lignite Combustion Product Enhancements, for the $42.5 million loan request.

On a roll vote Rachel Retterath, Josh Teigen, Dave Glatt, Lynn Helms, Justin Kringstad, John Weeda, Charlie Gorecki, and Todd Steinwand all voted aye. Motion carried unanimously.

C-04-G:

- Average 38.43, feasible
- Mr. Gorecki abstained from voting due to his proximity to this project.

A motion was made by Mr. Steinwand and seconded by Mr. Helms to recommend funding C-04-G Unlocking the Full Potential of Produced Water, for the $5 million grant and $50 million loan request.

On a roll vote Rachel Retterath, Josh Teigen, Dave Glatt, Lynn Helms, Justin Kringstad, John Weeda, and Todd Steinwand all voted aye. Charles Gorecki abstained from voting. Motion carried.

C-04-H:

- Average 31.86, feasible with conditions
- Mr. Helms stated that he would like to see a condition to partially fund per certain deliverables.

- Mr. Gorecki abstained from voting due to his proximity to this project.

A motion was made by Mr. Helms and seconded by Mr. Steinwand to recommend partial funding for C-04-H Enhancement of Energy Infrastructure, with the added condition.

On a roll vote Rachel Retterath, Josh Teigen, Dave Glatt, Lynn Helms, Justin Kringstad, John Weeda, and Todd Steinwand all voted aye. Charles Gorecki abstained from voting. Motion carried unanimously.

C-04-J:

- Average 32.75, feasible with conditions
- Ms. Retterath stated that she would like to see a condition to provide financial information to be analyzed before funding.
- Mr. Teigen asked if it needed to be audited financials for if it could be unaudited.
- Mr. Steinwand stated that they needed to be acceptable internal statements.
- Mr. Helms added that he'd like to see a second condition that they provide clarity around their carbon capture strategy.

A motion was made by Mr. Helms and seconded by Ms. Retterath to recommend funding C-04-J Project CAN, with the added conditions of adequate financial and technical information provided to the committee.

On a roll vote Lynn Helms, Justin Kringstad, Rich Garman, Rachel Retterath, Todd Steinwand, and Dave Glatt all voted aye. Motion carried unanimously.

Other Business

- Mr. Steinwand shared appreciation for the vetting process that these projects go through. Rep. Bosch mentioned that the original CSEA legislation was designed to carefully scrutinize projects in order to effectively meet the goals of the program.

- Sen. Patten mentioned that he'd like to engage more conversation around infrastructure at the next grant round.

With no further business, Rep. Bosch adjourned the meeting at 12:24 p.m.

Rep. Glenn Bosch, Co-chairman

Sen. Dale Patten, Co-chairman

CLEAN SUSTAINABLE ENERGY AUTHORITY PROJECT MANAGEMENT AND FINANCIAL REPORT

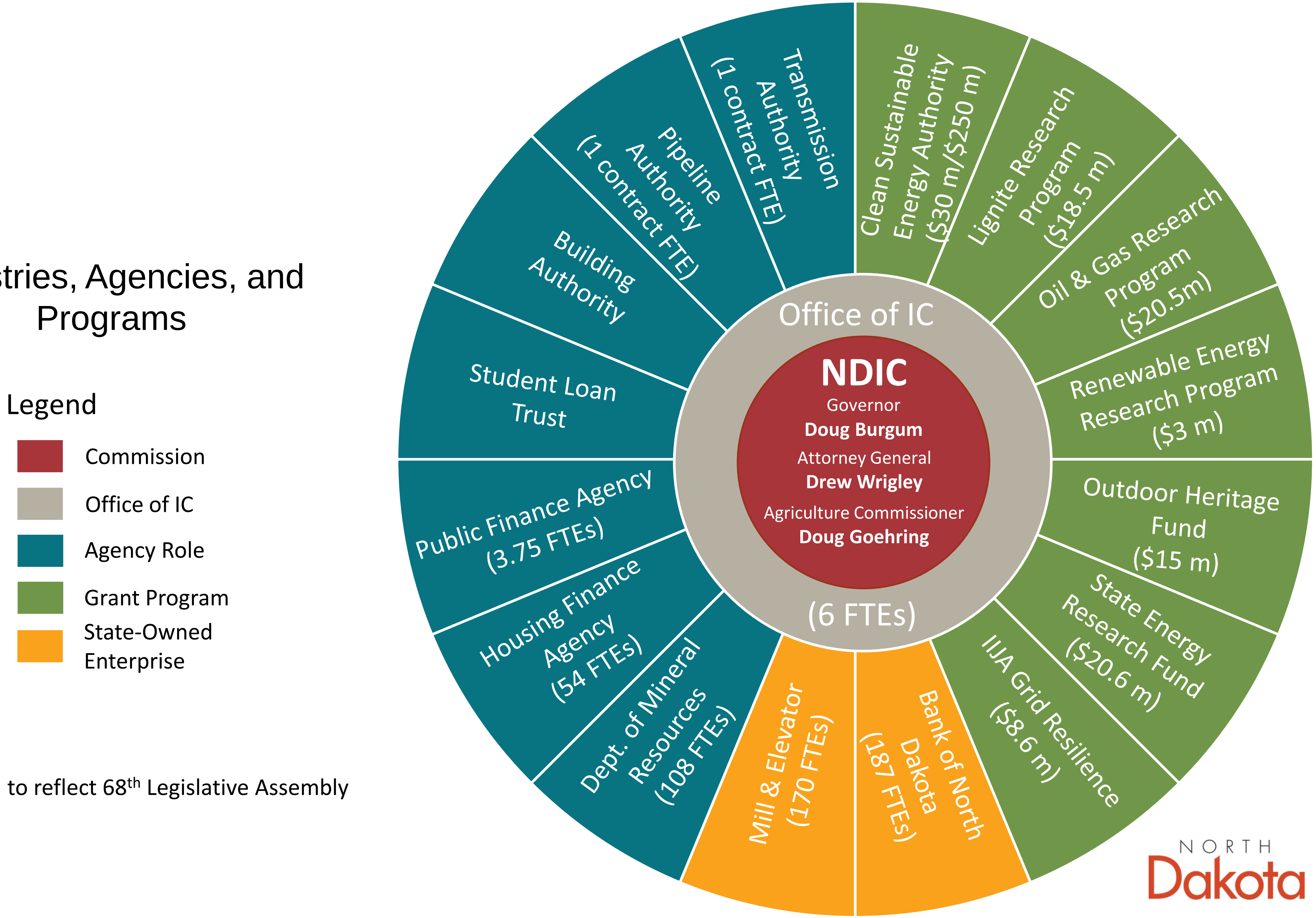
Reice Haase, Deputy Executive Director, NDIC

January 16, 2024

CLEAN SUSTAINABLE ENERGY AUTHORITY
CSEA

NORTH Dakota Be Legendary.™

Industries, Agencies, and Programs

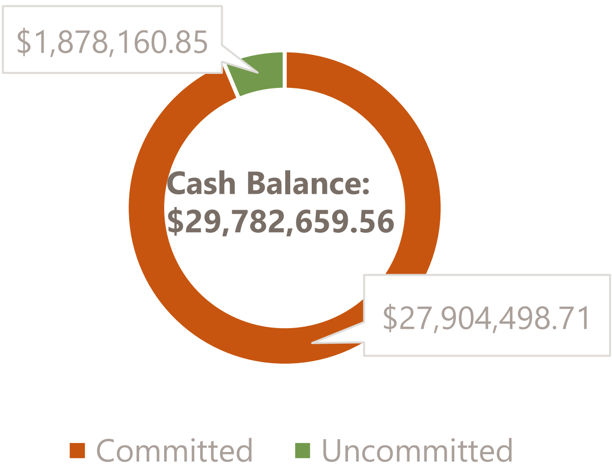


Updated to reflect 68th Legislative Assembly changes

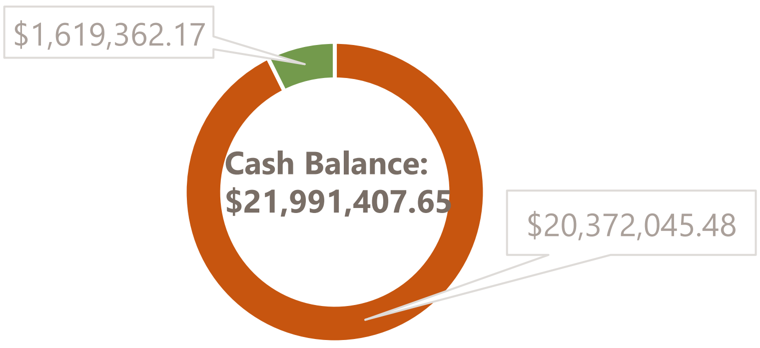
North Dakota Be Legendary.

INDUSTRIAL COMMISSION-MANAGED FUNDS

Lignite Research Fund

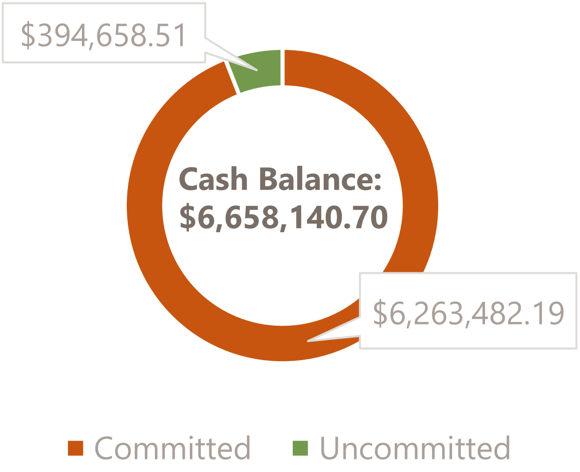


Oil and Gas Research Fund*

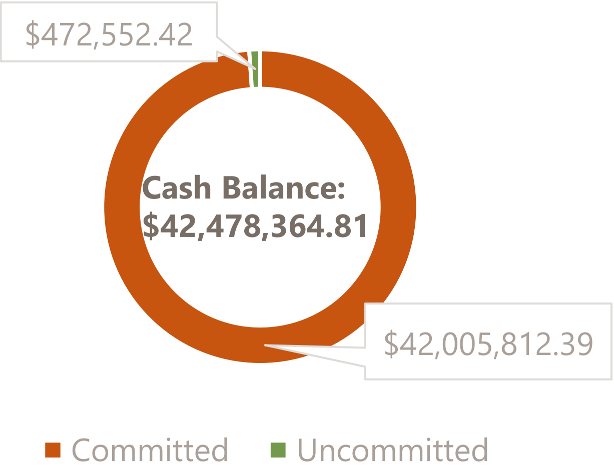


*Does not include SIIF or Gas Capture

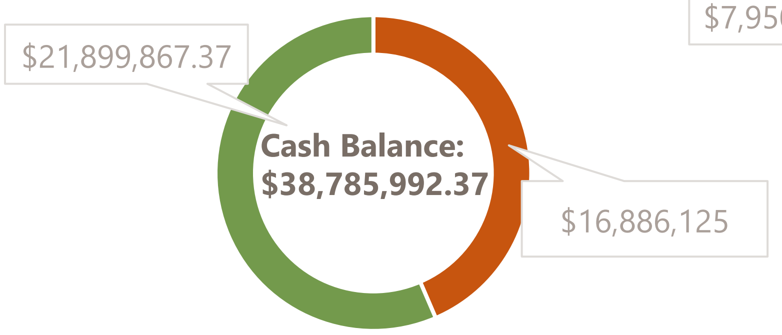
Renewable Energy Fund



Outdoor Heritage Fund

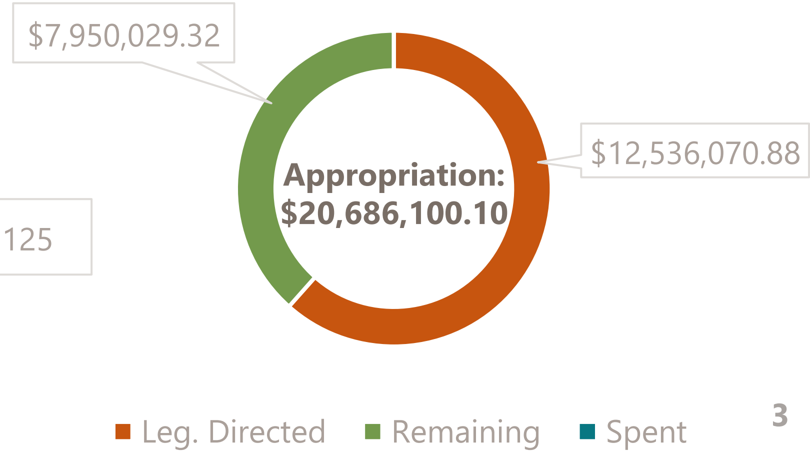


CSEA Fund*

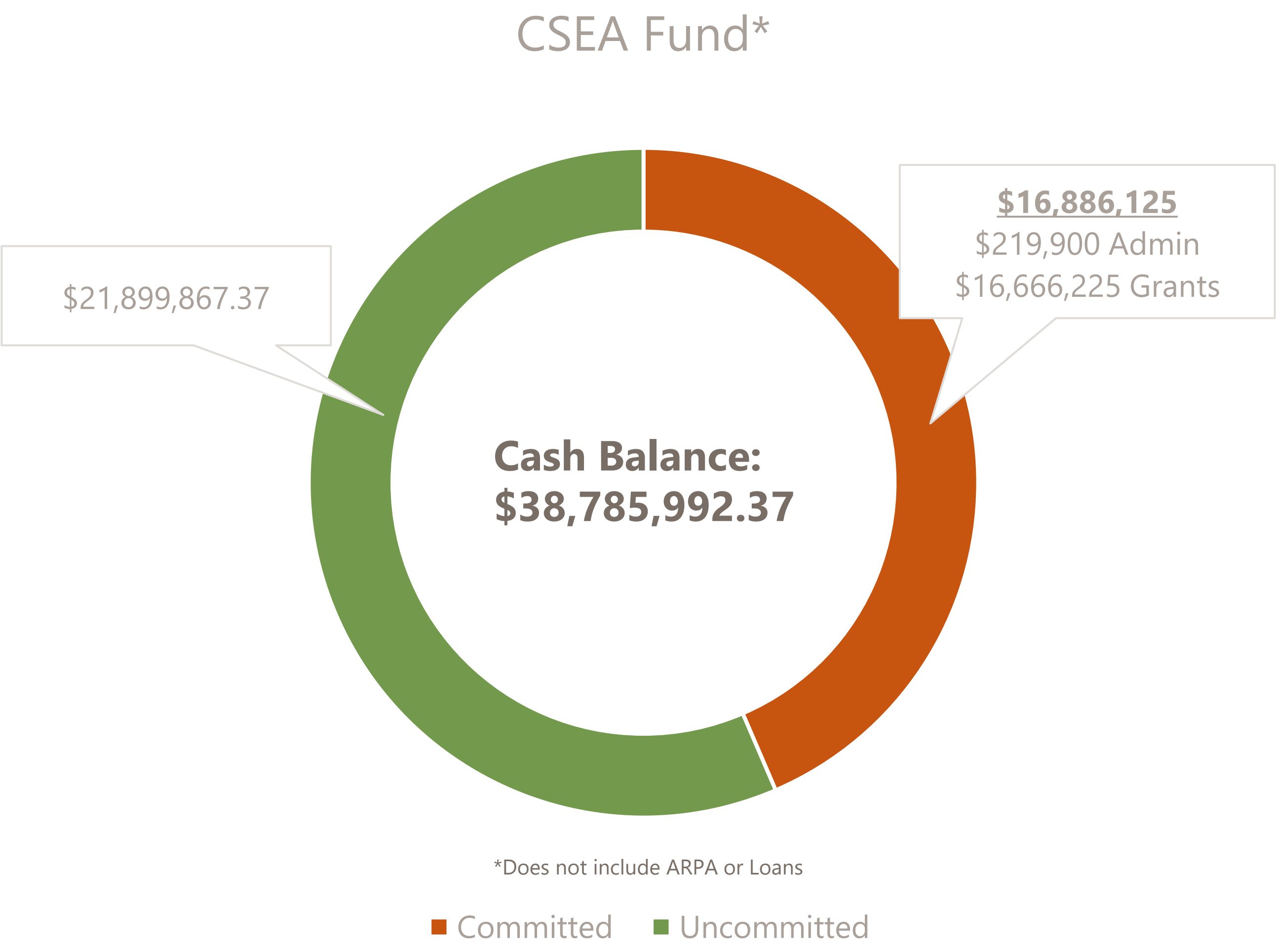


*Does not include ARPA or Loans

SERC Fund



CSEA FUND BALANCE
JANUARY 2024



Funding Source:
- $25 million General Fund (21-23 Biennium)
- $30 million General Fund (23-25 Biennium)
- $10 million Federal ARPA (Hydrogen)

17 Cumulative Projects

14 Active Projects
- 8 Grant Projects
- 6 Loan Projects

Cumulative Value:
- $42.7 million granted
- $392.5 million loaned
- $5.2 billion project value

Clean Sustainable Energy Authority Project Management Update (January 2024)									
Contract Number	Project	Project Sponsor	Status	Original Grant Award	Original Loan Award	Total Spend To Date	Remaining Grant Commitment	Total Project Costs	Projected End Date
C-01-02	Cerilon Gas-to-Liquids Plant	Cerilon	Project complete, FEL #2 complete, proceeding to FEL #3	$7,000,000	$40,000,000	$7,000,000	$0	$2,800,000,000	Jan 2024
C-01-03	Produced Water Recycling	Wellspring Hydro	Project complete, FEL #3 complete	$1,000,000	$0	$1,000,000	$0	$2,200,000	Sept 2023
C-01-04	Blue Flint Ethanol Carbon Capture	Midwest Ag Energy	Final Report in progress, expected Quarter 1 2024	$3,000,000	$0	$2,700,000	$300,000	$58,800,000	March 2024
C-01-05	Coal Creek Carbon Capture	EERC	Nearly 100% of CSEA-funded work completed, over 400 engineering documents completed, design mostly complete pending final review	$7,000,000	$0	$5,417,900	$1,582,100	$15,065,200	March 2024
Loan Only	Natural Gas Solutions	Valence	Loan only; captured over 1.7 BCF of gas, emissions reduction of over 155,000 tons of CO_2e; $31.3 million additional tax revenue to State	$0	$15,000,000	N/A	$0	$44,000,000	Dec 2022
C-02-06	Internal Combustion Engine Carbon Capture	Enerplus	Contract in negotiation	$1,000,000		$0	$1,000,000	$18,110,000	
Loan Only	Blue Flint Ethanol Carbon Capture	Midwest Ag Energy	Loan only	$0	$15,000,000	N/A	$0	$68,934,121	March 2024
Loan Only	Project Tundra	Minnkota	Loan only	$0	$100,000,000	N/A	$0		May 2027
C-03-07	Liberty H_2 Hub	EERC	FEL-1 for ammonia facility, environmental, and subsurface storage complete; FEL-2 for H_2 facility complete; began FEED of H_2 and CO_2 pipelines	$10,000,000	$0	$258,011	$9,741,989	$24,290,528	Oct 2024
C-03-08	Aircarbon Production Facility	Newlight	FEED study 20% complete; focus on development of specs for long lead time equipment in next quarter	$4,185,625	$0	$0	$4,185,625	$8,371,250	May 2024
C-03-09	Geothermal Power Generation	Enerplus	Contract in negotiation	$1,098,500	$0	$0	$1,098,500	$2,197,000	
C-04-10	Bushel Farm Traceability Dashboard	Bushel Inc	Processing first report deliverable (Due 12/31/2023)	$3,500,000	$0	$0	$3,500,000	$12,265,250	Dec 2026
C-04-11	Produced Water Recycling Stage 2	Wellspring Hydro	Processing first report deliverable (Due 12/31/2023)	$5,000,000	$0	$0	$5,000,000	$250,886,700	Dec 2025
Loan Only	Project Tundra	Minnkota	Loan only	$0	$150,000,000	N/A	$0	$1,400,000,000	May 2027
Loan Only	Project Phoenix	Newlight	Loan only	$0	$30,000,000	N/A	$0	$446,000,000	July 2026
Loan Only	Lignite Combustion Product Enhancements	Rainbow Energy	Loan only	$0	$42,500,000	N/A	$0	$85,000,000	Oct 2025
Total (Excluding ARPA Hydrogen):				**$32,784,125**	**$392,500,000**	**$16,117,900**	**$16,666,225**	**$5,211,829,521**	
Total (Including ARPA Hydrogen):				**$42,784,125**	**$392,500,000**	**$16,375,911**	**$26,408,214**	**$5,236,120,049**	
Available Funding (Excluding Fertilizer):				$21,899,867	$27,500,000				

Clean Sustainable Energy Authority											
Grant Round 5 Applications (January 2024)											
Application Number	Application Title	Applicant	Principal Investigator	Email	Description	Grant Funding Requested	Loan Requested	Total Project Costs	Category	Confidentiality Requested	Duration
C-05-A*	Clean H_2 and N-fertilizer Production Facility	Prairie Horizon Energy Solutions LLC	Justin Gutknecht	justin_gutknecht@tcenergy.com	Installation of facilities capable of 73,000 tons/year (200 tons/day) of clean hydrogen via electrolysis, 419,750 tons/year (1,150 tons/day) of clean ammonia, and a urea production facility associated with the Heartland Hydrogen Hub; CO_2 reduction of 650,000 tons/year	$0	$125,000,000	$2,200,000,000	Fertilizer	Yes	Aug 2025 - Dec 2028
C-05-B*	Spiritwood Fertilizer Project	NextEra Energy Resources Development, LLC	Joseph Matteo	joseph.matteo@nexteraenergy.com	Construction of production facility near Jamestown, ND capable of 100,000 tons/year zero-carbon anhydrous ammonia through electrolysis of water; CO_2 reduction of 190,000 tons/year	$0	$125,000,000	$1,293,000,000	Fertilizer	Yes	2024-2028
C-05-C	"Green" Pig Iron Production Facility	Scranton Holding Company/North American Iron, Inc.	James Bougalis	jimbougalis@gmail.com	Construction of processing facility in ND capable of producing 2 million tons/year of near carbon-neutral pig iron; 0.1 ton CO_2/ton pig iron vs. 2.3 tons CO_2/ton traditional pig iron, over a 96% CO_2 reduction; CO_2 sequestration of 1.6 million tons/year	$12,000,000	$0	$2,000,000,000	Low-carbon Materials	Yes	2024-2026
C-05-D	Unlocking the Full Potential of Produced Water as a Key Component of Clean Sustainable Energy	Wellspring Hydro	Mark Watson	mark@wellspringhydro.com	Continued engineering and design as well as an "issue for purchase" to make downpayments on equipment for its proposed produced water recycling facility in Williams County	$5,000,000	$25,000,000	$324,730,000	Produced Water Recycling	Yes	2024-2026
C-05-E	Blue Ammonia Facility	Catalyst Midstream (USA) LLC	Edward Neibauer	eneibauer@catalystmidstream.com	Construction of blue ammonia facility in Berthold, ND capable of producing 1,080,000 tons/year; would use approximately 120,000 mcf gas/day; CO2 sequestration of 2.5 million tons/year	$10,000,000	$0	$960,000,000	Fertilizer	Yes	2024-2025
C-05-G	Marathon Petroleum Dickinson Renewable Fuel Facility Expansion	EERC	Chad Wocken	cwocken@undeerc.org	Expansion of Dickinson renewable fuels refinery to add sustainable aviation fuel production; Would reduce carbon-intensity of the facilities products by more than 20%	$10,000,000	$0	$21,761,930	Low-carbon Fuels	Yes	Mar 2024 - Feb 2026
C-05-H	Demonstration and Scale-Up of a Low-Cost Long-Duration Energy Storage Technology for Lithium-Ion Batteries	Dakota Lithium Materials	Dr. Yong Hou	hou@dakotalithium.com	Construction of demonstration facility at UND for the production of 1,000 tons/year of lithium iron phosphate materials; feedstock for lithium-ion batteries; 99% reduction in water use, 51% reduction in electric use, 51% reduction in CO2 emissions	$4,000,000	$0	$10,250,000	Low-carbon manufacturing	Yes	2024-2027
C-05-I	Grand Power - North Dakota Battery Manufacturing Plant	Packet Digital	Terri Zimmerman	terri.zimmerman@packetdigital.com	Construction of high energy density Lithium-ion battery manufacturing facility in Fargo, ND; 10x life cycle of currently-available batteries; 2,000 batteries/day	$10,000,000	$17,355,992	$56,558,592	Low-carbon manufacturing	Yes	2024-2026
C-05-J	Carbon Convert Prototype	Carbon Convert	Jim Silrum	jim@carbonconvert.tech	Use of artificial photosynthesis to convert CO2 into oxygen and carbon monoxide; partnerships with BSC and Dakota Spirit Ethanol	$500,000	$0	$4,500,000	Low-carbon manufacturing	No	Jan 2024 - Nov 2024

C-05-K	Cerilon GTL	Cerilon	Nico Duursema	nico.duursema@cerilon.com	Continued front-end engineering and design of Trenton gas-to-liquids facility; conversion of 240,000-280,000 mcf natural gas/day into 24,000 bpd of base oils and synthetic lubricants with carbon capture up to 2 million tons per year;	$20,000,000	$80,000,000	$3,600,000,000	Value-added natural gas processing	Yes	2024-2028
C-05-L	NDeV Flare Gas Mitigation Project	ND Energy Ventures	Steve Wolf	steve.wolf@extiel.com	Demonstration project for conversion of natural gas into carbon black and zero-carbon hydrogen using absolute pyrolysis technology; focused on the capture of gas that would have otherwise been flared; up to 5.7 millon tons/year of CO2 emissions avoided	$3,000,000	$10,000,000	$30,000,000	Natural gas capture	Yes	2024-2025
Subtotal (Excluding Fertilizer):						**$74,500,000**	**$132,355,992**	**$7,007,800,522**			
Available Funding (Excluding Fertilizer):						$21,899,867	$27,500,000				
Total All Grant Round 5 including Fertilizer:						**$74,500,000**	**$382,355,992**	**$10,500,800,522**			

Sixty-eighth Legislative Assembly of North Dakota
In Special Session Commencing Monday, October 23, 2023

HOUSE BILL NO. 1546
(Legislative Management)

AN ACT to amend and reenact section 54-63.1-04 of the North Dakota Century Code, relating to the clean sustainable energy authority's fertilizer development incentive program; to provide for retroactive application; and to provide an effective date.

BE IT ENACTED BY THE LEGISLATIVE ASSEMBLY OF NORTH DAKOTA:

SECTION 1. AMENDMENT. Section 54-63.1-04 of the North Dakota Century Code is amended and reenacted as follows:

54-63.1-04. Clean sustainable energy authority - Duties - Report.

1. The authority shall make recommendations to the commission for program guidelines, including eligibility criteria for entities to receive funding under this chapter.

2. The nonvoting technical advisors shall develop a process to review and evaluate projects to determine the technical merits and feasibility of any application, including potential benefits of the development of low-emission technology, the expansion of the development of the state's natural resources or energy production, and the contribution to the economic diversity in the state.

3. The authority may develop a loan program or a loan guarantee program under the clean sustainable energy fund. The Bank of North Dakota shall administer the loan program or loan guarantee program. The interest rate of a loan under this program may not exceed two percent per year. The maximum term of a loan under this section must be approved by the commission based on a recommendation from the authority. The Bank shall review applications for loans or loan guarantees and shall consider the business plan, financial statements, and other information necessary to evaluate the application. To be eligible for a loan or loan guarantee, an entity shall agree to provide the Bank of North Dakota with information as requested. The Bank of North Dakota may develop policies for loan participation with local financial institutions.

4. The authority shall make recommendations to the commission for grant awards, loan approvals, or other financial assistance to provide funding to support research, development, and technological advancements for the large scale development and commercialization of projects, processes, activities, and technologies that reduce environmental impacts and increase sustainability of energy production and delivery in accordance with this chapter. Any projects, processes, activities, and technologies selected by the commission for funding must have been recommended by the authority, must demonstrate feasibility based on a technical review conducted by the nonvoting technical advisors of the authority, must have other sources of financial support, and must achieve the priorities and purposes of the program. At the request of the authority, the Bank of North Dakota shall provide a recommendation regarding the economic feasibility of a project, process, activity, or technology under consideration by the authority. The Bank shall review the business plan, financial statements, and other information necessary to provide a recommendation.

5. The authority shall develop a fertilizer development incentive program, including guidelines to provide loan forgiveness. Funding for the fertilizer development incentive program under this subsection is limited to one hundred twenty-five million dollars.

    a. To be eligible for the fertilizer development incentive program:

(1) The fertilizer production facility must be located within the state;

(2) The owner of the fertilizer production facility must be an entity domiciled in the United States or Canada;

(3) The owner must borrow money under a program administered by the Bank of North Dakota; and

(4) The fertilizer production facility must use hydrogen produced by the electrolysis of water.

b. Upon completion of the construction of the fertilizer production facility, the authority shall forgive the loan and shall use fertilizer development incentive funding to repay any outstanding amount borrowed, as certified by the Bank. The authority shall request an appropriation from the strategic investment and improvements fund or other funding sources to provide fertilizer development incentive funding to repay any outstanding amount borrowed.

6. The authority may consult with any other state agency necessary to carry out the purposes under this chapter.

~~6.~~7. Each biennium, the authority shall provide a written report to the legislative management regarding its activities and the program's financial impact on state revenues and the state's economy.

SECTION 2. RETROACTIVE APPLICATION. This Act applies retroactively to July 1, 2023.

SECTION 3. EFFECTIVE DATE. This Act becomes effective immediately upon its filing with the secretary of state.

Speaker of the House	President of the Senate
Chief Clerk of the House	Secretary of the Senate

This certifies that the within bill originated in the House of Representatives of the Sixty-eighth Legislative Assembly of North Dakota and is known on the records of that body as House Bill No. 1546.

House Vote:	Yeas 60	Nays 30	Absent 4
Senate Vote:	Yeas 40	Nays 7	Absent 0

Chief Clerk of the House

Received by the Governor at ________M. on _____________________________________, 2023.

Approved at ________M. on ____, 2023.

Governor

Filed in this office this ___________day of _______________________________________, 2023,

at ________ o’clock ________M.

Secretary of State

FINAL TECHNICAL REPORT: CERILON GTL ND PHASE 1

Entity:	**Cerilon GTL ND**
Submitted To:	**North Dakota Industrial Commission** **Clean Sustainable Energy Authority**
Cerilon Document No.:	**NDV2103-0000-2050-RPT01-0001**
Rev. No.:	**0**
Project Period of Performance:	**Oct 31, 2021 to Dec 13, 2023**

Rev.	Date	Rev. Description	Originator	Reviewer	Cerilon Approval
0	2023-Dec-14	Issued for Information	Ryan Galloway	Andy Nagy, Nico Duursema, Ryan Galloway	Peter Farkas Peter Farkas Peter Farkas (Dec 14, 2023 10:41 MST)

Cerilon Disclaimer

This technical report has been compiled by Cerilon GTL ND Inc. as an account of work sponsored by the Industrial Commission of North Dakota. This report primarily details the FEL-2 stage and preparatory work of the project. Due to the exploratory and developmental nature of the tasks undertaken, Cerilon, along with its employees, neither offers any express or implied warranties nor assumes any legal liability or responsibility for the accuracy, completeness, or practical utility of the information, equipment, product, or process detailed within. Furthermore, the inclusion or mention of specific commercial products, processes, or services by trade name, trademark, manufacturer, or otherwise, in this report, does not imply endorsement, certification, or recommendation by Cerilon.

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Unauthorized use of any such information presented herein is prohibited.

Executive Summary

This FEL-2 stage of the project by Cerilon GTL ND Inc. ('Cerilon'), initiated with the support of the North Dakota Clean Sustainable Energy Authority ('CSEA') and facilitated through a loan from the Bank of North Dakota, has reached successful completion. This FEL-2 Stage focused on securing land, advancing feedstock and offtake agreements, and conducting FEL-2 feasibility study engineering work. These accomplishments set the stage for the more detailed FEL-3 / FEED study, and an eventual Final Investment Decision ('FID') event anticipated for the middle of 2025, enabling the future development of a ground-breaking gas-to-liquids (GTL) facility in North Dakota.

Project Objectives and Achievements

- **Land Acquisition and Preparation:** Successfully secured strategic land parcels for the GTL facility. This step involved comprehensive site analysis, ensuring suitability for the subsequent construction and operations of the GTL plant.
- **FEL-2 Engineering Work:** Completed the crucial FEL-2 stage, which included feasibility studies and engineering. This stage laid the technical groundwork for the GTL facility, addressing key design, environmental, and operational considerations.
- **Environmental Planning and Compliance:** Conducted in-depth environmental assessments to align the project with North Dakota's commitment to net-zero emissions by 2030. This involved preliminary environmental impact studies, environmental baselining, progressing permitting, and planning for sustainable operations.
- **Strategic Planning for Energy Security:** Developed a strategic plan for producing transition energy products, including the future supply of Group III+ base oils. This planning stage sets the foundation for enhancing North Dakota's role in the energy sector.
- **Blueprint for Carbon Capture and Utilization:** Initiated planning for a Carbon Capture, Utilization, and Storage (CCS) hub, integral to the future GTL facility. This early-stage planning is pivotal for achieving low-carbon operations.
- **Economic and Community Impact Assessment:** Conducted comprehensive studies to understand the project's potential economic impact, focusing on job creation, industry development, and community benefits. The State of ND provided an updated REMI model that outlines the community and state impact.
- **Stakeholder Engagement and Partnership Building:** Successfully engaged with key stakeholders, including local communities, industry partners, and state authorities, laying a strong foundation for collaboration in the subsequent stages of the project.

Next Steps

With the successful completion of this preliminary phase, Cerilon GTL ND Inc. is poised to transition to the next stages of the GTL project. This will involve the FEED (FEL-3 engineering), securing additional funding from private investors, finalizing commercial arrangements for feedstock, offtake, licensing utility and services agreements, and other related commercial matters, finalizing environmental permits, and moving towards the Final Investment Decision (FID) and eventual construction of the GTL facility.

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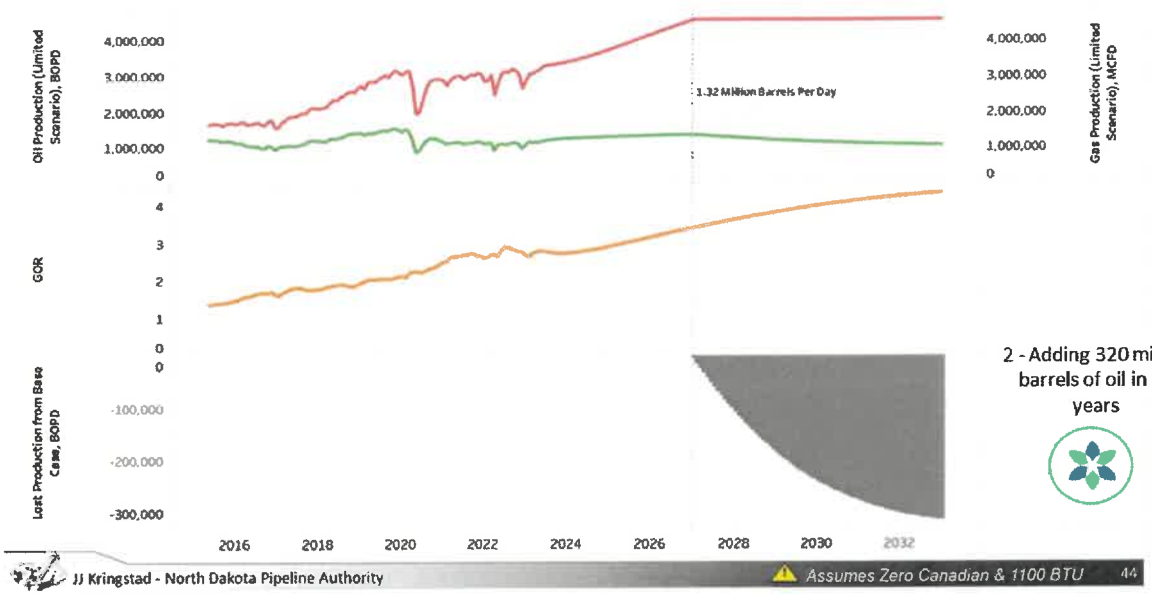
1 Background

North Dakota, a state abundant in natural resources, has faced challenges with natural gas flaring due to constraints in pipeline infrastructure and limited local gas consumption capabilities. Cerilon's project will directly address these issues by proposing to utilize 257 million standard cubic feet per day (scf/day) of natural gas within the state. This initiative is set to transform the excess natural gas into high-value products, thereby ensuring that the lack of local gas customers or infrastructural bottlenecks does not hamper oil production in North Dakota. The calculations provided by Justin Kringstad (ND Pipeline Authority) and Tom Oakland (Director Dept of Commerce) indicate that the Cerilon GTL Project – Phase 1, will enable the state to continue producing over 320 million barrels of oil in the first 10 years.

Gas Limitations Would Force Oil Production Down As GOR Rises



One of the most significant impacts of this project will be the substantial reduction in the need for gas flaring. By converting excess natural gas into valuable commodities, Cerilon not only mitigates environmental harm but also capitalizes on an underutilized resource, turning what was once a byproduct into an asset. This approach aligns with the growing global emphasis on environmental sustainability and responsible energy use.

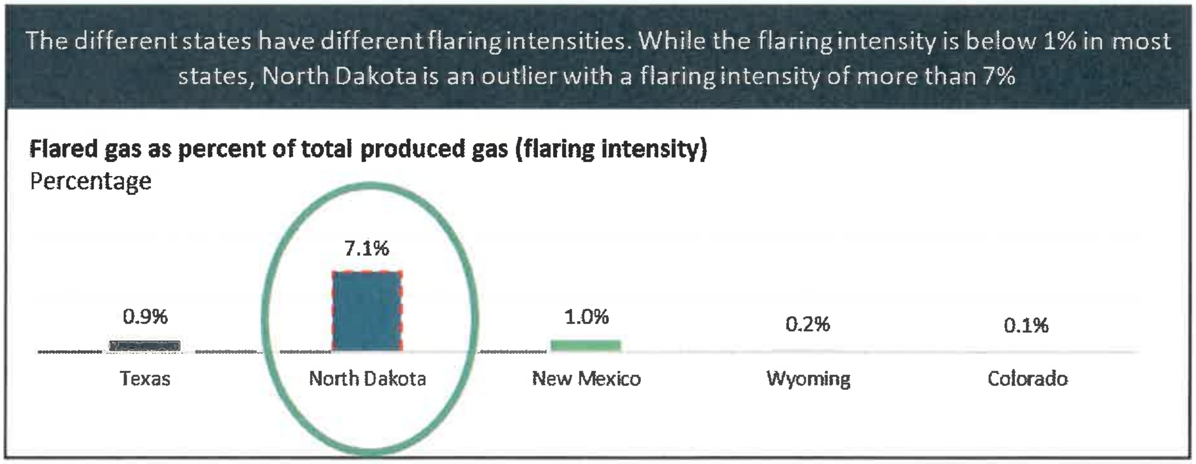


Figure 1 North Dakota's Flaring Intensity Versus Other States

Source: Rystad Energy

The project represents a paradigm shift for the local energy industry, transitioning from a purely resource-based approach to a value-addition-oriented model by initiating the development of a downstream industry. This transition is crucial for the development of a new downstream industry in North Dakota, adding significant value to the local gas and diversifying the region's economic base. By processing and enhancing the value of local natural gas, Cerilon is helping to build a more integrated and robust oil and gas industry, capable of withstanding the volatility of boom-and-bust cycles.

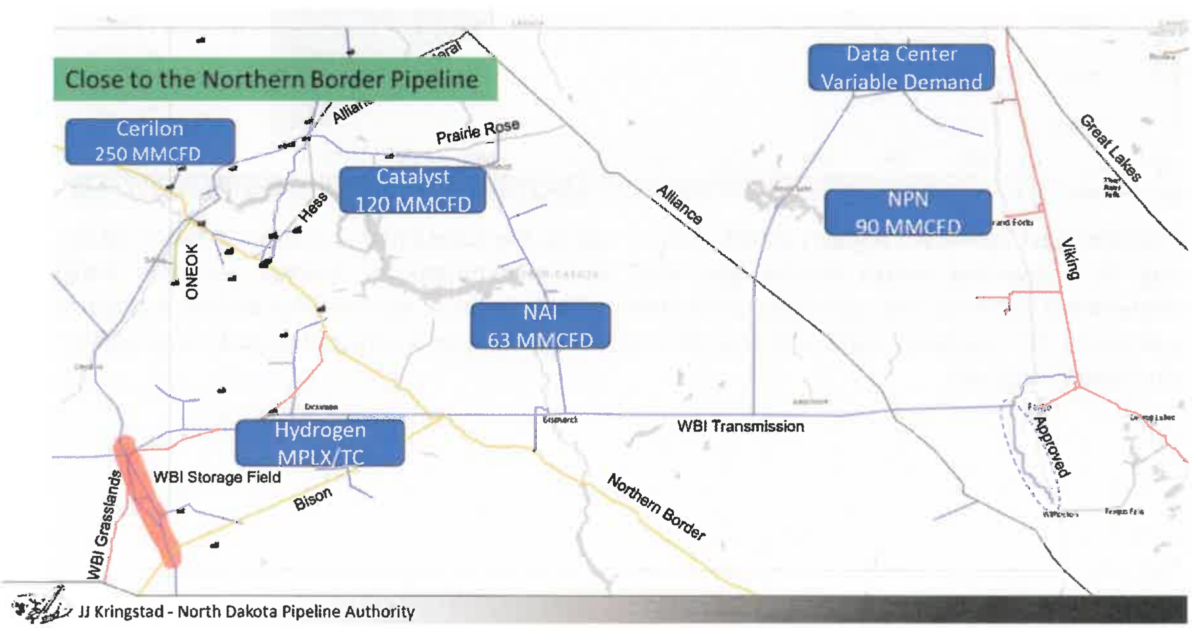


Figure 2 Local Demand for Natural Gas

Calculations by Justin Kringstad indicate that the current in-state gas consumption is around 515 MMSCFD. The Cerilon GTL will add 250 MMSCFD thus increasing the instate consumption by 49%.

Moreover, Cerilon's initiative is instrumental in reducing the carbon footprint of energy products. Compared to traditional chemical plants, the project adopts cleaner, more efficient processes, aligning with the global shift towards lower carbon emissions in the energy sector.

A critical component of Cerilon's vision is the support and development of Carbon Capture and Sequestration (CCS) technologies. By capturing and storing CO2 emissions, the project not only contributes to environmental preservation but also positions North Dakota as a leader in CCS technology.

The project is expected to create a ripple effect, attracting other major organizations to invest in North Dakota, thereby fostering a climate of innovation and economic growth. The local community stands to benefit significantly, with the creation of high-caliber technology jobs, enhanced local services, and overall economic stimulation.

2 Project Scope

As part of Cerilon's project platform for gas to liquids (GTL) projects, the company aims to strategically position natural gas-producing regions as leading producers of environmentally responsible energy products for decades to come. The Cerilon GTL plant in North Dakota will provide energy security and much-needed jobs in conjunction with a strategic project portfolio that produces environmentally friendly synthetic energy products in high demand. In accordance with Cerilon's core operating principles, the key technical, commercial, and risk mitigation elements for a GTL project portfolio have been identified and aligned to take advantage of current and anticipated future markets.

The GTL facility will utilize natural gas reforming and Fischer Tropsch (FT) technologies to produce advanced Renewable Fuel Standard (RFS)-qualifying products. The facility will convert natural gas to produce ultra-low sulfur diesel (ULSD), naphtha, and Group III+ base oils (lubricant base).

The GTL process involves six main process areas:

- Syngas production
- Fischer-Tropsch synthesis
- Product Work-Up
- Air Separation Unit
- Carbon Capture Unit
- Utilities and Offsites

The operational facility design encompasses a fully functional GTL facility, including all utilities, offsites, and infrastructure.

Cerilon has established separate contracts with the two Process Licensors, Syngas Preparation and Fischer Tropsch (F-T) with a large supermajor established licensor (L1) and a Product Workup license with a large supermajor established licensor and energy company (L2). Formal contracts for an Air Separation Unit (ASU) package provider / operator, and (waste)water treatment packages are still to be awarded in FEL-3. The base case is for the ASU is to be owned and operated by ASU provider and oxygen and nitrogen to be provided to Cerilon GTL over the fence.

Figure 3 Illustration of Planned Cerilon GTL Site Once Completed

3 Land Acquisition and Preparation

The land required for the Project has already been acquired and conditionally rezoned for industrial use. The Project is located near Trenton, North Dakota. It is strategically situated within proximity to abundant natural gas supply, key utilities and transport links, and suitable geology for carbon sequestration. The Project Site is close to the Northern Border Pipeline, the primary source of gas supply, and is proximate to the Cochin pipeline, a major offtake transport option for naphtha, as well as rail and road transport facilities, providing low-cost access to in-state and North American markets. Carbon capture and sequestration (CCS) is an integral part of the Project's design, and preliminary in-state CCS locations have been identified.

Key attributes for the selected North Dakota site include:

- access to natural gas via existing natural gas pipelines for feedstock supply
- suitable geology for CO_2 sequestration and pore space ownership jurisdiction
- rail and road loading facilities and product pipelines to support product shipment to customers
- access to sufficient electric power for start up, and for interconnection to the grid to supply excess electricity
- access to other necessary utilities and services

Cerilon owns, and is under contract to acquire additional parcels, for a contiguous land block of approximately 370 acres in Sections 25 and 36, Township 153 North, Range 103 West in Williams County on which the Project will be constructed (the "Project Site"). The Project Site is approximately 1.5 miles southwest of Lake Trenton and the unincorporated community of Trenton, 2.75 miles northwest of the Missouri River, 5 miles northeast of the unincorporated community of Buford, and 7.5 miles southwest of the city limits of Williston. The Project Site is bordered to the west by Savage Services' Bakken Petroleum Services Hub (Savage), to the north by the Great Northern Railroad, and to all other sides by agricultural land, homesteads, and farmsteads.

Cerilon has also received conditional approval from Williams County to zone the Project Site for heavy industrial, contingent upon receiving a Conditional Use Permit from Williams County.

Figure 4 Preliminary Site Layout

4 FEL 2 Engineering Work

An overview of the project is described in this block flow diagram of the facility, followed by an abbreviated summary of the key procedural steps. The full FEL-2 Engineering Report prepared by Worley was presented to the CSEA and is bound by licensor confidentiality. A redacted version that excludes the licensor confidential information can be provided confidentially upon request.

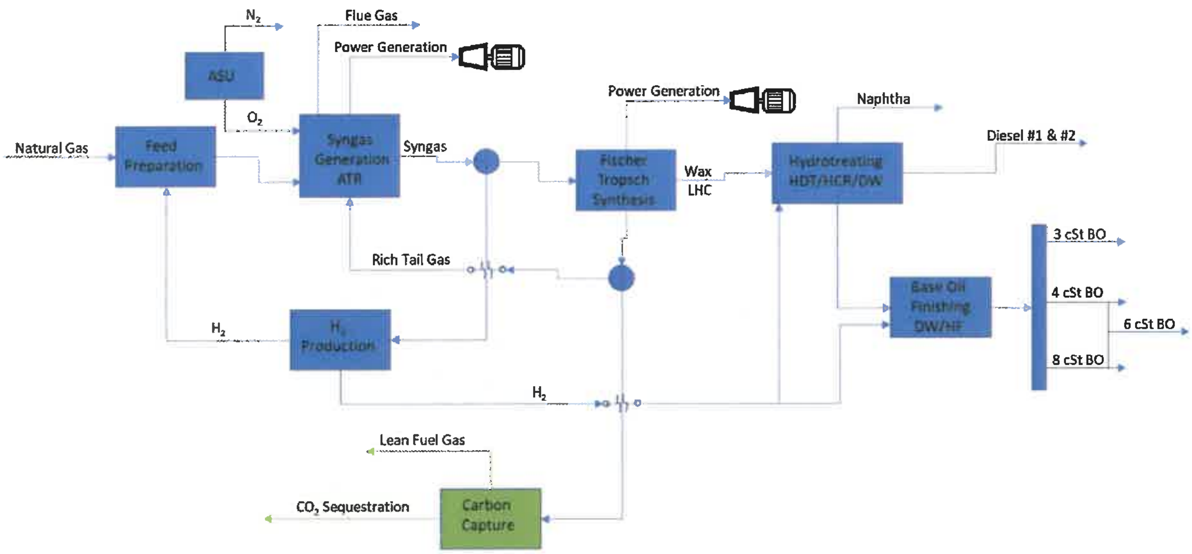


Figure 5 Simplified Overall Block Flow Diagram

4.1 Syngas Production

Feed Gas Preparation: Natural gas feedstock is received at approximately 865 psi. This gas initially passes through a Natural Gas Feed KO Drum, and its pressure is regulated via a controller. A hydrogen stream from the PSA unit is also mixed with the natural gas. This mixture undergoes a hydrodesulfurization (HDS) process using a catalyst in the HDS Vessel to transform complex sulfur compounds into hydrogen sulfide (H2S). The H2S is then absorbed using zinc-oxide beds in the Desulphurization Vessels, which operate in a lead/lag configuration for continuous online operation. This process not only converts sulfur compounds but also achieves ultra-purification of the natural gas. The natural gas is preheated through heat exchange with desulfurized gas and then by reformed gas, ensuring it reaches the optimal temperature for the HDS reaction. The system is designed for efficient conversion and absorption, maximizing sulfur retention on the absorbent.

Gas Feed and Saturation: The Syngas Production Unit begins with the purified natural gas feed and pressurized FT tails gas recycling being split and sent to two independent reforming trains. These trains, each comprising a saturator, pre-reformer, ATR, and various heaters and drums, rejoin post the reformed gas KO Drum, resulting in parallel operation. The natural gas is initially saturated with steam in the Saturator through direct contact with hot water, efficiently using heat and minimizing steam addition before the ATR. Further steam is added downstream to achieve the ideal steam-to-carbon ratio for the reforming catalyst. This ratio is carefully controlled based on the flow and composition of the natural gas feed and tails gas recycle, with manual input by operators based on natural gas feed analysis.

Pre-Reforming and Autothermal Reforming (ATR): In pre-reforming, the saturated gas feed is heated to facilitate the conversion of heavy hydrocarbons to methane and carbon oxides over a CRG catalyst. This process balances exothermic and endothermic reactions and reduces the risk of CO-induced decarburization. The pre-reformed gas then enters the ATR, where it undergoes partial oxidation with pre-heated oxygen from the Air Separation Unit, followed by endothermic reforming over a fixed catalyst bed. The ATR design ensures uniform flow and effective mixing for optimal reaction performance, maintaining high temperatures while protecting the catalyst bed and reactor shell.

Syngas Cooling and Process Condensate Handling: Post-reforming, the syngas undergoes cooling and condensation, with condensed water being separated in the Reformed Gas KO Drum. Process condensate from various drums is collected and treated, with part of it reused in the Saturator. The handling system ensures removal of dissolved gases from the condensate, enabling its reuse post-treatment. During start-up, various loops involving a circulator, coolers, and drums are used for drying and heating catalyst beds, using LP Nitrogen for pressurizing prior to operation. This comprehensive process ensures efficient syngas production, purification, and condensate management, integral to the facility's operation.

4.2 FT Synthesis

The FT Synthesis process in the facility involves syngas feed from the Syngas Generation Unit (SGU) being mixed with recycled gas from the FT Synthesis loop, facilitating the recovery of unreacted syngas and ensuring thermal stability in the FT Converter. The FT Converter operates at a pressure, where hydrogen and carbon monoxide react to form long-chain paraffins and water vapor through highly exothermic reactions. The FT Converter uses a multi-tubular fixed bed reactor with CANS™ inserts for efficient reaction and heat removal. The radial flow through the catalyst beds allows for efficient use of small catalyst particles, enhancing productivity and heat transfer. The heavy hydrocarbons are separated in the FT Converter Wax Trap, and the light hydrocarbons and water produced are cooled and separated in subsequent stages. Most of the overhead stream from these separation stages is recycled back to the FT Converter, with a small tails gas stream being used for inert gas removal and loop pressure control. This comprehensive process maximizes the overall CO conversion and maintains the reactor's temperature for optimal reaction conditions.

Following the FT Synthesis, light hydrocarbons and produced water are collected and cooled, with the resulting off-gas being routed to an off-gas export header. These components are then separated in the FT Hydrocarbon Separator through gravity settling. Wax from the FT Wax Trap is sent to the Wax Receiver, which is designed to prevent solidification of heavy hydrocarbons during shutdowns. The Wax Receiver also produces flash gas due to the pressure difference, which is then routed to the off-gas export header. The tail gas purge from the FT Synthesis loop undergoes compression and is split to each train's Saturator for optimal H2:CO ratio control in the syngas feed. A CO2 Removal Package is incorporated to eliminate CO2 from the tail gas purge, with the CO2-rich stream being disposed of or sequestered. The remaining tail gas is utilized in the fuel gas system or exported for fuel.

The activation of the FT Catalyst during start-up involves a hydrogen and nitrogen mixture, which reduces cobalt oxide to active cobalt metal. This activation gas is dried to avoid catalyst degradation and is heated by circulating hot gas and HP-saturated steam. The Activation Dryer Package ensures the continuous drying of the circulating activation gas. The entire activation process is crucial for initiating the FT Synthesis, ensuring the efficiency of the catalyst, and maintaining the required reaction conditions within the FT Converter.

4.3 Product Work-Up Unit

The product work-up unit's primary goal is to maximize production of Group III base oils (3 cSt, 4 cSt, 6 cSt, & 8 cSt), with a secondary aim of boosting diesel production. This is achieved by initially processing Fischer Tropsch (FT) wax and condensate feeds to saturate olefins and oxygenates. Diesel-range fractions are diverted to a diesel DW unit for isomerization to meet cloud and pour point specifications, while base oil range feed is stored in intermediate waxy base oil tanks. Heavier material, unfit for base oil feed, is sent to a hydrocracker to generate more base oil feed, producing diesel, naphtha, and LPG as byproducts. The waxy base oils are processed in the base oil DW/HDF unit in two blocks (3 cSt & 4 cSt block, and 8 cSt block), with 6 cSt base oil produced by blending 4 cSt & 8 cSt products in tanks. The HDT Reaction Section processes wax and condensate from the FT unit, involving filtration, boosting, heating, and combining feeds, with dimethyl sulfide (DMDS) injection to maintain the reactor catalyst's active sulfided state. The combined feed is then heated for the hydrotreating reaction section, with control mechanisms for temperature and pressure maintenance.

Additional processes with complexity outside the scope of this final report handle diesel splitting, light ends recovery and naphtha stabilization.

4.4 Air Separation Unit

The Air Separation Unit (ASU) is designed for cryogenic air separation, delivering high purity oxygen for the Auto Thermal Reforming (ATR) burner and low-pressure nitrogen for plant utility. It involves multiple stages of air purification and compression. Initially, air is filtered and compressed, followed by cooling, and washing to remove impurities. CO_2, water, and hydrocarbons are removed in the Molecular Sieve Adsorbers. The clean air is then divided, with part going through further compression processes and cooling, and part entering the cold box for liquefaction. The cryogenic rectification system comprises the Pressure Column, Low Pressure Column, Main Condenser, and Subcooler, separating the air into pure oxygen and nitrogen. Pure liquid oxygen (LOX) is split for process use and storage, while pure liquid nitrogen (LIN) is similarly managed. The unit includes various components like compressors, coolers, pumps, and vaporizers to facilitate these processes, ensuring the efficient production of gaseous high purity oxygen and nitrogen for the plant's needs.

4.5 Carbon Capture Unit

The Carbon Capture Unit (CCU) in the process flow efficiently captures carbon dioxide from FT Tails gas purge using an amine-based solvent system. The CO_2-rich tails gas from the FT Reactor is treated in the CO_2 Absorber where CO_2 is absorbed by lean amine solvent. The treated gas, now with significantly reduced CO_2 levels, is utilized as fuel or exported to the fuel system. The amine solvent, now rich in CO_2, undergoes regeneration in the Rich Solvent LP Flash Column & Regenerator, transforming it back to lean amine for recirculation. The process involves several key stages including LP Flash, stripping, solvent boosting, heat exchanging, and air cooling. Additionally, the system incorporates a wash water section to prevent amine ingress into the vapor and various filters to maintain solvent quality. The wet CO_2 extracted is compressed, dehydrated, and prepared for pipeline transportation. Oily wastewater generated from the process is managed through a dedicated treatment system. The intricate design of the CCU ensures efficient carbon capture and solvent regeneration, aligning with environmental standards and operational efficiency.

4.6 Utilities and Offsites

Cerilon is collaborating with local partners to provide utilities for the Project. Key utility requirements include connection to the power grid, provision of raw water, and disposal of treated process water. During normal operations, the Project will generate sufficient power to operate the plant with a surplus of up to 50 MW (per phase) for sale back to the grid. Power from the grid will be required during start-up and shutdowns. Cerilon is working with the local power provider, LYREC, to design the infrastructure necessary to connect the Project to the grid. Applications to the Southwest Power Pool have been made by LYREC for the additional load and by Cerilon for authorization to connect to the grid.

Raw water for the plant will be sourced from the Missouri River using infrastructure dedicated to the Project. The Missouri River is not a highly allocated water source and securing a Water Appropriation Permit from the state for the GTL Facility is not considered to be a significant project risk. Cerilon is working with an experienced local company that operates a similar industrial water intake facility in the area. This partner will secure regulatory authorizations, design, build, and operate the river intake, initial sedimentation pond, pumphouse and pipeline, and Cerilon will buy water at the plant battery limit. The pipeline will be sized to accommodate Phase 2 in addition to requirements for the Project.

A treated water disposal line will be included in this design to return treated process water to the Missouri River in accordance with state and Federal regulations. Cerilon has been working with a local landowner who has space available for the water source infrastructure on the Missouri River.

Other utilities and supporting infrastructure, including potable water supply, and fiber optic and cellular data connections, will be supplied by existing service providers or municipal agencies.

5 Environmental Planning and Compliance

Regulatory authorizations for the Project are required from multiple agencies within the State of North Dakota and Williams County. Several of the state authorizations are provided under delegated authority from the US Government. A project permitting plan was developed with a target to have all permits required before construction issued at least 4 months before the FID. The status of key permit applications is as follows:

- An application to the North Dakota Public Service Commission for a Certificate of Site Compatibility pursuant to the North Dakota Siting Act was submitted on October 5, 2023. A public hearing on the project is expected in Q1 2024 with Certificate issuance anticipated in Q2 2024.
- A generator interconnection application has been filed with the Southwest Power Pool and the review of the current group of applicants is expected to begin in December 2023.
- Applications to the North Dakota Department of Environmental Quality for the Permit to Construct (air emissions permit) pursuant to the US Clean Air Act and a Water Discharge Permit pursuant to the US Clean Water Act are being prepared for submission in Q1 2024, with permits anticipated in Q3 2024.

Several supporting studies have been completed, including Phase 1 and Phase 2 Environmental Site Assessments, a Wetland Delineation Report, a Threatened and Endangered Species Evaluation, and a Class III Cultural Resources Inventory. None of these reports identified any significant risks to the Project.

County and township authorizations will be secured in 2024 and all required operational plans will be prepared before construction or start-up, depending on their purpose.

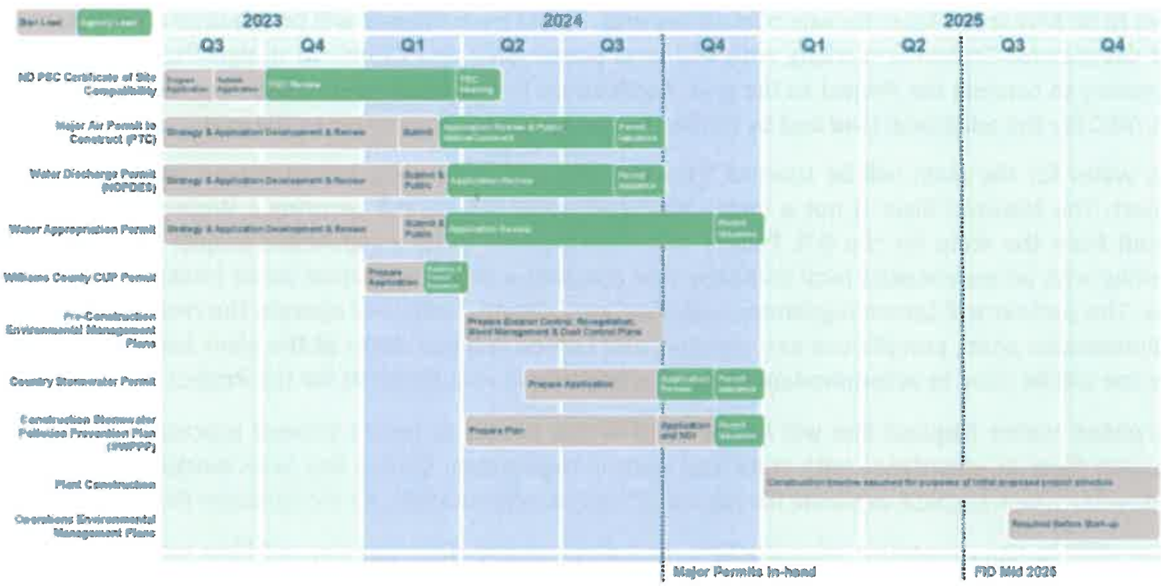


Figure 6 Cerilon Permits and Licenses Schedule as of Q4 2023

Cerilon partnered with Barr to support permitting for the Project. Barr was selected for their extensive history of permitting for both modifications to existing plants and the construction of new industrial facilities in North Dakota. Barr staff have strong working relationships with the regulatory decision-makers who will review applications for this Project.

6 Strategic Planning for Energy Security

Group III+ base oil demand is currently satisfied through imports of 15,000 bpd, with demand growing by at least 8% per annum. Current Group III base oil production in North America is about 5,000 bpd with a demand of about 20,000 bpd. For both Group III and Group III+, the majority is imported from Asia and the Middle East. The Project enables offtakers to improve their competitive position by aligning strategically with a stable and reliable domestic supplier of superior products.

Cerilon has received strong interest in product offtake and negotiations with several large credit-worthy counterparties are well underway.

- Cerilon has prepared a first draft offtake LOI with a major multinational company that manufactures and sells high-quality refined products for the purchase of 100% of the Project's expected Group III+ base oil production, at a Group III+ plus a premium price. Cerilon has also engaged in preliminary discussions with reputable global lubricant manufacturers and specialized local lubricant formulators as alternatives for Group III+ base oil offtake.
- In addition, Cerilon has exchanged LOI drafts with a major North American midstream company to purchase 100% of the Project's expected naphtha production at an Edmonton-based published market index price.
- Finally, Cerilon has received an indicative proposal from a leading North American Energy Marketer having informed its intent to offtake the Project's full capacity production of #1 and #2 ULSD. Product

pricing would be calculated at the rate OPIS Ultra-Low Sulfur Diesel Fargo, North Dakota Gross Unbranded. Cerilon is also in discussions with a major multinational energy company interested in offtaking the ULSD product.

7 CCS Plan

The Project is centred around producing transition energy while embracing a low-carbon strategy. CO_2 will be captured onsite and sent offsite for sequestration. The Project has been designed to enable the capture and safe sequestration of CO_2. The GTL Facility will have the lowest GTL carbon footprint in the world providing the ability to offer consumers materially higher quality but lower carbon products.

Cerilon conducted a CCS Pre-feasibility Study with the EERC to assess geologic CO_2 storage sites for its 24,000 bpd GTL Facility in Trenton, North Dakota. The study evaluated two geologic CO_2 storage options: saline formations and depleted gas and/or oil fields. Suitable sites require a confining zone, continuous sealing layers, sufficient porosity, and a depth that accommodates dense-phase CO_2 storage. Saline formations and depleted oil and gas reservoirs offer advantages but require careful site selection and monitoring to ensure long-term safety and effectiveness.

Through the work with EERC, geologic formations in western North Dakota have been identified with properties suitable for use as long-term CO_2 storage reservoirs. The Inyan Kara and Broom Creek Formations are suitable targets for large-scale deployment of CCS, with an estimated combined storage capacity of between 20 and 70 billion tonnes of CO_2. In addition, The Mission Canyon Formation and the Deadwood Formation in North Dakota also have potential for CO_2 sequestration. Cerilon's preliminary area of interest encompasses a 40-mile radius around the GTL Facility, excluding all land within the State of Montana.

The study analyzes four potential sites for CO_2 storage, considering factors like well density, proximity to existing infrastructure, topography, and more. The Inyan Kara Formation is present at all four sites and, based on its characteristics, is an important contributor to the storage capacity required for the Project. The Broom Creek Formation, present only at Site 4, is also a good candidate for CO_2 storage.

Cerilon will use this study to high grade a specific location to carry out the next steps in evaluating and finalizing an appropriate site for the storage and sequestration of CO_2. Additional evaluation and consideration of alternative sites is being completed with potential partners before finalizing a site for CO_2 storage. 450,000 MT of CO_2 per annum is anticipated to be captured by Cerilon under the current plant design. Cerilon will further partner with an experienced operator to develop the infrastructure (pipeline, surface injection facilities and subsurface well placement) and manage the sequestration operations of the captured CO_2. Eligibility for Investment Tax Credits (~$ 100m) and Producer Tax Credits (PTC) under the Inflation Reduction Act (IRA) were confirmed. Note however that PTC (45Q) are anticipated to constitute ~ 1% of Project revenues.

Cerilon has worked with the EERC to confirm the capital expenditure (CapEx) and operational expenditure (OpEx) costs involved and has received a confirmation letter from the EERC that a period of 2 years is required to obtain the necessary Class VI well permits. This allows Cerilon and our partners to conclude the partnership arrangements and commence with the development in time for our Commercial Operations Date (COD).

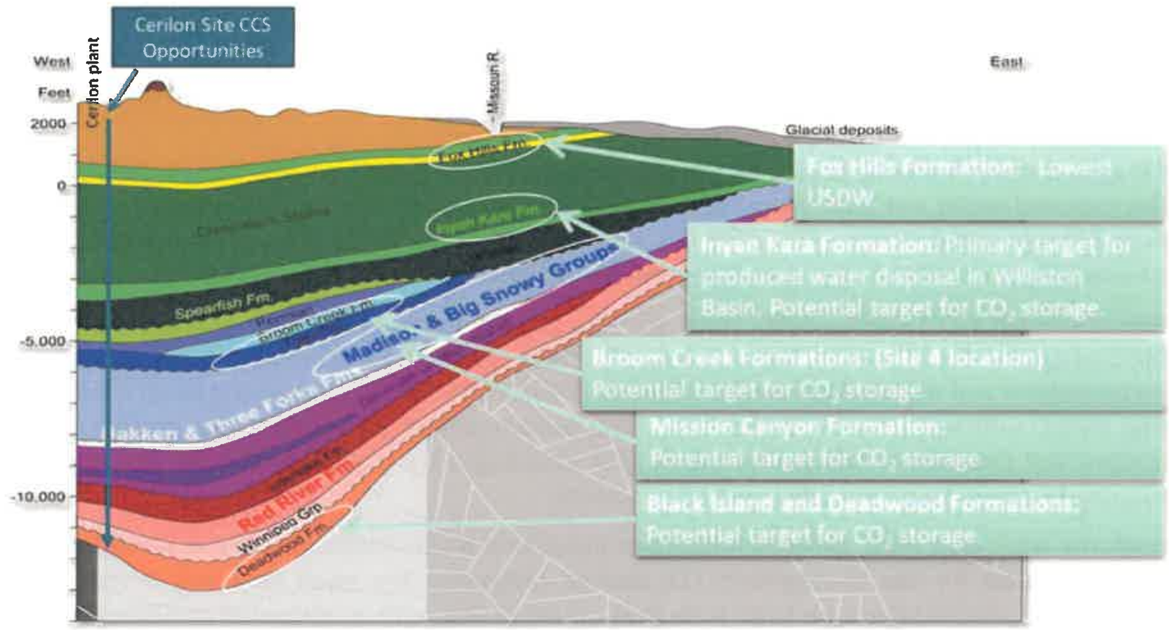


Figure 7 Willington Basin Storage Opportunities

8 Economic and Community Impact Assessment

The Project will positively impact the region by adding infrastructure, increasing the County's tax base, and providing jobs. Cerilon anticipates that the Project will create over 1,000 direct jobs during construction, increasing to a total of over 2,200 on a direct, indirect, and induced basis. During operation, there will be an average of 250 direct employment opportunities with an additional 2,250+ indirect and induced jobs created by the Project. Economic benefit estimates were created in 2021 using the State of North Dakota regional economic model ('REMI') and subsequently updated in October of 2023. Cerilon plans to use local contractors and suppliers, where feasible, for portions of construction that will contribute to the economy of Williams County. Purchases of products to construct and operate the facility such as fuel, equipment, services, and supplies will benefit the local businesses of Williams County as well as the State of North Dakota. A more detailed output of the REMI model is available in Appendix B.

Table 1 Economic Benefits Estimates

Benefit	Development and Construction	Operation
Job Creation	100 to 2,200 (1)	600 to 3,100(1)
Wages and Salaries	\$70 MM Annual Average \$360 MM 5-Year Impact	\$140 MM Annual Average \$690 MM 5-Year Impact
State GDP	\$130 MM Annual Average \$630 MM 5-Year Impact	\$480 MM Annual Average \$2,400 MM 5-Year Impact

Benefit	Development and Construction	Operation
State Output	$230 MM Annual Average $1,150 MM 5-Year Impact	$1,100 MM Annual Average $5,400 MM 5-Year Impact
State Tax Revenue (total)	$15 MM Annual Average $75 MM 5-Year Impact	$60 MM Annual Average $300 MM 5-Year Impact
Notes: (1) Total Direct, indirect and induced employment within the State (varies by year). All figures above have been rounded		

9 Stakeholder Engagement and Partnership Building

Cerilon has been working with state and county officials and staff since before North Dakota was selected as the Project location and both levels of government have provided unwavering support for the Project. State and county representatives provided input on site selection, facilitated introductions and partnerships for Cerilon in the state and continue to work closely with Cerilon as the Project develops. Most importantly, both levels of government have demonstrated their confidence in the Project by providing financial support in the form of grants and loans.

The strategic partnership between Cerilon and the state is a mutually beneficial alignment. Cerilon's objective of developing the GTL Facility and incorporating CCS aligns with the state's objective to reduce flaring, enhance gas transport capacity, and ultimately achieve a net-zero carbon footprint. This collaboration establishes a win-win situation, with the county and state providing their full support for the development of the Project.

North Dakota has an ambitious target to be the first carbon-neutral state by 2030 and has identified the Cerilon GTL facility as a key piece of energy transition infrastructure vital to achieving this objective. The GTL Facility will use a significant volume of associated gas that may otherwise be flared to generate sustainable energy products. State officials view the scalability and replicability of the GTL Facility design as an innovative and adaptable in-state solution for managing surplus natural gas that aligns with the state's long-term energy goals. The GTL Facility will also bring new technology, business opportunities, and quality jobs to the State of North Dakota.

Cerilon initiated engagement with local stakeholders early in Project development. Cerilon believes that transparent, open, and frequent two-way communication with project stakeholders is critical to building strong relationships that benefit both Cerilon and the local community. Cerilon shares project information as it becomes available and is committed to continued engagement and information transfer as the Project develops. Engagements to date have included:

- Frequent communication with state, county, and township officials and staff from an early stage in project development to align the Project with the objectives and requirements of state and local governments.
- In-person opportunities for adjacent neighbors and local landowners to receive information about the Project and raise potential concerns.
- In-person meetings with key local stakeholders including local Indigenous leaders, the school district, and emergency services providers to identify ways Cerilon can support their efforts to strengthen the local community.

- In-person meetings with state, county, and Federal regulatory agencies to provide project information and solicit guidance on Project design, application content, and mitigation options.
- Sponsorship of community events and economic development organizations.

Cerilon hosted a public open house in Trenton in November 2023 to provide a venue for all interested stakeholders and the broader public to learn more about the Project and provide their input. Members of Cerilon's leadership and technical teams were present. Feedback was positive with the community and different counties supportive of the project.

There are five residences directly adjacent to the Project, and these neighbors have participated in Cerilon's early engagement activities. Cerilon will work with these neighbors to address Project impacts through mitigation measures to address specific concerns, Project design changes (where possible), and other options to be identified during consultation with the landowners.

10 Next Project Development Steps

Cerilon's next development step, outlined in the latest CSEA application dated October 31, 2023, are critical to advancing towards the final investment decision ("FID"). The FEED or FEL-3 stage is the final stage before the FID, the followed by the detail engineering, construction, and start up of the facility. These steps are pivotal in transitioning from the conceptual stages to an operational stage.

1. **FEL-3 / FEED Engineering:** A primary focus in the upcoming phase is the Front-End Engineering Design (FEED) or FEL-3 engineering. This phase is integral to refining and finalizing the project's design, engineering specifics, and technical requirements. The FEED engineering will detail the technical aspects, project scheduling, and cost estimates, providing a comprehensive blueprint for the project's execution. It's a process that will aim to mitigate risks and further improve the accuracy of technical, financial, and environmental estimates. The findings and conclusions of this engineering will play a crucial role in informing the decision-making process for the final investment.
2. **Securing External Equity Financing:** Another significant step is securing external equity financing. For this purpose, Cerilon has engaged Société Générale ("SocGen") as financial advisor. SocGen's expertise in financial structuring and their deep understanding of the energy sector will be instrumental in navigating the complex landscape of project financing. Their role will encompass identifying potential investors from their global network, structuring the financing in alignment with the project's needs, and facilitating negotiations. This step is vital for ensuring the financial health and sustainability of the project, balancing the risks and returns effectively. This will augment the list of Post FID investors that already indicated they want to be part of the construction financing.
3. **Advancing to an FID:** The culmination of these efforts will lead towards the FID. The FID is a pivotal milestone, marking the transition from planning and design to the actual commencement of construction and operational activities. It represents a commitment to move forward based on the confidence in the project's feasibility studies, design maturity, and financial arrangements. The FID will be informed by the outcomes of the FEED study and the success in securing the necessary financing. It's a decision that signifies confidence in the project's potential to transform the energy landscape of North Dakota. The FID is anticipated for early-to-mid 2025.

Appendix A Plot Plan Overlay on the Project Site

Appendix B REMI Model Information – Construction and Operations

Economic Impacts[1] from the Construction Phase of the GTL Facility and ASU Facility

Employment (Job Creation)

Category	Units	2022	2023	2024	2025	2026	2027	Annual Average	5-years Impact
Total Employment[2]	Individuals (Jobs)	111	113	112	2,231	2,254	2,205	The employment concept is the same as used by the U.S. Bureau of Economic Analysis, so it captures full-time, part-time and sole proprietors as one. Because employment is a stock concept, the results cannot be aggregated over multiple years. They should be only interpreted as the impact in the single year relative to base year.	
Direct Employment (Construction Contractors' employees)[3]	Individuals (Jobs)	0	0	0	1,124	1,094	1,061		
Indirect Employment[4]	Individuals (Jobs)	0	0	0	122	116	111		
Induced Employment[5]	Individuals (Jobs)	111	113	112	985	1,043	1,033		

Wages and Salaries

Category	Units	2022	2023	2024	2025	2026	2027	Annual Average	5-years Impact
Wages and Salaries (across All Industries)[6]	Millions of Fixed (2020) Dollars	$4.9	$5.0	$5.0	$114.6	$116.4	$116.7	$71.53	$357.67

State Gross Domestic Product (GDP) & Output

Category	Units	2022	2023	2024	2025	2026	2027	Annual Average	5-years Impact
State GDP (from All Industries)[7]	Millions of Fixed (2020) Dollars	$10.9	$11.0	$10.9	$202.4	$206.1	$203.8	$126.83	$634.17
State Output (from All Industries)[8]	Millions of Fixed (2020) Dollars	$17.6	$17.9	$18.0	$371.0	$374.4	$367.9	$229.85	$1,149.23

Total Impacts on the State Tax Revenue[10]

Category	Units	2022	2023	2024	2025	2026	2027	Annual Average	5-years Impact
Tax Revenue from Sales & Use Tax[11]	Millions of Fixed (2020) Dollars	$0.88	$0.90	$0.90	$18.59	$18.76	$18.43	$11.52	$57.58
Tax Revenue from Individual Income Tax[12]	Millions of Fixed (2020) Dollars	$0.24	$0.24	$0.24	$5.57	$5.66	$5.67	$3.48	$17.38
Total Tax Revenue[13]	Millions of Fixed (2020) Dollars	$1.12	$1.14	$1.15	$24.18	$24.42	$24.10	$14.99	$74.96

Notes:

[1]As REMI develops a baseline forecast for the State of North Dakota, the results should be interpreted as the difference in absolute value or as a percentage change in each year relative to the baseline forecast. Therefore, the impacts should be seen as increases in Employment, Wages and Salaries, State GDP, State Output, and State Tax Revenue at a **STATE LEVEL**.

[2]Total Employment comprises estimates of the number of jobs, full-time plus part-time, by place of work for all industries. Full-time and part-time jobs are counted at equal weight. Employees, sole proprietors, and active partners are included, but unpaid family workers and volunteers are not included.

[3]Direct Employment refers to the estimated number of employees that will be hired by the Construction Contractors to design and construct the GTL plant and ASU facility.

[4]Indirect Employment includes the employment in upstream industries that supply and support the designing and construction of the GTL plant and ASU facility. Workers in such positions may produce steel, plastics, or other materials, or they provide financial and other services. That means these jobs are supported by business to business transactions as a result of the economic activity generated by the construction contractors in the construction industry.

[5]Induced employment encompasses jobs beyond the construction industry and its upstream industries, such as jobs in the consumer goods industry. When people who are employed directly or indirectly spend their incomes on a variety of items in the broader economy (such as food, clothing, transportation and entertainment), the expenditure gives rise to induced employment effects.

[6]Wages & Salaries refers to the monetary remuneration of employees across all industries, including the compensation of corporate officers; commissions, tips, and bonuses; voluntary employee contributions to certain deferred compensation plans, such as 401(k) plans; and receipts in kind that represent income.

[7]GDP refers to the total of all value added created in North Dakota's economy. The value added means the value of goods and services that have been produced minus the value of the goods and services needed to produce them, the so called intermediate consumption. Thus, the total GDP from all industries (i.e., private + government) at a State level.

[8]State Output refers to the amount of production, including all intermediate goods purchased as well as value added (compensation and profit). Can also be thought of as sales or supply. The components of Output are Self Supply and Exports (Multiregions, Rest of Nation, and Rest of World). Thus, Total Output from all industries (i.e., private + government) at a State level.

[10]Assumptions Applied to State Tax Revenue: (i) All projected Output will be taxable (i.e., Taxable Sales and Purchases); and (ii) all projected wages and salaries will be taxable (i.e., Taxable Wages & Salaries). Cerilon GTL ND Inc. and the State are in discussions regarding potential temporary partial state tax exemptions.

[11]The increase in Sales Tax Revenue based on a 10-year Average Effective Marginal Tax Rate of 5.01%.

[12]The increase in Tax Revenue from Individual Income Tax based on a 10-year Average Effective Marginal Tax Rate of 4.86%.

[13]The increase in the State Total Tax Revenue is equal to: Total Tax Revenue from Sales & Use Tax + Total Tax Revenue from Individual Income Tax

Please Note: All estimates (computed using the REMI Tax PI+ model) are adjusted for inflation using 2020 as the base year. That means the forecasted values are in real dollars and pegged to 2020. Tax-PI v3.1.0 was used for this analysis, with the earliest year for analysis being 2022.

North Dakota Clean Sustainable Energy Program
Final Report

Recipient: Wellspring Hydro
Contract Number: C-01-03
Report for time period of: (7/22/2022 – 9/18/2023)
Spent: $2,023,025 USD

Description of Project
Please provide a brief description of the project:

Wellspring Hydro is a locally founded North Dakota company with a mission to unlock the full potential of produced water into a feedstock for sustainable clean energy. The Wellspring Hydro process is new and emerging technology focused on developing products from various renewable components, including produced water waste stream as the key feedstock.

Wellspring Hydro's project will produce three commercially essential commodity products and lithium production to the State of North Dakota in a sustainable format that will diversify the economy, bolster existing industries (clean sustainable energy) through lower prices, and operate with a goal of zero waste or harmful emissions. The objectives of the project include;

- Execute the final phase of front-end engineering (FEL-3) and design to recover valuable resources with commercial value from a waste stream from the Bakken oil fields
- Confirm produced water feedstock process through pilot testing with subject matter experts to optimize high quality of recovered salt to meet stringent demands in chlor-alkali production.
- Utilizing output of FEL-3 and produced water analysis, complete validation of lithium extraction process with Prairie Lithium to be officially included in scope (FEL-1).

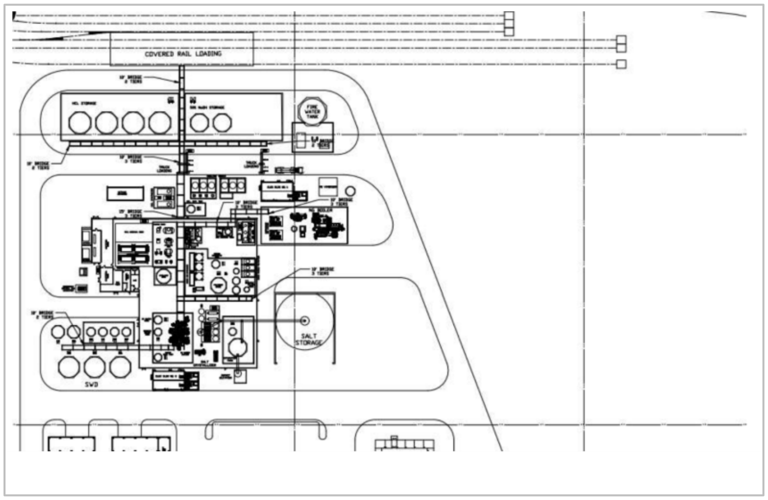
Summary of CSEA grant requests and payments to date;

Date	FEL-3 Invoice	CSEA Funds	Status
7/20/2022	$732,173.00	$366,086.50	Paid
4/21/2023	$330,000.00	$165,000.00	Requested – Status Report 1
6/30/2023	$427,050.00	$213,525.00	Requested – Status Report 2
9/18/2023	$320,288.00	$160,144.00	Submitted – Final Report
9/18/2023	$213,524.00	$95,244.50	Submitted – Final Report
TOTAL	**$2,023,025.00**	**$1,000,000.00**	**Total Outstanding- $633,913.50**

Project Tasks
Please describe the progress on all project tasks achieved during the reporting period:

- Final FEL-3 Report is a technical and commercial report prepared for Wellspring Hydro. The output of this report was the primary deliverable for the CSEA grant and the outputs were required to support several other deliverables. As identified in next steps for Wellspring Hydro, the team has continued to refine and optimize the detailed design into an FEL-3.1 to FEL-3.2 and ultimately, FEL-3.3. The majority of the information contained in this report was supplied by the following team:
    - Hargrove: Generated and compiled the preliminary design and engineering quantities and documents to develop and support the FEL-3.1 and the estimate. This includes technology vendor packages for the process.
    - Tormod, a Hargrove Company: Developed a preliminary Commissioning Plan to serve as a basis
    - for further development during detailed design.
    - Alfa Laval: Developed a preliminary engineering proposal for the crystallizer system.
    - Mastec: Developed construction cost estimate with the support of local contractors InDemand and FCI.
    - Appendices include;
        - A. Site Layout
        - B. Process Design Criteria and Scope of Work
        - C. Mechanical/Piping Design Criteria and Scope of Work
        - D. Civil Design Criteria and Scope of Work
        - E. Structural Design Criteria and Scope of Work
        - F. Electrical Design Criteria and Scope of Work
        - G. Instrumentation Design Criteria and Scope of Work
        - H. Controls + Automation Scope of Work
        - I. Not Used
        - J. Not Used
        - K. Not Used
        - L. Estimate Management Summary
        - M. Capital Cost Estimate
        - N. Risk Register
        - O. EPC Schedule
        - P. PFDs & HMB
        - Q. P&IDs
        - R. Equipment List
        - S. Single Lines
        - T. Equipment Layout
        - U. Electric Center Layout
        - V. Buildings Layout
        - W. Control Architecture
        - X. Execution Plan for Engineering & Procurement
        - Y. Commissioning Plan
        - Z. Operating Cost Estimate Calculations
    - *(Deliverable Reference – 1, 4, 5, 6, 7)*

- Plant Layout in FEL-3.1



- Received final FEL-3 outputs and mass balance on waste streams. Wellspring Hydro has initiated the permitting process with BARR Engineering, DEQ and NDIC for future permitting submission. This was a significant dependency for progressing the permitting process. *(Deliverable Reference – 4, 5)*

- Initiated permitting process with the support of Barr engineering and work sessions with DEQ on reviewing the FEL-3 output for determination of Class 1/Class 2 saltwater disposal well. This also represents the full scope of permitting requirements for submission to the DEQ and NDIC. *(Deliverable Reference – 4, 5)*

- IHS Markit/CMA completed an updated market research report and comparative sustainability analysis to comparative producers. This was a joint marketing report prepared with Wellspring Hydro investor (Saconix/Nex-Chlor). This represents additional detail to highlight the market opportunity and impact on sustainability. Wellspring Hydro has completed a Phase 1 and Phase 2 marketing report to identify macro and micro market intel on the chlor-alkali market.   *(Deliverable Reference – 1, 6, 7)*

Deliverables
Please describe the progress on project deliverables, as stated in your contract, achieved during the reporting period:

The following deliverables have been completed in alignment with the expectations of Contract Number: C-01-03 for the Wellspring Hydro CSEA grant;

1. Report on FEL-3
    - The FEL-3 report is the focal points for all deliverables in this grant. The combination of Hargrove, Veolia and Mastec have completed the final +/- 10% estimates to give designs the build the facility. The results met all technically and commercial expectations to support the operational process to develop products from produced water waste. Wellspring Hydro will continue to optimize and improve the design of the facility, along with additional validation of the front-end design.
    - Attachment sent 9/18 - HAR-201015-EN-RPT-001 FEL 3.1 Report
    - All appendices of FEL-3 can be sent upon request with additional details on engineering, design, layout, project execution, and others.
2. Report on pilot plan tests and results
    - This third bench scale test has been completed by Veolia and considered very successful. This represents additional validation on the front-end process to create high quality salt. The bench scale results helped demonstrate the success of the feasibility (technically and commercially) of meeting and exceeding the specifications.
    - Attachment sent 8/4 – NaCl_Test_Report_Lab4_12_23 Wellspring_5300222062
3. Report on water analysis and results
    - The water analysis and characterization will be an ongoing deliverable for Wellspring Hydro until the facility is fully constructed and implemented. An independent third party has completed a report on water analysis and further crystallizer testing to validate multiple water samples. This work was completed with multiple different water samples and different variations of testing to optimize pretreatment.
    - Attachment sent 8/4 – Report on Produced Water Pretreatment and Crystallization
4. Report on process patent
    - Wellspring Hydro has worked with an IP consultant to understand how to build a more comprehensive strategy for the technology. With the completion of FEL-3 in June, Wellspring Hydro will plan to submit for a process patent on the front-end to chlor-alkali process. The timing of submission could depend on investors interest in approach on protecting intellectual property of this novel treatment approach.
    - Attachment sent 9/18 – Wellspring Hydro Patent Process Report
5. Report on permitting process, including verification of initiation of DEQ permitting.
    - The initiation of this deliverable was completed in building a plan with both NDIC and DEQ to follow up once more FEL-3 outputs were available. In working with Hess and Neset, Wellspring Hydro is also positioned to complete the permitting process for the salt-water-disposal well required in 2024.
    - Attachment sent 9/18 - Wellspring Hydro Permit Process Report
    - Attachment sent 9/18 - Barr_Wellspring_Pre-Permitting Engagement Letter 230915
6. Report on the overall estimated reduction in environmental impacts with completion of this project.
    - CMA is now working to identify the projected competitive analysis from a variable cost perspective and improved supply chain perspective. The market analysis highlights the environmental impact of the Wellspring Hydro facility compared with other chlor-alkali facilities that are under regulatory pressure and environmental scrutiny for a design with diaphragm cells. Wellspring Hydro will be able to produce market products through the produced water waste stream, as the process indicates in the FEL-3 engineering and design output.
    - Attachment sent 9/18 – Wellspring Hydro Phase 1 Marketing Report

7. Report on the overall estimate of the increased sustainability of energy production and delivery with the completion of this project.
    - The FEL-3 report deliverable highlights the improved sustainability of energy production and delivery through the output of valuable products with a produced water waste stream. With completion of the FEL-3 report, there will be quantifiable impact of increased sustainability. In addition, there is an impact created with our produced water and lithium extraction partners on the front and back ends of the chlor-alkali process.
    - Attachment sent 9/18 - HAR-201015-EN-RPT-001 FEL 3.1 Report

Clean Sustainable Energy Authority Grant Round 5
Summary of Project Infrastructure Needs

C-05-A – Prairie Horizon:

1. Quantity of water, power, and natural gas needed for your project?

   All utility volumes are based on the current stage of engineering and are subject to change given updated licensor data and final commercial structure.

   Water: 500gpm

   Power: 160MW

   Natural Gas: 855mmBtu/hr

2. Timeline of how long water, power, and natural gas will be needed?
   a. If your project will be built in phases, please provide your needs for each phase

   The project is targeting initial contract life of 10-20yrs. The equipment will be designed for minimum of 30yrs, but will be able to be in service for much longer than that with the maintenance and inspections plans put in place. These types of facilities normally run for 30+ years if the demand for the product continues. Full utility supply will be required for the duration of the asset life.

3. Have you begun working with any political subdivisions for access to utilities/infrastructure, and if so, who?

   Water: We are in advanced negotiations with the municipalty regarding water supply and delivery to site.

   Power: The easments and permitting requried for the transmission lines to the project site will be the responsibility of the utility. They have not started the approval process yet. The project team is working with both MDU and Roughrider to evaluate system availability and options for serving the project.

   Natural Gas: The easments and permitting requried for the transmission lines to the project site will be the responsibility of the utility. They have not started the approval process yet. The project team is working with WBI Energy Transmission to evaluate system availability and options for serving the project, including use of an existing nearby line serving nearby industrial users.

4. Have you begun any permitting processes, and if so, with which entity?

   The project is currently working on long lead permitting activities such as planning, identification of permits and respective governing authorities, and environmental studies.

   No permit applications have been submitted, however the project has contacted the below agencies to introduce the project and for preliminary consultations to gain an understanding of the permitting framework and requirements:

   - North Dakota Department of Environmental Quality
   - U.S. Army Corp of Engineers.
   - North Dakota Industrial Commission
   - Town of Dickinson
   - Stark County

<u>C-05-B – NextEra Energy Resources</u>

1. Quantity of water, power, and natural gas needed for your project?

   Water: ~0.3 to 1.1MGPD raw water

   Power: ~1.2 MM MWh/year will be required to run the proposed electrolyzer and ammonia plant
2. Timeline of how long water, power, and natural gas will be needed?
   a. If your project will be built in phases, please provide your needs for each phase

   The proposed Spiritwood Fertilizer project is a long term investment for NextEra. Phase 1 is planned to reach COD in 2028 – 2029 and we anticipate decades (20yrs+) of commercial operation during which the project will require power and water utilities.
3. Have you begun working with any political subdivisions for access to utilities/infrastructure, and if so, who?

   Renewable Energy: NextEra's renewable development team has secured critical land positions to support wind development which supports the development of carbon-free fertilizer. The project team has secured generator interconnection queue positions sufficient to support the capacity of the project and potential expansion phases in both the Southwest Power Pool (SPP) and Midcontinent Independent System Operator (MISO) for the Project, which is a critical differentiator in our ability to bring zero carbon fertilizer to North Dakota this decade.

   Additionally, NextEra is continuing project development as follows:

   Water: Project team is working with Stutsman Rural Water District regarding raw water supply and with City of Jamestown for effluent discharge options

   Power: Project team is in discussion with 2 co-ops and 1 IOU in the region regarding grid power requirements

Land Infrastructure: Project team has approximately ~1000 acres of land under option in proximity to proposed project location

4. Have you begun any permitting processes, and if so, with which entity?

   NextEra is continuing to work closely with SPP and / or MISO to further additional interconnection applications as the interconnection MWs in queue are key to our project meeting development milestones. Project team aims to drive application and permitting for water and power utilities and environmental permitting activities in 2024.

<u>C-05-C – Scranton Holding</u>

1. Quantity of water, power, and natural gas needed for your project?

   2.1 million gallons of raw water/day

   63,000 dekatherms of natural gas/day

   125 MW power load
2. Timeline of how long water, power, and natural gas will be needed?

   The design and construction of the facility is a single phase. Production is intended for a minimum of 20 years. For the most part, power will be consumed, to a much lesser extent, during the construction phase.
   a. If your project will be built in phases, please provide your needs for each phase
3. Have you begun working with any political subdivisions for access to utilities/infrastructure, and if so, who?

   We plan to utilize Rainbow Energy and its contacts in the utility sector to provide not only the site but the power, water and gas. The Coal Creek Station site near Underwood ND has a power plant that can provide the necessary power. The gas main intended is the Northern Border Pipeline in Glen Ullin, however Rainbow may have alternatives for consideration. The water is piped from the Missouri River to the Coal Creek site with an existing pipeline that has the capacity needed for the new facility.
4. Have you begun any permitting processes, and if so, with which entity?

   Kiewit has had preliminary meetings with ND DEQ and we plan to apply for permitting after preliminary engineering (anticipated 3 months). In addition, we have applied for permitting in MN and have had preliminary meetings with the MN local permitting team. MN DNR and MPCA are familiar with our process and are ready when we are to continue the permitting process after preliminary engineering (anticipated 1 month)

C-05-D – Wellspring Hydro

1. Quantity of water, power, and natural gas needed for your project?

   Water – 115 - 500GPM

   Power- 24 MW

   Natural Gas – 2.11 mmscfd

2. Timeline of how long water, power, and natural gas will be needed?
   a. If your project will be built in phases, please provide your needs for each phase

   Once the Wellspring Hydro facility is fully operational within 22-28 months, these utility quantities will be required throughout the life of the operation, with asset plans for a minimum of 30 years.

3. Have you begun working with any political subdivisions for access to utilities/infrastructure, and if so, who?

   Wellspring Hydro has been a part of the Marley Crossing Development call for over the past year (led by the county commissioner's office). In this call, we have shared utility and infrastructure needs for construction and operation.

   In addition, Wellspring Hydro has discussed utilities with the following local entities:

   Power – Lower Yellowstone Power Cooperative

   Rail – Savage Transload

   Gas – Grayson Mill Energy/Rainbow Gas

   Process Water – Internal production and County Commission

4. Have you begun any permitting processes, and if so, with which entity?

   Wellspring Hydro has initiated the permitting process through several discussions with the North Dakota Industrial Commission (NDIC) and North Dakota Department of Quality (DEQ). BARR Engineering has been hired to support Wellspring Hydro in all permitting scopes of work.

   With the support of Barr, NDIC and DEQ, Wellspring Hydro has identified the following permit requirements:

   - Salt-Water Disposal Permit - A critical area of the permitting process will be alignment on the proposed Salt-Water Disposal well on the Wellspring Hydro facility. Wellspring Hydro has had initial Guidance on Class 2 SWD requirement and reviewed the FEL-3 mass balance with the DEQ.
   - Air Quality Permit(s)
     - Air Quality Permit Registration on CERIS-ND – Completed.
     - Air Permit for Construction – In Process
     - Air Permit for Completed Facility – In Process
   - Water Permit(s)
     - Ground water construction permit

    - Ground water/rainwater discharge permit
- Solid Waste Permit
    - Verify the exact scope of any required solid waste permit for operations.
    - Complete permitting on various solid waste

C-05-E – Catalyst Midstream

1. Quantity of water, power, and natural gas needed for your project?
   The pre-FEED model shows the water need to be approximately 10,000 gal/day, 14MW electric power and 120,000 dekatherms/day of natural gas feedstock.
2. Timeline of how long water, power, and natural gas will be needed?
   The estimated project life is 30 years however it is not unusual for these ammonia plants to remain in operation for 50 years.
    a. If your project will be built in phases, please provide your needs for each phase
   It is anticipated that the project will be built in phases over a 40 month build-out timeline. The exact phases will be identified during the FEED study.
3. Have you begun working with any political subdivisions for access to utilities/infrastructure, and if so, who?
   The utilities currently exist on the Berthold Terminal property. No additional subdivision work is anticipated.
4. Have you begun any permitting processes, and if so, with which entity?
   No permitting has begun. Air quality and construction permits are scheduled to be performed by Ramboll USA and the CCS permit by TERRACOH. Any additional permitting required will be identified in the FEED study.

~~C-05-F – Avalon XTL - WITHDRAWN~~

C-05-G – Dickinson Renewable Fuel Facility

1. Quantity of water, power, and natural gas needed for your project?
   Does not apply, FEED study only
2. Timeline of how long water, power, and natural gas will be needed?
    a. If your project will be built in phases, please provide your needs for each phase
   N/A
3. Have you begun working with any political subdivisions for access to utilities/infrastructure, and if so, who?
   N/A
4. Have you begun any permitting processes, and if so, with which entity?

N/A

C-05-H – Dakota Lithium

1. Quantity of water, power, and natural gas needed for your project?
   Water Use is negligible and limited to general purposes such as washing hands, containers, safety eyewash station, etc. The technology operates on a dry basis only.
   There is no natural gas use for this process. The furnaces are run by electricity.
   The estimated demand for power capacity is 1.5 – 2 MW.
2. Timeline of how long water, power, and natural gas will be needed?
   a. If your project will be built in phases, please provide your needs for each phase
   Approximate timeline of power usage is as follows:
   - 2024 – 2026: 0.73 GWh/yr (90 – 100 tons/yr capacity)
   - 2027: 6 GWh/yr (1,000 tons/yr capacity)
   - 2029 – 2030: 9 GWh/yr (1,440 tons/yr capacity)
   - 2030 and beyond: 18 GWh/yr (4,320 tons/yr capacity)
3. Have you begun working with any political subdivisions for access to utilities/infrastructure, and if so, who?

No.

4. Have you begun any permitting processes, and if so, with which entity?

Dakota lithium has Purchased a piece of land in Grand Forks to build the commercial facility in a future expansion, but the permitting process has not been initiated yet.

C-05-I – Packet Digital

1. Quantity of water, power, and natural gas needed for your project?

From 2024 to 2033, Packet Digital's electricity consumption will peak at 3,900 MWh per year, with a maximum power demand of 1.7 MW anticipated in 2027. Additionally, the project is estimated to utilize 40,000 gallons of water annually. Natural gas consumption will be minimal.

2. Timeline of how long water, power, and natural gas will be needed?
   a. If your project will be built in phases, please provide your needs for each phase

From 2024 – 2033, electricity and water consumption are detailed in the table below:

	Year 1 - 2024	Year 2 - 2025	Year 3 - 2026	Year 4 - 2027	Year 5 - 2028	Year 6 - 2029	Year 7 - 2030	Year 8 - 2031	Year 9 - 2032	Year 10 - 2033
Estimated electric consumption (MWh)	120	150	700	2,000	3,400	3,400	3,400	3,400	3,400	3,400
Electric power requirement (MW)	0.5	1	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
Natural gas consumption (ft3)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Water consumption (kgal)	30	30	30	40	40	40	40	40	40	40

3. Have you begun working with any political subdivisions for access to utilities/infrastructure, and if so, who?
   We have identified the location. This is an existing building with infrastructure withing the City of Fargo. Xcel Energy services the building for utilities. We are working with Tony Grindberg, Xcel Energy North Dakota Principal Manager, and Shawn Paschke, Xcel Energy North Dakota Key Account Manager, and they have confirmed they can service the required load and provide the future upgrades through the expansion. In addition, we verified with the City of Fargo that our water requirements are well under their acceptable limits.
4. Have you begun any permitting processes, and if so, with which entity?
   Yes, we have started discussions with the City of Fargo, and they have confirmed the location is zoned for industrial including battery cell manufacturing. Further permitting is ongoing.

<u>C-05-J – Carbon Convert</u>

1. Quantity of water, power, and natural gas needed for your project?
   Our needs for these will be minimal since our proposed project is through the development of the full-scale prototype. When our completed, sold, and deployed units are in use in those locations where the CO_2 is being converted, the need for water and power will occur, but will not be much. It is unlikely that we will have any need for natural gas during the prototype phase.
2. Timeline of how long water, power, and natural gas will be needed?
   One year for the prototype phase, that that will be minimal for the reasons stated above. As we move to commercialization of the project, our need for water, power, and natural gas will increase at the facility where we are building the units and we will work with the appropriate political subdivision prior to commercialization as our construction facility is preparing to be built.
   a. If your project will be built in phases, please provide your needs for each phase
3. Have you begun working with any political subdivisions for access to utilities/infrastructure, and if so, who?

Not necessary for the reasons stated above

4. Have you begun any permitting processes, and if so, with which entity?

Not necessary for the reasons stated above

C-05-K – Cerilon

1. Quantity of water, power, and natural gas needed for your project?

	Phase 1 Qty	Phase 1 Timing	Phase 2 Qty	Phase 2 Timing
Raw Water - Startup	900 gpm	2028	+ 220 gpm	2031
Raw Water during operations	220 gpm	-	+ 220 gpm	-
Startup Power required	35 MW	2028	35 MW (Not simultaneous with Phase 1)	2031
Operational Startup required, after shutdown	35 MW	-	35 MW (Not simultaneous with Phase 1)	-
Power Sales into the grid	27 MW (annual avg)	2028	+27 MW (annual avg)	2032
Gas	250 million scf/day	2028	+ 250 million scf/day	2032

2. Timeline of how long water, power, and natural gas will be needed?
    a. If your project will be built in phases, please provide your needs for each phase

The Cerilon GTL Facility's projected lifespan is 30 years and utility supply is required for the entire duration as a minimum.

The Phase 1 details of the Project are included in the CSEA Application, while information about Phase 2 is currently excluded (e.g., revenue and benefits). Phase 2 of the Project is scheduled to start in 2032.

3. Have you begun working with any political subdivisions for access to utilities/infrastructure, and if so, who?

Raw water will be appropriated from the Missouri River. Cerilon has entered commercial discussions with a local third-party water supplier who will secure a Water Appropriation Permit from the North Dakota Department of Water Resources. The supplier will be responsible for permitting, building, operating, and maintaining the water supply and discharge infrastructure suitable for two Project phases and will adhere to Cerilon's operating parameters, monitoring and control requirements, and maintenance procedures.

The Northwest Rural Water District and Williams County are planning to provide a potable water supply for the community of Trenton and the Marley Crossing industrial area where the Project is located, by 2026. Cerilon does not intend to install a potable water treatment system onsite. Consequently, if the regional water supply is not available at the start of construction, Cerilon will deliver potable water to the site by truck.

The GTL Facility will generate sufficient power for internal use and will export excess power to the grid.

The planning and delivery of electrical power in North Dakota is a multi-layered system, involving several organizations and cooperatives responsible for delivering different components of the overall system. The following organizations are involved with the electrical interconnection to the grid near the Project, each having some involvement with the interconnection, electrical power delivery, or purchase of electrical power from the GTL Facility:

• Southwest Power Pool (SPP): The technical administrator of the bulk electrical system where the GTL Facility will be located. SPP also works with the Midcontinent Independent System Operator, which is responsible for an adjacent region in North Dakota.

• Lower Yellowstone Rural Electric Cooperative (LYREC): The regional electrical distributor and Cerilon's primary point of contact into the system. LYREC is expected to own and operate the infrastructure connected to the GTL Facility.

• Upper Missouri Power Cooperative (UMPC): The electrical transmission facility operator in the region. Upper Missouri G & T Electric Cooperative Inc., doing business as UMPC, is the regional power provider of Basin Electric Power Cooperative (BEPC) and Western Area Power Administration power. UMPC provides services to 11 distribution cooperatives in eastern Montana and western North Dakota, including LYREC.

• Basin Electric Power Cooperative (BEPC): The primary generator, and coordinator of generation, in the region. Cerilon will generate power for internal use and export to the grid; therefore, the Project will need to be interconnected for both demand and supply. Cerilon will construct, own, and operate the electrical infrastructure within the Project site and LYREC will construct, own, and operate infrastructure beyond the Project site. Cerilon filed a generator interconnection application with the SPP and has been accepted into the Definitive Interconnection System Impact Study for 2024.

4. Have you begun any permitting processes, and if so, with which entity?

   Cerilon has initiated permitting for the GTL Facility, with the following major applications either submitted or under development. Additional filings and studies have been completed and submitted to the appropriate regulatory agencies (e.g., United States Army Corps of Engineers Approved Jurisdictional Determination for wetlands, North Dakota State Historic Preservation Office cultural resources inventory).

North Dakota Public Service Commission (NDPSC) Certificate of Site Compatibility – The NDPSC is statutorily charged with siting energy conversion and transmission facilities under the North Dakota Siting Act, codified in Chapter 49-22 of the North Dakota Century Code (NDCC). The purpose of the Siting Act is to ensure that the location, construction, and operation of energy conversion facilities and transmission facilities will produce minimal adverse effects on the environment and upon the welfare of the citizens of North Dakota by providing that no energy conversion facility or transmission facility shall be located, constructed, and operated within North Dakota without a Certificate of Site Compatibility, or a route permit issued by the NDPSC. Preparation of this application was initiated in January 2023 and a pre-application meeting was held with the NDPSC in May 2023. This application was submitted in October 2023 and Cerilon has requested a public hearing date be scheduled in Q2 2024. If granted, the NDPSC will issue the Certificate of Site Compatibility following the hearing.

North Dakota Department of Environmental Quality (NDDEQ) Division of Air Quality Permit to Construct (PTC) - The State of North Dakota has delegated authority to implement and enforce requirements established in the federal Clean Air Act and air pollution control is codified in NDCC Chapter 23.1-06. In North Dakota, a New Source Review is handled through the state permitting program and the issuance of a PTC. The NDDEQ is the regulatory agency responsible for the issuance of the PTC. The PTC process provides for reviewing proposed sources or modifications to existing sources of air contaminants. North Dakota Administrative Code (NDAC) Chapter 33.1-15-14 requires that no construction, installation, or establishment of a new stationary source within a source category designated in the section be commenced unless a PTC has been received. A construction permit is issued only if it is expected that the proposed source or modification will comply with the applicable rules. The GTL Facility is considered a designated air contaminant source pursuant to NDAC Chapter 33.11514, which triggers the requirement to submit a PTC application. Cerilon's strategy for the PTC application is to apply for the construction of two 24,000 bpd GTL plants (Phase 1 and Phase 2) at the same time. This approach is preferred by the NDDEQ as it allows for a cumulative understanding of potential Project effects. For Cerilon, this approach leads to cost and schedule efficiencies for Phase 2 of the Project. Cerilon first engaged the NDDEQ to discuss this permit in October 2022 and has conducted multiple preapplication meetings with the NDDEQ as the Project has progressed. Cerilon expects to submit the PTC application in March 2024.

NDDEQ Division of Water Quality Discharge Permit - The North Dakota Pollutant Discharge Elimination System (NDPDES) program was developed to comply with the federal Clean Water Act and is the program through which the NDDEQ regulates discharges of pollutants from point sources into the water of the state. Any discharge of wastewater from a point source must have an NDPDES permit before discharging to comply with state and federal regulations. Cerilon is currently planning to release treated process water to the Missouri River by pipeline as part of the water source and discharge infrastructure. Cerilon first engaged the NDDEQ to discuss this permit in October 2022 and has conducted multiple pre-application meetings with the NDDEQ as the Project has progressed. Cerilon expects to submit the NDPDES application in March 2024.

C-05-L – NDeV Flare Gas Mitigation

1. Quantity of water, power, and natural gas needed for your project?

   The capital cost of Phase 1 includes a genset to self-generate all power to operate the process. The plant site will be connected to the grid for the purpose of operating lights, space heaters and other power consumers found in a typical warehouse setting. A standard 400-amp service should support these needs. The project scope includes installation of a nominal 1 MW gas fueled generator for process needs. The process consumes 650 kw when fully operational. A multi-fuel engine that can operate on flare gas and hydrogen or a mixture of both, will allow for cold start of the process on flare gas, with transition to up to 100% hydrogen once the plant is operational. This will ensure a 100% CO2 free process.

   The process will be able to produce more power than it uses. If possible, we will use the grid connection, through a net-metering interface, to sell our excess power back into the grid.

   The process does not consume water; however, water and sewer will be needed for use of personnel (sinks and toilets) at the facility.

   In pyrolysis mode, the APT-500k consumes 320 mscfd of associated gas. We will make agreements with gas producers who are currently flaring some of their production to divert this gas to beneficial use. We intend to operate the unit in gasification mode for perhaps 30 days during which time gas consumption will increase to 1.5 mmscfd.

2. Timeline of how long water, power, and natural gas will be needed?

   Once operational, we intend to operate the plant for a minimum of one year up to ten years. According to the above schedule, site improvements will begin on project month 8 with utilities installed in months 9 through 12. The plant will be operational in month 18 then operate for another 12 months up to ten years.

a. If your project will be built in phases, please provide your needs for each phase

We consider this Phase 1 project as a single project with all utilities needed at the initiation.

3. Have you begun working with any political subdivisions for access to utilities/infrastructure, and if so, who?

Not yet, within our team we have "land" experts (GAP Midstream and Triple Curl Resources) with experience in siting oil and gas projects and knowledge of associated gas gathering, processing, compression, and transmission. We will initiate site acquisition and permit process upon grant award.

4. Have you begun any permitting processes, and if so, with which entity?

The project has minimal environmental impact with no liquid discharge and only exhaust emissions from a genset and emergency flare. The maximum air emission will be no more than the existing flare that is handling the gas currently.

We have not contacted any companies or contractors to help with the environmental and air permitting, survey work, or delivering utility power to site for this project. On past and current projects, we are in constant communication with contractors for environmental and building permitting. We typically bid the work out between three contractors and select the best bid to accomplish the scope desired. We do a similar process for survey work as well. When it comes to the electric power utilities and local permitting agencies, we research to find out who the appropriate contact would be and then engage directly to establish communication. We then work with that person to get everything submitted for the respective scope and required approvals.

Once we determine the exact location, we will reach out to the local utility company to get power and water to site. We would also work with the respective local county government for the Conditional Use Permit and get zoning regulations adjusted and approved for the site. For survey, we will most likely bid the project out to Golden Field Services, WH Smith, and Encompass. For the environmental permitting, we will request bids from Spirit Environmental, Arcadis, and SWCA.

CLEAN SUSTAINABLE ENERGY AUTHORITY
CONFLICT OF INTEREST
DISCLOSURE FORM

A conflict of interest may develop for Clean Sustainable Energy Authority members as a result of considering applications for funding from the Clean Sustainable Energy Authority Fund. A conflict of interest exists for an Authority member if there is a monetary or material investment or interest in a project submitted for Authority consideration, such as employment or individual investment. **If a conflict of interest exists, then the member must disclose the nature of the conflict of interest prior to any vote by the Authority in consideration of the application. A motion must be approved to allow members with conflicts of interest to vote.**

Grant Round 5:

Conflict of Interest		
	Yes	No
C-05-A – Clean H2 and N-fertilizer Production Facility; Submitted by Prairie Horizon Energy Solutions LLC; Total Project Costs: $2,200,000,000; Amount Requested: $125,000,000 fertilizer loan		
C-05-B – Spiritwood Fertilizer Project; Submitted by NextEra Energy Resources Development, LLC; Total Project Costs: $1,293,000,000; Amount Requested: $125,000,000 fertilizer loan		
C-05-C – "Green" Pig Iron Production Facility; Submitted by Scranton Holding Company/North American Iron, Inc.; Total Project Costs: $2,000,000,000; Amount Requested: $12,000,000 grant		
C-05-D – Unlocking the Full Potential of Produced Water (3rd Ask); Submitted by Wellspring Hydro; Total Project Costs: $324,730,000; Amount Requested: $5,000,000 grant, $25,000,000 loan		
C-05-E – Blue Ammonia Facility; Submitted by Catalyst Midstream (USA) LLC; Total Project Costs: $960,000,000; Amount Requested: $10,000,000 grant		
C-05-G – Dickinson Renewable Fuel Facility Expansion; Submitted by EERC; Total Project Costs: $21,761,930; Amount Requested: $10,000,000 grant		
C-05-H – Energy Storage Technology for Lithium-Ion Batteries; Submitted by Dakota Lithium Materials; Total Project Costs: $10,250,000; Amount Requested: $4,000,000 grant		
C-05-I – Grand Power North Dakota Battery Manufacturing Plant; Submitted by Packet Digital; Total Project Costs: $56,558,592; Amount Requested: $10,000,000 grant, $17,355,992 loan		
C-05-J – Carbon Convert Prototype; Submitted by Carbon Convert; Total Project Costs: $4,500,000; Amount Requested: $500,000 grant		
C-05-K – Cerilon GTL (2nd Ask); Submitted by Cerilon; Total Project Costs: $3,600,000,000; Amount Requested: $20,000,000 grant, $80,000,000 loan		
C-05-L – NDeV Flare Gas Mitigation Project; Submitted by ND Energy Ventures; Total Project Costs: $30,000,000; Amount Requested: $3,000,000 grant, $10,000,000 loan		

CLEAN SUSTAINABLE ENERGY AUTHORITY
CONFLICT OF INTEREST
DISCLOSURE FORM

Print - CSEA Member ______________________________

Signature - CSEA Member ______________________________

TECHNICAL REVIEWERS' RATING SUMMARY
C-05-A

Clean H_2 and N-fertilizer Production Facility
Submitted By: Prairie Horizon Energy Solutions LLC
Date of Application: October 2023
Request for $125,000,000 Loan
Total Project Costs $2,200,000,000

		Technical Reviewer		
		A1	**A2**	
Rating Category	**Weighting Factor**	**Rating**	**Rating**	**Average Weighted Score**
1. Objectives	3	4	2.5	9.75
2. Impact	9	4	4	36
3. Methodology	9	4	2	27
4. Facilities	3	3	3	9
5. Budget	9	4	3	31.5
6. Partnerships	9	4	2	27
7. Awareness	3	4	3	10.5
8. Contribution	6	4	2	18
9. Project Management	6	4	3	21
10. Background	6	4	3	21
	315	249	172.5	210.75

OVERALL TECHNICALLY SOUND	A1	A2
GOOD (IF > 214)	☒	☐
FAIR (200-213)	☐	☐
QUESTIONABLE (IF< 200)	☐	☒

Mandatory Requirements	A1		A2	
Diversification Delivery:	Yes	No	Yes	No
Project enhances the production of clean sustainable energy, to make the State a world leader in the production of clean sustainable energy, and/or to diversify and grow the State's economy.	✓		✓	
Commercialization or Development/Expansion:	Yes	No	Yes	No
Concept will lead to the **large-scale development and commercialization** of projects, processes, activities, and technologies that reduce environmental impacts and/or increase sustainability of energy production and delivery.	✓		✓	

In State Requirement:	Yes	No	Yes	No
The funds distributed from the financial assistance are to be applied to support in-state activities and must have other sources of financial support.	✓		✓	

1. The objectives or goals of the proposed project with respect to clarity and consistency with Clean Sustainable Clean Energy Authority goals of projects, processes, activities, and technologies that reduce environmental impacts and increase sustainability of energy production and delivery are: 1 – very unclear; 2 – unclear; 3 – clear; 4 – very clear; or 5 – exceptionally clear.

Reviewer A1 (Rating 4)
There is clear articulation of the project's objectives and alignment with the overarching goals of the Clean Sustainable Energy Authority. The project aims to reduce environmental impacts, increase sustainability in energy production and delivery, and support regional economic growth, which are in line with the Authority's focus on sustainable and environmentally responsible energy solutions.

Reviewer A2 (Rating 2.5)
The objective presented in the objective section, and throughout the document are to reduce energy requirements and C footprint of the anhydrous ammonia and urea manufacturing process, resulting in increased efficiency of the processes. It would have been better stated if the authors would have stated:
Objective 1-Establish means to subject water to hydrolysis, releasing H_2 and O_2, which would be used later in the process.
Objective 2-utilize an Autothermic Reforming method to decrease energy requirement of anhydrous ammonia production, utilizing the O_2 from water hydrolysis to greatly decrease energy requirement of the process (I had to look up Autothermic Reforming (ATR), the authors did a poor job of defining acronyms).
Objective 3-produce urea with some of the CO_2 generated from the ATR process.
Then summarize with the overall objective of reducing energy and C release during ammonia/urea production processes.

2. The objectives will make a difference in the near term to the state's economy: 1 – no impact; 2 – small impact; 3 – likely impact; 4 – most likely impact; or 5 – significant impact.

Reviewer A1 (Rating 4)
This proposal, with its innovative approach towards clean hydrogen and nitrogen fertilizer production, holds significant potential for positively impacting North Dakota's economy, particularly in the long term. The construction and operational phases of the project promise to create job opportunities and stimulate economic activities in related sectors, marking a progressive step towards sustainable energy and agricultural practices. The participation of well-established infrastructure companies enhances the project's strategic and financial stability, increasing the likelihood of its successful execution and operation. However, it is important to approach this optimism with a degree of caution due to several factors. Firstly, the anticipated

delay in construction commencement could defer the immediate economic benefits, potentially impacting the project's short-term economic contribution. Additionally, there are concerns regarding the project's ability to produce clean fertilizer at a cost competitive with traditional methods. The higher initial investment and operational costs associated with clean ammonia production might challenge the project's market competitiveness, especially in the current market dominated by conventionally produced fertilizers. These concerns are compounded by the potential for fluctuating environmental regulations and energy policies, which could further affect the project's feasibility and market positioning. Therefore, while the project exhibits promising economic prospects and aligns with sustainable energy goals, these potential challenges and uncertainties should be carefully considered and addressed in the project's planning and execution stages.

Reviewer A2 (Rating 4)
The addition of the manufacturing of anhydrous ammonia and urea by this 'Blue Ammonia' method will provide jobs and tax base to the county and state. It decreases the energy requirements of the process over current anhydrous ammonia manufacture in the state and decreases the C emissions through production of urea. However, the grand scheme of agriculture, the C in the urea will be released soon after it is applied to the soil.

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

Reviewer A1 (Rating 4)
The methodology seems to be clear and well defined. The CSEA loan will support the construction of large-scale facilities and infrastructure to bolster the Northern Great Plains agriculture industry. The project aligns with the Clean Sustainable Energy Authority's purpose by deploying large-scale projects that reduce environmental impacts and enhance energy production and delivery sustainability. The completion of this project is a crucial step in building H2 and N-fertilizer infrastructure, contributing to North Dakota's economic diversification and reducing the environmental footprint of energy production and use in the region.

Reviewer A2 (Rating 2)
The authors assume that the evaluation of the proposal would be made by people well acquainted with terms like ATR (Autothermic Reforming), SMR/SR (Steam Methane Reforming/Steam Reforming) or POX (Partial oxidation). I doubt if some of the authors of letters of support had expertise in knowing the methodology behind these systems. The authors do a poor job in actually describing how the methods would be put into practice, and just usually evoked the term. The one explanation that they provided within the proposal was that water hydrolysis through electric current (a very enhanced high school laboratory experiment, becoming increasingly common in the ammonia production business) which splits H_2O into H_2 and O_2 with an electric current into two capture structures, one for H_2 with one electrode and one for O_2 with the other, provides the O_2 for the ATR, instead of a process of removing O_2 from the air, which requires more energy. The electricity source proposed comes from the power grid, presumably using coal primarily with wind maybe secondarily? Reading the methodology requires a great deal of 'filling in gaps' and lacks specifics to make certain judgements regarding the energy savings, C capture resulting from a project this size.

4. **The facilities and equipment available and to be purchased for the proposed pilot or commercialization strategy is: 1 – very inadequate; 2 – inadequate; 3 – adequate; 4 – notably good; or 5 – exceptionally good.**

Reviewer A1 (Rating 3)

There is solid planning regarding the significant investment needed for the project. The project is set to have a significant economic and environmental impact with an investment of over $500 million, mainly for building in North Dakota. This demonstrates a strong commitment to developing the necessary infrastructure. It aims to produce hundreds of megawatts of electricity from low-carbon or renewable sources, which is essential for creating clean hydrogen through electrolysis, aligning with the project's primary objectives. It will drive more transportation and supply chain activity, as well as create secondary job opportunities, boosting local spending and economic growth. Financially, it would provide ample positive impacts for the local economy, bringing in millions in tax revenue every year during its operational lifetime.
However, this is a project with much of the infrastructure still to be built, and several risks and uncertainties have not been fully considered in the application. These include challenges in scaling up emerging technologies efficiently and risks of construction delays and cost overruns, as well as the difficulties of starting up new facilities. Additionally, there's the unpredictability of both demand and prices for clean hydrogen and nitrogen fertilizers in growing markets, and the impact of changing environmental rules and energy policies on the project's feasibility. Managing environmental effects and maintaining safety standards are critical, particularly when handling hazardous materials. There is also a significant need for capital investment, which could greatly affect the project's financial returns because financing conditions may change.

Reviewer A2 (Rating 3)

The companies involved in the project have expertise in aspects of the petroleum business. The actual facilities will be bid out to others with expertise in the specific areas of anhydrous ammonia production, ATR and others. Pipeline access for natural gas is specified. Anhydrous ammonia movement will be by rail or truck.

5. **The proposed budget is comprehensive and sufficient relative to the outlined work and the timetable: 1 – not sufficient; 2 – possibly sufficient; 3 – likely sufficient; 4 – most likely sufficient; or 5 – certainly sufficient.**

Reviewer A1 (Rating 4)

The proposed budget seems realistic to the scale and timing of the project. The stated budget of approximately $2.2 billion, with $1.8 billion for H2 and NH3 production and $0.4 billion for urea production, aligns with the typical capital-intensive nature of such projects. Large-scale energy projects like the one proposed require substantial upfront investment for infrastructure, technology development, and meeting environmental and safety standards. The financial figures in the project's budget are consistent with industry norms for similar-scale projects in the clean energy sector. Development of hydrogen production facilities, especially those involving electrolysis or ammonia synthesis, usually require investments in the range of several hundred million to over a billion dollars, depending on the capacity and technology used. The combination of a $125 million forgivable loan and the remainder from project partners indicates a diversified funding strategy. The budget appears to be aligned with the project's scope, including the construction of new facilities, purchase of equipment, and operational expenses.

The timetable, from early material orders in 2025 to commercial operations in 2028, suggests a realistic allocation of funds over the project duration.

Reviewer A2 (Rating 3)
Because the major facilities are to be bid, the budget assumes that the bids will fall within a range of values. Because the proposal entity has no power over the facility builder/operator sources, the bids might come in greater than anticipated. Also, the proposal assumes that N fertilizer requirements for regional farmers would grow every year. However, the reality is that N fertilizer requirements have been stable for several years. Although crop yields continue to increase in absence of drought or extreme wetness, N rate increases have not been required to achieve these greater yields. Crop breeding improvements continue to increase fertilizer use efficiency. The proposed facility profitability should be based on cost savings and increased competitiveness with present manufacturing, not with increased N rates by regional farmers.

6. **The appropriate strategic partnerships are in place for short and long term plans to be successful: 1 – very limited; 2 – limited; 3 – adequate; 4 – better than average; or 5 – exceptional.**

Reviewer A1 (Rating 4)
The project's ties with two of the largest infrastructure firms in North Dakota and across North America- MPLX and TC Energy. These partners contribute substantial infrastructure expertise, and a dedication to innovation, The partners have shown a solid history in managing capital and upholding fiduciary duties, signaling a strong and reliable approach to carrying out the project. Their significant financial commitment, which greatly exceeds the proposed grant value, demonstrates a profound financial base and a serious pledge to the initiative. The application also shows a thorough grasp of the risks involved in pioneering clean hydrogen and nitrogen fertilizer production. This knowledge, paired with the support of skilled and financially robust partners, places the project in a favorable position strategically and in risk management. Altogether, these aspects underline the project's solid groundwork for both immediate and future success, justifying its higher-than-average rating for strategic partnerships.

Reviewer A2 (Rating 2)
The two proposal entities are TC and MPC. TC's business is mostly pipelines and petroleum movement. MPC's businesses are related to reduced energy and alternative energy strategies. The 2 companies should be able to work together since petroleum is a necessary feedstock for the project and MPC should be able to develop the water hydrolysis. I wonder about the tensions, though, with a company mostly linked with petroleum and one with solar and other non-petroleum strategies. I would have given it a higher rating if an entity involved with chemical engineering was involved. Perhaps one of both have this, but is was not stated specifically.

7. **The likelihood that the project approach (time & budget) will achieve its technical and market goals is: 1 – not achievable; 2 – possibly achievable; 3 – likely achievable; 4 – most likely achievable; or 5 – certainly achievable.**

Reviewer A1 (Rating 4)
The project has a well-structured timeline that includes distinct planning, development, and execution phases, thereby increasing the chances of meeting technical milestones on schedule. With a hefty budget of around $2.2 billion, allocated with $1.8 billion for hydrogen and

ammonia production and $0.4 billion for urea production, financial planning seems well-matched to the project's technical ambitions. The involvement of experienced infrastructure companies such as MPLX and TC Energy lends further credibility and reinforces the project's potential for success. The clear market need for clean hydrogen and nitrogen fertilizers hints at a strong market reception and likelihood of success, while a conscious acknowledgment of the risks tied to emerging technologies indicates a realistic strategy essential for overcoming potential hurdles.

Reviewer A2 (Rating 3)
The proposal outlines methods and strategies to achieve their goal of reduced energy input with some C capture. With bids accepted by the right facility builders and the project should be achievable within the time anticipated for completion. The facility builders are an unknown right now, so that is why I rated it a 3 instead of higher.

8. The scientific and/or technical contribution of the proposed work to specifically address Clean Sustainable Energy Authority goals of impacting technology used in North Dakota's energy industries will likely be: 1 – extremely small; 2 – small; 3 – significant; 4 – very significant; or 5 – extremely significant.

Reviewer A1 (Rating 4)
The project, focusing on clean hydrogen and nitrogen fertilizer production, is attuned to the world's momentum towards sustainable energy and agriculture, potentially playing a key role in advancing these vital clean energy technologies. Its objectives align with ambitions to mitigate environmental impacts and enhance the sustainability of energy production in North Dakota's energy sectors. With its considerable scale and scope, the project is poised to significantly impact the field of clean energy, specifically in the increasingly important areas of hydrogen and nitrogen fertilizer production. It holds promise for contributing valuable insights and progress to the clean hydrogen and nitrogen fertilizer industry, potentially shaping future developments within these pivotal sectors.

Reviewer A2 (Rating 2)
The project proposal as written specifies that energy savings would be achieved over present anhydrous ammonia manufacture in the state, region, through the ATR process (Autothermic Reforming). Also, C capture will be achieved through urea production [$(NH_2)_2CO$]. However, the C in urea is released as CO_2 as soon as it is applied to the soil (within a couple weeks, usually). Therefore, the C is not truly sequestered. If the O_2 was generated through water hydrolysis through wind energy and/or solar, my rating would be much higher.

9. The project management plan, including budgeting projections, partner connections and well-defined milestone chart is: 1 – very inadequate; 2 – inadequate; 3 – adequate; 4 – notably good; or 5 – exceptionally good.

Reviewer A1 (Rating 4)
The project partners have established unique corporate management and operational strategies tailored to their organization, incorporating essential elements vital for successful execution, budget adherence, and maintaining schedules. Their management and operating practices, alongside operational performance, are under constant scrutiny by shareholders, industry analysts, and regulators, ensuring the effectiveness of their systems, tools, and personnel in consistently planning and managing assets and operations. They have the systems, tools, and

experienced personnel to handle a diverse range of projects, spanning traditional to emerging energy technologies, demonstrating their broad expertise and adaptable project management capabilities. Additionally, they prioritize community engagement and environmental stewardship, recognizing these elements as critical to the successful delivery and development of new projects.

Reviewer A2 (Rating 3)

Building facilities to produce anhydrous ammonia in 18 months I think is a little optimistic. My guess is that it will require 30 months, start to finish.

10. The background and experience of the project principals with regards to technical qualifications and competence is: 1 – very limited; 2 – limited; 3 – adequate; 4 – better than average; or 5 – exceptional.

Reviewer A1 (Rating 4)

The project leads for the 'Clean H2 and N-fertilizer Production Facility' show a commendable level of expertise and experience. Their backgrounds indicate a deep understanding of the clean energy sector, with notable strengths in project management and execution. This is proven by their involvement in similar projects and initiatives, showing their ability to manage complex tasks effectively. Additionally, their leadership and strategic decision-making skills, demonstrated in previous roles, are valuable assets for the success of this ambitious project. However, although their general experience in energy and project management is impressive, there is a slight lack of experience specifically in hydrogen and nitrogen fertilizer production. This minor gap doesn't substantially lessen their overall ability but points to an opportunity for more specialization or additional expertise to meet the distinct technical challenges of this project.

Reviewer A2 (Rating 3)

TC and MPC have background and experience in petroleum, petroleum pipelines and alternative energies. They are familiar with companies who have experience in the methodologies required to build an anhydrous ammonia/urea manufacturing facility using the technologies proposed, but they do not appear to work directly with these technologies to date as I read the proposal. So I believe they are aware of the technologies and who to contact, they do not have the direct experiences to build a facility that uses them.

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 the project is technically sound.

Reviewer A1

Strengths:

1. **Alignment with Clean Energy Goals:**

• The project's focus on clean hydrogen and nitrogen fertilizer aligns well with the global push towards renewable energy solutions and the decarbonization of key industrial processes. IRENA's report on Renewable Ammonia underscores the potential of hydrogen as a crucial element in future energy systems, especially in sectors hard to electrify (IRENA, 2022). By

integrating renewable energy sources for hydrogen production, the project stands at the forefront of this transformative shift.
• The U.S. National Clean Hydrogen Strategy and Roadmap highlight the growing emphasis on hydrogen as a strategic resource for achieving carbon neutrality goals (U.S. DOE, 2023). This project, therefore, contributes directly to these broader national and international objectives.

2. **Economic and Employment Opportunities:**

• The proposal's potential to create jobs and stimulate the local economy is significant. According to the U.S. Department of Energy, clean energy projects can substantially contribute to economic development, particularly in rural areas (U.S. DOE, 2021). The employment opportunities span from construction to operational phases, offering a range of skilled and unskilled positions.
• The project may also stimulate growth in ancillary industries, including manufacturing and services, leading to a multiplier effect in the regional economy.

3. **Technical Viability and Innovation:**

• The technology proposed for hydrogen and fertilizer production is supported by research indicating its potential efficiency. Studies like those in the MIT CEEPR Working Paper 2023-21 demonstrate the evolving nature of hydrogen production technologies and their increasing viability.
• The project's innovative approach, if successful, could set a new benchmark in the field and serve as a model for similar initiatives worldwide.

Weaknesses:

1. **Market Competitiveness and Cost Concerns:**

• The Boston Consulting Group's report on renewable ammonia highlights the challenge of high production costs associated with green ammonia, which may hinder the product's competitiveness against traditionally produced fertilizers (BCG, 2023). This is a significant concern for the project's long-term viability in a market sensitive to price fluctuations.
• Given that the cost of renewable energy sources and carbon capture technologies is still relatively high, the project may face challenges in offering products at competitive prices without subsidies or policy support.

2. **Implementation and Scaling Risks:**

• The U.S. DOE's Hydrogen Shot Technology Assessment points out the complexities involved in scaling up new technologies, which include not only technical challenges but also issues related to infrastructure, supply chains, and market acceptance.
• Projects of this scale often face delays and cost overruns, which can significantly impact their timelines and financial viability.

3. **Regulatory and Policy Dependence:**

• The project's success is closely tied to the stability and continuation of environmental policies and incentives for clean energy, as outlined in the U.S. National Clean Hydrogen Strategy and Roadmap. Changes in these policies could significantly impact the project's feasibility and economic model.
• The reliance on government subsidies or incentives to offset higher production costs makes the project vulnerable to policy shifts.

4. **Environmental Impact Assessment:**

• While the project aims to reduce greenhouse gas emissions, it is imperative to conduct a comprehensive life-cycle environmental assessment. This includes evaluating emissions from production, transportation, and end-use of the fertilizers.

• Adherence to stringent environmental standards and continuous monitoring of environmental impacts are crucial to ensure that the project delivers on its sustainability promises.

In summary, the proposal has the potential to contribute significantly to clean energy initiatives and the regional economy. However, it faces substantial challenges in terms of cost competitiveness, implementation risks, policy dependence, and the need for a comprehensive environmental assessment. These factors need careful consideration and strategic planning to ensure the project's success and sustainability.
The project is promising, and it aligns well with current environmental and sustainability goals. It demonstrates technical soundness in its approach to clean hydrogen and nitrogen fertilizer production. However, the project's success is not without challenges. It faces potential risks in terms of implementation, market competitiveness, and dependence on regulatory frameworks.

Reviewer A2

The proposal attempts to adjust current technologies for anhydrous ammonia manufacture to reduce the energy requirements and therefore the overall carbon footprint. The proposal is weakened by having to bid out the basic manufacture and technology components of the production facilities and to not have at least one of the production entities as a sponsor. The usefulness of the project towards the goals of the ND legislature is reduced by receiving the electricity required for hydrolysis from the existing power grid, rather than a 'green' energy source (wind/solar). This places the anhydrous ammonia manufacture into a 'blue' category, rather than a less C releasing 'green' or 'yellow' category, with lowest C emissions. The project is technically sound.

Clean Sustainable Energy Authority

North Dakota Industrial Commission

Application

Project Title: Prairie Horizon Energy Solutions LLC Clean H_2 and N-fertilizer Production Facility

Applicant: Prairie Horizon Energy Solutions LLC

Date of Application:
October 16, 2023

Amount of Request
Grant: $0
Loan: $125,000,000

Total Amount of Proposed Project:
$2,200,000,000

Duration of Project: Estimated .
(August 2025 – December 2028)

Point of Contact (POC):
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TABLE OF CONTENTS

ABSTRACT

The two major energy companies, TC Energy Development Holdings Inc. (“TCE”) and MPC Investment LLC (“MPC”) collectively “Partners”, each wholly owned subsidiaries of publicly traded enterprises with annual revenues in excess of \$10B (billion), with encouragement from state governments, form the core of Prairie Horizon Energy Solutions LLC (“PHES”), a new potential clean hydrogen (“H_2”) and clean ammonia (“NH_3”) production facility paired with carbon dioxide (“CO_2”) capture, transport and sequestration (“CCTS”) and potential long term H_2 subsurface storage (“PHES Project”) in Stark County, North Dakota (ND). The proposed Project, contingent on a Final Investment Decision (“FID”) by the PHES Partners, through a Joint Venture (“JV”) being finalized, and potentially other strategics, are exploring the feasibility to install 200 metric tons/day (tpd) of clean H_2 (Carbon intensity [CI] of <0.45 kg CO_2eq/kg H_2) and up to ~1,150 tpd of clean NH_3 production capacity, with an additional investment to construct a urea production facility. Clean H_2 as a feedstock to NH_3 production would help decarbonize the fundamental building block of the nitrogen-based fertilizer (“N-fertilizer”) consumed in large quantities across the Northern Great Plains Region (“NGP”).

Objectives and Expected Results:

The proposed PHES Project will support the Clean Sustainable Energy Authority’s (CSEA’s) mission to develop and deploy large-scale commercial projects that reduce environmental impacts and increase the sustainability of energy production. The CSEA loan would provide critical support to the Partner investment in commercial deployment of clean H_2 and NH_3 that can diversify North Dakota’s economy, leverage existing energy resources, create sustainable jobs, and reduce the environmental footprint of energy production and use in the region and beyond.

Duration:

Planned EPC Contract Execution through commercial operations date is estimated May 2026 through December 2028.

Total Project Cost:

About \$1.8B for H_2 and NH_3 production and storage, and \$0.4B for urea production.

Participants:

The Project will be managed and sponsored by the Project Partners. The Project is progressing pre-FID engineering in partnership with the North Dakota Industrial Commission (“NDIC”) through CSEA, Wood Group USA Inc., Black & Veatch, Sargent & Lundy, and ERM. Post-FID, detailed engineering, equipment procurement and construction may rely on work from parties outside the current Project.

PROJECT DESCRIPTION

Objectives:

The CSEA loan will provide critical investment support to the Project Partners, to construct large-scale facilities and infrastructure to support the Northern Great Plains ("NGP") agriculture industry. Project objectives meet the Clean Sustainable Energy Authority's (CSEA) purpose of deploying large-scale projects that reduce the environmental impacts and increase the sustainability of energy production and delivery. Completion of this Project will achieve the necessary next step in building the H_2 and n-fertilizer infrastructure that can help diversify North Dakota's economy, leverage existing energy resources, and reduce the environmental footprint of energy production and use in the region.

Methodology:

FEED can be categorized into four phases defined as front-end loading (FEL) Levels 1–3 followed by Detailed Engineering and Construction. FEL-1 typically consists of planning and screening studies. FEL-2 consists of feasibility studies and preliminary design. FEL-3 includes a complete system design with sufficient detail to enable a business decision to invest in the project. Detailed Engineering and Construction consists of final engineering design, procurement, and facility construction through start of operations. This proposal requests funds to advance the project after FID (at the conclusion of FEL-3) and through Detailed Engineering and Construction.

Expected Results:

The proposed Project will synergistically balance cost and carbon intensity to fulfill an existing supply deficit, reduce transportation costs from Canadian and Gulf imports, and lower CI by 30-50% compared to conventional NH_3 production. This will ensure market longevity and relies on creative partnerships through financial incentives (grants and low-interest loans) from Federal and State partners.

The value of low-CI products is expected to increase given Scope 3 emissions expectations on consumer products. For example, the benefits of low-CI H_2 as feedstock to N-fertilizer translates to an estimated ~15% reduction in ethanol (EtOH) CI given that the EtOH feedstock used low-CI N-fertilizer. This virtuous cycle could help the NGP region producers further integrate into low-CI liquid fuels markets that use agricultural feedstock. Linkage of customers into the supply chain is anticipated to create a strong market incentive and customer loyalty in a large market. The Project will provide the necessary information for the project sponsors to invest in and execute commercial deployment of clean H_2, NH_3 and urea production technologies. That investment and subsequent operation would generate clean H_2 and n-fertilizer for use in multiple sectors and enable emerging use cases in North Dakota.

Environmental and Economic Impacts:

Project Partners have initiated permit screening and preliminary consultations associated with the Project. The team has significant experience in successfully permitting high-priority projects. This work is completed by a combination of internal environmental services staff and consultants. Project Partners have experience and expertise working with all applicable federal, tribal, state, and local authorities having jurisdiction (AHJs), and employ the practice of early AHJ engagement. Principles of environmental stewardship, protection, and performance are core to the effective development and operation of assets as well as establishing healthy partnerships with employees, industry partners, Indigenous groups, and regulatory agencies. The Project Partners anticipate taking similar approaches for the PHES Project.

Ultimate Economic and Technological Impacts:

The PHES Project represents a significant economic development opportunity for North Dakota. With equipment, materials, and labor investment of more than $500 million expected for construction in North Dakota alone, the PHES Project is projected to provide a significant boost in local wages and spending during both the construction process and throughout the life of operations. High-level projections include:

- Creation of hundreds of megawatts of new electrical demand from low-carbon or renewable sources to support clean H_2 production via electrolysis.
- Reduction of 1,770 tpd (about 650,000 tpy) of industrial CO_2 emissions.
- Additional transportation needs, supply chain demand, and secondary jobs created by increased local spending.
- Millions annually in local tax revenue over the life of the project.
- Tens of millions of dollars in new economic activity in North Dakota, including construction and operations wages, landowner payments, and new local tax revenue, creating stable revenue to fund local schools and other taxing bodies.

PHES partnered with the ND State University (“NDSU”) Agriculture Department to perform an analysis of the induced direct economic benefits of the Project (modeled for 2025). The analysis indicates that upon start-up of Operations, the H_2 and NH_3 production facility would result in 75 direct well-paying jobs, with expected gross annual employee compensation of $12.5 million (wages, salary, bonus, benefits, payroll taxes). Further, the taxable value of the H_2 and NH_3 production facility is estimated to be $210 million, representing a 5% increase in Stark County’s taxable valuation (against the current 7-year average).
PHES Partners have robust selection processes for securing contractors and evaluate them on safety performance, diversity metrics, historical performance, and other criteria. The value of retaining a well-trained staff to maintain a long-term workforce by providing quality jobs and investing in their employees is recognized. PHES Partners each benchmark their salary and benefits packages annually to confirm they are offering competitive pay packages for recruitment and retention efforts. They invest significantly in their employees through continued education, training, retraining, and professional skill development, and plan to require contractors to ensure their laborers and mechanics are paid prevailing wages, as defined in the Davis–Bacon Act, and required by the Inflation Reduction Act of 2022 (IRA). PHES Partners will collaborate with their contractors to meet or exceed IRA apprenticeship requirements.

At the state level, benefits of the Project are twofold. First, the Project is supportive of multiple sectors of the ND economy and not narrowly focused on decarbonization. The products to be generated by the Project (low-CI H_2 and NH_3) have clear pathways to market today (industrial and agricultural sectors) and growth prospects going forward (energy and transportation sectors). The Project will help to proliferate and strengthen ND’s dominant economic sectors (e.g., energy, agriculture, etc.) by offering resilience to N-fertilizer supply shortages from out of state through use of energy generated from within. Local production provides a competitive advantage to a remote fertilizer manufacturer by offering insulation from drastic price swings and transportation disruptions. Second, the successful buildout of the Project will provide Stark and potential surrounding Counties with a first mover advantage as the clean H_2 economy continues to grow. As the U.S. economy appears to move towards carbon neutrality and associated economic development, clean H_2 and NH_3 production are set to play leading roles.

The ultimate technological impacts include:

- Production of 200 tpd of clean H_2 and up to ~1,150 tpd of clean NH_3 production capacity.
- Commercial deployment of clean H_2 technology based on innovative ATR/electrolysis integration.
- Geologic storage for gaseous H_2, truck- and rail-loading facilities, and H_2 pipeline to deliver H_2 to market. An underground salt cavern will provide long-duration H_2 storage to ensure reliable supply for large industrial users.
- Geologic sequestration of CO_2 from H_2 production (ATR) and other sources in the surrounding area, enabling decarbonization of facilities beyond the scope of the PHES Project.

Why the Project Is Needed:
The proposed project is needed to catalyze meaningful investment in new, clean H_2 energy technology that can diversify North Dakota's economy, leverage and expand use of North Dakota's vast resources, materially reduce the CI of the state's economy, and address regional supply gaps for n-fertilizer. Clean H_2 supports Governor Burgum's goal for North Dakota to become carbon-neutral by 2030, and DOE has declared clean H_2 crucial to achieving President Biden's goals of a 100% clean electrical grid by 2035 and net-zero carbon emissions by 2050.

STANDARDS OF SUCCESS

Successful commercial deployment of clean H_2 energy and N-fertilizer production technology in North Dakota, resulting in economic and environmental benefits consistent with CSEA goals and enumerated in the previous section "Ultimate Economic and Technological Impacts."

BACKGROUND/QUALIFICATIONS

MPC is a subsidiary of Marathon Petroleum Corporation, a leading integrated downstream energy company headquartered in Findlay, Ohio and operating the nation's largest refining system, including refineries in Mandan, North Dakota, and Saint Paul, Minnesota, as well as a renewable fuels facility in Dickinson, North Dakota. Marathon Petroleum Corporation is also the general partner and majority limited partner of MPLX LP (MPLX), a midstream company that owns and operates gathering, processing, and fractionation assets and crude oil and product logistics infrastructure. MPC and MPLX have extensive management experience and an engineering team of 100 professionals assembled on a project-by-project basis to meet the specific needs relative to project controls, environment and safety, and design. Since 2012, MPC has managed over $2B in large capital growth projects consisting of new pipeline construction, cavern development, tank farm expansions, and dock expansions.

TCE is a wholly owned subsidiary of TC Energy Corporation, a company with over 70 years of experience and a leader in the responsible development and reliable operation of North American energy infrastructure, including NG pipelines (57,900 miles, 25% of North American NG pipelines), liquid pipelines (3,000-mile network), power generation (4,200 MW), and gas storage facilities (653 Bcf). TC Energy's assets will be utilized to lower the cost and increase the speed of H2 delivery. TC Energy employs over 4,400 highly skilled engineers, developers, scientists, and project managers who have been transforming the energy landscape across North America. TC Energy's U.S. power and emissions commercial trading and marketing business provides customers with various physical and financial products, with a measured approach to risk management and a focus on financial discipline, compliance, and operational excellence. TC Energy is in the process of decarbonizing its midstream network through securing renewable energy projects. Additionally, TC Energy has entered into joint development agreements for the development of H_2 hubs across North America. On CCS, TC Energy has partnered to develop Project Tundra which will capture and sequester up to 4 million TPY of CO_2 produced from the Milton R. Young Station.

MANAGEMENT

Project Partners have corporate management and operational strategies unique to the organization and business. Nonetheless, all possess core elements that drive toward successful project execution, budget, and schedule compliance. PHES Partner management and operating practices and operational performance are continuously scrutinized by shareholders, industry analysts, and government regulators, and their management systems, tools, and trained personnel provide consistent planning, management of capital, operations and maintenance, plant improvement/optimization projects, community engagement, environmental stewardship; successful delivery of new assets; and project development for a variety of energy projects that include traditional and emerging technologies. Qualifications of Key Personnel can be found in Appendix D-Qualifications of Key Personnel.

Project Partners have management systems, tools, and trained personnel to provide consistent planning and management of capital, operations and maintenance (O&M), plant improvement/optimization projects, community engagement, and environmental stewardship; successful delivery of new assets;

and project development for a variety of energy projects that include traditional and emerging technologies and full supply chain from energy generation through use.

TIMETABLE

Project Schedule: Long-lead material order as soon as February 2025, and EPC Contract Execution through commercial operations date estimated May 2026 through December 2028, respectively.

BUDGET

About $1.8B for H_2 and NH_3 production and $0.4B for urea production will be subsidized with a $125,000,000 forgivable loan from CSEA (being sought in this application), and the remainder in cash from Project Partners is anticipated during the detailed engineering and construction phase under consideration for this loan opportunity. Potential additional grant support from State and Federal Sources is pending at the time of application. Nonetheless, a leverage ratio in excess of 8x for the CSEA loan in question would be maintained.

The PHES Partners have a strong track record of living up to its fiduciary duty to manage the capital of its stakeholders. The PHES Project strategic advantage is the participation of two of the largest infrastructure companies operating in North Dakota and in North America. The capital barrier to entry into emerging technologies is significant, as demonstrated by the cost estimate above; however, it represents a massive investment on behalf of the proponents, over and above the proposed grant value. MPLX and TC Energy are dedicated to innovation and to bringing carbon reduction services to industry, but there is still significant risk involved in being a first mover. Government incentives such as the 45Q tax credit, grants and low-interest loans are imperative to commercializing these emerging technologies. The financial investment being sought from the CSEA will help ensure Project success contingent on FID by the PHES Partners.

TAX LIABILITY

The signed Tax Liability form is contained in Appendix H.

CONFIDENTIAL INFORMATION

This proposal contains confidential information. A confidential request form is provided in Appendix A. Additional confidential information is contained in Appendixes A, B, E, F, G and I.

PATENTS/RIGHTS TO TECHNICAL DATA

Project design (currently undergoing pre-FEED and long-lead development) will rely on technology licensors to provide the core process equipment along with rights to use of IP required to design, build, operate, and maintain the equipment. The project will not seek to develop any new IP. Patented processes could be anticipated for CH_4 Reforming; Air Separation Unit (ASU); Pressure Swing Adsorption (PSA); CO_2 Capture; Oxygen compression and dehydration; Electrolysis, and NH_3 synthesis.

STATE PROGRAMS AND INCENTIVES (PHES)

Pending and awarded State support to the applicant is listed in Appendix B.

APPENDIX C

LETTERS OF SUPPORT

PRAIRIE HORIZON
HYDROGEN

October 7, 2023

North Dakota Industrial Commission
Attn: Clean Sustainable Energy Authority
State Capitol – 14th Floor
600 E. Boulevard Ave. Dept. 405
Bismarck, ND, 58503-0804
Email:Sustainableenergy@nd.gov

Subject: Proposed Prairie Horizon Energy Solutions Clean H_2 and Ammonia Project
.
Dear Executive Director Al Anderson and the Clean Sustainable Energy Authority

TC Energy Development Holdings Inc. (together with its affiliates, TC Energy) and MPC Investment LLC (MPC) form the core of **Prairie Horizon Energy Solutions LLC (PHES).** TC Energy and MPC will be collaborating within PHES to support development of a new potential clean hydrogen and ammonia production facility in Stark County, North Dakota (the Project), and are pleased to jointly submit this proposal to secure funding from the Agriculture Diversification and Development Fund as established in House Bill No. 1276 and Senate Bill 2015.

Over the past year, TC Energy and MPC have collaborated through PHES to perform front-end engineering work on the Project. In partnership with the Energy & Environmental Research Center (EERC) and the state of North Dakota's Clean Sustainable Energy Authority (CSEA) the project development was kickstarted with $14.29 MM partner investment and $10MM CSEA funds. The Project will include clean hydrogen production powered by renewable electricity and renewable natural gas paired with carbon capture and sequestration technology. The Project plans to initially produce 200 metric tons per day (TPD) of clean hydrogen for industrial use within renewable liquid fuel manufacturing, newly constructed ammonia fertilizer manufacture, and blending to decarbonize natural gas. Both renewable diesel and ammonia manufacture represent hydrogen offtake occurring within the project and being both producer and consumer of hydrogen will increase the likelihood of commercial success. Through these investments, PHES is positioned to successfully execute the proposed infrastructure development with an expectation to achieve full facility operations in 2028.

PHES is seeking $125M in available loan funds from the CSEA through the Bank of North Dakota to support portions of forthcoming equipment procurement and construction. The financial investment being sought from the CSEA will help ensure project success contingent on a Final Investment Decision ("FID") by the PHES partners.

TC Energy and MPC have established commitments to the communities in which they operate and see CSEA investment in the Project as a catalyst to expand the benefits, quality jobs, economic expansion, and growth in diversity, equity, inclusion, and accessibility (DEIA) to the communities of western North Dakota. TC Energy and MPC have a long and successful history developing, constructing, and operating large energy infrastructure projects:

TC Energy

TC Energy has over 70 years of experience and is a leader in the responsible development and reliable operation of North American energy infrastructure, including NG pipelines (57,900 miles, 25% of North American NG pipelines), liquid pipelines (3,000-mile network), power generation (4,200 MW), and gas storage facilities (653 Bcf). TC Energy's assets will be utilized to lower the cost and increase the speed of H2 delivery. TC Energy employs over 4,400 highly skilled engineers, developers, scientists, and project managers who have been transforming the energy landscape across North America. TC Energy's U.S. power and emissions commercial trading and marketing business provides customers with various physical and financial products, with a measured approach to risk management and a focus on financial discipline, compliance, and operational excellence. TC Energy is in the process of decarbonizing its midstream network through securing renewable energy projects. Additionally, TC Energy has entered into joint development agreements for the development of H2 hubs across North America. On CCS, TC Energy has partnered to develop Project Tundra which will capture and sequester up to 4 million TPY of CO2 produced from the Milton R. Young Station.

MPC

MPC is a subsidiary of Marathon Petroleum Corporation, a leading integrated downstream energy company headquartered in Findlay, Ohio and operating the nation's largest refining system, including refineries in Mandan, North Dakota, and Saint Paul, Minnesota, as well as a renewable fuels facility in Dickinson, North Dakota. Marathon Petroleum Corporation is also the general partner and majority limited partner of MPLX LP (MPLX), a midstream company that owns and operates gathering, processing, and fractionation assets and crude oil and product logistics infrastructure. MPC and MPLX have extensive management experience and an engineering team of 100 professionals assembled on a project-by-project basis to meet the specific needs relative to project controls, environment and safety, and design. Since 2012, MPC has managed over $2B in large capital growth projects consisting of new pipeline construction, cavern development, tank farm expansions, and dock expansions.

Prairie Horizon Energy Solutions LLC and its partners look forward to being a valuable partner to the CSEA in the development of this Project and improving the prosperity of the State of North Dakota.

Sincerely,

Omar Khayum

Omar Khayum
President
TC Energy Development Holdings Inc.

October 05, 2023

North Dakota Industrial Commission
Attn: Clean Sustainable Energy Authority
State Capitol – 14th Floor
600 E. Boulevard Ave. Dept. 405
Bismarck, ND, 58503-0804
Email:Sustainableenergy@nd.gov

Subject: Proposed Prairie Horizon Energy Solutions Clean H_2 and Ammonia Project

Dear Executive Director Al Anderson and the Clean Sustainable Energy Authority

Sumitomo Corporation of Americas, a New York Corporation (SCOA), is pleased to participate in the proposal submitted by Prairie Horizon Energy Solutions LLC ("PHES") to secure funding from the Agriculture Diversification and Development Fund as established in House Bill No. 1276 and Senate Bill 2015 to construct a hydrogen and ammonia production facility in North Dakota.

Sumitomo Corporation, the parent company of SCOA, aims to reach carbon neutrality in 2050 through developing technologies and business models for creating a sustainable energy cycle by reducing CO2 emissions and achieving negative emissions for society as-a-whole. In August 2022, SCOA entered a MOU with the State of North Dakota with the intention of accelerating the progress towards carbon neutrality of the state and wider societies. ND Department of Commerce has highly valued SCOA's active engagement in various, on-going de-carbonization projects and, in Nov 2022, they introduced SCOA to the PHES partners with the intention to participate as a partner in the proposed Heartland Hydrogen Hub (an applicant to the U.S. Department of Energy Office of Clean Energy Demonstration Funding Opportunity Announcement DE-FOA-0002779 to establish regional clean hydrogen hubs).

Leveraging broad industry coverage and diverse business experience, SCOA is taking a leading role in creating low CO H2 demand that is the fundamental challenge for inland states and requires long-term, committed, persistent efforts. Over the last few months, SCOA has retained market, engineering & tax consultants to understand the feasibility of producing & marketing lower carbon intensity fertilizer from low CI H2 in the Northern Great Plains region. In addition, SCOA intends to collaborate with potentially "stranded" ethanol producers with hart to abate sources of biogenic CO2 to produce urea fertilizer. This provides a platform to decarbonize ethanol businesses and create a circularity in the agricultural industry.

SCOA is committed to the communities in which we operate and envision Clean Sustainable Energy Authority investment in PHES project as a catalyst to expand the benefits, quality jobs, economic expansion, and growth in diversity, equity, inclusion, and accessibility (DEIA) to the communities across the state.

We are committed to the development and operation of the hydrogen and ammonia production facility being developed by PHES through collaborative partnerships and through low CI H2, ammonia, fertilizer production & distribution, subject to the feasibility assessment, terms and conditions and our management approval.

SCOA, through its 400 year group history, has embraced and demonstrated the business philosophy that stresses the need for an enterprising spirit to stay a step ahead in dealing with change, while ascribing importance to maintaining integrity and sound management, avoiding easy gains, and working for the public interest, without being misled by short-term immediate changes. The energy transition challenge is the fundamental one, with which we are now faced with in our 400 year group history. We are confident that our participation could bring great value to the project.

We look forward to working with Prairie Horizon Energy Solutions LLC and the team on this exciting opportunity.

Sincerely,

Shinichi Hasegawa
Senior Vice President
General Manager, Energy Innovation Initiative Americas

ADMINISTRATION

October 16, 2023

Mr. Al Anderson
Director
Clean Sustainable Energy Authority
North Dakota Industrial Commission
State Capitol – 14th Floor
600 East Boulevard Avenue, Dept. 405
Bismarck, ND 58505-0840

Dear Mr. Anderson:

Subject: Prairie Horizon Hydrogen Fertilizer Development Incentive Program Loan Application

On behalf of the community of Dickinson, ND, this letter expresses our support for the proposal submitted by Prairie Horizon Hydrogen LLC to secure funding from the North Dakota Industrial Commission Fertilizer Development Incentive Program Loan Application to develop a fertilizer facility in Dickinson, North Dakota.

We believe Prairie Horizon Hydrogen' proposed fertilizer facility would provide jobs for many and increase the growth of infrastructure within our community. Through a number of productive conversations, the City of Dickinson has advised TC on the City of Dickinson's extra-territorial zone, potential designated setbacks, and anticipated water usage. I appreciate TC Energy taking the time to include the City of Dickinson in these discussions. We look forward to accommodating a new workforce, children in our schools, and businesses that Prairie Horizon Hydrogen's fertilizer facility would bring to our community and others nearby.

We look forward to working with Prairie Horizon Hydrogen LLC and the team on this exciting effort.

Sincerely,

Dustin Dassinger
City Administrator
Dickinson, ND

38 1st ST W | Dickinson ND 58601 | 701.456.7744
www.dickinsongov.com | Fax: 701.456.7723 | www.facebook.com/cityofdickinsonnd

Greater North Dakota Chamber

October 16, 2023

To Whom It May Concern:

Subject: Prairie Horizon Hydrogen Fertilizer Project

On behalf of the Greater North Dakota Chamber (GNDC), this letter expresses our support for the project proposed by Prairie Horizon Hydrogen LLC to develop a fertilizer facility in Dickinson, North Dakota.

As North Dakota's oldest and largest business advocacy organization, GNDC is supportive of Prairie Horizon Hydrogen LLC's innovative approach to addressing North Dakota's energy needs. Further, GNDC is pleased to continue its support of Prairie Horizon Hydrogen member company TC Energy.

As a Cornerstone Member of the GNDC, TC Energy plays an essential role in the development of North Dakota's economy and is seen as a leader within the statewide business community. We believe Prairie Horizon Hydrogen's proposed North Dakota fertilizer facility, being developed by TC Energy and its partners, will provide jobs for many in the local community and will ultimately lead to further economic development across North Dakota.

We look forward to working with Prairie Horizon Hydrogen LLC and the team on this exciting effort.

Sincerely,

Arik Spencer
President & CEO
Greater North Dakota Chamber
arik@ndchamber.com

NORTH DAKOTA
PETROLEUM
COUNCIL
100 West Broadway, Ste. 200 | P.O. Box 1395 | Bismarck, ND 58501-1395
701.223.6380 | ndpc@ndoil.org | www.NDOil.org

October 3, 2023

Mr. Al Anderson
Director
Clean Sustainable Energy Authority
North Dakota Industrial Commission
State Capitol – 14th Floor
600 East Boulevard Avenue, Dept. 405
Bismarck, ND 58505-0840

Dear Mr. Anderson:

Subject: Prairie Horizon Hydrogen Fertilizer Development Incentive Program Loan Application

On behalf of the North Dakota Petroleum Council (NDPC), this letter expresses our support for the proposal submitted by Prairie Horizon Hydrogen LLC to secure funding from the North Dakota Industrial Commission Fertilizer Development Incentive Program Loan Application to develop a fertilizer facility in Dickinson, North Dakota.

The North Dakota Petroleum Council is the primary voice of the oil and gas industry in North Dakota and advocates for enhancement and development across the entire oil and gas value chain. As such, we are supportive of Prairie Horizon Hydrogen's innovative approach to addressing North Dakota's energy needs. The region's favorable geology, strong infrastructure, and abundant fossil energy resources, coupled with significant carbon capture and storage potential, are attributes that make the proposed project one that NDPC encourages the North Dakota Industrial Commission to fund.

We look forward to working with Prairie Horizon Hydrogen LLC and the team on this exciting effort.

Sincerely,

Ron Ness

Ron Ness
President
North Dakota Petroleum Council

Phone: 701.225.5997
Fax: 701.227.8647

STARK DEVELOPMENT CORPORATION

www.starkdev.com
team@starkdev.com

103 1st Avenue West, Suite 101 • Dickinson, ND 58601

Tuesday, October 3, 2023

Mr. Al Anderson
Director
Clean Sustainable Energy Authority
North Dakota Industrial Commission
State Capitol – 14th Floor
600 East Boulevard Avenue, Dept. 405
Bismarck, ND 58505-0840

Dear Mr. Anderson:

Subject: Prairie Horizon Hydrogen Fertilizer Development Incentive Program Loan Application

On behalf of Stark Development Corporation this letter expresses our support for the proposal submitted by Prairie Horizon Hydrogen LLC to secure funding from the North Dakota Industrial Commission Fertilizer Development Incentive Program Loan Application to develop a fertilizer facility in Dickinson, North Dakota.

As the economic development organization serving Dickinson and Stark County North Dakota, Stark Development is supportive of the proposed Prairie Horizon Hydrogen's proposed fertilizer facility. Stark Development Corporation works to promote economic development, innovation, and entrepreneurship, continuing to making Southwest North Dakota a great place to live. Further, Stark Development is supportive of Prairie Horizon Hydrogen LLC's innovative approach to addressing the energy needs of Stark County and the State of North Dakota.

Stark Development Corporation works closely with all sectors of industry and sees growing interest in low-carbon energy projects that can result in new industry opportunities. We look forward to accommodating a new workforce, children in our schools, and businesses that the Prairie Horizon Hydrogen and fertilizer facility would bring to our community and others nearby.

We look forward to working with Prairie Horizon Hydrogen LLC and the team on this exciting effort.

Sincerely,

Ryan B Jilek

Ryan Jilek, Executive Vice President
Stark Development Corporation

Plug Power
968 Albany Shaker Road
Latham, NY 12110

October 5, 2023

North Dakota Industrial Commission
Attn: Clean Sustainable Energy Authority
State Capitol – 14th Floor
600 E. Boulevard Ave. Dept. 405
Bismarck, ND, 58503-0804
Email: SustainableEnergy@nd.gov

Subject: Proposed Prairie Horizon Energy Solutions Clean H_2 and Ammonia Project

Dear Executive Director Al Anderson and the Clean Sustainable Energy Authority:

On behalf of Plug Power Inc. ("Plug"), I am writing in support of the partnership between TC Energy Development Holdings Inc. & Marathon Petroleum Corporation through Prairie Horizon Energy Solutions LLC ("PHES") and their proposal to secure funding from the Agriculture Diversification and Development Fund as established in House Bill No. 1276 and Senate Bill 2015 to construct the above-referenced hydrogen and ammonia production facility in North Dakota.

Plug (NASDAQ: PLUG) is the vertically integrated hydrogen leader with decades of innovation and experience in PEM electrolysis and fuel cells. With over 25,000 PEM electrolyzer stacks deployed and operating worldwide, we have built a global reputation for reliability and excellence serving commercial, industrial, and utility customers, including Amazon, Uniper, Walmart, GALP, Phillips 66, MOL Group, and Hydro Havrand. Our success serving the oil & gas sector including refiners is indicative of the value we deliver and risk we reduce for our partners. Together with the PHES consortium, we passionately believe in hydrogen as an important alternative to various traditional and carbon-intensive industrial fuels, chemical feedstocks, and commercial vehicles fuels.

Plug is pleased to offer our technical and industry experience to assist PHES through their design phase with our Basic Engineering & Design Package, and if the proposal is selected for award, Plug is ready to commit to supporting TC Energy and its partners as a vendor so that they may perform the work described in the application.

To our understanding, the proposed project will develop a strong hydrogen and fertilizer production facility to meet clean energy, transportation, and agricultural needs from multiple energy sources using innovative technologies to accelerate a clean energy portfolio and strengthen national energy security. These attributes make the proposed project one Plug encourages the CSEA through the Bank of North Dakota to fund.

We look forward to working with PHES and the team on this exciting opportunity. Please feel free to contact me at kstrickland@plugpower.com if you would like additional information.

Sincerely,

Kenneth Strickland

Kenneth Strickland
Vice President, Electrolyzer Sales - Americas

October 9th, 2023

North Dakota Industrial Commission
Attn: Clean Sustainable Energy Authority
State Capitol – 14th Floor
600 E. Boulevard Ave. Dept. 405
Bismarck, ND, 58503-0804

Subject: Proposed Prairie Horizon Energy Solutions Clean H2 and Ammonia Project

Dear Executive Director Al Anderson and the Clean Sustainable Energy Authority

On behalf of Accelera by Cummins, I am writing in support of the partnership between TC Energy Development Holdings Inc. & Marathon Petroleum Corporation through Prairie Horizon Energy Solutions LLC and their proposal to secure funding from the Agriculture Diversification and Development Fund as established in House Bill No. 1276 and Senate Bill 2015 to construct a hydrogen and ammonia production facility in North Dakota.

Accelera by Cummins is the new brand for Cummins' New Power business segment, launched March 8, 2023. Accelera is an energy technology leader committed to securing a sustainable future for the industries that keep the world running. A diverse portfolio of zero-emissions solutions includes battery systems, fuel cells, ePowertrain systems and electrolyzers.

The proposed project will develop a strong hydrogen and fertilizer production facility to meet clean energy, transportation, and agricultural needs from multiple energy sources using innovative technologies to accelerate a clean energy portfolio and strengthen national energy security. These attributes make the proposed project one Accelera encourages the CSEA through the Bank of North Dakota to fund.

We look forward to working with Prairie Horizon Energy Solutions LLC and the team on this exciting opportunity. Please feel free to contact me if you would like further background or any additional information.

Sincerely,

Alex Savelli
Managing Director - Americas for Hydrogen Technologies
+1 612 430 3794
alex.savelli@cummins.com

LinkedIn Twitter Instagram accelerate the shift™

3850 North Victoria Street
Shoreview, MN 55126 USA

accelerazero.com

Black & Veatch
11401 Lamar Avenue, Overland Park, KS 66211 USA
P +1 919-462-7291 E RowellJ@bv.com

October 2, 2023

Justin Gutknecht
Director | Energy Origination and Development
TC Energy

RE: Proposed Prairie Horizon Energy Solutions Clean H2 and Ammonia Project

Dear Justin:

Black & Veatch is pleased to provide this Expression of Support and participate in the proposal submitted by Prairie Horizon Energy Solutions LLC ("PHES") to secure funding from the Agriculture Diversification and Development Fund as established in House Bill No. 1276 and Senate Bill 2015 to construct a hydrogen and ammonia production facility in North Dakota.

We are interested in collaborating with TC Energy, Marathon, and the hub stakeholders on the Engineering, Procurement, and Construction (EPC) scope for the project.

Black & Veatch is a market leader in hydrogen engineering and construction, with more than 365MW of electrolysis projects in construction and more than 80 years' experience in hydrogen and ammonia. We are committed to advancing implementation of hydrogen production, storage, transportation, and utilization with upmost safety through our decades of lessons learned. As an executive member of the Center of Hydrogen Safety, we are collaborating across many industrial partners to implement our lessons learned across projects such as the one proposed by PHES.

It is our pleasure to provide this Expression of Support regarding such a future collaboration that would benefit PHES and Black & Veatch. We understand any future commercial arrangements would be subject to the completion of all necessary due diligence, satisfactory documentation, and our management's approval. Please note that this Expression of Support does NOT constitute or create any legally binding or enforceable obligation for TC Energy, Marathon, PHES, or Black & Veatch.

The proposed project will develop a strong hydrogen and fertilizer production facility to meet clean energy, transportation, and agricultural needs from multiple energy sources using innovative technologies to accelerate a clean energy portfolio and strengthen national energy security. These attributes make the proposed project one Black & Veatch encourages the Clean Sustainable Energy Authority through the Bank of North Dakota to fund.

We look forward to working with Prairie Horizon Energy Solutions LLC and the team on this exciting opportunity.

Please contact me if you have any questions on our support of the project.

Very truly yours,

Black & Veatch

Jason Rowell
Vice President, Sustainable Process Portfolio Leader

APPENDIX D

QUALIFICATIONS OF KEY PERSONNEL

PRAIRIE HORIZON
ENERGY SOLUTIONS

Key Personnel Name	Company	Title	Position/Role
Zack Thobe	MPC	Business Development Representative	Business Development and Management
Justin Gutknecht	TCE	Director, Energy Origination & Development	Business Development and Management
Andrew Isherwood	TCE	Director, Energy Origination & Development	Business Development and Management
Jake Chenevey	MPC	Project Manager, Logistics & Storage Support Services - Major Projects	EPC Implementation Risk Analysis/Mitigation
Joseph Brisebois	TCE	Senior Developer	Development
Dr. Prashanth Mandalaparty	TCE	Senior Reservoir Engineer	EPC Implementation
Jason Martin	TCE	Manager, Storage Program Support	EPC Implementation
Chad Guthrie	MPC	Project Engineer	Pipeline and EPC Implementation
Ryan Dick	MPC	Project Engineer	Pipeline and EPC Implementation
Brian Adams	MPC	Senior Project Engineer	Pipeline and EPC Implementation
Colin Daly	TCE	Senior Originator	Development
Lisa Leland	TCE	Senior Manager, Energy Origination & Development	Technical Data/Analysis
Tayla Snapp	TCE	State Government & Community Relations Specialist	Community Engagement
Jean Gould	MPC	Stakeholder and Issues Management Advisor	Community Engagement

ZACHARY D. THOBE

BUSINESS DEVELOPMENT – MARATHON PETROLEUM COMPANY LP
(419) 429-2588, zdthobe@marathonpetroleum.com

LIBERTY PRINCIPAL INVESTIGATOR

EDUCATION AND TRAINING

Master of Business Administration, Bowling Green State University, December 2014

Bachelor of Mechanical Engineering, The Ohio State University, June 2012

PROFESSIONAL EXPERIENCE

Mr. Thobe has over a decade of experience in the energy industry. In 2012, Mr. Thobe joined Marathon Petroleum Company (MPC) as a Project Engineer where he developed and managed long-haul pipeline system integrity projects throughout the United States. This role included multiple technology inspections through in-line inspection tools and any in-field rehabilitation scope that followed. Following this role, he supported the Company's Major Capital Projects organization by developing new pipeline systems and expansions of existing systems. In this role, Mr. Thobe had the unique opportunity to support a portfolio of projects from concept to close-out. Through this four-year tenure, he was able to effectively accomplish key technical aspects as well as manage several hundred contract employees throughout field implementation. After his experience within the Engineering organization, Mr. Thobe transitioned to the Commercial organization within the Logistics and Storage business segment where he originated, managed, and sought approval of growth projects across MPC's crude oil business. Mr. Thobe now supports MPC's Renewable and Emerging Technology organization within the Business Development unit. Given his experience and successful track-record developing and managing major capital projects as well as his financial acumen, Mr. Thobe is well equipped to support the project as the **Liberty Principal Investigator**.

PROFESSIONAL HISTORY

- In his Commercial role, Mr. Thobe managed a portfolio reflecting **several hundred million** in earnings before interest, taxes, depreciation, and amortization (EBITDA) and he consistently grew many assets at 30 percent or higher compound annual growth rate (CAGR).

- Mr. Thobe has developed and managed projects across various energy commodities including; crude oil, natural gas, liquified petroleum gas, butane, condensate, diesel, gasoline, propylene, ammonia, carbon dioxide, and hydrogen and through various transportation modes, pipeline, rail, marine, and truck. He has designed pressure spheres and commercially justified new above ground storage tanks for crude oil storage.

- Within his Major Capital Projects engineering role, Mr. Thobe pioneered the engineering development of a portfolio which consisted of a collection of new pipeline systems and expansions of existing systems with an objective of becoming the pipeline transportation solution for shale producers and customers – **$400 million portfolio**.

- Mr. Thobe developed and led a charity event raising over $50,000 which was donated across four counties in Ohio; giving back to communities in which the projects were implemented and the company operates the new assets.

- **Ohio, United States, New Pipeline Construction and Completion**
    - Mr. Thobe led three years of engineering development and management of the project. He worked closely with company stakeholders and external partners to develop pipeline routing to achieve long term operations, right-of-way acquisition, project quality plan, and obtain necessary federal and state environmental and regulatory permits.
    - He thoroughly evaluated contracts for the mainline construction scope offering a $20 MM cost savings opportunity to the company.
    - Mr. Thobe successfully managed 12-months of project construction with a diverse team of over 450 resources across a 50-mile pipeline alignment.
    - The project achieved a best-in-class weld repair percentage of 0.7 percent on over 5,300 welds and zero construction anomalies during construction over the alignment marking high in quality and outperforming industry standards.
    - The project accomplished an accelerated pipeline connectivity scope.
    - Mr. Thobe directed a **$300 million project** and achieved completion ahead of schedule and on budget; while maintaining a solid safety record.

- **Ohio, United States, Major Pipeline Expansion**
    - Mr. Thobe worked closely with company stakeholders to evaluate pipeline risks by developing and executing a pipeline removal project purposed to implement cyclic and pressure testing. The results were used to inform stakeholders and ultimately to validate operating pressures early within the project development cycle. The outcome further justified the project and prevented inefficiently carrying multiple scoping options into late-stage engineering development.
    - Mr. Thobe developed complete replacement scope for seven miles of line pipe and a mainline hydrostatic test of a 100-mile system. The outcome increased the maximum operating pressure (MOP) by two times allowing for more commodity throughputs.
    - Successfully implemented the project over 11-months of construction including 90-days of system downtime.
    - Mr. Thobe effectively managed a **$100 million** project and achieved completion on schedule; and maintained a solid safety record. The project’s budget was impacted by the hydrostatic scope, but Mr. Thobe proactively managed internal and external requirements.

- **Gulf Coast, United States, Major Pipeline System Decommissioning**
    - Mr. Thobe established a novel technical scope to nitrogen purge/ displace and decommission a 750-mile pipeline system originating in Texas and terminating in Illinois.
    - Mr. Thobe managed the execution of Phase I and II which displaced over 440 miles of pipe; 1.50 MMbbls of product utilizing over 175 MMscf of nitrogen; the company's largest of similar scope. Based on the systems pressure profile, the nitrogen displacement occurred by creating multiple injection sites across the system.
    - Collaborated with company stakeholders and third-party joint owner to convey technical information as well as cost and schedule updates which aided in making informed decisions.
    - Mr. Thobe lucratively managed the **$20 million** project.

Justin Gutknecht
Director, Energy Origination and Development
TC Energy
180 N LaSalle Street, Suite 3030, Chicago, IL 60601
(312) 576-8004, Justin_Gutknecht@tcenergy.com

Education and Training

The University of Chicago Booth School of Business 2014 – 2017
Master of Business Administration (M.B.A.), Accounting, Finance and Strategy, Graduated with Honors

University of Illinois at Urbana-Champaign 2001 – 2004
Bachelor of Science in Finance

Designations
- Chartered Financial Analyst (CFA) Charterholder, 2013 – Current
- CFA Society of Chicago, 2013 – Current

Research and Professional Experience

TC Energy 2021 - Current

Director, Energy Origination and Development
- Manage TCE Energy's origination and development of utility scale renewable power projects and low carbon hydrogen production projects in the United States
- Identify new customers and joint venture partnership opportunities and develop and commercialize new trading products to grow TC Energy's commodity marketing business
- Manage project development activities, including but not limited to site origination, due diligence, permitting and project management, for new energy projects
- Lead negotiations with clients and internal support staff such as legal, risk, credit and other teams

Annova LNG 2017 - 2021

Senior Vice President, Finance and Development
- Manage the proposed project finance structure consisting of $3.9 billion of non-recourse debt and $1.3 billion of equity including the preparation of financial models and presentation materials for the Board of Directors
- Lead due diligence, development and execution efforts in multi-phase equity financings with joint venture partners, including Enbridge Inc., Black & Veatch Corporation and Kiewit Corporation
- Assist outside counsel with developing and negotiating the commercial terms of financing term sheets, letters of interest, commitment letters and definitive equity sales agreements, Sales and Purchase Agreements (SPAs), Pipeline Precedent Agreement, and Engineering, Procurement and Construction (EPC) contracts
- Supervise the financial advisor, coordinating lead debt arranger, and insurance advisor engagements to support the bankability of terms and conditions of various project contracts and provide general structuring advice
- Support Origination for pricing, technical and legal aspects of structuring LNG transactions, assist in LNG marketing, and coordinate customer due diligence for prospective LNG supply and co-investment opportunities

Exelon Corporation 2015 - 2017

Manager, Generation Development Analytics

- Supported the financial evaluation and development of new power generation assets (gas, wind, solar, and storage) related to external acquisitions and organic development
- Led project management and transaction execution support for the acquisition of 198 MW Bluestem Wind Energy, a $300+ million wind facility in Beaver County, Oklahoma
- Expanded the pipeline of Energy Storage to over 120 MW of projects and managed development activities such as site control, permitting, interconnection, engineering, vendor partnerships, technology evaluation, and offtake

Evraz North America 2011 - 2015

Manager, Financial Planning and Analysis

- 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 $200 million of capital investment projects and provided technical financial support and recommendations on the evaluation of potential alliances, acquisitions, capital investments and other issues affecting operations

Telephone and Data Systems Inc. 2004 - 2011

Senior Financial Analyst, Corporate Development

- Performed discounted cash flow analysis and other financial techniques to model valuations for the acquisitions of companies and minority interests with market values ranging from $20 million to $2 billion
- Participated in FCC spectrum auctions and successfully increased U.S. Cellular’s wireless footprint
- 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
- Constructed recommendations to Senior Management on the Company's cash investment strategy, monitored the investment environment, and evaluated suitable investment products

Jean Gould
Stakeholder and Issues Management Advisor
Marathon Petroleum Corporation
210-542-1334; jgould@marathonpetroleum.com

Education and Training
New York University, Global Affairs, MS, 2008
University of Houston, MBA, 1991
Georgia Institute of Technology, Chemical Engineering, BS, 1985

Research and Professional Experience
2021 – preset: Stakeholder and Issues Management Advisor: Marathon Petroleum – TX
- Develop and implement strategic risk/issues management program for enterprise and regional business/operational activities
- Devise and execute stakeholder engagement, community relations and communications strategies to address operational issues

2020 – 2021: Deputy Assistant Director, Policy and Communications: City of Houston – TX
- Direct communications and policy development for City department responsible for creating affordable homes and community facilities
- Led the development and implementation of strategies/programs for stakeholder engagement, communications and media relations
- Managed team of 22 communications and community outreach professionals

2020 – 2020: Principal Consultant, Communications and Stakeholder Engagement: Environmental Resources Management – Houston, TX
- Developed and implemented public affairs and communications strategies/campaigns for utility, energy and chemical clients
- Managed stakeholder and community relations initiatives for infrastructure projects

2018 – 2020: Sr. Advisor, Public and Government Affairs: Husky Energy – Superior, WI
- Managed communications, community relations and government affairs for the rebuild of the Superior Refinery (April 2018 incident resulted in an explosion/fire)

2016 – 2018: Sr. Director, Public Policy and Communications: Petroleum Equipment and Services Association – Houston, TX
- Directed government relations and public policy for upstream service providers trade association; managed federal/state legislative and regulatory affairs activities

2010 – 2015: Vice President, External Affairs: American Bureau of Shipping – Houston, TX
- Led global communications and international affairs for leading marine classification society which promoted safety in marine and energy industries
- Accountable for global reputation and executive communications strategies
- Managed global team of 20 professionals

2006 – 2010: Director, Government and Corporate Affairs: Coyne Public Relations – NJ

- Conceived, developed and executed communications and government relations strategies and programs for energy, healthcare and manufacturing clients

1997 – 2003: International Corporate Affairs Advisor: Exxon Mobil – Florham Park, NJ

- Directed corporate affairs activities for operations in Africa and Latin America
- Stewarded issues management process and community investment programs for international affiliates

1991 – 1997: International Government Affairs Representative: Exxon Mobil – D.C.

- Managed public policy and business issues affection operations and interest in Asia, Africa and Latin America
- Managed relations with Department of State, DOE, embassies, World Bank, IMF and business associations

1988 – 1991: Natural Gas Business Development Advisor: Exxon Mobil – Houston, TX

- Managed client portfolio for natural gas business in TX/LA; sales revenue $300 M/yr.

1985 – 1988: Engineer: Exxon Mobil – Houston, TX

- Reservoir engineer for Texas operations; planning analyst for Gulf Coast operation

Synergistic Activities

- Exxon Mobil: Chad-Cameroon Upstream Development Project
  Directed public affairs campaign for $4 billion energy development project in Sub-Sahara Africa, including a 600-mile pipeline through environmentally sensitive regions of Cameroon. The multi-year campaign involved activities on three continents and involved IMF, World Bank and IFC. Objective to secure World Bank participation in the project was achieved in 2000. Oil production began 2003.
- Husky Energy: Superior Refinery Rebuild Project
  Developed and implemented stakeholder engagement program to rebuild trust in the community; it had been evacuated in 2018 due to the fire/explosion at the refinery. Developed and implement outreach program to garner support from the community, labor and other key stakeholders for Husky to acquire necessary federal/state permits for the rebuild. Permits were obtained in 3rd quarter 2019.
- City of Houston: New multi-family home development projects
  Developed and implemented community engagement programs for the 5 multi-family homes developments. The developments were in 5 different neighborhoods with different socioeconomic characteristics. The engagement programs were tailored to unique characteristics of each community. The objective of generating support for and minimizing opposition to the project was achieved.

ANDREW ISHERWOOD
Director, Energy Origination & Development
TC Energy
700 Louisiana Street, Houston, Texas, 77002
713-828-4609, andrew_isherwood@tcenergy.com

Education and Training

- CFA Institute (2016-Present) – Chartered Financial Analyst
- University of Calgary (2004-2008) – Bachelor of Commerce (Finance with Distinction)

Research and Professional Experience

- TC Energy - Director of Energy Origination & Development (2022-Present) - Houston, TX
    - Responsible for the origination and development of customer-focused, low carbon infrastructure and products across North America
    - Includes customer solutions for energy efficiency, renewable power, green feedstocks and carbon capture and sequestration
- TC Energy - Director of US Gas Innovation (2021-2022) - Houston, TX
    - Responsible for developing the emission reduction plan for the US Gas Pipelines business unit which included the development of a roadmap to business unit targets in support of emission reduction targets for TC Energy
- TC Energy - Manager of Business Development (2018-2021) - Houston, TX
    - Identify, develop, and commercially executing new development opportunities across entire U.S. regulated natural gas footprint
    - Developed commercial underpinning, including precedent agreements, for over $2,500 million of projects across the United States with annual EBITDA in excess of ~$500 million
- TC Energy - Commercial Manager, Columbia Midstream (2017-2018) - Houston, TX
    - Develop both new unregulated natural gas pipeline projects within the U.S. along with developing the business unit's strategy.

- TC Energy - Senior Financial Analyst, Strategy and Corporate Development (2015-2017) - Calgary, AB
  - Responsible for the development and execution of corporate development initiatives in Canada, U.S., and Mexico, which included playing a critical role in the $14 billion acquisition of Columbia Pipeline Group.
  - Lead the divestiture of ~$1 billion of non-core assets
- TC Energy - Senior Financial Analyst, Investment & Market Analysis (2012-2015) - Calgary, AB
  - Co-ordinate and develop long-term financial forecasts for natural gas and oil pipelines, including conducting a sum-of-parts valuation of business units
  - Assist with financial and transactional work for ~$1 billion of non-core asset divestments
- TC Energy - Business Analyst, Commercial East (2010-2012) - Calgary, AB
  - Provide analytical support to internal stakeholders on natural gas pricing, flows, and market dynamics throughout North America
- TC Energy - Business Analyst, New Grad Rotational Program (2008-2010) - Calgary, AB
  - Program included a variety of Commercial Operations roles within the Canadian Pipelines business unit

Publications

- None

Jacob Chenevey
Marathon Petroleum Corporation-MPLX

Education and Training
Ohio University, Civil Engineering, BS, 1999

Research and Professional Experience
2014 to Present: Project Manager: Logistics & Storage Support Services – Major Projects

- Responsible for managing large capital growth projects for MPLX Logistics & Storage organization
- Leads teams of engineers of all disciplines on projects from conceptual engineering through project commissioning. The project manager is responsible for the entire project life cycle.
- Requires managing multiple projects concurrently.
- Currently involved in the development of renewable/emerging energy (hydrogen, ammonia, carbon capture, etc.)

2012 – 2014: Corrosion Management Services Supervisor: Marathon Pipe Line Company

- Managed the Marathon Pipe Line (MPL) corrosion department that was responsible for cathodic protection design and monitoring of all the company's corrosive assets such as MPL pipelines, tank bottoms, marine facilities, and convenient stores
- Managed a budget of roughly $30 million and a staff of approximately 12 direct reports
- Was a member of several corrosion related industry committees such as committees through PRCI and NACE

2010 - 2012: Project Manager: Marketing and Transportation Engineering – Major Projects

- Responsible for managing large capital growth project throughout the United States including facility flare design, pipeline rehabilitation, and other pipeline speed to market projects
- Designed, constructed, and commissioned three successful major projects during his first experience in major projects

2008 - 2010: Supervisor: Global Procurement

- Supervised the department within global procurement that supported the brand marketing organization within Marathon Petroleum Company
- Organization supported the marketing supply chain efforts for the Marathon retail convenient store organization, tasked with negotiating contracts with key suppliers and vendors
- Department successfully supported a re-branding program of many brand marketing locations

2004 - 2008: Supervisor: Marketing and Transportation Engineering

- Supervised various engineering departments during this time
- Managed teams of engineers that completed a large volume of integrity and corrosion small projects for Marathon Pipe Line
- Organization routinely employed new engineers for development. Responsible for developing, mentoring, and training these new engineers through their projects to become leaders within Marathon Petroleum Company

2001 - 2004: Project Engineer: Marketing and Transportation Engineering

- Successfully completed many pipeline integrity projects ranging from inline inspection tool runs to major pipeline hydrotest projects.
- Led the design and construction of several Speedway convenient stores and truck stops.

- Gained valuable time management and prioritization skills while leading many projects simultaneously

1999 - 2001: Engineer: Johnson and Associates – Oklahoma City, OK

- Successfully designed several civil packages for businesses throughout the greater Oklahoma City Area

1999 - 1999: Engineer: HNTB – Oklahoma City, OK

- Worked as a project engineer on several large railroad projects.
- Completed extensive hydraulic studies of rivers throughout the Midwest to support structural analysis of railroad bridges

Publications

None

Synergistic Activities

MPLX Logistics & Storage Project Management

- Step-Out Energy Projects
    - Led an engineering team through pre-conceptual and conceptual engineering development of various “step-out” opportunities to date including: carbon transportation and sequestration, hydrogen terminal, and hydrogen fueling stations. The team has provided scope development, estimates, and schedule recommendations to internal Business Development.

- Southwest Gathering - Undaunted Pipeline System
    - Led the design and construction of a 15-mile new pipeline system in Texas and New Mexico and four new/modified facilities. Project schedule was accelerated to hit customer required completion date. Project costs totaled $22 million.

- Mt. Airy Expansion Projects
    - Led the design and construction of a major expansion of Marathon’s Mt. Airy Terminal. Expansion includes 9 new 150-barrel storage tanks, two pipelines, and a new large Mississippi river dock. The facility and pipeline work included 10,500 feet of installation via HDD’s; 4,231 controlled modulus columns for the tank foundations; six major pumping units and miles of facility piping. The facility expansion was commissioned remotely during a worldwide pandemic.

- Cornerstone Pipeline Projects
    - Led the design and construction of a new 50-mile pipeline from Cadiz, Ohio to Canton, Ohio with two new origination stations and two new receipt stations. Construction of this pipeline was through mountainous terrain which provided many logistic challenges. The project was completed on time and on budget for a total of $180 million.

Dave Richards, P.Eng
Project Manager, TC Energy
560 6th ave SE #404, Calgary AB, T2G1K7
david_richards@tcenergy.com 403-835-1143

Education:

- BSc. Mechanical Engineering - University of Calgary 2004
- Professional Engineer Registered in Alberta
- PMP Certification - PMBOK 2013

Professional Experience:

Dec 2017 to present, TC Energy Power & Storage

- Project Manager for hydrogen development projects, managing front end engineering, permitting and supporting commercial development.
- Participated in the Energy Transition GHG Reduction Working group. Developed CO2 reduction plans and conducted preliminary assessments of emerging low carbon technologies.
- Project Manager for a portfolio of operations and maintenance projects across multiple assets of co-gen and gas storage facilities.
- Managed a $28M HRSG boiler tube bundle replacement including overseas fabrication, logistics and transportation, and installation during a tight outage duration.

Aug 2015 – Dec 2017, Shell Foothills Sour Gas Facilities Small Project Portfolio:

- Project manager for equipment installations, compressor station retrofits, pipeline construction and well pads.
- Project engineer for an acid gas (H2S/CO2) sequestration FEED project for a large brownfield sour gas plant.

Dec 2013 – Aug 2015, Shell Gas Plants:

- Developed construction scopes of work for lump sum contracts for a 70 mmscfd gas plant.
- Project Engineer for pre-FEED and FEED phases for a greenfield 200 mmscfd gas plant.

Oct 2010 – Nov 2013, Imperial Oil Resources Small Projects Portfolio:

- Project Engineer for a demonstration plant for oil sands extraction research project.
- Project Manager for FEED phase for thermal well pads.
- Project Engineer for construction and commissioning of a 30 mmscfd gas plant.
- Mechanical engineer for gas plant vendor packages, pipelines and thermal facility retrofits

Jun 2009 – Sep 2010, BP Small Projects Portfolio:

- Project Engineer for a $2M produced water pipeline.
- Mechanical Engineer for equipment retrofits in NGL midstream facilities.

May 2006 – Jun 2009, Nexen Long Lake:

- Field engineer for construction, commissioning and operations for a 70 bbl/d SAGD facility.

Nov 2004 – May 2006, Imperial Oil Resources Taglu Gas Plant

- Mechanical EIT during FEED phase of a greenfield gas facility.

Brian Adams
Marathon Petroleum Corporation – MPLX

Education and Training
Pennsylvania State University – Mechanical Engineering, BS, 2014
Bowling Green State University – Master of Business Administration, 2016
Project Management Institute – Project Management Professional, 2018 – present

Research and Professional Experience

2018 to Present: Project Engineer: Logistics & Storage Support Services – Major Projects
- Responsible for managing large scale capital projects
- Work on project teams to plan and execute high speed-to-market growth projects
- Key member of acquisition and buildout team for large Mississippi River storage facility
    - Responsible for the development and construction of 1.3 million barrels of product storage, infrastructure, and connectivity for in/out movements
- Paired with a senior engineer to execute a facility expansion project in West Texas
    - One-hundred-foot PDC building, large diameter piping, large booster pumps installed as part of this project
- Team member in future energy project evaluations
    - Contribute in the pre-conceptual and conceptual engineering development of various technologies including carbon sequestration, hydrogen creation, and hydrogen storage

2017 to 2018: Field Engineer: Logistics & Storage Support Services – Portfolio South
- Strategically placed at a facility for field support of Southeast terminal assets
- Worked through continued development and execution of a project portfolio
- Participated in troubleshooting facility issues as they arose, alongside operations technicians
- Underwent operations training and life critical safety courses

2014 – 2017: Project Engineer: Marketing & Transportation Engineering – Portfolio North
- Managed all phases of project development; from conceptual stages to overseeing construction and project closeout
- Project scopes encompassed civil, mechanical, and electrical engineering disciplines
- Projects improved terminal safety, functionality, and product throughput
- Managed a large portfolio of projects simultaneously
- Effectively communicated daily with management, vendors, contractors, operations personnel, etc.
- Frequently worked with local, state, and federal government agencies

Publications
None

Ryan Dick
Marathon Petroleum Corporation-MPLX

Education and Training
Rose-Hulman Institute of Technology, Mechanical Engineering, BS, 2016

Research and Professional Experience
2022 to Present: Project Engineer: Logistics & Storage Support Services – Major Projects
- Core team member for managing large capital growth projects for MPLX Logistics & Storage organization, oftentimes assisting multiple projects at once.
- Perform development and management tasks on projects from conceptual engineering through project commissioning. Tasks range from engineering development to construction management.
- Work directly with internal/external stakeholders daily for all levels and phases of projects to design, construct, and commission per company standards.

2021 – 2022: Strategy & Business Development: Adv. Business Development Rep
- Assisted in the analysis of organic and inorganic M&A opportunities.
- Responsible for initiating and leading an internal team from all parts of the company (Finance, Accounting, Law, Engineering, etc.) to perform due diligence and vet opportunities.
- Responsible for effective communication on M&A prospects with external parties.
- Managed the acquisition of a cogeneration facility co-located at a Marathon refinery from an UK based parent company.

2020 – 2021: Project Engineer: Marathon Pipe Line (MPL) Operations & Logistics (O&L)
- Led a group of internal engineers, technicians, etc. across numerous organizations to onboard a pipeline for remote operations into the Findlay Operations Center.
- Provided 24-hour support for leading STOP-HELP-START (SHS) events for MPL by guiding stakeholders through the process to identify, analyze, and correct emergencies, incidents, and other abnormal operating conditions.
- Managed the budget, goal process, and assisted in the risk analysis process for the MPL O&L organization.

2016 - 2020: Project Engineer: Marketing & Transportation Engineering – Houston Region
- Managed a portfolio of pipeline projects ranging from equipment maintenance to large horizontal directional drills.
- Developed projects from the earliest conceptual phase all the way through construction and closeout. Worked with internal and external stakeholders to complete project on time, on budget, and according to company standards.

Publications
None

Synergistic Activities
MPLX Logistics & Storage Project Management
- Step-Out Energy Projects
    - Contributed to an engineering team performing pre-conceptual and conceptual engineering development of various “step-out” opportunities to date including: carbon transportation and sequestration, hydrogen terminal, and hydrogen fueling stations. The team has provided scope development, estimates, and schedule recommendations to internal Business Development.

Chad Guthrie
Marathon Petroleum Corporation - MPLX

Education
University of Toledo, Mechanical Engineering, BS, 2005
Bowling Green State University, Master of Business Administration, 2014

Professional Experience
2022-Present: Senior Project Engineer: Marathon Petroleum, Major Projects
- Successfully completed a pipeline purge and cutouts for a 6" - 40 miles pipeline. Project include pipe fabrication, hydrotest, purge, cutouts, valve replacement and flaring.
- Managed alternate energy project which include electrolysis, pipeline design, auto thermal reforming and carbon capture.

2021-2022: Project Engineer: Marathon Petroleum, Mainline Integrity
- Successfully completed many pipeline integrity projects ranging from inline inspection tool runs to major pipeline hydrotest projects.
- Managed over 40 pipeline rehab digs and 8 ILI runs included trap modification and installation.

2019-2021: Project Engineer: Marathon Petroleum, Pipeline
- Lead pipeline projects that included piping design, fabrication, hydrotesting, construction verification and installation on pipeline projects.
- Developed the design and fabricated the Detroit meter run valve and piping replacement

2011-2019: Engineering Manager: Cooper Tire – Findlay, OH
- Completed Six Sigma Black Belt training and worked on continuous improvement and cost reduction projects.
- Managed the equipment design team for all domestic and international projects for new equipment.
- Managed the Continuous Improvement/Six Sigma Black Belt training and completion of continuous improvement projects.

2001-2011: Engineering Manager: Phoenix Technologies – Bowling Green, OH
- Successfully completed multiple process expansion and equipment upgrade projects
- Managed the maintenance and engineering departments for all equipment related issues.

Publications
None

Colin Daly
Senior Originator
TC Energy
180 N LaSalle Street, Suite 3030, Chicago, IL 60601
(312) 639-7372, colin_daly@tcenergy.com

Education and Training

BS Civil and Environmental Engineering, University of Illinois, Urbana-Champaign 2011
BS Physics, Illinois State University 2009

Professional Engineering License (PE) – Illinois 2015
Project Management Professional (PMP) - 2019

Research and Professional Experience

Senior Originator
TC Energy | Power & Energy Solutions, Chicago, Illinois 10/2022 – Present
Support TC Energy's origination and development of utility scale power and hydrogen production projects in targeted markets through managing relationships with consultants and stakeholders from various disciplines.
Identify new market opportunities for TC Energy projects, working alongside TC Energy's Marketing, Operations, and Corporate Development Teams. Coordinate closely with other internal TC Energy business units, including USNG, CNG, and Liquids.

Project Manager
TC Energy | GPMC West, Tinley Park, Illinois 3/2016 – 10/2022
Lead teams of colleagues, consultants and contractors through design, permitting, contracting, execution, commissioning, and close out of projects with environmental, geotechnical, reliability, and natural gas pipe system integrity drivers. Control scope, schedule, quality, safety and budget performance against baseline in conjunction with monthly forecast and risk assessment of $30M annual portfolio. Partner with and coordinate technical subject matter experts, regulatory permitting and legal counsel to generate project business cases, contract terms, scope alternatives, and organizational process improvements.

- Support multiple internal clients as part of the GPMC program with portfolio of pipeline expansions, replacements, abandonments and ROW improvements. Work through rugged, remote terrain as well as critical public and private infrastructure rights-of-way (levees, railroads, etc.) requiring extensive alternatives analysis, and permitting coordination.
- Collaborate with Supply Chain and contract analysts to efficiently bid, and negotiate contract terms.
- Incorporation and early adoption of emissions reduction by bypass or mobile compression on projects realizing over $500k in savings in 2021.
- Development and implementation of a multi-year water management infrastructure remediation effort at compressor station facilities across the US, permanently reducing annual operating costs and regulatory liability.
- Coordinate and manage multiple nationwide integrity data gathering programs including, collection and assessment of data by LiDAR, sonar, and conventional survey methods.

Environmental Engineer
O'Brien and Gere Engineers | Chicago, IL 2/2014 – 5/2018
(seconded with TC Energy 2016-2018)

Led investigation/remediation report writing and work plan design for sites enrolled in USEPA Superfund Program through collaboration with data scientists, engineers, geologists, and data visualization teams. Go-to resource for technical editing client deliverables. Design and field oversight of in-situ stabilization, in-situ chemical oxidation, dredging and capping remediation projects at former manufactured gas plant and industrial legacy remediation sites across Northern IL, WI and MI. Pivotal contributor to company quality management team.

Environmental Engineer
Terracon Consultants, Inc.| Chicago, IL 6/2011 – 2/2014
Environmental Site Assessment and Investigation proposals, reports, drawings, and field work for clients in private and public sectors. Supported performance of electrical resistance heating system at site with chlorinated hydrocarbon plume.

JASON MARTIN
Manager – Storage Program Support
TC Energy
301 Maple St., Sugar Grove, OH 43155
(phone 740-503-4410), jason_martin@tcenergy.com

EDUCATION

West Virginia University – Morgantown, WV
Bachelor of Science Petroleum & Natural Gas Engineering, 1994

PROFESSIONAL EXPERIENCE

TC Energy Corporation - Sugar Grove, OH 8/1997 – present

Manager – Storage Program Support *6/2021 – present*

- Newly created role to support energy transition efforts company-wide
- Responsible for supporting various business units in evaluation and implementation of carbon capture, transportation and sequestration along with hydrogen generation, transport and storage
- Responsibilities also include managing gas storage-related projects and programs at high levels and representing Storage Technical Services on various cross-functional teams and initiatives
- Evaluated and progressing multiple projects in Canada and the United States
- Continuing development as an industry subject matter expert on energy transition as it relates to pipeline companies and underground storage operators

Manager – Well Engineering & Technology *6/2017 – 6/2021*

- Responsible for engineering, projects and programs for the continent's largest underground gas storage operator with 4,400 wells in five US state and one province in Canada during a challenging period of new regulations and compliance
- Led a diverse team of 25 direct reports including engineers, technicians, and analysts in four US states while hiring nine positions throughout my tenure
- Successfully navigated through difficult integration of teams, processes and assets during the full absorption of Columbia Pipeline Group
- Active and supportive member of Storage Technical Services management team sharing in decisions, vision and direction
- Safely and prudently managed >$10 MM in O&M budgets and >$50 MM in capital projects annually with maintenance and Modernization programs

Senior Storage Engineer *3/2004 – 6/2017*

- Lead storage engineer for Ohio depleted-reservoir gas storage fields
- Developed, implemented, and managed gas storage well workover and stimulation programs for over 100 wells annually
- Served as principal in developing new gas storage opportunities including drilling new wells, pipelines, land rights, permitting, and estimating
- Lead technical architect of well projects associated with the Modernization II program
- Repeatedly recognized for top-performance and selection for high-priority teams
- Developed reputation as technical expert in gas storage both internally and externally

Storage Engineer III *8/1997 – 3/2004*

- Field engineer for Ohio depleted-reservoir gas storage fields
- Primary responsibilities included hands-on field engineering for drilling, completions, workovers, and fracture stimulations
- Developed innovative processes and procedures for gas storage well reconditioning and rehabilitation

Northern Illinois Gas (Nicor Gas) – Naperville, IL 5/1994 – 8/1997

Engineer

- Served as a field engineer responsible for five aquifer-based gas storage fields in north-central Illinois
- Performed reservoir engineering duties including managing storage volumes injected and withdrawn from wells
- Primary responsibilities included hands-on field engineering for drilling, completions, workovers, snubbing operations, and stimulation
- Secondary responsibilities for compression, measurement, dehydration, and regulation

Joseph Brisebois
Senior Manager
TC Energy
180 N LaSalle Street, Suite 3030, Chicago, IL 60601
(847) 714-6090, joseph_brisebois@tcenergy.com

Education and Training

BS, Civil Engineering, McGill University, Montreal QC 2005

Research and Professional Experience

TC Energy 2021-Present

Senior Manager
- Lead development on several solar power generation and hydrogen production facilities within the US
- Manage permit process, land acquisition, preliminary engineering and EPC negotiations
- Negotiate water and electrical interconnection agreements with public utilities, including management of interconnection queue process
- Identify new customers for Hydrogen offtake and renewable power PPAs

J-Power USA 2017-2021

Director of Business Development
- Permitting, land acquisition, and preliminary engineering for Jackson Generation, a 1,200 MW combined cycle in Northern Illinois
- Lead development on a 50 MW brownfield solar project in Virginia

Exelon 2015-2016

Principal Generation Project Developer
- Initiated gas fired power plant development pipeline in the US
- Site identification and land acquisition for thermal and storage facilities

Invenergy LLC 2007-2015

Business Development Manager
- Managed development and construction for Ector County Energy Center, a 330MW gas fired peaker in west Texas
- Spearhead effort to identify new thermal development opportunities in the US
- Project engineer on 1000MW+ of wind projects in Canada and the US from early-stage development to COD

Kiewit 2006-2007

Project Engineer

- Cost controls, and scheduling for Chicago O'Hare International Airport, 10C-28C Mass Grading Project
- RFP proposal development for major infrastructure projects

Lisa Leland
Senior Manager, Energy Origination & Development
TC Energy
700 Louisiana Street, Houston, Texas, 77002
346-451-0340, lisa_leland@tcenergy.com

Education

- University of Regina (1990) – Bachelor of Administration - Co-op Work/Study

Professional Experience

- TC Energy – Senior Manager, Energy Origination & Development (2021-Present) - Houston, TX
  - Originate and develop customer-focused, low carbon infrastructure and renewable products across the United States
  - Create customer solutions for energy efficiency, renewable power, green feedstocks and hydrogen development
  - Identify new customers and commercialize new trading products to grow TC Energy's commodity marketing business
- Annova LNG – Senior Vice President, Gas Supply (2019-2021) - Houston, TX
  - Led all aspects of natural gas procurement for the Annova LNG facility ranging from originating key assets to selecting and ensuring third party fuel manager performance, to managing natural gas portfolio risk
  - Negotiated firm transportation contracts to ensure deliverability of natural gas to the facility
  - Developed asset and portfolio strategy to manage long term natural gas supply security
  - Provided cross-functional support for off-take marketing, power procurement, finance and regulatory
- CFE International, LLC – Senior Gas Trader (2018-2019) - Houston, TX

- On the ground floor of developing and executing trading strategies to monetize and ensure optimal natural gas flow for over 2.5 Bcf/d on an 8 Bcf/d Texas pipeline asset base
- Created and implemented contingency plans to assure natural gas supply flowed to markets

Prashanth Mandalaparty

Senior Reservoir Engineer
TC Energy **p_mandalaparty@tcenergy.com**
(336)-509-9709

Education

University of Utah, Utah, USA
PhD, Chemical Engineering **GPA 3.8 / 4.00** August 2012
Osmania University, Andhra Pradesh, India
Bachelor of Technology, Chemical engineering. **GPA 3.98 / 4.00** May 2006

Professional Experience

Senior Reservoir Engineer September 2021-Present
TC Energy
5250 Corporate Dr Troy, MI 48098.
Chief Geomodeler/ Reservoir Engineer December 2013- August 2021
PetroTel Inc
5240 Tennyson Pkwy, Suite 207, Plano TX.
Research Scientist September 2011 – December 2013
Energy & Geoscience Institute, and Department of Civil & Environmental Engineering,
The University of Utah

Relevant Publications

1. **Mandalaparty, P.,** Deo, M., and Moore, J. 2011**.** ***Gas-Compositional Effects on Mineralogical Reactions in Carbon Dioxide Sequestration*.** *SPE J.* 16 (4): 949-958. SPE-124909-PA
2. McLin, K., Brinton, D., **Mandalaparty, P**., Jones, C., Moore, J., 2010, ***The Chemical and thermal stability of proppants under geothermal conditions***: GRC Transactions, v. 34, p. 397-402. Published, 10/2010.
3. Moodie, N., McPherson, B., **Mandalaparty, P**., Lee, SY**.** ***Fundamental Analysis of the Impacts Relative Permeability has on CO2 Saturation Distribution and Phase Behavior***. *Transp Porous Med* **108**, 233–255 (2015).
4. Tan, H., Pan, F., Xu, T., McPherson, B.J., Yue, G., **Mandalaparty, P.,** ***Impacts of hydrological heterogeneities on caprock mineral alteration and containment of CO_2 in geologic Storage sites***, *International Journal for Green House Gas Control*, Issue 0, May 2014, Pgs 30-42**.**
5. **Prashanth Mandalaparty,** Milind Deo, Joe Moore and Brian McPherson, "***Carbon Dioxide Sequestration: Effect of the Presence of Sulfur Dioxide on the Mineralogical Reactions and on the Injectivity of CO_2+SO_2 Mixtures***" Topical Report DOE award number: DE-FC26-06NT42808, September 2009.
6. Vivek Patil**, Prashanth Mandalaparty**, Brian McPherson, Hailong Tan, Tianfu Xu, **" *Comparison of two geochemical Modeling simulators for CCUS"*** Proceedings of the 12th Annual Conference on Carbon capture and sequestration, Pittsburgh, Pennsylvania, May 13-16 2013.
7. Vivek Patil, Brian McPherson, Hailong Tan, **Prashanth Mandalaparty**, Tianfu Xu ***"Damkohler number framework for characterizing fault sealing vs opening in CCUS"*** Proceedings of the 12th Annual Conference on Carbon capture and sequestration, Pittsburgh, Pennsylvania, May 13-16 2013.
8. **Prashanth Mandalaparty**, Brian McPherson, Milind Deo, Ramesh Goel, Kip Solomon," ***Aquifer Risk Assessment Framework***, " EPA STAR Annual review meeting, Washington D.C., January 2013.

9. Nathan Moodie, Brian McPherson, Si-Yong Lee and **Prashanth Mandalaparty.** "***Fundamental Analysis of heterogeneity and relative permeability on CO_2 storage and plume migration*** " Proceedings at TOUGH symposium, Berkeley, California. September 17-19 2012.
10. **Prashanth Mandalaparty,** Milind Deo, Robert Krumm, ***" A study of retorted shale formations as CO2 sinks"***, proceedings of 2011 Annual AIChe meeting, Minneapolis, Minnesota,
11. Alan Burnham, Michael Herron, Susan Herron, Alyssa Charsky, Milind Deo, Robert Krumm, **Prashanth Mandalaparty**, Andre Levchenko, Pierre Allix; "***Comparison of various mineral analysis methods for green river formation oil shale",*** 31st Oil Shale Symposium, Colorado School of Mines, Colorado, 2011.
12. **Prashanth Mandalaparty**, Pankaj Tiwari and Milind Deo. ***"Spent shale formations: Potential source for CO_2 sequestration"***. 30th Oil Shale Symposium at Colorado School of Mines, Colorado, USA, 2010.
13. Jacob Bauman, **Prashanth Mandalaparty**, Pankaj Tiwari, Milind Deo, ***" A low CO2 hybrid in-situ oil shale liquid production process"***, 30th Oil Shale Symposium at Colorado school of mines, Colorado, 2010

Static Modeling Experience

Barmer basin (India), Musandam Peninsula and Southern tight rock formations (Oman), Uinta basin, Gordon Creek (Utah), SACROC (Texas), Elk Hills Oil Field-Stevens Reservoirs (California), Gulf of Mexico (Coastal Plain), Mississippi Salt Basin, Southern Arabian Gulf basin (Bahrain), Appalachian basin, Michigan basin.

Technical Support

- Lead the technical team on the development of a Comprehensive Aquifer Risk Assessment Framework (ARAF) to Model the effect of CO2 injection on underground sources of drinking water (USDWs) as part of developing an Integrated Design for Monitoring the effect of Geologic sequestration of Anthropogenic Carbon dioxide on Sources of drinking water
- Technical lead on the development of Probability Density Functions (PDFs) by building static model of the reservoir units from the available well data, seismic data and petrophysical analysis to evaluate and build a platform for comprehensive, quantitative risk assessment of CO_2 Geologic Sequestration
- Provide technical support for evaluating the potential of deep saline formations for geological storage of CO_2 for Southwest Partnership (regional NETL funded sequestration partnership)
- Technical lead for the team to generate type curves and full field scale up for CO_2 flooding in Elk Hills Oil Field-Stevens Reservoirs, California by integrating data from a repository of 4200 wells, well surveys, multiple seismic 3D volumes, interpretations, surfaces and building a geocellular model, developing well designs, pattern optimizations and infill well recommendations for the field
- Key member of the technical team responsible for incremental oil recovery of 14 million barrels (~208M$) through water flood studies, recommendation and field implementation in Mississippi Salt Basin
- Technical support for the team delivering an incremental oil recovery of 22 MMSTB (~600M $) from depleted oil reservoir through CO_2 flooding studies and field operation optimization in Oligocene Frio formation, Gulf of Mexico Coastal Plain
- Chief member of the team involved in multiple hydrocarbon discoveries onshore and offshore Musandam peninsula
- Chief Geomodeler on the team responsible for discovery of 6TCF deep gas reservoir units in Barmer basin, Western India by building basin models for prospecting and volume estimations.
- Primary member of the team involved in the discovery and appraisal of 600 MMSTB of oil in place in Sarsang Block, Northern Kurdistan

TAYLA SNAPP

700 Louisiana Street Houston TX 77002 • 406-366-3923 • tayla_snapp@tcenergy.com

Skills

- Able to work with a variety of people of diverse backgrounds, political views, and ethnicities in a friendly, professional manner
- Highly organized with a strong work ethic
- Team leader as well as a team player
- Skilled with computers and electronics
- Consistently willing to be a life-long learner

Experience

State Government & Community Relations Specialist | TC Energy | November 2018 - Current

- Act as a liaison between TC Energy and the communities and states in which TC Energy pipeline assets exist including Montana, Wyoming, North Dakota, South Dakota, and Minnesota
- Represent TC Energy within industry memberships and external organizations
- Communicate with local elected leaders and community organizations regarding projects that may be affecting them
- Manage a team of lobbying consultants in respective states and assist in monitoring proposed legislation
- Develop and implement stakeholder outreach plans, stakeholder engagement plans, stakeholder contact lists, and political risk assessments
- Actively support teams with the execution of solutions that address stakeholder concerns
- Incident Management Trained as a Liaison Officer

Field Representative | United States Congressman Greg Gianforte | July 2017 – November 2018

- Agriculture Advisory Committee Chairperson – organized and effectively ran meetings
- Represent the office through attending and speaking at events on behalf of the Congressman
- Act as a liaison between DC Staff and constituents of 22 Counties in Eastern and North Central Montana
- Communicate with local elected leaders and community organizations
- Assist the Scheduler with logistics of district events in my area
- Train new field representatives

Administrative Assistant | Waddell & Reed | September 2015 – July 2017

- Acted as office receptionist by greeting visitors and professionally handling of all public contacts in the office
- Audited and paid district office expenses and prepares expense reports for the financial advisors
- Reviewed orders/applications for completeness and accuracy while processing orders on a timely basis
- Scheduled appointments and readied paperwork for visit

Filing Clerk | Bosch, Kuhr, Dugdale Lawfirm | May 2015 – September 2015

- Coded and filed records away in alphabetical and numerical order
- Made copies, faxed, and printed important documents
- Maintained minutes and agenda of business meetings

Business Office Clerk/Cashier | Montana State University Northern | August 2014 – May 2015

- Prepared and processed reports, letters and documents as assigned
- Reviewed financial statements, and created student loans for different student accounts
- Executed general duties such as scheduling, mailings and filing
- Handled student account payments

Education

Bachelor of Technical Science | August 2013 – May 2017 | MSU-Northern

- Major: Business Administration
- Minor: Applied Agriculture, Marketing, Small Business Management
  - GPA: 3.7
  - Montana State University Northern Dean's List: Fall 2013 – Spring 2017

TAYLA SNAPP

700 Louisiana Street Houston TX 77002 • 406-366-3923 • tayla_snapp@tcenergy.com

Activities

- **REAL (Resource Education and Agriculture Leadership) Montana**
  - Leadership Series | September 2019 – May 2022
    - Develop skills and acquire a network to advance the natural resource industries in Montana.
    - Attended seminars ranging from leadership training, educational tours, and networking.
    - Traveled to Washington DC to visit with the Department of Energy Coal Division
- **Montana Stockgrowers**
  - Leadership Series | December 2017 – June 2019
    - Develop personal leadership skills to maximize contribution to employers, organizations, and the community.
    - Study how to become a high impact leader by:
      - Communication to inspire action
      - Character to create followership
      - Courage to raise tough questions
      - Connections to get projects done
      - Competence to execute and drive results
- **MSU-Northern**
  - Collegiate Stockgrowers Secretary | January 2015 – May 2017
    - Assist with upholding Montana Stockgrowers Association mission and be an advocate for the livestock industry in Montana and the nation
    - Records and distributes the minutes from previous meetings
    - Responsible for official correspondence (i.e. email, agendas, minutes, and any other communication with members, students, and advisors)
    - Volunteer and lead community activities such as fundraisers, local producer brandings, ranching projects, etc.
  - Student Ambassador President | August 2014 – May 2017
    - Train and lead other Ambassadors in all duties assigned
    - Give campus tours to prospective students and their parents
    - Assist with all organization of Freshman Orientation
    - Organize and participate in community service projects
  - Student Senate Business Manager | August 2014 – May 2017
    - Prepare a detailed financial statement for Senate business meetings every month which will include the paid and/or outstanding bills
    - Handle all financial transactions
    - Work with the President and the appropriate committees of Senate on the yearly budget request and the final budget allocation to be approved by Student Senate

Community Service

- SkillsUSA Montana Board Member
- REAL Montana Board Member
- Montana FFA Foundation Scholarship Committee
- Volunteer for local political campaign
- Volunteer at Central Montana Fair in 4-H
- Volunteer at local community cupboard

Timothy J. Prather
Senior Originator
TC Energy
Houston, TX
(817) 713-1899, tim_prather@tcenergy.com

Education and Training

The University of Texas at Austin

Master of Science - Geological Sciences 2016
Thesis - *Architecture, Depositional Systems, and Ichnology of the Loyd Sandstone of Northwest CO*

Bachelor of Science - Geology 2013
Honor's Thesis - *Chlorine and Hydrogen Isotope Geochemistry: Behavior during Volcanic Degassing*

Research and Professional Experience

TC Energy August 2022 - Present

Senior Originator – Power & Energy Solutions

Lead for Carbon Capture (CCS) project business development efforts

- Interfaced with internal and external stakeholders to define economically viable carbon capture, transport, and sequestration opportunities
- Developed strategic geospatial databases and mapping tools to identify and screen projects
- Compiled various subsurface datasets to prospect for geologic formations across North America capable of storing in excess of 650 million tons of CO_2
- Organized and managed external contractors to perform in-depth characterization of high-graded prospects

Premier Oilfield Group June 2017 – July 2022

Senior Geologist, Senior Project Manager - U.S. Operations

Lead for ESG & Carbon Capture (CCS) projects, technical programs, and business development efforts

- Served as lead Geologist & Project Manager for the CarbonSAFE Patterson KGS well core analysis program
- Organized a CCS Core Analysis workshop and guidebook for 40+ participants across 20+ organizations
- Identified and promoted key technologies to offer advanced CCS consulting and analytical services
- Designed and managed subsurface core analysis programs for clients to satisfy EPA Class VI UIC CO_2 well regulatory guidelines
- Generated written technical proposals for Class VI permit/RFP core analysis and geologic data requirements

Senior member of Customer Success Team for laboratory analysis programs and geology consulting

- Leveraged project management tools/software to guide operational priorities, update project stakeholders, organize data, and track budget forecasts for multiple concurrent projects
- Facilitated project scoping discussions between clients and technical teams to advise on services/consulting
- Reviewed, presented, and modeled data for client consumption across 100's of projects in U.S. Basins
- Trusted consultant to clients during all stages of projects (sales, data presentation, and technical services)

Geologist, Project Manager - Reservoir Geology & Geochemistry

Subsurface geology lead in the Permian Basin and Williston Basin

- Integrated core, drill cuttings, and well log data to characterize geologic, mechanical, and petrophysical properties in unconventional formations
- Generated maps of the Wolfcamp, Spraberry, Bone Springs, Bakken, and Three Forks formations
- Leveraged data analytics to assess linkages between geochemistry datasets for development of ML models

Anadarko Petroleum May - August 2016

Geoscience Intern - Colombia Exploration Team

Generated a shallow geohazard and petroleum systems risk assessment in deepwater offshore Colombia

- Mapped seafloor/subsurface geohazards impacting drilling operations using 3-D seismic & multi-beam data
- Integrated seismic interpretations and organic geochemistry data to determine reservoir-source history

BHP Billiton May - August 2015

Geoscience Intern - Pore Pressure Prediction Team

Developed a geocellular model of a deepwater Gulf of Mexico field to aid in pore pressure prediction

- Modeled a probabilistic range of fluid migration from hypothesized source rock into the primary reservoir
- Compiled and input geologic, drilling, and reservoir pressure data parameters to design model

Publications

Prather, T., et al. (**2022**) *A Journey Through a Carbon Capture Focused Core Analysis* Program – AAPG 2022 CCUS Conference Short Course Field Trip

Prather, T., et al. (**2022**) *Core and Cuttings Repository Networks for Initiating CCUS Projects* – AAPG 2022 CCUS Conference Poster Presentation

Flaig, P., Hasiotis, S., **Prather, T**., and Burton, D. (**2019**) *Characteristics of a Campanian delta deposit controlled by alternating river floods and tides: the Loyd Sandstone, Rangely Anticline, CO, U.S.A,* Journal of Sedimentary Research, *89* (12): 1181-1206.

Prather, T. (**2019**) *Elemental and mechanical stratigraphy: rapid core-based rock-typing in the Wolfcamp Fm of NE Martin County, Midland Basin* – RMAG 2019 Symposium Presentation

Burton, D., Flaig, P., **Prather, T.** (**2016**) *Regional controls on depositional trends in tidally-modified deltas: insights from sequence stratigraphic correlation and mapping of the Sego and Loyd sandstones, Uinta and Piceance Basins of UT and CO, U.S.A.*, Journal of Sedimentary Research, 86 (7): 763–785

Barnes, J.D., **Prather, T**., et al. (**2013**) *Stable chlorine isotope behavior during volcanic degassing of H_2O and CO_2 at Mono Craters, CA*, Bulletin of Volcanology, V. 76, Issue 3

APPENDIX H

TAX LIABILITY FORM

Industrial Commission

Tax Liability Statement

Applicant:
Prairie Horizon Energy Solutions LLC

Application Title:
Prairie Horizon Energy Solutions LLC Clean H2 and N-fertilizer Production Facility

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.

Omar Khayum
____
Signature

President
____
Title

10/7/2023
____
Date

TECHNICAL REVIEWERS' RATING SUMMARY

C-05-B

Spiritwood Fertilizer Project

Submitted By: NextEra Energy Resources Development LLC

Date of Application: November 2023

Request for $125,000,000 Loan

Total Project Costs $1,293,000,000

		Technical Reviewer		
		B1	**B2**	
Rating Category	**Weighting Factor**	**Rating**	**Rating**	**Average Weighted Score**
1. Objectives	3	3	3	9.75
2. Impact	9	2	3	36
3. Methodology	9	3	3	27
4. Facilities	3	2	2	9
5. Budget	9	3	3	31.5
6. Partnerships	9	3	2	27
7. Awareness	3	3	2	10.5
8. Contribution	6	4	3	18
9. Project Management	6	3	3	21
10. Background	6	4	2	21
	315	189	168	178.5

OVERALL TECHNICALLY SOUND	B1	B2
GOOD (IF > 214)	☐	☐
FAIR (200-213)	☐	☐
QUESTIONABLE (IF< 200)	☒	☒

Mandatory Requirements	B1		B2	
Diversification Delivery:	Yes	No	Yes	No
Project enhances the production of clean sustainable energy, to make the State a world leader in the production of clean sustainable energy, and/or to diversify and grow the State's economy.	✓		✓	
Commercialization or Development/Expansion:	Yes	No	Yes	No
Concept will lead to the **large-scale development and commercialization** of projects, processes, activities, and technologies that reduce environmental impacts and/or increase sustainability of energy production and delivery.	✓		✓	

In State Requirement:	Yes	No	Yes	No
The funds distributed from the financial assistance are to be applied to support in-state activities and must have other sources of financial support.	✓		✓	

1. The objectives or goals of the proposed project with respect to clarity and consistency with Clean Sustainable Clean Energy Authority goals of projects, processes, activities, and technologies that reduce environmental impacts and increase sustainability of energy production and delivery are: 1 – very unclear; 2 – unclear; 3 – clear; 4 – very clear; or 5 – exceptionally clear.

Reviewer B1 (Rating 3)
The Spiritwood Fertilizer Project's objectives, as proposed by NextEra, are in alignment with the Clean Sustainable Clean Energy Authority's goals, but with certain caveats, especially regarding efficiency. The project aims to leverage only electrolyzer technology for ammonia production, which is inherently less efficient than other existing methods, such as steam methane or auto-thermal reforming, when considering energy input versus output ratios. Electrolyzers, typically used for producing hydrogen from water, require significant electrical energy input. When this electricity is sourced from renewable energy, it adds to the sustainability of the process but may not necessarily enhance overall energy efficiency. Electrolyzers powered by renewable energy are inherently cleaner from a greenhouse gas emissions perspective however they have other environmental impacts. Real-world operational conditions indicate that approximately 9 tons of water are required to produce 1 ton of ammonia. This substantial water usage is attributed to several factors. Firstly, electrolyzers are not 100% efficient in splitting water molecules, thus necessitating more water than the stoichiometric ratio suggests. Secondly, the water used in electrolysis must be highly purified, which incurs additional water consumption. Furthermore, there are inevitable losses due to evaporation and other process inefficiencies during electrolysis. Additionally, to ensure a consistent hydrogen supply for ammonia synthesis, electrolyzers may produce an excess of hydrogen, leading to further water usage.

Reviewer B2 (Rating 3)
The objective stated is to utilize green electricity to produce anhydrous ammonia. The objective paragraphs were cluttered with explanation of the entity in charge of the proposal, with little detail of the objective itself.

2. The objectives will make a difference in the near term to the state's economy: 1 – no impact; 2 – small impact; 3 – likely impact; 4 – most likely impact; or 5 – significant impact.

Reviewer B1 (Rating 2)
The Spiritwood Fertilizer Project by NextEra, which is anticipated to start commercial operations between 2028 and 2029, presents a promising opportunity for economic growth in North Dakota. During its construction phase, the project is likely to generate employment opportunities, which will positively impact the local economy. However, the broader economic impact projected from local fertilizer production may only become evident once the project is fully operational. The

timeline suggests that near-term impacts will primarily revolve around construction-related activities and job creation. While the project has the potential to make a difference in North Dakota's economy, the most significant impacts will likely be observed in the longer term, post-2028.

Reviewer B2 (Rating 3)
The objective of the proposal with aim to decrease C emissions from anhydrous ammonia manufacture is a good objective. As my comments on methodology will state, the link between green, wind-power energy and hydrogen storage and ammonia manufacture is nearly non-existent, thus my lower rating of the ability to make a difference in the ND economy.

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

Reviewer B1 (Rating 3)
The methodology outlined in the Spiritwood Fertilizer Project by NextEra displays a moderate level of clarity and quality. The proposal includes a detailed plan for utilizing electrolyzer technology in ammonia production, which is a forward-thinking approach aligning with sustainable and clean energy goals. However, there are areas where the methodology could be further clarified or elaborated. For instance, while the use of electrolyzers for hydrogen production is a well-understood process, its application at the scale proposed by NextEra, particularly for ammonia production, is less commonly demonstrated. There is a need for more detailed information on how the project intends to overcome challenges associated with scaling up this technology, including managing water usage, ensuring energy efficiency, and integrating the system with existing infrastructure. Additionally, the proposal could benefit from a more detailed explanation of the project's lifecycle, from construction through to operational stages, including specific technical milestones, risk management strategies, and contingency plans. A clearer outline of these aspects would enhance the overall quality of the methodology, providing greater assurance of the project's feasibility and alignment with the state's clean energy objectives.

Reviewer B2 (Rating 3)
The methodology with regards to electricity generation and the water hydrolyzation into hydrogen and oxygen are well explained and supported. These are the strengths of the company submitting the proposal and their affiliates. If this proposal was linked with another partner with expertise in anhydrous ammonia manufacture, it would be a great proposal. However, I am left wondering how that anhydrous ammonia facility will be built, who would run it and if there is any future partner considered to link with the green hydrolysis side of the project.

4. The facilities and equipment available and to be purchased for the proposed pilot or commercialization strategy is: 1 – very inadequate; 2 – inadequate; 3 – adequate; 4 – notably good; or 5 – exceptionally good.

Reviewer B1 (Rating 2)
The Spiritwood Fertilizer Project proposal has significant gaps in detailing the specific facilities and equipment planned for the project. While the proposal references NextEra's experience in

hydrogen pilot projects, it lacks much relevant information about the infrastructure and technology that will be specifically used at the Spiritwood site. This absence of detail is particularly concerning given the project's ambitious scale, which is unprecedented in the current global context of electrolyzer-based ammonia production. The project does not provide clear information on the type and specifications of electrolyzers to be used, nor does it detail the infrastructure for ammonia production and storage. This is critical, as ammonia storage presents unique challenges due to its chemical properties, requiring specialized handling and containment systems. The absence of such details in the proposal makes it difficult to assess the feasibility and safety of the project. Furthermore, the scale of the proposed project raises concerns. There are no existing models of a similar scale in operation globally, which means the project would be pioneering in terms of its size and scope. This novelty brings inherent risks and uncertainties, particularly in terms of technical feasibility, economic viability, and environmental impact.

Reviewer B2 (Rating 2)

The facilities & equipment required to produce the green electricity enabled water hydrolysis is well explained and documented, with experience in building similar facilities presented. However, almost no information is provided to support the anhydrous ammonia manufacturing facility construction and operation.

5. The proposed budget is comprehensive and sufficient relative to the outlined work and the timetable: 1 – not sufficient; 2 – possibly sufficient; 3 – likely sufficient; 4 – most likely sufficient; or 5 – certainly sufficient.

Reviewer B1 (Rating 3)

The proposed budget for the Spiritwood Fertilizer Project by NextEra appears to be inadequately detailed, raising concerns about the overall financial planning and allocation of resources for such a large-scale and ambitious project. A major concern is the lack of specificity in the budgetary breakdown. For a project of this magnitude, especially one involving cutting-edge technology in ammonia production via electrolysis, a detailed budget is crucial. This budget should include specific allocations for the purchase and installation of electrolyzer technology, infrastructure development for ammonia synthesis and storage, integration with renewable energy sources, and other associated costs like water treatment and supply, safety measures, and contingency planning. The absence of these details hinders a comprehensive understanding of how the funding will be utilized to meet the technical and logistical demands of the project. It also raises questions about the project's capacity to manage unforeseen costs and challenges, which are likely in such innovative ventures. Furthermore, considering the novel and unprecedented scale of the project, a detailed budget should also account for research and development costs, potential scale-up challenges, and the integration of the project within the existing energy and industrial framework in North Dakota. However, NextEra will be providing 90% of the capital for the project and they have a long history of success with large scale energy projects. However, concerns might be raised about the financial stability of the company as their stock prices have recently plummeted in past months. Furthermore, the rate at which major renewable projects similar to this one are being abandoned across the globe raises more alarm. While the proposal lacks detailed cost breakdowns, it is not unusual for initial project estimates to provide a broad financial outline rather than an itemized budget. It is likely that the budget will be sufficient.

Reviewer B2 (Rating 3)
The budget is very general. It would be improved if a breakdown of expenses towards electricity infrastructure and anhydrous ammonia facility construction would be presented, as well as permitting and other associated expenses.

6. The appropriate strategic partnerships are in place for short and long term plans to be successful: 1 – very limited; 2 – limited; 3 – adequate; 4 – better than average; or 5 – exceptional.

Reviewer B1 (Rating 3)
The Spiritwood Fertilizer Project by NextEra demonstrates an adequate level of strategic partnership involvement, which is crucial for the success of such a pioneering and large-scale project. The project, being led by NextEra, a company with a strong background in energy projects, benefits from the company's existing network and experience. However, the proposal lacks detailed information about specific partnerships that will be leveraged for this project. For a project of this scale and complexity, partnerships with technology providers for electrolyzers, experts in ammonia production and storage, offtake partners, and possibly academic and research institutions for ongoing support and innovation would be highly beneficial.

Reviewer B2 (Rating 2)
There is a lack of partnerships in anhydrous ammonia manufacture.

7. The likelihood that the project approach (time & budget) will achieve its technical and market goals is: 1 – not achievable; 2 – possibly achievable; 3 – likely achievable; 4 – most likely achievable; or 5 – certainly achievable.

Reviewer B1 (Rating 3)
Given the complexities and uncertainties associated with this large-scale, innovative project, the provided time and budget estimates can be considered adequate, albeit with some reservations. The project's timeline, targeting commercial operations between 2028 and 2029, while ambitious, is not unprecedented for large-scale industrial projects. Both time and budget estimates for projects involving new technologies and large-scale implementations are inherently subject to a higher degree of uncertainty. This is due to potential challenges in technology scaling, regulatory compliance, and market dynamics. While the project's time and budget estimates are adequate given the scale and scope, a degree of flexibility and contingency planning would be advisable to accommodate unforeseen challenges and changes. NextEra also has a history of success when it comes to large scale projects.

Reviewer B2 (Rating 2)
The hydrolysis using wind energy and hydrogen storage is achievable. The lack of information regarding anhydrous ammonia manufacture is very lacking.

8. The scientific and/or technical contribution of the proposed work to specifically address Clean Sustainable Energy Authority goals of impacting technology used in North Dakota's energy industries will likely be: 1 – extremely small; 2 – small; 3 – significant; 4 – very significant; or 5 – extremely significant.

Reviewer B1 (Rating 4)
The Spiritwood Fertilizer Project has the potential to make a very significant scientific and technical contribution to the Clean Sustainable Energy Authority's goals, particularly in advancing energy technology within North Dakota's industries. The project's focus on using electrolyzer technology for ammonia production represents a significant shift towards cleaner and more sustainable energy practices in industrial processes. Successfully implementing electrolyzer-based ammonia production at the proposed scale would be a pioneering endeavor in North Dakota, and potentially the world. The success of this project could serve as a model for other industries in the state and beyond, demonstrating the viability of integrating renewable energy sources into traditional industrial processes. The successful implementation of this project could lead to significant advancements in sustainable energy practices, potentially influencing a wider adoption across various industries.

Reviewer B2 (Rating 3)
The work on the water hydrolysis was exciting; however, the lack of specific linkage into the ammonia synthesis was disappointing. The potential is there with the right partner(s).

9. The project management plan, including budgeting projections, partner connections and well-defined milestone chart is: 1 – very inadequate; 2 – inadequate; 3 – adequate; 4 – notably good; or 5 – exceptionally good.

Reviewer B1 (Rating 3)
Their team and defined milestones are adequate for a project of this scope.

Reviewer B2 (Rating 3)
The management of the water hydrolysis part of the project was very impressive. However, no management was included that considered the anhydrous ammonia phase of the project.

10. The background and experience of the project principals with regards to technical qualifications and competence is: 1 – very limited; 2 – limited; 3 – adequate; 4 – better than average; or 5 – exceptional.

Reviewer B1 (Rating 4)
NextEra stands out in the energy sector for successfully developing and overseeing many large-scale energy projects, notably those featuring renewable sources. The company's depth of knowledge, especially in renewable and cutting-edge energy solutions, equips the project with substantial technical know-how. NextEra's experience with complex technologies, such as wind and solar power, shows they are adept at handling intricate and technologically advanced projects. This company expertise is particularly pertinent to the Spiritwood Fertilizer Project, which will incorporate electrolyzer technology to produce ammonia - an innovative technique in the field of industrial fertilizer production. Although the proposal is short on many specific details, the project team has excellent credentials, and NextEra's solid track record and history of adept project management imply that it has the necessary technical abilities and experience to successfully carry out such an initiative.

Reviewer B2 (Rating 2)
The background and experience of the principals in energy and water hydrolysis through electric current, and hydrogen storage was excellent. However, the ammonia phase was not nearly detailed enough.

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 the project is technically sound.

Reviewer B1
Merits of the Proposed Project:

1. Technological Innovation and Clean Energy Contribution:
   - The project's use of electrolyzer technology for ammonia production is innovative and aligns with the trend towards sustainable energy solutions. It represents a significant step towards cleaner industrial processes.
2. Economic Benefits and Job Creation:
   - The project can stimulate local economies through job creation, especially during the construction phase, and contribute to economic diversification in North Dakota.
3. Increased Local Fertilizer Production:
   - If the project is successful it could significantly increase local fertilizer production helping to bolster our domestic supply, however it likely won't have much effect on fertilizer pricing considering market trends and lack of sufficient competition in the marketplace.

Flaws and Concerns of the Proposed Project:

1. Market Competitiveness and Cost Concerns:
   - According to the Boston Consulting Group (2023), green ammonia production faces high costs compared to traditional methods, potentially impacting market competitiveness.
   - The high cost of renewable energy sources and carbon capture technologies could make the project's products less competitive without subsidies or policy support.
2. Implementation and Scaling Risks:
   - The U.S. DOE's Hydrogen Shot Technology Assessment underscores the complexities of scaling new technologies, including technical challenges and issues related to infrastructure and market acceptance.
   - Projects of this scale are prone to delays and cost overruns, affecting timelines and financial viability.
3. Regulatory and Policy Dependence:
   - The project's success is heavily dependent on the stability and continuation of environmental policies and incentives, as per the U.S. National Clean Hydrogen Strategy and Roadmap.
   - Reliance on government subsidies or incentives introduces vulnerability to policy shifts.
4. Environmental Impact Assessment:

- A comprehensive life-cycle environmental assessment is necessary to evaluate emissions from production to end-use.
- Adherence to environmental standards and continuous monitoring is essential for the project's sustainability.

Technology Viability:

1. Technological Maturity and Efficiency:
   - While electrolyzer technology is established, its application at the scale proposed for large-scale ammonia production is less common.
   - The efficiency of electrolyzers, particularly in terms of energy conversion, is a crucial factor. There are ongoing developments to improve efficiency and reduce energy losses, but these are still areas of concern.
   - The proposed scale of electrolyzer-based ammonia production is unprecedented, posing significant risks related to technology viability.
   - Operational challenges, efficiency issues, and integration complexities with existing infrastructure could impede successful implementation
2. High Capital and Operational Costs:
   - Electrolyzers, especially those required for large-scale operations, involve significant capital investment.
   - Operational costs, including maintenance and energy consumption, also contribute to the overall expense of the technology. These costs can be prohibitive and affect the economic feasibility of projects.
3. Integration with Renewable Energy Sources:
   - Electrolyzers used for green ammonia production typically rely on renewable energy sources, which can be intermittent.
   - Ensuring a consistent and reliable energy supply to run electrolyzers efficiently is a challenge.
   - This requires sophisticated energy management systems and potentially energy storage solutions.
   - When renewable energy sources are down production can strip large amounts of energy from the grid if connected.
   - Requires 60GJ of electricity/ton of ammonia.
4. Water Usage:
   - Electrolyzers require water as a feedstock for hydrogen production.
   - The quantity and purity of water needed can be significant, raising concerns about resource availability, especially in water-scarce regions.
   - Efficient water management and recycling systems are essential to mitigate this issue.
   - Requires 9 tons of pre-treated, high purity deionized water per ton of hydrogen produced, however that number may come down over time as efficiencies with this technology improve.
5. Scalability:
   - Scaling up electrolyzer technology to the levels required for industrial ammonia production is still a relatively new endeavor.
   - There are challenges associated with scaling, including maintaining efficiency and performance, ensuring reliability, and managing the larger infrastructure.
6. Durability and Longevity:

- The lifespan of electrolyzers and their components, under continuous operation, is a concern.
- Frequent replacements or maintenance can increase operational costs and affect the overall sustainability of the technology.

7. Safety and Handling:
   - Hydrogen leakage from electrolyzers to the atmosphere is a significant concern according to recent studies.
8. Environmental Impact:
   - While electrolyzers themselves are a clean technology, their environmental impact depends on the source of electricity used.
   - If the electricity is not from renewable sources, the overall environmental benefit may be diminished. If the wind isn't blowing and they're using the grid for power, it is no longer "green".

Recommendation:
Given the merits and concerns, the Spiritwood Fertilizer Project is an ambitious endeavor that could significantly contribute to clean energy technology and increased fertilizer production. However, the high production costs, scaling risks, dependence on regulatory and policy stability, and environmental impact considerations present substantial challenges. Hydrogen production from electrolysis is expected to have production costs at a minimum of 120% higher than traditional methods (World Economic Forum, 2023). The costs of renewable ammonia production are significantly higher than low carbon fossil ammonia and are not forecasted to come close to convergence until after 2050. The project should have a detailed risk assessment, including market competitiveness analysis, technological viability review, and contingency planning for policy changes. Collaboration with industry experts and thorough environmental impact studies are essential to address these challenges. While the project is aligned with clean energy objectives, it requires careful planning, robust financial modeling, and strategic risk management to ensure technical soundness and long-term viability. Adjustments to the proposal to address the specific concerns around cost competitiveness, technology scaling, policy dependence, and environmental impacts are necessary to enhance the project's prospects for success.

Reviewer B2

It almost seems as though the mostly ammonia proposal with some green electricity generation/hydrolysis and this proposal were meant to go together, but perhaps the people thought that this way they might get 2 loans? I find it strange that this proposal would focus so much on the electricity/energy/hydrogen part of green ammonia production, and almost totally neglect the ammonia, and another proposal focused so heavily on the ammonia production, but not so much on the wind-energy electric contribution. Certainly, the wind-power electricity combined with the ammonia production is a very good avenue to increase energy efficiency in the state. The problem with this proposal is the lack of partnership with anyone with expertise building and engineering an anhydrous ammonia plant. Clearly, one cannot make ammonia (or shouldn't) in a bathtub.

Clean Sustainable Energy Authority

North Dakota Industrial Commission

Application

Project Title: Spiritwood Fertilizer Project

Applicant: NextEra Energy Resources Development, LLC

Date of Application: November 13, 2023

Amount of Request
Grant:
Loan: $125,000,000

Total Amount of Proposed Project:

$1.3 Billion (Approximate; Breakdown in Confidential Appendix – A)

Duration of Project: Construction: 5 years; Operation: 20 years

Point of Contact (POC): Joseph Matteo, Executive Director Development

POC Telephone: 415-846-3058

POC Email: joseph.matteo@nexteraenergy.com

POC Address: 700 Universe Blvd, Juno Beach, FL 33408

TABLE OF CONTENTS

1. ABSTRACT

Objective:

NextEra Energy Resources Development, LLC ("NextEra Development") is an indirect, wholly owned subsidiary of NextEra Energy Resources, LLC ("NEER"). NEER is the world's largest generator of renewable energy from the wind and sun, a world leader in battery storage, and is driving the development of the green hydrogen economy. NEER is a subsidiary of NextEra Energy, Inc ("NEE") which conducts operations principally through two wholly owned subsidiaries - Florida Power & Light Company ("FPL"), which is the largest rate-regulated electric utility in the US as measured by retail electricity sold, and NEER. NextEra Energy Capital Holdings, Inc. ("NEECH"), another wholly owned subsidiary of NextEra Energy, owns and provides funding for NEER's and NextEra Energy's other operating subsidiaries. For purposes of this application, NEER and its subsidiaries which includes NextEra Development are collectively referred to as "NextEra".

NextEra, a leading U.S. based investor and developer of energy infrastructure, is at the forefront of developing electric fertilizer production solutions to benefit regions at the end of the supply chain, such as North Dakota, which are subject to elevated pricing for conventional fertilizer. North Dakota has a unique opportunity to convert electricity, including electricity that is often exported to surrounding states, to locally produced fertilizer, providing supply stability to the North Dakota agricultural sector. Over the years, North Dakota has experienced fertilizer supply shortages and price spikes from volatility in fertilizer production and logistics costs to transport fertilizer to the market. A NextEra Development facility in North Dakota would provide local fertilizer supply, supply chain resiliency, offer improved price stability not subject to price fluctuations in natural gas, and bring significant economic development to the local community and to the state of North Dakota. We applaud North Dakota for creating a program to encourage new investments in fertilizer production for the state.

Expected Results:

The Spiritwood Fertilizer Project (the "Project") would provide agriculture resiliency by producing fertilizer for North Dakota, in North Dakota, and decouple the agricultural sector from the pricing of imports to the market from foreign governments. Additionally, North Dakota currently exports roughly half of the electricity produced in the state, which is produced by a diverse mix of natural resources. The fertilizer Project would convert abundant North Dakota electricity into a higher value and much needed product for the agriculture sector. The electric fertilizer plant would make the grid more stable as the plant would enable transmission system upgrades and exhibit the ability to be curtailed when power is needed most by ratepayers, and it would provide a revenue opportunity to local utilities and co-ops.

This Project would secure an in-state supply of fertilizer that would allow for cost and supply stability in North Dakota thereby supporting farmers. This would enable electric fertilizer production in a region currently lacking production capacity to serve local markets. We expect the Project to provide stability to the grid and additional revenue to North Dakota utilities and co-ops while converting abundant electricity to value-added fertilizer in the State.

NextEra Development has funded the Project's research and development activities to date. This post-production incentive implies that North Dakota doesn't provide any financial support unless a fertilizer plant is successfully built and operational in the state. A commitment from the Clean Sustainable Energy Authority (CSEA) and receipt of commitment letter from Bank of North Dakota (BND) for the requested $125 million post-production incentive towards an electric fertilizer facility in North Dakota will facilitate further development of the Project targeting commercial operations in 2028 - 2029.

This Project aims to produce zero carbon anhydrous ammonia through electrolysis of water, which is the imperative first step to produce any downstream products, such as urea or other fertilizers. Establishing an anhydrous ammonia production facility would meet existing agricultural demand for anhydrous ammonia. We envision a phased approach to development, including potential, future capacity expansions for anhydrous ammonia and potential integration with urea production in the future. Electrolytic fertilizer plants are capital intensive with low variability in operating costs, enabling stable future fertilizer production costs.

Duration:

Construction of the Project is estimated to take five years to complete in a phased approach, including potential capacity expansions. The operating life thereafter is designed for a minimum of 20 years.

Total Project Cost:

Projected to be approximately $1.3 Billion (Breakdown in confidential Appendix – A)

Participants:

NextEra Development is the current project sponsor and a to be formed subsidiary of NEER would be the owner of the Project. NextEra Development plans to manage best-in-class Engineering/ Procurement/ Construction firms, Operations and Maintenance personnel, and Original Equipment Manufacturers to design, build, finance, own, and operate the Project. Clean Sustainable Energy Authority's support is critical to the development and large-scale commercial deployment of the Project.

2. PROJECT DESCRIPTION

Confidential (please see Appendix – A – Confidential Application)

3. STANDARDS OF SUCCESS

Emissions Reduction and Reduced Environmental Impacts

The proposed Project plans to produce zero carbon nitrogen-based fertilizer to effectively reduce the carbon intensity of key products, such as corn for ethanol, and increase the value of North Dakota crops. This zero-carbon fertilizer would reduce emissions from North Dakota's agricultural sector by displacing conventional ammonia produced from natural gas.

NextEra Development's proposed electric fertilizer facility would reduce the emissions contribution of North Dakota's agricultural sector by millions of metric tons of CO2 over the initial operating life of the Project and would target a further reduction in following potential expansion phases. Detailed breakdown provided in confidential Appendix – A.

The electric fertilizer production facility leverages NextEra's technical expertise in developing renewable projects which power the electrolyzer facility. The project provides a zero-carbon nitrogen-based fertilizer along with long-term price certainty for the benefit of the local agricultural community.

Value to North Dakota Agriculture

The Project would introduce incremental local production of ammonia to the North Dakota market, representing a significant portion of in-state nitrogen demand before potential subsequent expansions to include other nitrogen-based fertilizers including Urea and UAN in future phases. The nitrogen-based fertilizer produced by the Project will also offset a significant portion of the State's imports with domestic production. Detailed projections provided in confidential Appendix – A.

Providing a secure and in-state supply of nitrogen fertilizer would create cost and supply stability in North Dakota, inviting further fertilizer production investment in the state with potentially billions of dollars of total investment in the sector. This would position North Dakota as not just a national leader in clean energy agriculture, but a global leader.

Impact to North Dakota Workforce

NextEra Development plans to collaborate with Bismarck State College, Lake Region State College, and North Dakota Tribal College System to facilitate energy Train-the-Trainer workshops where Instructors will master effective ways to educate and train students on green hydrogen technology. This also includes plans to collaborate with school districts, including Tribal Schools, to deliver STEM camps focused on renewable energy, including green hydrogen to help identify and nurture local talent. NextEra Development's plans include opportunities for students to tour the facility and meet with operational engineers to learn about the technologies to be demonstrated at the site.

NextEra Development aims to provide guest lectures with expertise in green hydrogen to present to renewable energy students, on hydrogen production, manufacturing, testing, operation, and maintenance and provide internship opportunities to provide the energy leaders of tomorrow access to cutting edge technology. NextEra Development also plans to facilitate green hydrogen capstone projects (research projects) with University of North Dakota and North Dakota State University. These plans include subject matter expert sessions to identify hydrogen related challenges, development of research projects, mentoring and potential funding.

The potential commercialization of the project's results and how it will preserve existing jobs and create new ones.

North Dakota's economy is primarily driven by energy and agriculture. Geographically, North Dakota is at the end of the fertilizer supply chain, with limited in-State production and highly reliant on imports from foreign countries. Current international political scenarios sent a shockwave through the fertilizer markets last year, increasing prices by over 400% in underserved areas like North Dakota. With continued global conflict and volatility, North Dakota needs to control its own supply of fertilizer for the critically important agricultural sector.

The Project is proposing to do just that, by developing an electric fertilizer plant in North Dakota to provide pricing and supply stability.

The Project provides a platform to develop and demonstrate advanced electrolyzer state-of-the-art technology and CSEA's post-production incentive would foster economic development in the local communities in eastern North Dakota and across the state in terms of jobs, property tax benefits, specialist positions, infrastructural development and development and retention of local talent.

How it will otherwise satisfy the purposes established in the mission of the Program.

The outlined purpose of the CSEA program is to support research, development and technological advancements through partnerships and financial support for projects ready for commercial deployment that reduce environmental impacts. The Project brings together each part of that mission, for all the reasons previously stated in this application. This project would play a critical role in stabilizing fluctuations in fertilizer supply due to supply chain issues, assure long term stable zero-carbon fertilizer while preserving jobs in the State, and nurturing local talent. NextEra's proven track record of execution and investing in the economy and communities of North Dakota makes NextEra Development the right partner to help CSEA realize the vision of this program.

4. BACKGROUND / QUALIFICATIONS

NextEra Development is excited about the opportunity to collaborate with State of North Dakota and are fully capable to develop, construct, finance, and operate this large-scale commercial deployment of electrical fertilizer facility. A commitment from CSEA via the post-production fertilizer incentive will help enable delivery of carbon-free nitrogen-based fertilizer economically and consistently helping the agricultural community. NextEra is one of the few companies in the industry that has the flexibility to initially fund the development and construction of a project of this size using our balance sheet and do not need to rely on third-party financing.

NextEra manages industry leading partners for design, engineering, construction, and equipment to develop state of the art electric fertilizer solutions and will do our best to incorporate local subcontractors in the development of this project where feasible.

Collaboration: We aim to tailor an optimal solution that meets CSEA's requirement and provides solutions to the fertilizer demand in North Dakota. Through this process, NextEra Development and CSEA would work together on an exclusive basis to develop the project further.

Infrastructure: NextEra is the ideal partner to pursue a large infrastructure project with. In 2022, NEE and its subsidiaries invested more than $19 billion in infrastructure, which places the company among the largest capital investors across any industry in the U.S.

Hydrogen: In the past three years, NextEra and FPL have been working expanding its clean hydrogen capabilities and competencies (in staff, technology, experience, and knowledge). In 2020, FPL announced the construction of a 25 MW green hydrogen pilot in Florida which has begun commercial operations ahead of schedule in Q4 of 2023. NextEra has recently announced that is working on a pipeline of hydrogen projects representing $20 B of capital investment and 15 GW of new renewables development through the end of the decade.

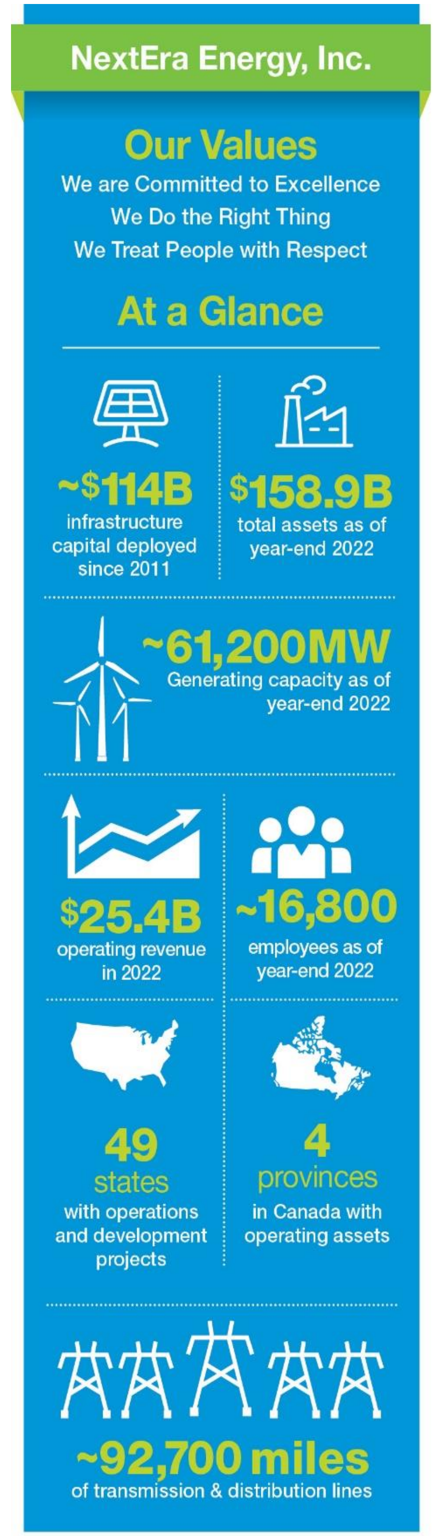
Competency: During 2023, NextEra made several industry-leading announcements related to clean hydrogen developments: A) Plans to build a 120 TPD clean liquid hydrogen project in Arizona in partnership with Linde, B) An MOU for a joint venture to develop a zero-carbon-intensity hydrogen project for fertilizer production at CF Industries' Verdigris Complex in Oklahoma.

Positions: NEE currently operates 31 GW of clean energy resources, with another 20 GW in backlog, as well as ~1,400 miles of transmission lines in service and ~$40 billion in potential pipeline. Additionally, NextEra has secured significant land positions in North Dakota earmarked specifically for project development - and has over 50GW of interconnection positions in the MISO queue for future development of renewable projects ensuring project timeline and delivery. NextEra controls an industry leading portfolio of the most crucial input to electrolytic hydrogen production i.e., renewable energy.

We look forward to working closely with CSEA and CSEA's commitment of a $125 million post-production incentive that will help foster project development and deliver carbon-free electric fertilizer at predictable cost to agricultural community in North Dakota.

Resources

NextEra Development is strategically positioned to design, build, finance, own, operate, and maintain the proposed electric fertilizer plant. NEE is America's leading clean energy company headquartered in Juno Beach, Florida. NEE owns FPL, which is America's largest electric utility that sells more power than any other utility, providing clean, affordable, reliable electricity to approximately 5.8 million customer accounts, or more than 12 million people across Florida. NEE also owns a competitive clean energy business, NEER, which, together with its affiliated entities (including NextEra Development), is the world's largest generator of renewable energy from the wind and sun, a world leader in battery storage, and is driving the development of the green hydrogen economy.



Through its subsidiaries, NEE generates clean, emissions-free electricity from seven commercial nuclear power units in Florida, New Hampshire, and Wisconsin. NEE has been recognized often by third parties for its efforts in sustainability, corporate responsibility, ethics and compliance, and diversity. NEE is ranked No. 1 in the electric and gas utilities industry on Fortune's 2022 list of "World's Most Admired Companies," recognized on Fortune's 2021 list of companies that "Change the World" and received the S&P Global Platts 2020 Energy Transition Award for leadership in environmental, social and governance. For more information about NextEra Energy companies, visit our website www.nee.com

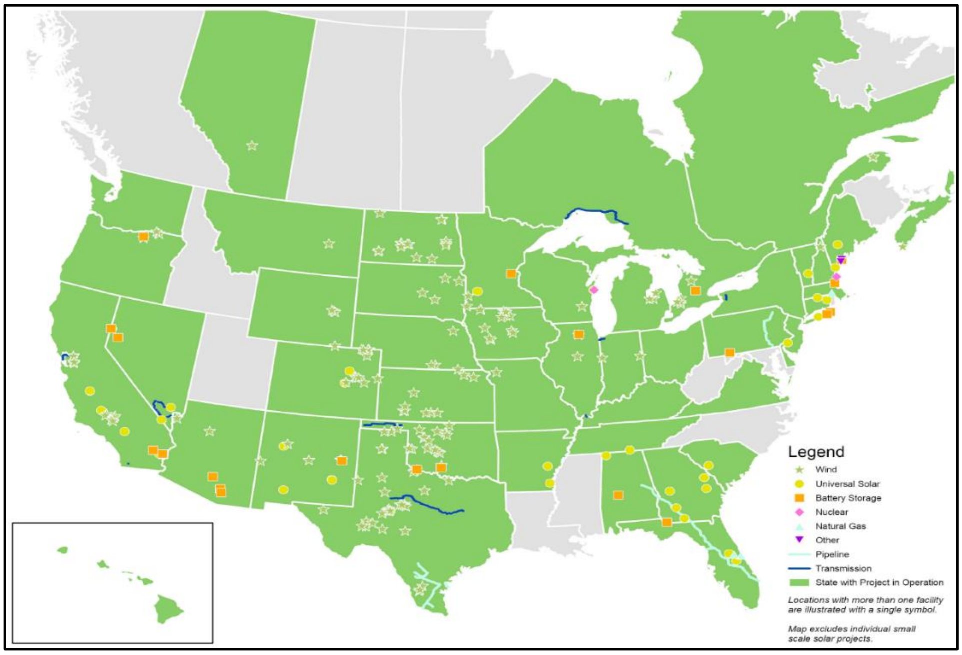
A history of best-in-class operations

NEE has been in business since 1925 and has been a leading operator of generation assets and energy efficiency projects. A Fortune 200 company, we are consistently recognized by our customers, suppliers, regulators, financing parties, and others for our efforts in sustainability, corporate responsibility, ethics, compliance, and diversity. NEE is ranked No. 1 in the electric and gas utilities industry on Fortune's list of "World's Most Admired Companies" and ranked in the top 25 on Fortune's list of companies that "Change the World."

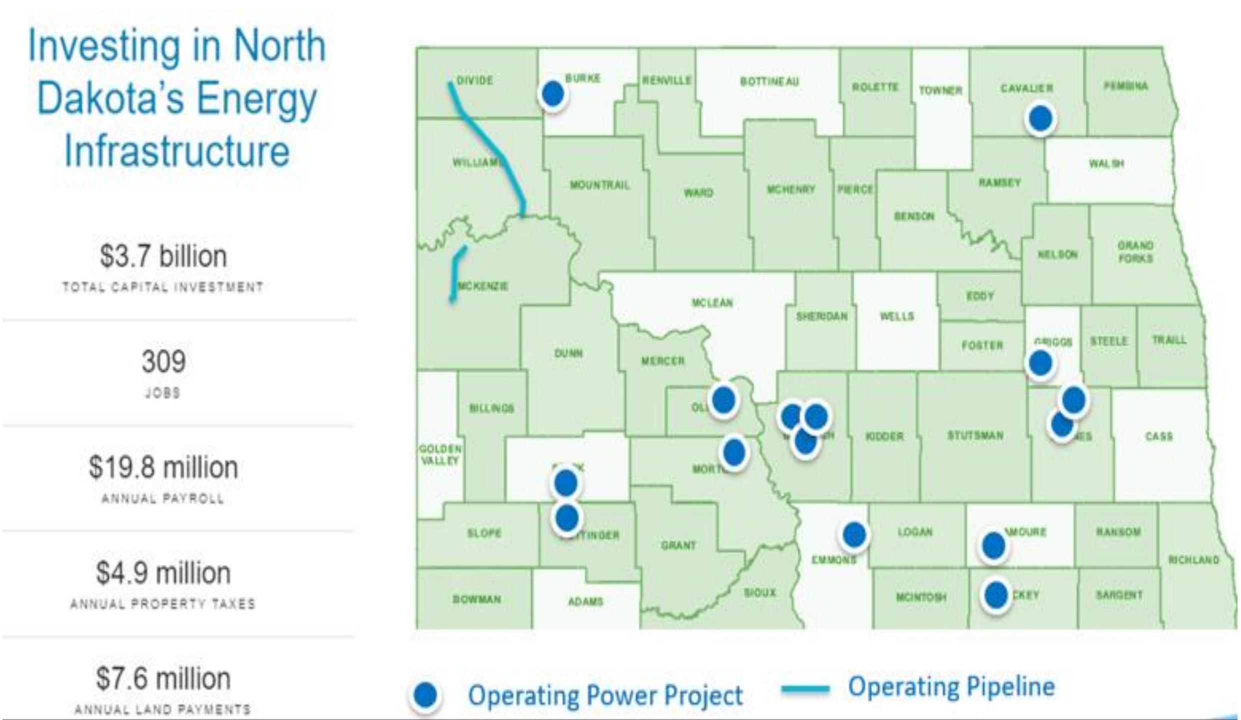
Annual Reports

Our annual reports may be accessed online at: http://www.investor.nexteraenergy.com/reports-and-filings/annual-reports

Portfolio Map - 33.8 GW of generating capacity (YE2022)



NextEra's North Dakota Investments



Credit Ratings

	S&P	MOODY'S	FITCH
NextEra Energy, Inc.			
Issuer Credit Rating	A-	Baa1	A-
Outlook	Stable	Stable	Stable
Florida Power & Light Company			
Issuer Credit Rating	A	A1	A
Outlook	Stable	Stable	Stable
NextEra Energy Capital Holdings, Inc.			
Issuer Credit Rating	A-	Baa1	A-
Outlook	Stable	Stable	Stable

NextEra Development, an indirect, wholly owned subsidiary of NEER, is pleased to submit this application for CSEA's post-production incentive for fertilizer production in North Dakota. NextEra Development hopes to demonstrate that our experience as a leading developer-owner-operator of renewable generation and carbon-free projects makes NextEra a strong fit to meet CSEA's goals. This response aims to demonstrate NextEra's reliable development and construction experience at predictable prices, optimized performance, and efficiency through a reliable supply of high-quality equipment that can be deployed timely, best-in-class installation standards, and sophisticated operation and maintenance protocols and deploys capital and resources to develop the project successfully on schedule.

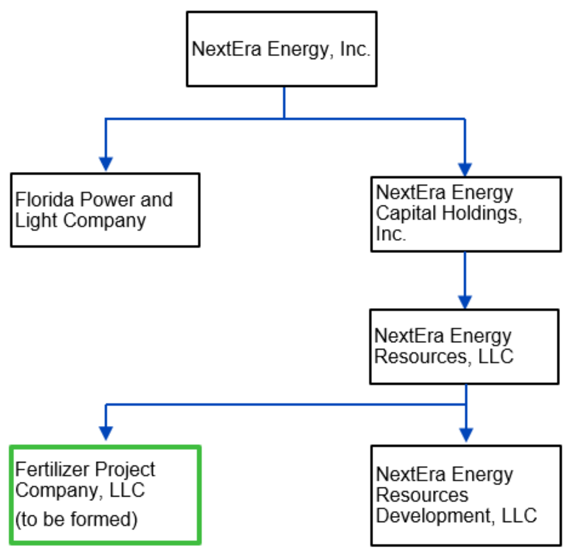


Figure 1. NextEra Organizational Chart

NextEra Development is uniquely positioned to support the state of North Dakota as the project team will have members that have worked on projects in North Dakota for over 20 years, resulting in NextEra's current investment in the state of nearly $3.7 billion. As a part of NextEra's Hydrogen Development publicly announced pipeline, the company recently stated that it plans to invest up to $20 billion in hydrogen projects highlighting NextEra's commitment and focus on driving the green hydrogen economy.

NextEra Development is excited about the opportunity to collaborate with State of North Dakota and are fully capable to finance, install, and operate this large-scale commercial deployment of electrical fertilizer facility. Commitment from CSEA via post-production fertilizer incentive would help enable delivering carbon-free nitrogen-based fertilizer economically and consistently helping the agricultural community.

Experience Summary

Projects listed below highlight technical, financial, and project & construction management capabilities.

Cavendish NextGen Hydrogen Hub | Okeechobee, FL

Project Overview | Florida Power & Light Company (FPL)'s first-of-its-kind clean hydrogen pilot project in Florida is scheduled to achieve COD in Q4 2023 and will produce hydrogen to be blended in with gas plant. FPL's Cavendish NextGen Hydrogen Hub will help the company explore using clean hydrogen to offset the use of natural gas to run a traditional power plant. Built with state-of-the-art technology, the hydrogen hub pilot project draws from Florida's most abundant natural resources – water and solar – to produce clean hydrogen. As the FPL Cavendish Solar Energy Center operates, a portion of solar energy will flow directly to the grid to serve customers, while the rest will go to power hydrogen production equipment, including a series of electrolyzers. Each electrolyzer splits water into its two basic elements: hydrogen and oxygen. The oxygen is released harmlessly into the air, while the hydrogen will be compressed, stored, and blended with natural gas, and used as fuel to produce electricity that will provide affordable and clean energy for FPL customers across the grid.

For this project, a 5% blend of hydrogen will be tested in one of three natural gas combustion turbines. The FPL Cavendish NextGen Hydrogen Hub will help maximize learning opportunities as it continues to pursue its Real Zero goal of decarbonizing its power-generation by 2045 at the latest.

NextEra Wind Portfolio | Multiple Locations, North Dakota

Since 2003, NextEra Energy Resources' subsidiaries have been helping fuel North Dakota's economic growth and quality of life and moving North America toward energy independence.

In total, NextEra's subsidiaries own and operate 15 wind energy centers and two pipelines in the state along with five wind projects in development.

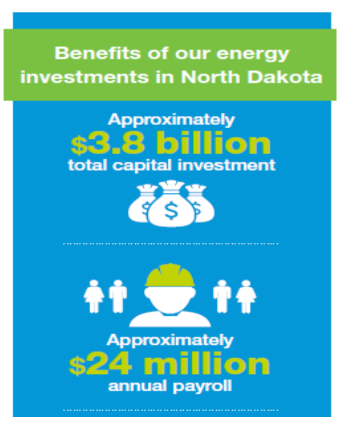
NextEra Energy Resources' North Dakota Wind Energy Centers

Name	County	# Turbines	MW
Ashtabula I	Barnes	99	148.5
Ashtabula II	Griggs, Steele	80	120*
Baldwin	Burleigh	64	102.4*
Brady	Stark	87	149.7*
Brady II	Hettinger, Stark	72	149*
Emmons-Logan	Emmons, Logan	102	200
Langdon I	Cavalier	79	118.5
Langdon II	Cavalier	27	40.5
New Salem (development)	Morton, Oliver	Up to 71	Up to 200
New Salem II (development)	Morton, Oliver	Up to 63	Up to 175
North Dakota	LaMoure	41	61.5
Northern Divide	Burke, Mountrail	74	197.9
Oliver	Oliver	22	50.6
Oliver II	Oliver	32	48
Oliver III	Morton, Oliver	48	99.3*
Oliver IV (development)	Oliver, Mercer	Up to 71	Up to 200
Prairie (development)	Nelson, Grand Forks	Up to 61	Up to 200
Red Butte (development)	Oliver	Up to 71	Up to 200
Wilton I	Burleigh	33	49.5
Wilton II	Burleigh	33	49.5

Includes megawatts associated with noncontrolling interests related to NextEra Energy Partners, LP.

NextEra Energy Resources' North Dakota Pipeline Assets

Pipeline Assets	Miles	Capacity
Flickertail	60	25 MMcf/d
Wheatland	22	10,710 Bbl/d



Wind energy is cost competitive*

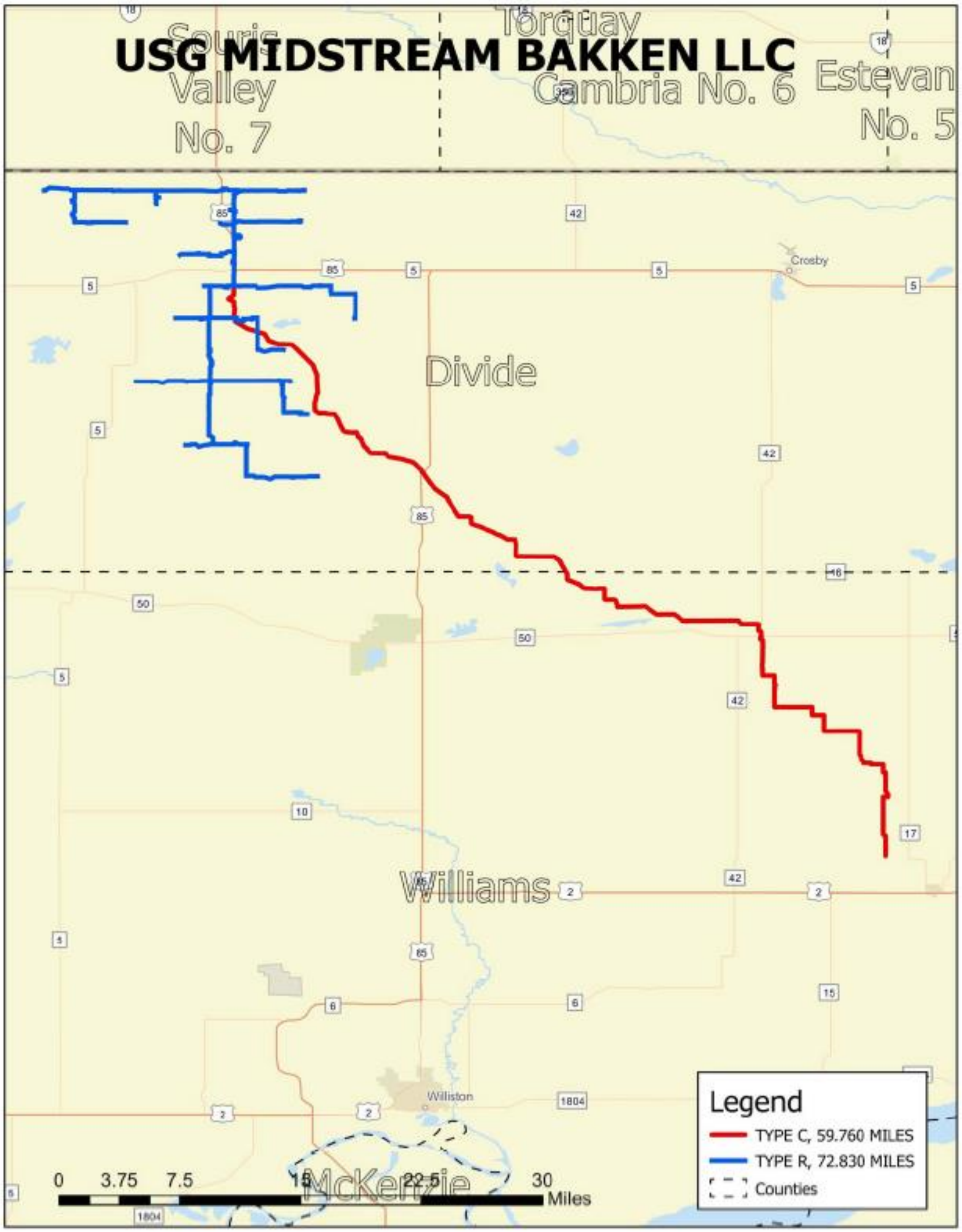
Since 2009, the cost of wind energy has decreased nearly

70%

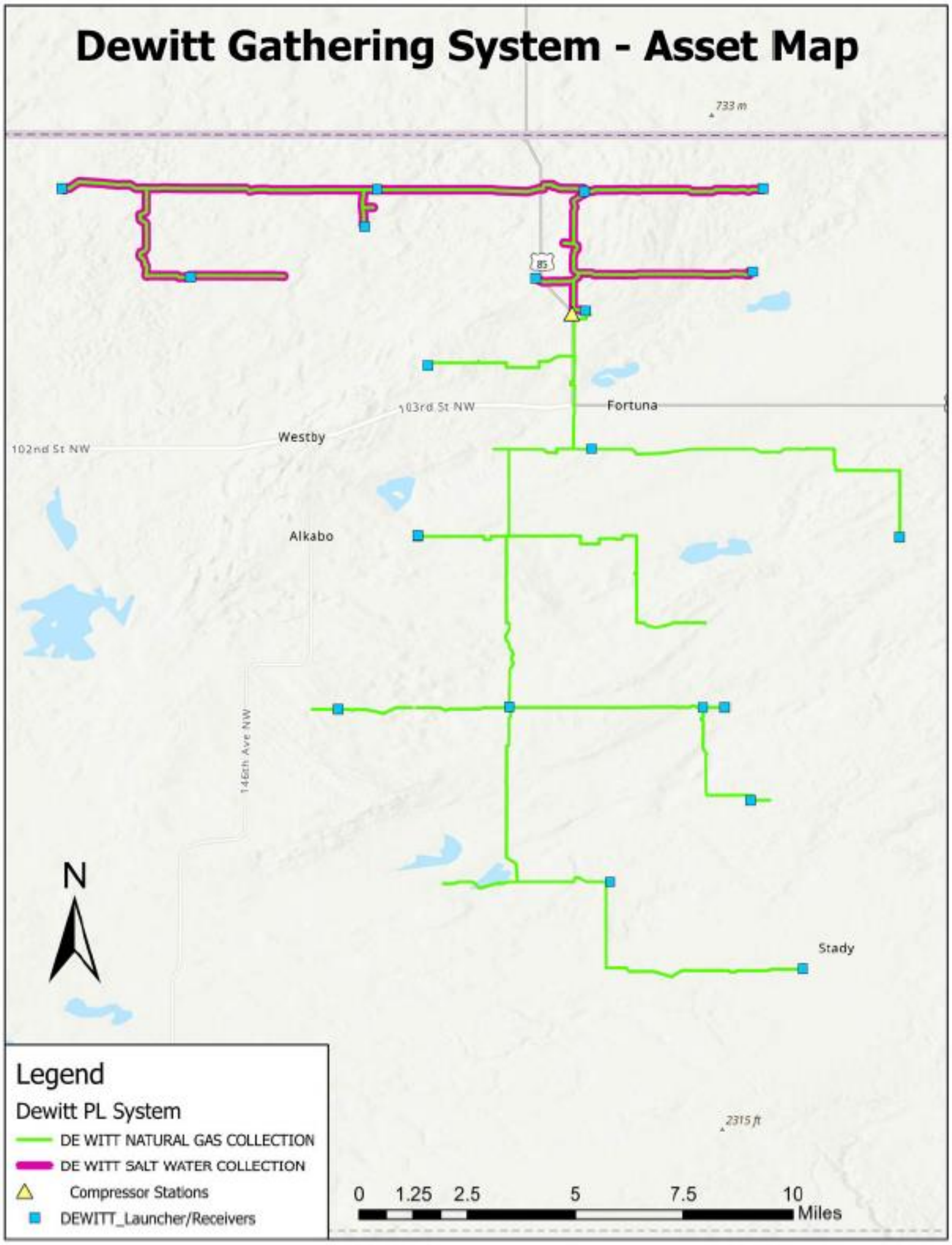
** Source: American Clean Power Association*

NextEra Pipeline Portfolio | Multiple Locations, North Dakota

NextEra currently operates USG Wheatland Pipeline LLC. Wheatland Pipeline, LLC, transports oil volumes from producers in McKenzie County, North Dakota. The project includes approximately 22 miles of low pressure 8" pipeline and a 10,000-barrel oil storage tank system interconnecting with the Enbridge Pipeline Alexander oil terminal.



Additionally, NextEra also operates USG Midstream Bakken LLC that has 60 miles of 10” natural gas pipe along with 72 miles of 12” & 4” produced water pipe in North Dakota. These pipelines have been operating in Divide and Williams Counties with only one recorded leak and no safety violations.



Okeechobee Clean Energy Center & Hydrogen Pilot | Okeechobee County, FL

- High-efficiency combined-cycle plant generates enough to power 350,000 homes
- Site of an upcoming zero-emissions hydrogen hub

Project Overview | NextEra Energy Inc.'s wholly owned subsidiary, Florida Power & Light Company (FPL), built the Okeechobee Clean Energy Center to meet customers' growing energy demand. This high-efficiency power-generating facility fueled by clean, U.S.-produced natural gas and one of the cleanest, most efficient of its kind in the world. The facility has a generating capacity of approximately 1,750MW – enough to deliver power around-the-clock to more than 350,000 homes. This project is a modern 3x1 combined cycle utilizing three highly efficient GE 7HA.02 combustion turbines, three triple pressure Nooter/Eriksen Heat Recovery Steam Generators (HRSGs), and a Siemens SST6-5000 reheat condensing steam turbine, cooling tower heat rejection system, well field cooling and process water supply and underground injection wells. The project included a seven-mile natural gas supply lateral and new gas yard and a new 500kV switchyard, however, the plant was located adjacent to the existing 500KV transmission corridor, minimizing offsite transmission costs. Construction of the plant took 2 ¼ years and was completed on budget and ahead of schedule. The workforce averaged 290 workers and peaked out at approximately 650 workers. The new facility requires approximately 25 skilled positions for plant operations.

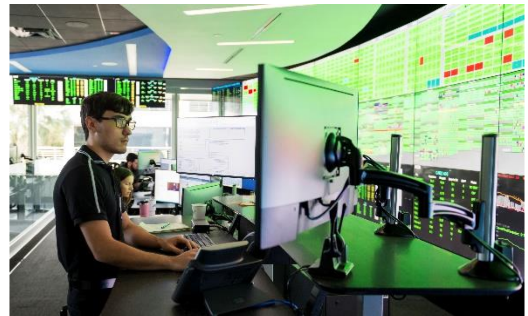
Delivery Type | Design Build Finance Own Operate

Infrastructure Involved | In addition to the combined-cycle plant, a large-scale solar energy center was constructed at the site, which has a positive impact on Okeechobee County and the State of Florida. Installed on ~550 acres, the solar center features ~330,000 solar panels producing 74.5MW of power with zero-emissions for customers - enough to power approximately 15,000 Florida homes and equivalent to removing approximately 12,000 cars from the road each year. There is also a planned $65 million hydrogen pilot project to be constructed at the site. The hydrogen hub will use a portion of the zero-emissions solar energy to power the onsite ~25MW hydrogen electrolysis system, one of the largest electrolysis units of its type. The hydrogen produced will be compressed and stored on-site to be blended with natural gas being supplied to the Okeechobee Clean Energy Center when needed, creating cleaner energy that will be distributed across the grid.

Experience Gained | The ability to take a hands-on approach to project execution and manage all aspects of the development and construction of the new facility. The company performed permitting and conceptual engineering using internal resources and third-party consultants and procured the major equipment, including the combustion turbines, HRSG's, steam turbine and generator step-up transformer. Additionally, the company retained the services of a major EPC contractor to perform detailed engineering and construction of the plant under a fixed price, date certain contract.

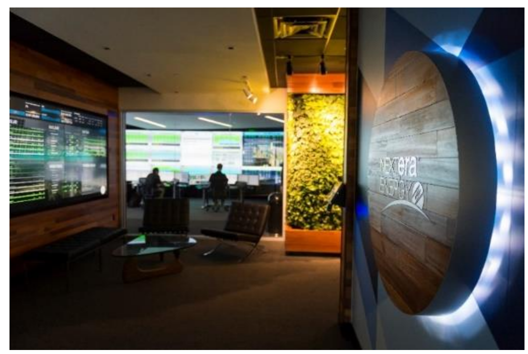
Fleet Performance Diagnostic Center | Juno Beach, FL

Project Overview | NextEra's Fleet Performance Diagnostic Center (FPDC) is the world's largest monitoring and diagnostic center for energy generation. The FPDC provides world-class predictive analytics for all of NextEra Energy's operating assets, encompassing over 60 GWs of fossil, nuclear, solar, wind and battery energy storage. FPDC provides the ability to monitor plant performance remotely, compare the performance of like components on similar generating assets, and proactively identify potential issues. The FPDC contains a massive display wall that provides an at-a-glance view of the performance of more than 170 sites, including those throughout the U.S. and Canada. In 2020, FPL provided its customers with the most reliable service in the company's history, continuing a trend in which FPL has improved reliability by nearly 40% since 2006.



- 24-hour-a-day, seven-day-a-work monitoring
- World-class predictive analytics
- In 2020, awarded the ReliabilityOne® National Reliability Excellence Award

Infrastructure Involved | The FPDC monitors solar, wind, battery storage, nuclear and fossil fuel plants across United States and Canada. The center monitors more than two million data points per second. These data points help measure and demonstrate how each site is performing, how much energy it is generating, dispatch information and weather conditions. The expertise and cutting-edge technology provided by the FPDC saves the company and our customers a great deal of money, around $18.5 million per year, by preventing and detecting anomalies before they become problems.



Experience Gained | The FPDC's constant and comprehensive monitoring of data points of generation assets has helped Florida Power & Light Company (FPL) track its electric service were better including the average amount of time a customer experienced an outage, the average number of outages and the average number of momentary interruptions or flickers. The company uses this data to continually strengthen and modernize the energy grid.

In 2020, for the fifth time in six years, FPL was awarded the ReliabilityOne® National Reliability Excellence Award, presented by PA Consulting to the regional-award recipient that has demonstrated sustained leadership, innovation and achievement in the area of electric reliability.

ReliabilityOne® AWARDS'20

Additionally, below are few publicly announced clean hydrogen projects to highlight technical, financial, and transactional capabilities of NextEra Energy's hydrogen Development team.

Cavendish NextGen H2 Hub

COD Q4 2023

NextEra Energy subsidiary Florida Power & Light Company began producing hydrogen at 25 MW electrolyzer facility at the Okeechobee Clean Energy Center in Florida. The project is online and is the largest green Hydrogen project in North America.

NextEra <> Linde Arizona Project

NextEra and Linde are collaborating to develop an up-to 120 ton-per-day electrolysis project in Arizona. The clean hydrogen produced by this facility will be used to support the decarbonization of the West Coast mobility and industrial markets.

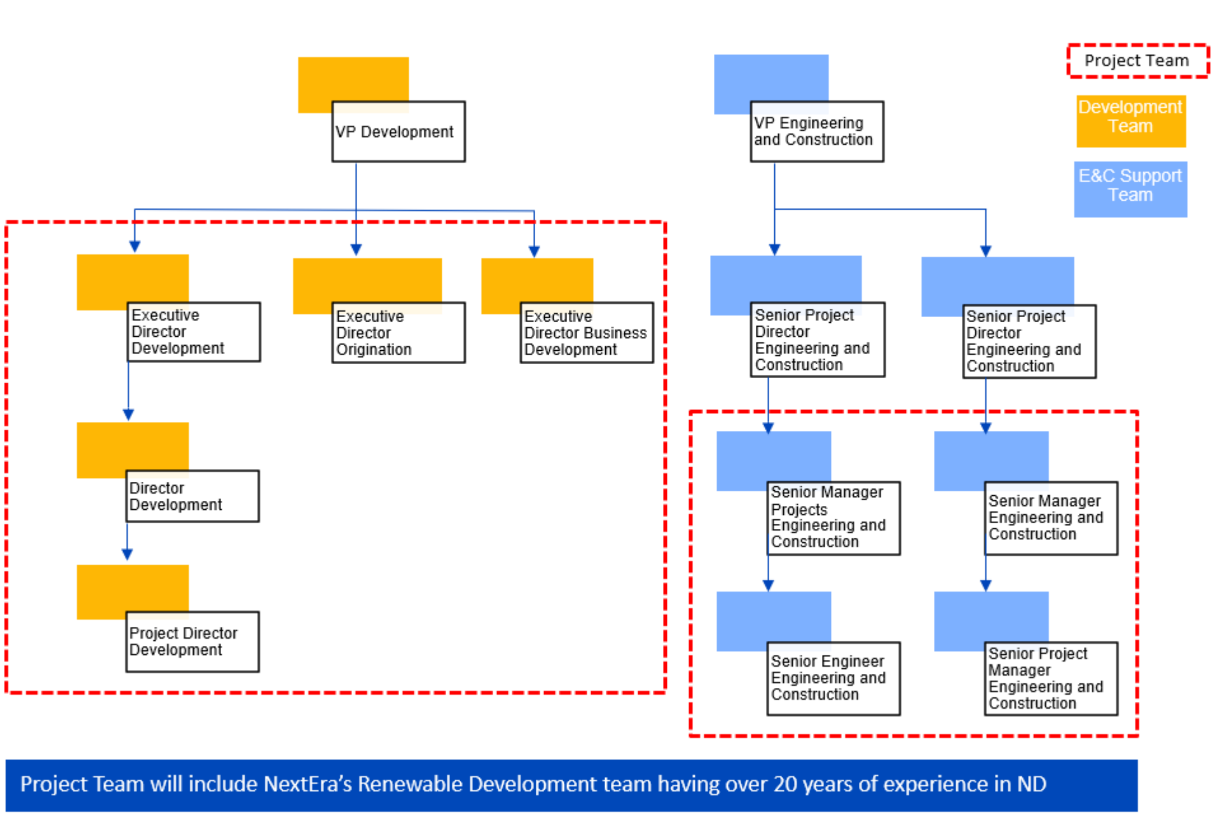
NextEra <> CF Industries Project

NextEra and CF Industries are collaborating to evaluate development of a 40 ton-per-day electrolysis project at CF Industries' Verdigris Complex in Oklahoma. CF Industries would utilize the zero-carbon hydrogen produce fertilizer.

5. MANAGEMENT

NextEra has a seasoned management team capable of successfully managing complex projects with our internal engineering, estimating, construction management teams, and seamlessly transitioning projects to our experienced project operators. NextEra also has a Fleet Performance and Diagnostic Center, which is a twenty-four hour a day, seven day a week Control and Monitoring Center located in Juno Beach, Florida. This center operates all of NextEra's renewable energy, natural gas, nuclear and hydrogen projects, to ensure world-class performance.

The Organizational Chart below shows the reporting structure for the key participants proposed by NextEra from Development, Origination, Development Services, and Engineering & Construction to support the Project. Detailed organizational chart and bios of key project team is presented in confidential appendix – A.



6. TIMETABLE

Given the unique technology, commercial scale and nature of this project, NextEra Development is expecting to need all permits and other regulatory approvals completed prior to financial close. The schedule listed below is indicative at this stage and is contingent upon NextEra applying and securing Interconnection and permitting. Detailed breakdown presented in confidential Appendix – A.

Task Name	Start	Finish
Project Development	2021	2024
Install, Integrate, Construct	2025	2028
Commercial Operations	2028 - 2029	

7. BUDGET

The total capital for the proposed Project is expected to be approximately $1.3 Billion. The $125MM post-production fertilizer development incentive from CSEA would represent approximately 10% of the total project capital expenditure while NextEra Development's contribution would approximately be 90% of the total project capital. NextEra Development's project capital includes the following project scope:

- Hydrogen electrolysis equipment
- Air separation unit
- Ammonia production loop
- Ammonia storage tanks
- Voltage transformation equipment
- Water treatment equipment
- Wind turbine power generation equipment
- Electric transmission lines
- Direct and indirect engineering, procurement, construction, and Owner's costs

NextEra Development's capital cost estimates reflect the current stage of engineering and development of the project and provide a budgetary estimate only. NextEra Development considers the cost of each of the line item listed above to be highly confidential in nature given the competitive and proprietary nature of these projects. A detailed breakdown of total project capital is presented in the budget table in confidential Appendix – A.

8. CONFIDENTIAL INFORMATION

A person or entity may file a request with the Commission to have material(s) designated as confidential. By law, the request is confidential. The request for confidentiality should be strictly limited to information that meets the criteria to be identified as trade secrets or commercial, financial, or proprietary information. The Commission shall examine the request and determine whether the information meets the criteria. Until such time as the Commission meets and reviews the request for confidentiality, the portions of the application for which confidentiality is being requested shall be held, on a provisional basis, as confidential.

If the confidentiality request is denied, the Commission shall notify the requester and the requester may ask for the return of the information and the request within 10 days of the notice. If no return is sought, the information and request are public record.

Note: Information wished to be considered as confidential should be placed in separate appendices along with the confidentiality request. The appendices must be clearly labeled as confidential. If you plan to request confidentiality for **reports** if the proposal is successful, a request must still be provided.

To request confidentiality, please use the template available at http://www.nd.gov/ndic/CSEA-app-doc-infopage.htm.

We have attached the confidentiality request document, which outlines the sensitive nature of the attached appendices and emphasizes the need for their security. We kindly request that the following items, be treated as confidential due to the competitive and protectionist nature:

Project Description
Management
Budget
Patents/Rights to Technical Data
Loan/Loan Guarantee Application
Business Plan
Timetable
Budgeted Projections
Other Appendices

These materials contain crucial information regarding our competitive advantage, encompassing our strategic direction, speed, and partnerships. Particularly, gives overview of our project planning, technology background and go-to-market strategy making it high risk of theft and replication. Therefore, it is of utmost importance that the confidentiality of these documents is maintained.

9. PATENTS/RIGHTS TO TECHNICAL DATA

Confidential (please see Appendix – A – Confidential Application)

10. STATE PROGRAMS AND INCENTIVES

NextEra has not participated in any programs or incentives from the State of North Dakota within the last five years.

November 13, 2023

Clean Sustainable Energy Authority
North Dakota Industrial Commission
State Capitol – 14th Floor
600 East Boulevard Ave Dept 405
Bismarck, ND 58505-0840

NEXTera ENERGY RESOURCES DEVELOPMENT

Subject: Spiritwood Fertilizer Project - Clean Sustainable Energy Authority (CSEA) Post-Production Incentive Application

Dear Clean Sustainable Energy Authority:

NextEra Energy Resources Development, LLC ("NextEra Development") which is a an indirect, wholly owned subsidiary of NextEra Energy Resources, LLC ("NEER") is pleased to submit an electronic copy of its application for Clean Sustainable Energy Authority's $125 million post-production incentive towards electrolytic fertilizer development in North Dakota. A commitment from CSEA will support the commercial deployment of fertilizer production leveraging electrolysis of water in North Dakota (the "Project"). NextEra Development appreciates the opportunity to work with CESA on this innovative program and is excited about the Project and the great opportunity it brings to North Dakota. Development of the Project would require selection by CSEA, a letter of commitment from Bank of North Dakota (BND), execution of definitive documents, and receipt of all requisite corporate management approvals.

This Project aims to provide the North Dakota market with stable supply adding fertilizer resiliency to the agricultural community in the state. The Project is expected to begin commercial operations between 2028 and 2029 and would generate hundreds of jobs and dozens of specialists' positions as the Project develops in multiple phases.

The $125 million post-production funding from CSEA is a strong incentive for deployment of an electrolytic fertilizer plant in North Dakota helping to diversify and grow North Dakota's economy in a highly economic and sustainable manner.

If you have any questions, please contact Joseph Matteo, Executive Director – Development by email at joseph.matteo@nexteraenergy.com or by phone at 415-846-3058.

Sincerely,

Ross Groffman
Vice President - Development
NextEra Energy Resources Development, LLC

Industrial Commission

Tax Liability Statement

Applicant:

NextEra Energy Resources Development, LLC

Applicant Contact Name: Ross Groffman, Vice President - Development
Phone: +1-561-304-5783
Email: ross.groffman@nexteraenergy.com

Application Title:

Spiritwood Fertilizer Project - Clean Sustainable Energy Authority (CSEA) Post-Production Incentive Application

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

Vice President - Development
____
Title

11/13/2023
____
Date

APPENDIX – D

LETTERS OF SUPPORT

November 13, 2023

Clean Sustainable Energy Authority
North Dakota Industrial Commission
State Capitol – 14th Floor
600 East Boulevard Ave Dept 405
Bismarck, ND 58505-0840

Subject: Letters of Support for Spiritwood Fertilizer Project's Post-Production Incentive Application to Clean Sustainable Energy Authority (CSEA)

Dear Clean Sustainable Energy Authority,

NextEra Energy Resources Development, LLC ("NextEra Development") which is a an indirect, wholly owned subsidiary of NextEra Energy Resources, LLC ("NEER") is pleased to submit an electronic copy of its application for Clean Sustainable Energy Authority's $125 million post-production incentive towards electrolytic fertilizer development in North Dakota. In addition to the application, NextEra Development is pleased to attached letters of support from interested parties and potential beneficiaries.

Table below outlines organizations that submitted a letter of support.

#	Name	Designation	Organization
1.	Doug Goehring	Agricultural Commissioner	ND Department of Agriculture
2.	Andrea Pfennig	Director	Greater ND Chamber
3.	Brenda Elmer	Executive Director	ND Corn Growers Association
4.	Kayla Pulvermacher	Executive Director	ND Grain Growers Association
5.	Mark Watne	President	ND Farmers Union
6.	Tyler Michel	Public Works Director	City of Jamestown
7.	Geneva Kaiser	General Manager	Stutsman Rural Water District
8.	Corry Shevlin	CEO - Development	Jamestown Stutsman County
9.	Dwaine Heinrich	Mayor	City of Jamestown
10.	Doug Darling	President	Lake Region State College
11.	Douglas Jensen	President	Bismarck State College

STATE OF NORTH DAKOTA
DEPARTMENT OF AGRICULTURE
600 E BOULEVARD AVE, DEPT 602
BISMARCK, ND 58505-0020

DOUG GOEHRING
COMMISSIONER

Oct. 20, 2023

Clean Sustainable Energy Authority
State Capitol 14th Floor
600 E. Boulevard Ave. Dept. 405
Bismarck ND 58505-0840

Dear Clean Sustainable Energy Authority,

I am writing in support of NextEra Energy's plan to develop a fertilizer production facility near Jamestown.

The facility would add value for the agriculture community by producing ammonia, a commonly used nitrogen fertilizer in the state. The fertilizer plays a vital role in the production of food and feed.

The project would also generate hundreds of jobs, including spots for skilled energy professionals, and would support food security in the state, nation and world.

Thank you for your consideration of NextEra Energy's project. If you have any questions, please feel free to contact me.

Sincerely,

Doug Goehring
Agriculture Commissioner

Greater North Dakota Chamber

10/27/2023

Clean Sustainable Energy Authority
State Capitol 14th Floor
600 E. Boulevard Ave. Dept. 405
Bismarck, ND 58505-0840

Re: Letter of support for NextEra Energy's Spiritwood Green Ammonia Project in North Dakota
Dear Clean Sustainable Energy Authority,

On behalf of the Greater North Dakota Chamber (GNDC), this letter expresses our support for the green ammonia project proposed by NextEra Energy. GNDC is the largest business advocacy organization in North Dakota. From a policy standpoint, GNDC supports strategic investments in economic development.

NextEra Energy, a leading U.S. based investor and developer of energy infrastructure, aims to leverage the Clean Sustainable Energy Authority's (CSEA) Fertilizer Development Incentive to support the development of a fertilizer production facility in Stutsman County near Jamestown, North Dakota.

This project is expected to generate hundreds of jobs, dozens of specialists' positions and open the door to strategically developing STEM programs to develop long term talent locally in North Dakota. Commitment from the Clean Sustainable Energy Authority (CSEA) through a post-production incentive will help demonstrate that the Spiritwood Project is worthy of consideration by potential stakeholders.

Our purpose is to ensure businesses have the ability to grow North Dakota's economy and secure its position in the global market. Projects, like this one being proposed near Jamestown by NextEra Energy, will help deliver jobs during construction, full time jobs for management and maintenance once built, and money in the form of local taxes that will benefit our state for years to come.

Sincerely,

Andrea Pfennig
Director of Government Affairs

October 27, 2023

Clean Sustainable Energy Authority
State Capitol 14th Floor
600 E. Boulevard Ave. Dept. 405
Bismarck, ND 58505-0840

Re: Fertilizer Development Incentive Application for North Dakota

Dear Clean Sustainable Energy Authority,

We understand there are plans to develop a fertilizer production facility in Stutsman County near Jamestown, North Dakota. The North Dakota Corn Growers Association, representing 13,000 growers across the state, is pleased to express our general support for in-state-projects that will greatly help with the North Dakota market currently subject to tremendous price spikes and sometimes supply shortages.

While we did not endorse specific projects or companies, we believe it necessary to convey the importance of local fertilizer development efforts. Corn growers have been disproportionately, negatively impacted by fertilizer shortages and price spikes. As the world population is expected to exceed nine billion by 2050, fertilizer will be needed more than ever to boost crop production to feed its inhabitants.

North Dakota is at the end of the fertilizer supply chain, which lends itself to greater price volatility, frequent supply shortages, and higher prices for producers. Ammonia is commonly half the price in the U.S. Gulf compared to our part of the country. Incentives to increase in-state fertilizer production will help ensure a more stable and more affordable fertilizer supply.

A project like this will not only benefit our state's growers, but is expected to generate many jobs and an economic development that will have a ripple effect throughout communities and the state.

Please consider funding a fertilizer project making a significant investment and leveraging the Clean Sustainable Energy Authority's (CSEA) Fertilizer Development Incentive. The funding will help our state's corn growers to better access locally produced fertilizer that will help with supply and affordable pricing. Thank you for your consideration.

Sincerely,

Brenda Elmer

Brenda Elmer
Executive Director

4870 ROCKING HORSE CIRCLE SOUTH, FARGO, ND 58104 701.566.9235 BRENDA@NDCORN.ORG

NDGGA
You Raise. We Represent.

October 30, 2023

Clean Sustainable Energy Authority
State Capitol 14th Floor
600 E. Boulevard Ave. Dept. 405
Bismarck, ND 58505-0840

Re: Letter of support for NextEra Energy's Spiritwood Green Ammonia Project in North Dakota
Clean Sustainable Energy Authority (CSEA),

North Dakota Grain Growers (NDGGA) is pleased to provide a letter of support for NextEra Energy's as the company works to develop a fertilizer production facility in Stutsman County near Jamestown, North Dakota.

The Spiritwood project is important to the future of agriculture in the state. Not only will this project provide better access to fertilizer that is integral to a producer's operation, but the facility will also generate hundreds of jobs in the Jamestown area. Commitment from the CSEA through a post-production incentive will help demonstrate that Spiritwood Project is worthy of consideration by potential stakeholders.

Finally, the proposed Spiritwood Ammonia project presents opportunities for NDGGA to promote the facility through membership site visits, research projects and collaboration. As Executive Director, I am authorized to commit NDGGA's support of NextEra's project as described in this letter and am confident that NextEra will successfully fulfill project deliverables to the Clean Sustainable Energy Authority.

Sincerely,

North Dakota Grain Growers
Kayla Pulvermacher
Executive Director

NORTH DAKOTA Farmers Union

PO Box 2136 • 1415 12th Ave SE
Jamestown, ND 58401
800-366-8331 • 701-252-2341
ndfu.org

October 27, 2023

Clean Sustainable Energy Authority
State Capitol 14th Floor
600 E. Boulevard Ave. Dept. 405
Bismarck, ND 58505-0840

RE: Letter of support for NextEra Energy's Spiritwood Green Ammonia Project in North Dakota

Dear Clean Sustainable Energy Authority,

On behalf of North Dakota Farmers Union (NDFU), I write to express our support for NextEra Energy's application for the Fertilizer Development Incentive Program. NDFU is North Dakota's largest general farm organization, representing more than 60,000 farm, ranch and member families. Expanding in-state fertilizer production capacity is a top priority for our members.

North Dakota's farmers and ranchers use over 700,000 metric tons of fertilizer annually.[1] Our state's current nitrogen production capacity is only half that demand, leaving our state's farmers to rely heavily on fertilizer produced outside the state. Moreover, nitrogen demand is growing. From 1987 to 2017, nitrogen use in North Dakota increased by 143%.[2] Global demand for ammonia is also expected to increase by 40% by 2050 to meet higher food demand for a growing world population.[3]

Expanding access to an in-state supply of fertilizer will help North Dakota farmers become more resilient. Over the last several years, global supply chain disruptions have caused fertilizer prices to skyrocket. From late 2021 through early 2023, nitrogen fertilizer prices were more than double the five-year average. While the markets slowly calmed through much of 2023, they have recently spiked due to low water levels on the Mississippi River, challenges with rail delivery and global conflicts.[4]

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[1] Falcone, J.A. (2020). *Estimates of county-level nitrogen and phosphorous from fertilizer and manure for approximately five-year periods from 1950 to 2017 for the conterminous United States.* U.S. Geological Survey. Retrieved from https://www.sciencebase.gov/catalog/item/5ebad56382ce25b51361806a.
[2] *Id.*
[3] International Energy Agency. (2021). *International Energy Agency.* Retrieved from https://iea.blob.core.windows.net/assets/6ee41bb9-8e81-4b64-8701-2acc064ff6e4/AmmoniaTechnologyRoadmap.pdf.
[4] Dehlinger, K. M. (2023, Oct. 18). *DTN Retail Fertilizer Trends.* DTN/Progressive Farmer. Retrieved from https://www.dtnpf.com/agriculture/web/ag/crops/article/2023/10/18/retail-anhydrous-fertilizer-price-16.

North Dakota is at the end of the fertilizer supply chain, which results in even greater price volatility, frequent supply shortages and higher prices for the state's producers. In fact, the Northern Plains ammonia price is commonly 50% higher than the price in the U.S. Gulf. Increasing in-state fertilizer production will help ensure a more stable and more affordable fertilizer supply.

NextEra's project would nearly double North Dakota's fertilizer production capacity, providing North Dakota producers with a more affordable and reliable supply of nitrogen fertilizer. Access to green ammonia would also position North Dakota producers to meet growing demand for lower carbon commodities.

While we cannot endorse any specific project, we appreciate the ongoing engagement we have had with NextEra over the last 18 months. We are impressed by the continued progress of the project and are confident its completion would create significant benefits for North Dakota producers.

Sincerely,

NORTH DAKOTA FARMERS UNION

Mark Watne

Mark Watne
President

Tyler Michel
Public Works Director
102 3rd Ave SE
JAMESTOWN, ND 58401

701-252-5900 City Hall
701-952-5941 Direct
www.JamestownND.gov
TMichel@JamestownND.gov

October 27, 2023

Clean Sustainable Energy Authority
State Capitol 14th Floor
600 E. Boulevard Ave. Dept. 405
Bismarck, ND 58505-0840

Re: Letter of support for NextEra Energy's Spiritwood Green Ammonia Project in North Dakota

Dear Clean Sustainable Energy Authority,

Nextera Energy, a leading U.S. based investor and developer of energy infrastructure aims to develop a fertilizer production facility in Stutsman County near Jamestown, North Dakota. The City of Jamestown Public Works is pleased to provide a letter of support for NextEra Energy's fertilizer project as Nextera Energy aims to leverage the Clean Sustainable Energy Authority's (CSEA) – Fertilizer Development Incentive to support the project. Spiritwood project is expected to go COD between H2 2028 – H1 2029 and generate close to hundreds of jobs, dozens of specialists' positions and open the door to strategically developing STEM programs to develop long term talent locally in North Dakota. Commitment from the CSEA through a post-production incentive will help demonstrate that Spiritwood Project is worthy of consideration by potential stakeholders.

The City of Jamestown Public Works looks forward to working with Nextera Energy on its project to help bring revenue, jobs, people, and all the other ancillary items that come with a project of this magnitude to the city of Jamestown. Also, we will undoubtedly work together to help in any way we can with providing water and/or wastewater services to the project as it proceeds, and any of the other items that may come up throughout the project.

The proposed Spiritwood Ammonia project presents opportunities for the City of Jamestown Public Works to participate in internships, site visits and research projects. As Public Works Director, I am authorized to commit the City of Jamestown Public Works to support NextEra as described in this letter and have confident that NextEra will successfully fulfill project deliverables to the Clean Sustainable Energy Authority.

Sincerely,

Tyler Michel

Tyler Michel
City of Jamestown Public Works Director

STUTSMAN RURAL WATER DISTRICT
701-252-7727
srwdistrict@daktel.com

October 19, 2023

Clean Sustainable Energy Authority
State Capitol 14th Floor
600 E. Boulevard Ave. Dept. 405
Bismarck, ND 58505-0840

Re: Letter of support for NextEra Energy's Spiritwood Green Ammonia Project in North Dakota
Dear Clean Sustainable Energy Authority,

Stutsman Rural Water District (SRWD) is pleased to provide a letter of support for NextEra Energy, as it aims to develop a fertilizer production facility in Stutsman County near Jamestown, North Dakota. SRWD is in full support of NextEra Energy's fertilizer project as NextEra Energy aims to leverage the Clean Sustainable Energy Authority's (CSEA) – Fertilizer Development Incentive to support the project. The Spiritwood project is expected to generate nearly hundreds of good paying jobs; bolstering the local economy, and has the potential to employ and attract other specialized talent to the greater Jamestown area.

Stutsman Rural Water District is committed to working with NextEra Energy Resources ("NEER") to ensure an adequate dependable water supply for their future operations.

The proposed Spiritwood Ammonia project presents opportunities for Stutsman Rural Water District to increase water sales and have the ability to provide stable long term water rates to its rural agricultural and residential water users in the future. As General Manager, I am authorized to commit Stutsman Rural Water District to support NextEra as described in this letter and am confident that the NextEra Energy Spiritwood Green Ammonia Project is worthy of the support of the Clean Sustainable Energy Authority.

Sincerely,

Geneva Kaiser

Geneva Kaiser
General Manager

Fax: 701-252-8711
1812 Hwy. 281 North
Jamestown, ND 58401

General Manager
Geneva Kaiser
genevasrwdistrict@daktel.com

Distribution Manager
Jesse Hewson
jessesrwdistrict@daktel.com

DEVELOPMENT
JAMESTOWN / STUTSMAN COUNTY

10/18/2023

Clean Sustainable Energy Authority
State Capitol 14th Floor
600 E. Boulevard Ave. Dept. 405
Bismarck, ND 58505-0840

Re: Letter of support for NextEra Energy's Spiritwood Nitrogen Project in North Dakota

Dear Clean Sustainable Energy Authority,

Nextera Energy, a leading U.S. based investor and developer of energy infrastructure aims to develop a fertilizer production facility in Stutsman County near Jamestown, North Dakota. Jamestown/Stutsman Development Corporation is pleased to provide a letter of support_for NextEra Energy's fertilizer project as Nextera Energy aims to leverage the Clean Sustainable Energy Authority's (CSEA) – Post-production incentive to support the project. Spiritwood project is expected to begin operations between H2 2028 – H1 2029, generate hundreds of jobs and dozens of specialists' positions as the project develops in multiple phases which will bring significant economic development to the local community and into North Dakota. Commitment from the CSEA through a post-production incentive will support development and large—scale commercialization of the Spiritwood Project.

The mission of the Jamestown/Stutsman Development Corporation is to develop employment, improve business conditions, and advance the interests of the City of Jamestown and Stutsman County. The Spiritwood Nitrogen project present many opportunities for the citizens, businesses and agriculture community in our region and State.

BSC and NextEra Energy Resources ("NEER") are committed to working together to ensure a robust talent pipeline of skilled energy professionals. NEER has made equipment and monetary donations and supports several advisory councils.

As Chief Executive Officer, I am authorized to commit Jamestown/Stutsman Development Corporation to support NextEra as described in this letter and have confident that NextEra will successfully fulfill project deliverables to the Clean Sustainable Energy Authority.

Sincerely,

Corry Shevlin
Chief Executive Officer

CITY OF JAMESTOWN "HOME OF THE WORLD'S LARGEST BUFFALO" NORTH DAKOTA

"THE BUFFALO CITY"

OFFICE OF MAYOR
102 THIRD AVENUE SOUTHEAST
JAMESTOWN, NORTH DAKOTA 58401

PHONE (701) 252-5900
FAX (701) 252-5903

October 19, 2023

Clean Sustainable Energy Authority
State Capitol 14th Floor
600 E. Boulevard Ave. Dept. 405
Bismarck, ND 58505-0840

RE: Letter of support for NextEra Energy's Spiritwood Green Ammonia Project in North Dakota

Dear Clean Sustainable Energy Authority,

NextEra Energy, a leading U.S. based investor and developer of energy infrastructure aims to develop a fertilizer production facility in Stutsman County near Jamestown, North Dakota. As Mayor of Jamestown, I am pleased to provide a letter of support for NextEra Energy's fertilizer project as NextEra Energy aims to leverage the Clean Sustainable Energy Authority's (CSEA) – post-production incentive to support the project.

The Spiritwood project is expected to being operations between the second quarter of 2028 and first quarter 2029 and generate hundreds of jobs and dozens of specialists' positions as the projects in multiple phases which will bring significant economic development to the local community and into North Dakota.

The City of Jamestown welcomes this opportunity to add jobs to the local workforce while also supporting our local agricultural economy. I am committed to working together with NextEra Energy and other stakeholders, to ensure a robust talent pipeline of skilled energy professionals.

The proposed Spiritwood Ammonia project presents opportunities for the City of Jamestown to participate in internships, site visits, research projects and employment. As Mayor, I am pleased to support NextEra as described in this letter and I am confident that NextEra will successfully fulfill project deliverables to the Clean Sustainable Energy Authority.

Sincerely,

Dwaine Heinrich

Dwaine Heinrich, Mayor
City of Jamestown

Lake Region
State College
1801 College Drive North, Devils Lake, ND 58301-1598
(701) 662-1600 | (800) 443-1313 | fax (701) 662-1570
TDD (701) 662-1572 | www.lrsc.edu

October 19, 2023

Clean Sustainable Energy Authority
State Capitol 14th Floor
600 E. Boulevard Ave. Dept. 405
Bismarck, ND 58505-0840

Re: Letter of support for NextEra Energy's application to Clean Sustainable Energy Authority's Fertilizer Development Incentive for North Dakota's Spiritwood Green Ammonia Project

Dear Clean Sustainable Energy Authority:

NextEra Energy, a leading U.S. based investor and developer of energy infrastructure, aims to develop a fertilizer production facility in Stutsman County near Jamestown, North Dakota. Lake Region State College (LRSC) is pleased to provide a letter of support for NextEra Energy's fertilizer project. NextEra Energy seeks to leverage the Clean Sustainable Energy Authority's – Fertilizer Development Incentive to support project feasibility. The project will generate significant jobs, dozens of specialists' positions and opens the door to strategically developing STEM programs to develop long term, North Dakota talent, locally.

Accredited since 1973, Lake Region State College, located in Devils Lake, North Dakota, serves a vital role in the community, region, state, and nation for preparing students for success. LRSC is home to distinguished Technical Trade programs including, Wind Energy Technician Program and Precision Agriculture Program. The programs produce exemplary technicians.

LRSC and NextEra are committed to working together to ensure a robust talent pipeline of skilled energy professionals. Collaborative efforts include, but are not limited to, internships, equipment donations, curriculum development, sponsorships and STEM camps. NextEra hires many LRSC graduates.

The proposed Spiritwood Ammonia Project presents opportunities for LRSC students to participate in internships, site visits, research projects and employment. Lake Region State College will provide community and workforce development/engagement support to help NextEra to successfully fulfill project deliverables to the Clean Sustainable Energy Authority.

Sincerely,

Doug Darling, Ph.D.
President

BISMARCK STATE COLLEGE | North Dakota's Polytechnic Institution

1500 Edwards Avenue
PO Box 5587
Bismarck, ND 58506-5587
701.224.5400

10/19/2023

Clean Sustainable Energy Authority
State Capitol 14th Floor
600 E. Boulevard Ave. Dept. 405
Bismarck, ND 58505-0840

Re: Letter of support for NextEra Energy's application to Clean Sustainable Energy Authority's Fertilizer Development Incentive for North Dakota's Spiritwood Green Ammonia Project

Dear Clean Sustainable Energy Authority:

NextEra Energy, a leading U.S.-based investor and developer of energy infrastructure, aims to develop a fertilizer production facility in Stutsman County near Jamestown, North Dakota. Bismarck State College, North Dakota's Polytechnic Institution (BSC) is pleased to provide a letter of support for NextEra Energy's fertilizer project. NextEra Energy seeks to leverage the Clean Sustainable Energy Authority's – Fertilizer Development Incentive to support project feasibility. The project will generate significant jobs, dozens of specialist positions and open the door to strategically develop STEM programs to develop long-term, North Dakota talent, locally.

BSC is the only polytechnic institution in North Dakota and is home to The National Energy Center of Excellence (NECE). The NECE advances education and training to support the energy sector. BSC and NextEra are committed to working together to ensure a robust talent pipeline of skilled energy professionals. NextEra has made equipment and monetary donations and supports several advisory councils.

The proposed Spiritwood Ammonia Project presents opportunities for BSC students to participate in internships, site visits, research projects, and employment. As BSC's President, I commit BSC to support NextEra as described in this letter. BSC will provide community and workforce development/engagement support to help NextEra successfully fulfill project deliverables to the Clean Sustainable Energy Authority.

Sincerely,

Douglas J. Jensen

Douglas J. Jensen, Ed.D.
President

TECHNICAL REVIEWERS' RATING SUMMARY
C-05-C
“Green” Pig Iron Production Facility
Submitted By: Scranton Holding Company/ North American Iron, Inc.
Date of Application: October 2023
Request for $12,000,000 Grant
Total Project Costs $2,200,000,000

		Technical Reviewer			
		C1	**C2**	**C3**	
Rating Category	**Weighting Factor**	**Rating**	**Rating**	**Rating**	**Average Weighted Score**
1. Objectives	3	3	3	4	10
2. Impact	9	3	4	4	33
3. Methodology	9	3	3	4	30
4. Facilities	3	2	2	4	8
5. Budget	9	2	2	3	21
6. Partnerships	9	1	2	4	21
7. Awareness	3	3	2	4	9
8. Contribution	6	3	4	4	22
9. Project Management	6	2	2	3	14
10. Background	6	3	3	4	20
	315	153	176	237	188

OVERALL TECHNICALLY SOUND			
GOOD (IF > 214)	☐	☐	☒
FAIR (200-213)	☐	☐	☐
QUESTIONABLE (IF< 200)	☒	☒	☐

Mandatory Requirements	C1		C2		C3	
Diversification Delivery:	Yes	No	Yes	No	Yes	No
Project enhances the production of clean sustainable energy, to make the State a world leader in the production of clean sustainable energy, and/or to diversify and grow the State’s economy.	✓		✓		✓	
Commercialization or Development/Expansion:	Yes	No	Yes	No	Yes	No
Concept will lead to the **large-scale development and commercialization** of projects, processes, activities, and technologies that reduce environmental impacts and/or increase sustainability of energy production and delivery.		✓	✓		✓	
In State Requirement:	Yes	No	Yes	No	Yes	No

The funds distributed from the financial assistance are to be applied to support in-state activities and must have other sources of financial support.	✓		✓		✓	

1. The objectives or goals of the proposed project with respect to clarity and consistency with Clean Sustainable Clean Energy Authority goals of projects, processes, activities, and technologies that reduce environmental impacts and increase sustainability of energy production and delivery are: 1 – very unclear; 2 – unclear; 3 – clear; 4 – very clear; or 5 – exceptionally clear.

Reviewer C1 (Rating 3)
The objectives are indicated, and some goals appear to reduce environmental impacts like cleaning up the pre-processed mine waste in Minnesota which would be processed in North Dakota, but they do not address a market for the byproducts (waste) in the process in North Dakota. They state that the rock could be used in the concrete industry. Nice to clear up the waste in Minnesota and reclaim the land, but what happens to the byproducts in North Dakota?

Reviewer C2 (Rating 3)
The proposed project has as its objective commercialization of a "Green pig iron facility" in North Dakota. It has the potential to reduce flaring of produced natural gas from North Dakota oil production. This activity includes the feasibility and permitting phases of the project.

Reviewer C3 (Rating 4)
The objectives are clear and focus on integrating green pig iron production into clean energy power generation. Both energy and iron production would provide lowered carbon footprint. Iron production would target 96% reduction in carbon dioxide emissions.

2. The objectives will make a difference in the near term to the state's economy: 1 – no impact; 2 – small impact; 3 – likely impact; 4 – most likely impact; or 5 – significant impact.

Reviewer C1 (Rating 3)
There appears to be a potential for positive impacts upon the economy of North Dakota if the process is able to produce enough usable iron to be profitable and if the byproducts can be sold and used by others.

Reviewer C2 (Rating 4)
The proposed activity could result in significant impacts on the ND economy if it proceeds to the next phase of construction and operation. This would include both the large construction activity required to construct the processing facility and continued operation.

Reviewer C3 (Rating 4)
Commercial application is projected to be a $2 billion effort requiring 1000 jobs during construction followed by 500 long term jobs. Commercial application will depend on findings of the proposed study.

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

Reviewer C1 (Rating 3)

There is no discussion of the process of separating the hydrogen from the flare gas. Basic information is supplied with little/no discussion of the chemistry or chemical process. There should also be information related to any discussion that may have taken place with the Minnesota DNR about land reclamation and removal of the waste stockpiles and there will need to be further discussion regarding carbon sequestration in North Dakota in light of the current ongoing discussions in the State at this time regarding that topic.

Reviewer C2 (Rating 3)

The methodology suggested in this proposal is light on details that this reviewer would like to see. For instance, is the ore tailings facility in Minnesota completed, or will it be financed along with the proposed plant in ND? Has there been discussion with ND oil/gas producers and will that include additional gathering and processing operations to produced gas to eliminate the currently required flaring?

Reviewer C3 (Rating 4)

The quality and clarity of the technique is well explained at a high level. The proposal does refer to "accelerating processes that may lead to green steel with much lower emissions"; the reviewer would like technology maturity / readiness discussed with the CSEA members.

4. The facilities and equipment available and to be purchased for the proposed pilot or commercialization strategy is: 1 – very inadequate; 2 – inadequate; 3 – adequate; 4 – notably good; or 5 – exceptionally good.

Reviewer C1 (Rating 2)

There is no discussion of facilities and equipment to be purchased other than providing diagrams of the process. There is a letter of interest with "Rainbow Energy" to enter into a potential property lease for facility construction.

Reviewer C2 (Rating 2)

The equipment called out in the proposed project appears adequate for this phase of the project, there are significant pieces of equipment for the overall activity that were not described in the information submitted. That would need to be provided before this reviewer would feel comfortable.

Reviewer C3 (Rating 4)

The bulk of the proposed work is for engineering and planning. Since the project is more of a paper study this category does not directly apply. Was scored as a 4 since equipment availability should not be a concern.

5. The proposed budget is comprehensive and sufficient relative to the outlined work and the timetable: 1 – not sufficient; 2 – possibly sufficient; 3 – likely sufficient; 4 – most likely sufficient; or 5 – certainly sufficient.

Reviewer C1 (Rating 2)
The budget does not identify other project sponsors if they are viable. In the abstract, it is stated that "Scranton Holding Company will seek strategic relationships in the metals processing industry to assist in project completion".

Reviewer C2 (Rating 2)
The information provided is not in sufficient detail for this reviewer to be confident in its sufficiency to complete the outlined work. A $27 million dollars budget would require more detail and due diligence prior to this reviewer suggesting the State of ND provide the $12 M in grant funding requested.

Reviewer C3 (Rating 3)
Additional cost detail would have been preferred to better evaluate the proposal, but the budget is likely adequate when considering projects of similar size and complexity. The budget shows expenses for stock offerings which should be explained to determine if it is an allowable budget item under CSEA.
Also, is the requested amount within the program limits for CSEA grants?

6. **The appropriate strategic partnerships are in place for short and long term plans to be successful: 1 – very limited; 2 – limited; 3 – adequate; 4 – better than average; or 5 – exceptional.**

Reviewer C1 (Rating 1)
Again, in the proposal it is stated that "Scranton Holding Company will seek strategic relationships in the metals processing industry to assist in project completion".

Reviewer C2 (Rating 2)
The proposal includes some critical partnerships that have been established. My concern is not with those partnerships noted but the ones that are not in place. There should be an oil/gas producer and I would have hoped an off-take partner for the pig iron produced. In addition, I would have liked to see more on the potential financing for commercial facility in ND. Not that it would require all the dollars to be identified but I would like more confidence that the group would be able to successfully raise the $2 billion plus dollars required. The goal is to have a commercial plant.

Reviewer C3 (Rating 4)
Have engaged steel industry experts, and engineering expertise. Also in communication with REC on integration with the power production and carbon management.

7. **The likelihood that the project approach (time & budget) will achieve its technical and market goals is: 1 – not achievable; 2 – possibly achievable; 3 – likely achievable; 4 – most likely achievable; or 5 – certainly achievable.**

Reviewer C1 (Rating 3)
Construction to start in 2026 with completion in 2029. There are still a number of permitting processes that must be completed before construction can begin.

Reviewer C2 (Rating 2)

The reason for the lower score noted is the lack of details in the proposal. This reviewer sees significant merit to the proposed activity but would require more information to be comfortable with the State of North Dakota investment of $12, 000,000.

Reviewer C3 (Rating 4)
The proposed effort is on an aggressive 21-month schedule, but that should be reasonable compared to projects of similar size and detail. A question for the project team would be whether there are any permit scheduling concerns. The extended schedule shows follow-on procurement beginning in early 2025.

8. The scientific and/or technical contribution of the proposed work to specifically address Clean Sustainable Energy Authority goals of impacting technology used in North Dakota's energy industries will likely be: 1 – extremely small; 2 – small; 3 – significant; 4 – very significant; or 5 – extremely significant.

Reviewer C1 (Rating 3)
Even if not significant, any incremental contribution to address Clean Sustainable Energy Authority goals is welcome.

Reviewer C2 (Rating 4)
The proposed activity has the potential to benefit the State of North Dakota by addressing the goals of the CSEA.

Reviewer C3 (Rating 4)
The project is not directly energy industry but is energy intensive iron production that could have a large impact on North Dakota's economy, while integrating well with the oil & gas and coal power industries.

9. The project management plan, including budgeting projections, partner connections and well-defined milestone chart is: 1 – very inadequate; 2 – inadequate; 3 – adequate; 4 – notably good; or 5 – exceptionally good.

Reviewer C1 (Rating 2)
There are no significant partners in this proposal, only experts in the feasibility phase. There are no other companies involved and discussions have only begun with investment firms.

Reviewer C2 (Rating 2)
More details would be required. I would want to see a series of go/no go decision points to allow for the funding group to monitor progress.

Reviewer C3 (Rating 3)
As mentioned above additional cost detail would have been preferred to better evaluate the proposal, but the budget is likely adequate when considering projects of similar size and complexity. Similarly, more detail in the management plan would have been helpful for the review.

10. The background and experience of the project principals with regards to technical qualifications and competence is: 1 – very limited; 2 – limited; 3 – adequate; 4 – better than average; or 5 – exceptional.

Reviewer C1 (Rating 3)
A number of individuals involved in this proposal have engineering experience in metallurgy, but they are only in discussion with potential partners.

Reviewer C2 (Rating 3)
The assembled team is made up of highly qualified technical staff.

Reviewer C3 (Rating 4)
They have a lot of experience in the iron mining and production industries and are engaging in partnerships as needed to add to their expertise. They are working with REC on integrating with the energy side. REC and EERC could be of further help as they address carbon storage.

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 the project is technically sound.

Reviewer C1
The iron recovery from waste stockpiles in Minnesota mining area would be great for the environment, but permitting requirements must first be explored. It seems the project would be successful providing there is a secure disposal option for the process waste because North Dakota does not need to have waste from Minnesota sitting in North Dakota.
There is no discussion regarding the quantity of iron that could be reclaimed, therefore it appears that this proposal may not be profitable or technically sound.

Certification:
I hereby certify that all Confidential Information and all embodiments thereof, including all copies and electronic files, have been destroyed in accordance with Section 2 of the Nondisclosure Agreement.

Reviewer C2
The proposed project offers an opportunity for significant economic value to the state of North Dakota and its residents. Although this reviewer has pointed out a number of concerns with the proposal as written, I would encourage the CSEA to work with the proposers to obtain the details that are not included such that a more realistic evaluation of the proposed activity could be completed.

Reviewer C3
The proposed project would have a very large economic impact in North Dakota if it were to move forward to commercialization. The estimated commercial impact include a $2 billion effort that would require approximately 1000 jobs during construction and 500 jobs during operations. The project appears to be technically sound and the proposed work will directly reduce many of the uncertainties relating to costs, permits, financing, markets, and others.

Scranton Holding Company

3402 15th Ave East, Hibbing MN 55746

October 30, 2023

Clean Sustainable Energy Authority
North Dakota Industrial Commission
Bismarck, ND

Dear Commission Members:

Scranton Holding Company and our North Dakota subsidiary North American Iron, Inc. are pleased to submit this application for grant funding from the Clean Sustainable Energy Authority (CSEA).

Included electronically with this letter are our application and supporting documents. We have not included any loan guarantee documents as we are not seeking any loans. We hereby authorize the CSEA to use the confidential Business Plan included herein for the purposes of reviewing the application (but for no other purposes).

We are excited to be working with North Dakota on our green pig iron processing project. The combination of geography and energy resources are critical drivers to making the project viable. We see a multi-faceted beneficial outcome to the state, the state's energy industry and our shareholders. Additionally, the project's intention is to replace high-carbon emission imported iron with a near neutral carbon, domestic source which benefits the entire country.

Please contact us as needed during your review of the application and we welcome the opportunity to meet further to present our plans.

Sincerely,

Jim Bougalis

James G. Bougalis
CEO

Attachments

Clean Sustainable Energy Authority

North Dakota Industrial Commission

Application

Project Title: "Green" pig iron production facility

Applicant: Scranton Holding Company/North American Iron, Inc.

Date of Application:

October 30, 2023

Amount of Request

Grant: $12,000,000

Loan: -0-

Total Amount of Proposed Project:

Feasibility/permitting phases - $27 million

Construction/operation - >$2 billion

Duration of Project:

First production of pig iron - 2029

Point of Contact (POC):

James Bougalis

POC Telephone:

218-969-6551

POC Email:

jimbougalis@gmail.com

POC Address:

3404 15th Ave. East Unit #1

Hibbing Minnesota 55746

TABLE OF CONTENTS

Please use this table to fill in the correct corresponding page number.

ABSTRACT

Objective: The mission of North American Iron, Inc. (NAI)[1] is to produce "green" merchant pig iron by replacing today's internationally sourced high carbon emission iron with a profitable, near carbon-neutral, United States-based solution. NAI is seeking deep decarbonization that significantly lessens carbon intensive industrial production processes leading to sustainable steel; timeliness by accelerating processes that may lead to green steel with much lower emissions; and market viability by transacting with some of the largest steel buyers in the U.S. Moreover, NAI seeks to address the waste stockpiles created through mining via reclamation.

Intended Results:

- Commercialization: NAI intends to construct a processing facility in North Dakota that produces 2 million tons of "green" pig iron for use in U.S. foundries and steel operations. Construction will involve up to 1,000 jobs for two to three years and plant operations will involve up to 500 employees on an ongoing basis.

- Emissions Reduction/Resource Synergies
  - NAI intends to reform the natural gas used in the process by removing the carbon for ultimate sequestration back into the earth and utilize hydrogen for its iron making process.
  - Relative to foreign sourced pig iron with an average 2.3 ton of carbon emissions per ton of pig iron produced, NAI intends to have a footprint of .1 ton of carbon emissions per ton of pig iron produced; over a 96% reduction.
  - NAI intends to reduce United States dependence on foreign imports.

- Reduced Environmental Impacts
  - The process is intended to produce minimal CO2 emissions and only two repurposed available byproducts, one of which is aggregate or concrete additive, and the other which is a farmland soil additive.
  - Initial ore extraction is intended to occur through reclamation of existing iron ore residue stockpiles in Northern Minnesota, with the intention of future use as forests, wetlands, parks or development.
- Increased Energy Sustainability and Synergy
  - NAI intends to use locally produced electricity and natural gas with the objective of minimal impacts to the existing transmission system.
  - NAI natural gas use and carbon sequestration will help sustain and allow increased North Dakota energy production and contribute to reduction of emissions and flaring.
  - NAI carbon capture intentions may help North Dakota oil production through enhanced oil recovery with 1.6 million tons of CO2 produced for every 2 million tons of pig iron produced.

Duration: The project involves approximately 21 months to go through the design and permitting phase. Upon permitting, construction will commence and take approximately 3 years. First production of pig iron is anticipated in 2029.

[1]Scranton Holding Company (SHC) is the parent company of NAI. Since 2020, SHC has been working to develop a process that produces merchant pig iron in a manner that, after a hydrogen based iron making process and sequestration, generates nominal net carbon emissions and reduces U.S. dependency on foreign iron.

Total Project Cost: The cost to bring the project through its feasibility, design and permitting phase is approximately $27 million. The cost to construct the processing facility and put other logistics in place is expected to exceed $2 billion.

Participants: SHC/NAI has involved experts in the feasibility phase of the project including Kiewit Corporation (Kiewit) and Tenova, Inc. (Tenova). When permitting is imminent, SHC will seek strategic relationships in the metals processing industry to assist in project completion. SHC has also begun discussions with investment firms on the financing of the processing facility.

PROJECT DESCRIPTION

Objectives:

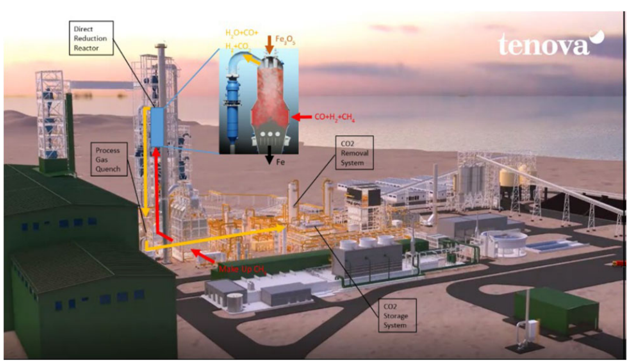
NAI's mission is to promote "green" production of merchant pig iron by replacing today's internationally sourced high carbon emission iron with a profitable, near carbon-neutral, United States-based solution. NAI is seeking deep decarbonization that significantly lessens carbon intensive industrial production processes leading to sustainable steel; timeliness by accelerating processes that may lead to green steel with much lower emissions; and market viability by transacting with some of the largest steel buyers in the U.S. Moreover, NAI seeks to address the waste stockpiles created through mining via reclamation.

Methodology:

SHC has also developed a proprietary mining plan for the Calumet reserve and intends to construct a facility in North Dakota to utilize pre-processed mine waste and convert it to pig iron. This conversion process is intended to eliminate the use of coal or coke, reduce carbon emissions substantially, and capture and sequester the remaining carbon.

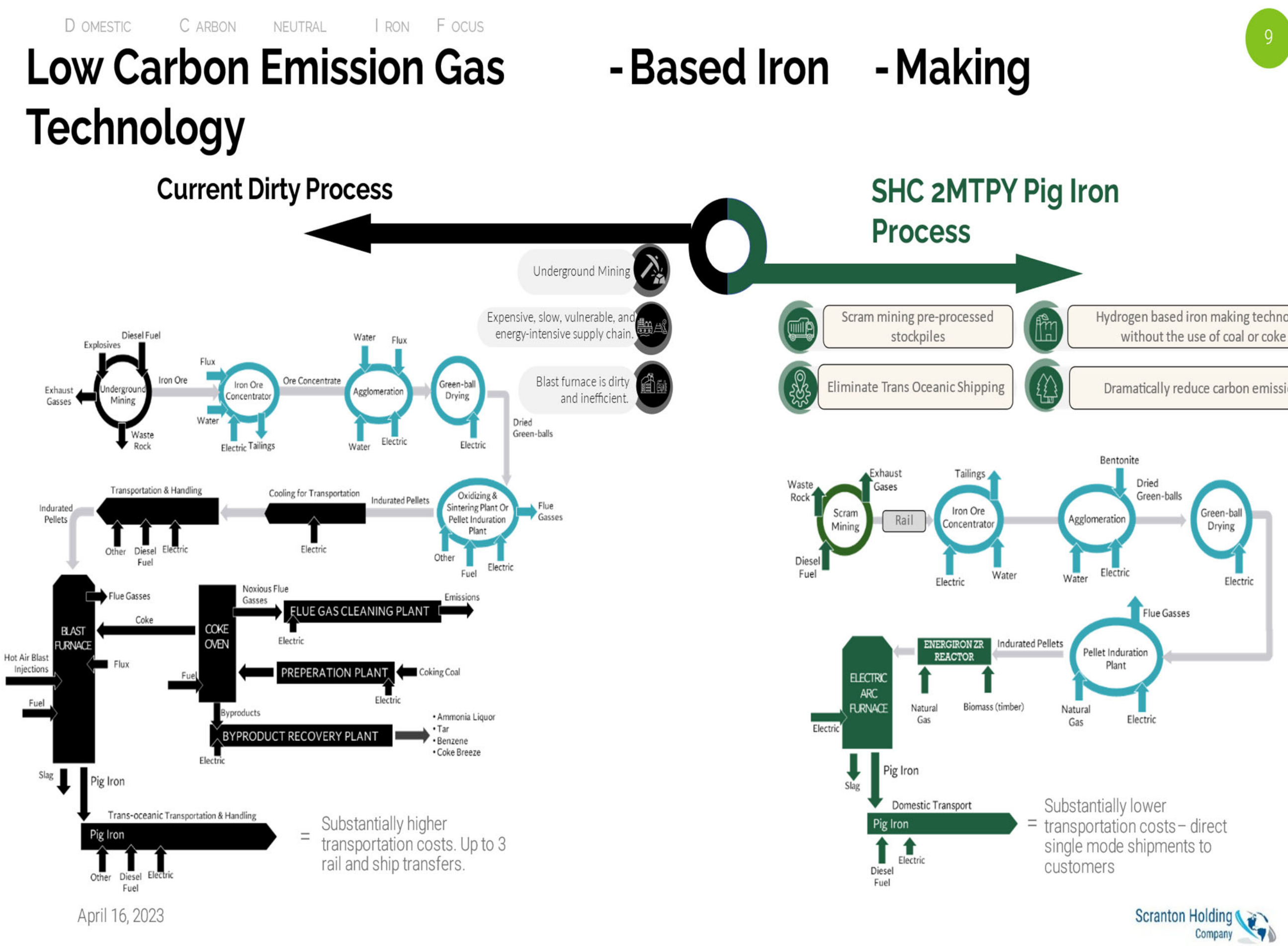
Conversion Process: Current iron making processes require iron ore and coke to form pig iron in a blast furnace. Contaminants within the iron ore are removed by adding different fluxes, such as limestone or feldspar. The flux converts the impurities in the iron to meltable slag. A typical blast furnace is used in this process. Hot air is blown through water cooled pipes into the lower part of the furnace known as the bosh. The floor of the furnace has discharge apertures that are typically sealed with refractory clay and may be opened to tap the molten iron. Above the apertures are additional skimmer openings to release the slag. A double bell system is used at the top of the machine to seal gases inside while providing the furnace with iron ore, coke and flux. Gases exit the top of the furnace through dedicated pipes.

New Production Strategies for Near Zero Emissions: Beyond the large number of emissions, this process causes current pig iron merchants to also face challenges and limitations, such as 1) logistics – multiple transloading, intermodal storage, trans-oceanic shipping, and a vulnerable supply chain; 2) high carbon emissions – coke/coal process with toxic byproducts; shipping related emissions, and product cooling, handling, and reheating; and 3) domestic barriers –such as political challenges.



Given the noted challenges with current iron making processes, NAI is proposing to use the Tenova hydrogen-based HYL iron making process (pictured to the left), which includes a complete amine carbon capture system. This system takes carbon emissions and converts them to CO2. The CO2 conversion results in a food grade CO2, available to provide to the domestic CO2 industry with any surplus CO2 being sequestered. Tenova's Open Slag Bath Furnace ("OSBF") produces a low Sulfur and Phosphorus pig iron product, which may be used by U.S. steel mills and foundries. Figure 1 shows the differences in the current and green steel making processes. NAI's ultimate goal is to develop a large-scale plant to process pig iron (2 MTPY by 2029) that is low cost, has near net zero emissions, and greatly reduces the U.S.' dependency on foreign iron.

Figure 1: Difference between the Current Steel Making Process and the Low Carbon Emission Gas-Based Iron-Making Technology



Moreover, through this process, Calumet Reclamation Company, a Minnesota corporation ("CRC"), a wholly-owned subsidiary of SHC, intends to take waste stockpiles and utilize mining reclamation, so land can be reshaped. For the proposed project, CRC plans to process mine waste stockpiles on site at the reserve in Calumet, Minnesota, converting them into usable acreage. CRC intends to remove the iron from the stockpiles and reform the land to a usable condition for forest, wetlands, recreational use, or other purposes.

Anticipated Results:

- Emissions Reduction/Resource Synergies
  - **The process requires large amounts of natural gas usage (63 MMCF per day)**, however NAI intends to reform the natural gas by removing the carbon for ultimate sequestration and utilizes hydrogen for its iron making process. **Alternatively, NAI's process for natural gas may be replaced with up to 100% direct hydrogen** (a video outlining this process may be viewed at the following link: https://www.youtube.com/watch?v=r-T0ypH9qDY&t=2s)

    - NAI intends to reduce United States dependence on foreign imports, with the goal of lowering the need for increased mining and processing in other countries which may not hold as strong environmental impact standards as the United States.
- Reduced Environmental Impacts
    - The process is intended to produce two by products, one of which is a slag rock (~400k tons per year) utilized as an aggregate or a concrete additive, and the other of which is a tailings sand (~1.4 million tons per year) that can be utilized in fertilizer or as a farmland soil additive.
- Increased Energy Sustainability
    - Energy sustainability is an objective of the process. While natural gas is planned to be utilized in large quantities, the carbon will be removed from the natural gas and sequestered back into the earth, then utilize the remaining hydrogen to fuel the iron making process.
    - The electric arc furnaces require over 70MW of electrical input with peak levels over 120MW. NAI intends to use locally produced electricity with the objective of more production and minimal impacts to the existing transmission system, which is intended to help grow and sustain North Dakota energy production.
- Commercialization
    - NAI intends to manufacture 2 million tons of pig iron for use in the United States reducing the need for foreign imports. NAI's process is intended to yield a competitive manufacturing cost profile relative to the current low-cost providers.
- Value and Synergies for North Dakota
    - The use of natural gas and carbon sequestration in the NAI process is intended to work synergistically with the oil and gas business sector, as well as the groundbreaking carbon sequestration business sector in North Dakota. **This scale of natural gas usage is intended to contribute to North Dakota's goals of reduction of emissions and flaring.** This scale of natural gas usage East of the Bakken is intended to promote gas pipeline infrastructure improvements. (See chart attached as "Other Appendix")
    - **NAI plans to produce 1.6 million tons per year of CO2 for sequestration.** Further, in the long term the project has the capability to expand and provide CO2 for use in enhanced oil recovery ("EOR").
    - The soil additive by product may assist in the logistical fertilizer challenges in the State and may be synergistic with future fertilizer facilities as an additive. This may positively impact the North Dakota agricultural sector by helping to source products locally in the state.
    - NAI may employ up to 1,000 North Dakota residents for construction of its plant. In addition to the intended preservation of existing jobs in the area (from the use of resources and byproducts), NAI initially plans to employ up to 500 people for the operation of its 2 million ton per year iron manufacturing facility. However, with the feedstock reserves in Minnesota, NAI may be able to expand its operations to employ over 1,500 people.

Facilities:

The facility is planned to be constructed in Underwood, North Dakota and NAI has a non-binding letter of interest dated April 28, 2023 from the land holder (Rainbow Energy Center) to enter into a real property lease. This location has ready access to water supply and power supply, and is located near existing rail lines.

Resources:

SHC, NAI and CRC are in discussions with industry leaders, including Kiewit Corporation, a corporation specializing in mine management, production, infrastructure construction, maintenance and contract mining ventures, and Tenova, a vendor/engineer for the provision of hydrogen-based iron making processes.

Techniques to Be Used, Their Availability and Capability:

See methodology above.

Environmental and Economic Impacts while Project is Underway:

There is a trend to move towards carbon-reducing technologies for steel production. As discussed, given the noted challenges with current iron making processes, NAI is proposing to use the Tenova hydrogen-based HYL iron making process which includes a complete amine carbon capture system. This system takes carbon emissions and converts them to CO2. The CO2 conversion results in a food grade CO2, available to provide to the domestic CO2 industry with any surplus CO2 being sequestered onsite. Tenova's OSBF produces a low Sulfur and Phosphorus pig iron product, which may be used by U.S. steel mills and foundries (see "Methodology" above).

Ultimate Technological and Economic Impacts:

The domestic demand for merchant pig iron is currently being met by importing this product from foreign countries – Brazil, Russia/Ukraine, India, China, and others. The cost and logistical advantages achieved by this project may give NAI an advantage over global competitors, including large steel companies. The objective is to: 1) utilize hydrogen-based iron making technology to produce pig iron from mine waste; 2) develop green domestic merchant pig iron, eliminating trans-oceanic shipping; 3) potentially create an estimated 1,000 North Dakota construction jobs, and long-term approximately 500 North Dakota plant operation jobs in North Dakota and an additional estimated 150 jobs in Minnesota; 4) expand on available land in Minnesota's Northland for environmental or recreational use; 5) develop a plant for the production of pig iron, and 6) allow increased energy production in North Dakota through natural gas consumption and carbon sequestration and contribute to enhanced oil recovery.

Why the Project is Needed:

SHC views the project as vital for reducing reliance on high-carbon emission foreign imports while best leveraging natural resources in the region. It is SHC's belief that this project is only viable due to the combination of existing underused iron resources in Minnesota in close proximity to North Dakota and its energy industry output and input needs to create a low-carbon footprint product.

STANDARDS OF SUCCESS

The standards by which the success of the project is to be measured. This may include:

- *Emissions reduction.*
- *Reduced environmental impacts.*
- *Increased energy sustainability.*
- *Value to North Dakota.*
- *Explanation of how the public and private sector will make use of the project's results, and when and in what way.*
- *The potential commercialization of the project's results.*
- *How the project will enhance the research, development and technologies that reduce environmental impacts and increase sustainability of energy production and delivery of North Dakota's energy resources.*
- *How it will preserve existing jobs and create new ones.*
- *How it will otherwise satisfy the purposes established in the mission of the Program.*

As discussed above, the project will be measured by achieving the key outcomes below while also being a profitable business that produces an acceptable return to investors.

Key outcomes:

- Emissions Reduction/Resource Synergies; relative to imported iron
- Reduced Environmental Impacts; reclamation, byproduct use
- Increased Energy Sustainability; carbon sequestration
- Commercialization Success; produces acceptable profitability
- Value and Synergies for North Dakota; jobs, benefits to energy industry

BACKGROUND/QUALIFICIATIONS

Please provide a summary of prior work related to the project conducted by the applicant and other participants as well as by other organizations. ***This should also include summary of the experience and qualifications pertinent to the project of the applicant, key personnel, and other participants in the project.***

See below for a copy of all biographies and resumes of the current project team.

James Bougalis

Mr. Bougalis is the CEO of Scranton Holding Company, North American Iron, Inc., and Calumet Reclamation Company. Mr. Bougalis is the Lead Project Manager for this initiative. Mr. Bougalis is the founder of Bougalis Companies, a civil construction firm located in Hibbing Minnesota. This firm specializes in underground utilities, road and site construction, demolition, and scrap processing. Mr. Bougalis also founded Scranton Iron, Inc., a full-service recycling hub located in the center of Minnesota's Iron Range.

Johann Grobler

Mr. Grobler is SHC's chief engineer. He has 40 years of experience in project management and engineering in iron ore, specifically in preliminary processing methods. Mr. Grobler's unique expertise and original contributions fall in two distinct areas: technical innovation and business management. Mr. Grobler has made original contributions in the development of three innovative technologies, including iron ore characterization, Ultra-High Dense Medium Separation, and ferrosilicon production. While each of these innovations may be used individually to solve various challenges in the mining industry, these technologies are also used in tandem to process low-grade iron ore dumps, such as those found in Minnesota, into sellable iron ore.

Dale Hintsala

Mr. Hintsala is the former President of Noramco Engineering Company, Hibbing, Minnesota. Mr. Hintsala graduated from Michigan Technological University with a Bachelor of Science degree with honors in Civil Engineering. Mr. Hintsala previously worked for Davy McKee in the position of Manager of Engineering for the Hibbing, Minnesota branch. More recently, Mr. Hintsala was one of the founders and President of Noramco Engineering Company, Hibbing, Minnesota.

Dan Hintsala

Mr. Hintsala has been in the mining engineering field for over 50 years. Mr. Hintsala founded and operated U.P. Fabricators for 25 years. Mr. Hintsala graduated from Michigan Technological University in 1964 as a Mechanical Engineer. He began his career in the mining industry with Hanna Mining Company in Iron River, Michigan. In 2005, Mr. Hintsala became part of a new Michigan company called UP Steel. With UP Steel, Mr. Hintsala received a $550,000 grant from Michigan State to design and build a rotary hearth furnace to turn iron ore into an iron nugget using microwave as the heating source. Mr. Hintsala designed the system used as a pilot project to process iron ore to manufacture iron nuggets.

Bruce Kettunen

Mr. Kettunen spent nearly 30 years as the Senior Process Engineer for Noramco Engineering Corporation. In this role he worked in mineral process engineering for projects in iron ore, industrial minerals, base metals, precious metals, and the chemical and pyro processing industries. Prior to taking on this role, Mr. Kettunen spent 10 years working as a Senior Engineer for United States Steel Corporation. He has his Bachelor of Science in Metallurgical Engineering from Michigan Technological University.

Gary Liubakka

Mr. Liubakka serves as a member of the Board of Directors and will provide oversight of mineral resources and characterization. As a fee representative of Great Northern Iron Ore Properties for over 25 years, he has logged and recorded the iron deposits across the Mesabi Range. Mr. Liubakka has been involved in the development of numerous technologies in the field of mining and oil. He has provided assistance to multiple mining operations on the Iron Range to include geological exploration and mining process evaluations.

James Sellner

James Sellner PE, PG, Sellner is SHC's mineral leasing and permitting specialist. He has been an engineer for 40 years and has worked in various aspects of mining engineering. For the past 4 years, he has served as a Mining and Geological Engineering consultant. In this role, he has performed lease negotiations and drafted mineral and surface leases for clients. Mr. Sellner also has experience performing mineral and surface title research. Mr. Sellner is a licensed professional engineer and geologist in the state of Minnesota.

Intended Industry Relationships

SHC, NAI and CRC are in discussions with industry leaders, including Kiewit Corporation, a corporation specializing in mine management, production, infrastructure construction, maintenance and contract mining ventures, and Tenova, a vendor/engineer for the provision of hydrogen-based iron making processes.

Kiewit Corporation

According to www.Kiewit.com, Kiewit is one of North Americas largest construction and engineering organizations (described as a $13.7 billion organization with over 25,700 staff and craft employees). Kiewit has developed a permitting plan for the proposed project. SHC/NAI intend to utilize Kiewit to serve as the general contractor for construction of the processing facility in North Dakota.

Tenova, Inc.

According to www.tenova.com, Tenova is a $1 billion multinational organization and a leading designer and developer of technological solutions for metal processing that reduce costs, save energy, decarbonize steel production and reduce environmental impacts (wholly owned by the Techint Group, a $25.5 billion (2022) multinational conglomerate with 52,000 employees globally dedicated to steel making, building of complex infrastructures, technologies for the metals and mining industries and several other related industries). SHC/NAI intend to utilize Tenova's hydrogen-based HYL iron making process (see "Methodology" above).

MANAGEMENT

*A description of **how** the applicant will manage and oversee the project to ensure it is being carried out on schedule and in a manner that best ensures its objectives will be met, **and a description of the evaluation points to be used** during the course of the project.*

The existing team will oversee the feasibility and permitting phase to fruition.

When permitting is imminent, NAI will seek strategic relationships in the metals processing industry to assist in project completion and ongoing operations. At such time, NAI intends to recruit executive talent with extensive large plant operation skillsets. SHC has also begun discussions with investment firms on the financing of the processing facility.

TIMETABLE

Please provide a project schedule setting forth the starting and completion dates, dates for completing major project tasks/activities, and proposed dates upon which the interim reports will be submitted.

Begin FEL-2 phase (design and permitting)	Q423
Determine financing plan	Q324
Complete FEL-2	Q225
Begin procurement and delivery	Q225
Begin construction	Q126
End construction/begin commissioning	Early 2029
Begin operations	Summer/Fall 2029

NAI is willing to provide regular updates to the CSEA to match this timetable or as otherwise requested.

BUDGET

*Please use the table below to provide an **itemized list** of the project's capital costs; direct operating costs, including salaries; and indirect costs; and an explanation of which of these costs will be supported by the financial assistance and in what amount. The budget should identify all other committed and prospective funding sources and the amount of funding from each source. **Please feel free to add columns and rows as needed.** Higher priority will be given to projects with a high degree of matching private industry investment.*

Project Associated Expense	NDIC Grant	NDIC Loan	Applicant's Share (Cash)	Other Project Sponsor's Share	Total
Engineering/permitting	3,600		3,600		7,200
Wages/benefits	1,300		1,300		2,600
Mineral exploration/testing	550		550		1,100
Capital equipment	300		300		600
Legal/accounting/tax	450		450		900
G&A/office/other	400		400		800
Contingent FEL-2	400		400		800
Stock offering expenses			1,200		1,200
FEL-3/early next phase activity	5,000		6,800		11,800
Total	12,000		15,000		27,000

Dollars in 000s; for current phase of project (feasibility, design and permitting; approximately 2 years)

Please use the space below to justify project expenses and discuss whether the project's objectives will be unattainable or delayed if less funding is available than requested.

The budget presented above mainly supports the FEL-2 (front end loading) phase where SHC's design and permitting contractors will perform full scale engineering work on the process and facility (including equipment) and apply for all permits. The remainder of the budget is intended to be utilized for consultants and internal support staff needed to complete this phase. Additionally, continued mineral exploration, testing and acquisition work will be required. SHC believes the budget is reasonable for other related administrative expenses.

However, SHC believes that without grants under CSEA that the project could be slowed. Although SHC is seeking equity financing in a Series B round, there are no assurances that SHC will achieve a full subscription. SHC also wishes to get a head start on post FEL-2 activities that will support achieving operational functionality in 2029. Without grant funds, the timing could be further delayed.

CONFIDENTIAL INFORMATION

A person or entity may file a request with the Commission to have material(s) designated as confidential. By law, the request is confidential. The request for confidentiality should be strictly limited to information that meets the criteria to be identified as trade secrets or commercial, financial, or proprietary information. The Commission shall examine the request and determine whether the information meets the criteria. Until such time as the Commission meets and reviews the request for confidentiality, the portions of the application for which confidentiality is being requested shall be held, on a provisional basis, as confidential.

If the confidentiality request is denied, the Commission shall notify the requester and the requester may ask for the return of the information and the request within 10 days of the notice. If no return is sought, the information and request are public record.

Note: Information wished to be considered as confidential should be placed in separate appendices along with the confidentiality request. The appendices must be clearly labeled as confidential. If you plan to request confidentiality for **reports** if the proposal is successful, a request must still be provided.

To request confidentiality, please use the template available at http://www.nd.gov/ndic/CSEA-app-doc-infopage.htm.

NOTE ON BUSINESS PLAN IN APPENDIX TO THIS APPLICATION. SHC HEREBY AUTHORIZES THE COMMISSION TO COPY OR REDISTRIBUTE THE BUSINESS PLAN AT THE COMMISSION'S DISCRETION AS REQUIRED TO EVALUATE AND PROCESS THIS APPLICATION (BUT NOT FOR ANY OTHER PURPOSE).

PATENTS/RIGHTS TO TECHNICAL DATA

Any patents or rights that the applicant wishes to reserve must be identified in the application. If this does not apply to your proposal, please note that below.

None noted.

STATE PROGRAMS AND INCENTIVES

Any programs or incentives from the State that the applicant has participated in within the last five years should be listed below, along with the timeframe and value.

SHC has applied with the North Dakota Development Fund for an investment. This is currently contemplated as an equity investment of $3 million.

Industrial Commission

Tax Liability Statement

Applicant:

Scranton Holding Company/North American Iron, Inc.

Application Title:

"Green" iron production facility

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

James Bougalis, CEO

Title

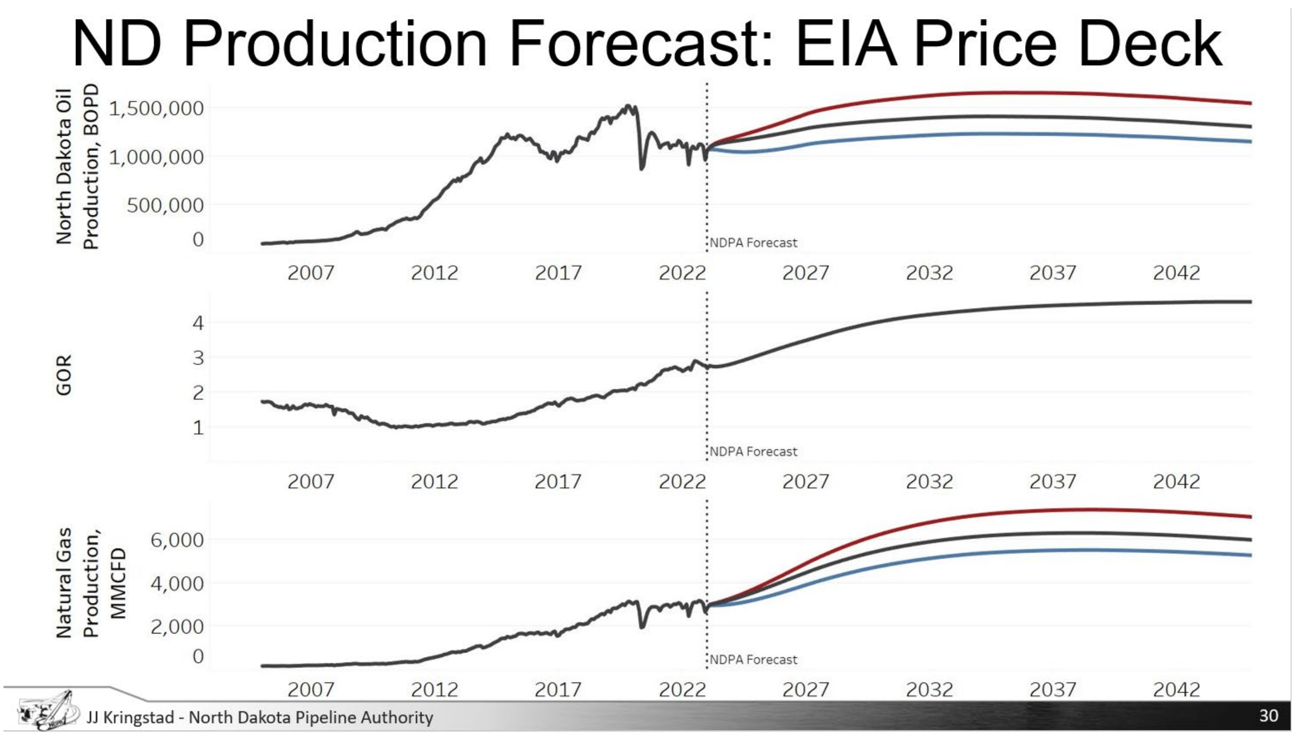
October 30, 2023

Date

Other Appendix

Scranton Holding Company Green Pig Iron Processing Facility

<u>Natural Gas Production Forecast North Dakota</u>



RAINBOW
ENERGY CENTER

2875 Third Street SW
Underwood, North Dakota 58576
701.207.9988
rainbowenergycenter.com

October 26, 2023

Mr. Jim Bougalis
Scranton Holding Company
jimbougalis@gmail.com

By Electronic Mail

Re: Letter of Support for Scranton Holding Company

By this letter, Rainbow Energy Center, LLC ("REC") offers its support for Scranton Holding Company ("Scranton") and its continued development of a business plan to produce merchant pig iron in a manner that, after a hydrogen based iron making process and carbon sequestration, generates nominal net carbon emissions and reduces US dependency on foreign iron (the "Project").

REC and Scranton are engaged in ongoing discussions regarding the Project and remain excited about the potential for this Project to develop at REC's Coal Creek Station located near Underwood, North Dakota. As we continue to execute our vision to reduce carbon emissions at Coal Creek Station, we welcome the opportunity for potential partnerships with companies such as Scranton that complement our vision.

Specifically, Scranton is seeking results such as commercialization, emissions reduction, resource synergies, reduced environmental impacts and increased energy sustainability, all of which align with REC's goals. Furthermore, REC has the ability to provide Scranton adequate water supply, power supply and existing rail, making Coal Creek Station an attractive site for the Project. Finally, the Project has the potential to foster development and growth for local communities such as Underwood, North Dakota that are exceedingly important to REC, our employees and their families.

We look forward to continuing our discussions regarding the Project and a potential partnership with Scranton. Please feel free to contact me if you have any questions.

Regards,

Stacy L. Tschider

TELEPHONE 701-223-9282
FAX NUMBER 701-223-4147

3501 E ROSSER AVE
BISMARCK, ND 58501

October 30th, 2023

Mr. Jim Bougalis

Scranton Holdings Company

DMVW, a locally owned and operated shortline railroad company offers its full support for Scranton Holdings Company potentially building their new facility at the Rainbow Energy Center. The economic impact that this will have on the local area will assure that North Dakota will remain strong for generations to come.

Scranton Holdings will create 100's of new jobs both during the construction and ongoing plant operations that will insure that the local communities will thrive even during tough economic conditions. We at DMVW will need to substantially increase our own workforce to be able to serve the needs of Scranton Holdings which will be excellent, long term careers.

At DMVW we feel that with the new carbon sequestration that is happening at Coal Creek Station and the ability to get natural gas produced at North Dakota oil wells, this project will make Scranton Holdings a key producer in the pig iron industry which will reduce the overall need for foreign sourced materials.

We look forward to this opportunity and feel strongly in the goals and long-term outcome for North Dakota and thus DMVW fully supports this project.

Sincerely,

Mark Trottier

DMVW Railroad

Bismarck ND

TECHNICAL REVIEWERS' RATING SUMMARY

C-05-D

Unlocking the Full Potential of Produced Water as a Key Component of Clean Sustainable Energy

Submitted By: Wellspring Hydro

Date of Application: November 2023

Request for $5,000,000 Grant / $25,000,000 Loan

Total Project Costs $324,730,000

		Technical Reviewer			
		D1	**D2**	**D3**	
Rating Category	**Weighting Factor**	**Rating**	**Rating**	**Rating**	**Average Weighted Score**
1. Objectives	3	4	4	5	13
2. Impact	9	5	5	5	45
3. Methodology	9	4	4	5	39
4. Facilities	3	3	3	5	11
5. Budget	9	4	3	4	33
6. Partnerships	9	4	4	5	39
7. Awareness	3	3	3	4	10
8. Contribution	6	4	5	5	28
9. Project Management	6	4	3	4	22
10. Background	6	3	3	4	20
	315	249	240	291	260

OVERALL TECHNICALLY SOUND	D1	D2	D3
GOOD (IF > 214)	☒	☒	☒
FAIR (200-213)	☐	☐	☐
QUESTIONABLE (IF< 200)	☐	☐	☐

Mandatory Requirements	D1		D2		D3	
Diversification Delivery:	Yes	No	Yes	No	Yes	No
Project enhances the production of clean sustainable energy, to make the State a world leader in the production of clean sustainable energy, and/or to diversify and grow the State’s economy.	✓		✓		✓	
Commercialization or Development/Expansion:	Yes	No	Yes	No	Yes	No
Concept will lead to the **large-scale development and commercialization** of projects, processes, activities, and technologies that reduce environmental impacts and/or increase sustainability of energy production and delivery.	✓		✓		✓	

In State Requirement:	Yes	No	Yes	No	Yes	No
The funds distributed from the financial assistance are to be applied to support in-state activities and must have other sources of financial support.	✓		✓		✓	

1. **The objectives or goals of the proposed project with respect to clarity and consistency with Clean Sustainable Clean Energy Authority goals of projects, processes, activities, and technologies that reduce environmental impacts and increase sustainability of energy production and delivery are: 1 – very unclear; 2 – unclear; 3 – clear; 4 – very clear; or 5 – exceptionally clear.**

Reviewer D1 (Rating 4)
The objectives and goals are well defined. Goals as presented will reduce environmental impacts but may still need to address Uranium decay products (Radioactive by-products of uranium decay such as Radium 226, Radium 22&, Uranium, and Thorium which are known to be contained in produced water in the oil industry in North Dakota). These and other radionuclides found in produced water are known as Technologically Enhanced Naturally Occurring Radioactive Material (TENORM) and North Dakota has rules that regulate the handling and disposal of TENORM.

Reviewer D2 (Rating 4)
Objectives are clearly stated, though some aspects are still a little vague. The extraction of lithium is a key factor in energy production and is a potential game-changer for North Dakota.

Reviewer D3 (Rating 5)
Taking a current waste product and developing it into a sustainable, value-added product stream. Removal/conversion of waste products from produced water reduces the environmental impact of oil and gas extraction while creating an in-state facility that provides products currently imported for other industrial uses.

2. **The objectives will make a difference in the near term to the state's economy: 1 – no impact; 2 – small impact; 3 – likely impact; 4 – most likely impact; or 5 – significant impact.**

Reviewer D1 (Rating 5)
The proposal states the goal is to be operational by 1 January 2026, which is only 2 years from now, so in the near term it will make a positive addition to the States economy once that goal is attained.

Reviewer D2 (Rating 5)
This could have a major impact on North Dakota energy production. Not only does this potentially enhance the EV factor but supports oil & gas production and makes a benefit of a waste product.

Reviewer D3 (Rating 5)

The project will employ 250 contractors during the construction phase, beginning as soon as early 2024. Operation in late 2025 will provide additional full-time employment and tax revenue. Availability of product stream aligns with other projects under development in the state.

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

Reviewer D1 (Rating 4)
The entire proposal is very clearly written and clearly demonstrated work of high quality. In addition, Hargrove Engineering ranks #51 in the country and has a large staff and a good reputation.

Reviewer D2 (Rating 4)
The methodology is more clearly described than the previous application, but still not completely clear.

Reviewer D3 (Rating 5)
Applicant has clearly analyzed dynamics and chemistry of produced water in the Williston Basin, as well as market potential of product streams.

4. The facilities and equipment available and to be purchased for the proposed pilot or commercialization strategy is: 1 – very inadequate; 2 – inadequate; 3 – adequate; 4 – notably good; or 5 – exceptionally good.

Reviewer D1 (Rating 3)
It appears that most of the equipment necessary has been identified in the proposal and is either readily available or can be sourced on the open market.

Reviewer D2 (Rating 3)
The required infrastructure needs are clear but some aspects are still questionable.

Reviewer D3 (Rating 5)
The chlor-alkali facility will join dozens of others currently operating around the country. Have also strategically located proposed facility to take advantage of produced water supply and existing infrastructure for environmental management and market access.

5. The proposed budget is comprehensive and sufficient relative to the outlined work and the timetable: 1 – not sufficient; 2 – possibly sufficient; 3 – likely sufficient; 4 – most likely sufficient; or 5 – certainly sufficient.

Reviewer D1 (Rating 4)
The budget presented appears to be very comprehensive and adequately described. It is a rather large budget considering the short timeline front start of construction to production.

Reviewer D2 (Rating 3)

This is beyond my area of expertise.

Reviewer D3 (Rating 4)
Budget has already increased significantly due to inflationary and market implications, current budget has a tight contingency.

6. The appropriate strategic partnerships are in place for short and long term plans to be successful: 1 – very limited; 2 – limited; 3 – adequate; 4 – better than average; or 5 – exceptional.

Reviewer D1 (Rating 4)
There are a number of trained engineers and other subject matter experts listed with Hargrove Engineering Team such as Electrical Engineers, Mechanical Engineers, and Process Engineers. Hargrove Engineering is a large corporation that does Engineering Design, Project Delivery, and Automation.

Reviewer D2 (Rating 4)
The partnerships on the development side are good and an environmental partner is at least started. The relationship is vague though.

Reviewer D3 (Rating 5)
Well-rounded partnerships both locally and nationally.

7. The likelihood that the project approach (time & budget) will achieve its technical and market goals is: 1 – not achievable; 2 – possibly achievable; 3 – likely achievable; 4 – most likely achievable; or 5 – certainly achievable.

Reviewer D1 (Rating 3)
The timetable is aggressive but appears to be achievable. The budget appears appropriate. Permitting could be the holdup on progress unless that process has already been started.

Reviewer D2 (Rating 3)
This is beyond my area of knowledge. This is too important a project to ignore though.

Reviewer D3 (Rating 4)
Project timeline seems aggressive, though project attributes are well-suited to current capital markets to achieve full funding for project deployment. Permitting risk appears minimal.

8. The scientific and/or technical contribution of the proposed work to specifically address Clean Sustainable Energy Authority goals of impacting technology used in North Dakota's energy industries will likely be: 1 – extremely small; 2 – small; 3 – significant; 4 – very significant; or 5 – extremely significant.

Reviewer D1 (Rating 4)

This proposal will have a positive impact on the reduction of salt in oilfield produced water and will produce marketable products here in North Dakota such as Lithium, Sodium Hydroxide that can be used in the coal fired power plants to scrub Sulfur Dioxide.

Reviewer D2 (Rating 5)
If successful, the scientific and technical contributions will be very significant. This will be a game-changer for both the state and the country.

Reviewer D3 (Rating 5)
Project is well-positioned to achieve commercial operation and adapt technology in a novel manner that will benefit several energy industries in the state.

9. The project management plan, including budgeting projections, partner connections and well-defined milestone chart is: 1 – very inadequate; 2 – inadequate; 3 – adequate; 4 – notably good; or 5 – exceptionally good.

Reviewer D1 (Rating 4)
Very well defined and appears to be comprehensive in budgeting, partner connections, and has a well-defined milestone chart. There is a good discussion of partner connections and the work that the engineering firm will be doing on construction.

Reviewer D2 (Rating 3)
Partnerships and milestones are well defined. The likelihood of achieving those milestones is beyond my scope of knowledge.

Reviewer D3 (Rating 4)
As mentioned under previous items, project timeline and budget are notably tight on contingencies, though application overall demonstrates attention to detail with respect to budgeting and schedule.

10. The background and experience of the project principals with regards to technical qualifications and competence is: 1 – very limited; 2 – limited; 3 – adequate; 4 – better than average; or 5 – exceptional.

Reviewer D1 (Rating 3)
Hargrove Engineers have most of the technical experience and there are others with administrative and management experience on project development. The principals in this proposal have management and budgeting experience as well as experience in company management.

Reviewer D2 (Rating 3)
Since this is the first of its kind of operation, it is difficult to judge qualifications. Many partners are reputable in other areas of energy production.

Reviewer D3 (Rating 4)

Majority of company leadership lacks direct experience in chlor-alkali facility development, though advisory and partnership teams have significant history and experience in the industry.

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 the project is technically sound.

Reviewer D1
This proposal appears to be well designed and involves a large number of experienced engineers and companies through the construction phase. The proposal appears to be technically sound but must address the potential Radionuclides found in produced water, namely Radium 226, Radium 228, Uranium, and Thorium. It is because of the above radionuclides that filter socks at the saltwater injection wells are radioactive and are regulated. In fact, this is one of the primary reasons that North Dakota has adopted TENORM Rules.

Reviewer D2
The significance of producing lithium from an oil production waste product cannot be overstated. This will support oil & gas production as well as make ND a player in the EV market.

Reviewer D3
Project appears well-positioned to move to commercialization. While questions remain about the economic feasibility of product streams compared to alternative production methods, the applicant has spent considerable time and expense on engineering, design, and market analysis. Recommend that the project is technically sound.

November 1, 2023

North Dakota Industrial Commission
State Capitol – Fourteenth Floor
600 East Boulevard Avenue
Bismarck, ND 58505

Re: Project titled "Unlocking the Full Potential of Produced Water as a Key Component of Clean Sustainable Energy"

To NDIC & Clean Sustainable Energy Authority Program:

Triple 8 LLC dba Wellspring Hydro (WH) is submitting this application for grant and loan funds under the North Dakota Industrial Commission Clean Sustainable Energy Authority Program. The Wellspring Hydro project will be operational by the end of 2025. The project's commercialization is a result of previous CSEA support for FEL-3 engineering, field validation progress and initial detailed design (completion of FEL-3.1 and FEL 3.2).

Wellspring Hydro will utilize a unique feedstock from oilfield brines (a.k.a. produced water) that presently is treated and pumped into disposal wells. Wellspring Hydro's project will produce three commercially essential products (and lithium extraction) in a sustainable format that will diversify North Dakota's economy, bolster existing industries with an improved cost position, and drive clean sustainable energy.

Wellspring Hydro, a North Dakota company, is prepared to execute a strategy to build a $324 million dollar treatment facility. When completed this business will:

1. create 53 new full-time jobs and 200+ local contractors to build.
2. generate new local products and tax revenues for North Dakota.
3. enhance North Dakota's economic diversity, sustainable energy, and environmental outlook.
4. create feedstocks from other valuable materials in the future, including lithium.

We are requesting $5,000,000 in grant funds and $25,000,000 in loan funds from the Clean Sustainable Energy Authority Program of the North Dakota Industrial Commission. In return, Triple 8 LLC commits to matching the funds and remaining capital with equity investment.

If you have any questions or require additional information, please do not hesitate to contact Mark Watson 281-813-6735 or mark@wellspringhydro.com.

Mark Watson
CEO
Wellspring Hydro

APPLICATION CHECKLIST

Use this checklist as a tool to ensure that you have all of the components of the application package. Please note, this checklist is for your use only and does not need to be included in the package.

☒	Application
☒	Transmittal Letter (Included in Application)
☒	Tax Liability Statement (Appendix)
☒	Letters of Support (Appendix)
☒	Confidentiality Request (Attached)
☒	Business Plan (Attached)
☒	Historical Financial Statements (3 years Included in Business Plan)
☒	Budgeted Projections (Included in Business Plan)
☒	Loan/Loan Guarantee Application (Attached)
☐	Other Appendices (If Applicable)

When the package is completed, send an electronic version to sustainableenergy@nd.gov and 2 hard copies by mail to:

Clean Sustainable Energy Authority
North Dakota Industrial Commission
State Capitol – 14th Floor
600 East Boulevard Ave Dept 405
Bismarck, ND 58505-0840

For more information on the application process please visit:
http://www.nd.gov/ndic/csea-infopage.htm

Questions can be addressed to Al Anderson (701) 595-9668.

Clean Sustainable Energy Authority

North Dakota Industrial Commission

Application

Project Title: Unlocking the Full Potential of Produced Water as a Key Component of Clean Sustainable Energy

Applicant: Mark Watson

Date of Application: Nov 1, 2023

Amount of Request
Grant: $5,000,000 USD
Loan: $25,000,000 USD

Total Amount of Proposed Project: $324,730,000 USD

Duration of Project: 26 Months

Point of Contact (POC): Mark Watson

POC Telephone: (281) 813-6735

POC Email: mark@wellspringhydro.com

POC Address: 4828 Highway 85 Williston, ND 58801

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ABSTRACT

Background:

Wellspring Hydro is a locally founded North Dakota company with a mission to unlock the full potential of produced water as a feedstock for sustainable, clean energy. Wellspring Hydro is requesting financial support for commercialization of an innovative solution that will diversify the state's economy through an environmental solution. The Wellspring Hydro process is based on combining proven technologies in a novel way to develop products from various renewable components, including produced water waste stream as the key feedstock.

Wellspring Hydro's project will produce commercially essential commodity products in the State of North Dakota in a sustainable format that will diversify the economy, bolster existing industries (clean sustainable energy), and operate with a vision of zero waste or harmful emissions.

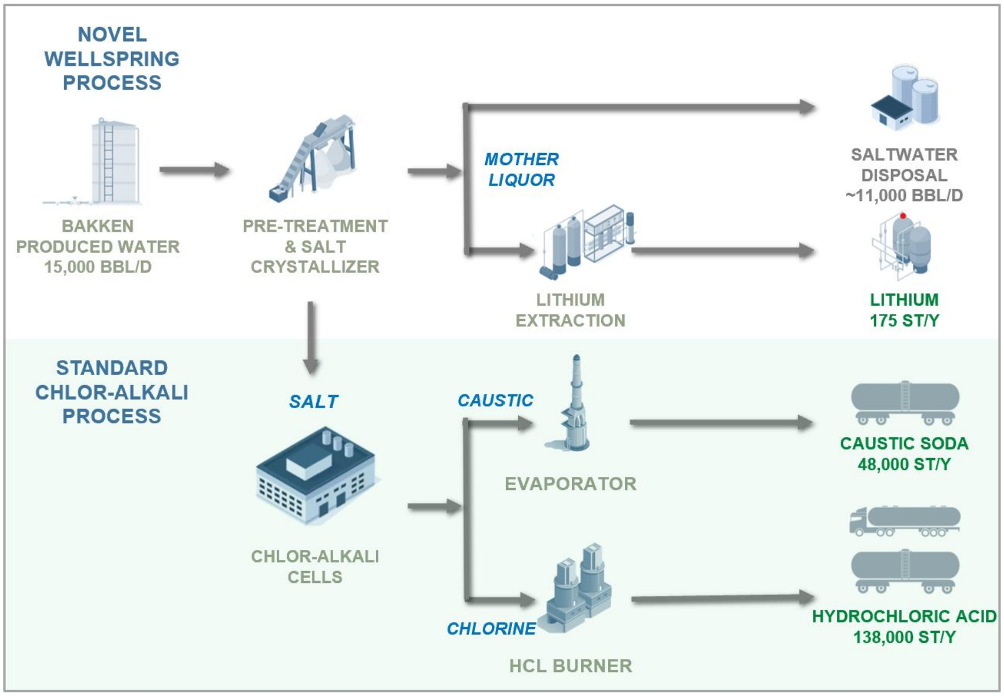
Wellspring Hydro was awarded a $5 M grant from the Clean Sustainable Energy Authority (CSEA) in August 2023 focused on Field Validation and Initial Detailed Design. This scope has already yielded great progress in the refined FEL-3.1 and FEL-3.2 engineering work as initial detailed design. Additionally, significant progress has been made on selecting a location and produced water partner. Wellspring Hydro has selected the Marley Crossing area of SW Willams County for the location of the facility. This location offers strategic and synergistic benefits of water, rail, power and infrastructure.

Based on recent escalation and inflation, Wellspring Hydro received a $350+ M FEL-3 estimate after having multiple estimates around $250 M previously. The CSEA funds from August have been utilized to initiate an FEL-3.1 and FEL-3.2 to complete additional design and cost estimates to fine tune the outlook. Fortunately, the Chlor-Alkali market has seen additional increases in pricing, which has supported the updated financial outlook. These challenges are always anticipated in a large-scale project, and Wellspring has been able to update the strategy to support a strategy approve for commercialization. In addition, Wellspring has been able to progress terms with a private equity investor, produced water partner and offtake agreements to solidify the status. If Wellspring Hydro has the opportunity to present to the CSEA committee following this application, there should be additional commercial progress to share.

Previously, Wellspring Hydro was awarded a $1 M grant from the Clean Sustainable Energy Authority (CSEA) in December 2021 focused on the execution of the FEL-3 engineering and design study to position for commercialization. The FEL 3 engineering study (led by Hargrove Engineers and Constructors) was completed in May 2023. The purpose of the FEL 3 study was to provide a +/- 10% estimate for a 150 ton per day chlor-alkali plant to be located outside of Williston, ND.

Wellspring Hydro's cost to build and install a new greenfield 150 STPD membrane plant in Williston, North Dakota, is $324 million. With an IRR of 21%- and 5-year payback, this project on its own merits is a crucial investment for the state of North Dakota, aligned with the intent of the Clean Sustainable Energy Authority's mission.

A high-level process flow from produced brine to product creation can be seen in the following diagram:



There is a more detailed overview of the Wellspring Hydro process diagram in the Methodology section, in addition to the methodology of the objectives for funds requested.

Objectives:

Finalize, execute, and deliver.

	Key Deliverables	Funds	Results
1	**Detailed Design Engineering**	$10.0 M ($5.0 M) CSEA	The critical objective is to continue detailed engineering in parallel to early construction in preparation for equipment installation and process start-up.
3	**Procurement of Specialized Equipment & Civil Construction**	$50.0 M ($25.0 M) CSEA	The critical objective is to secure specialized and long-lead item equipment to meet overall timeline. The objective will require early funds to complete "Issue for Purchase" (IFP) technical packages with vendors and make initial downpayments on equipment.
5	**Construction, Equipment & Plant Start-up**	$254.8 M	The critical objective is to execute engineering plans of all construction activities required from onsite mobilization through construction completion and pre-commissioning for a seamless implementation of the full-scale facility.

Indicates Grant Funds

Indicates Loan Funds

Expected Results:

The primary result is to complete the construction and start-up of the Wellspring Hydro Chlor-alkali facility by Q4 2025.

Key Deliverables	Results
Production of High Value Commodity Products	Wellspring Hydro's project will produce commercially essential commodity products Caustic Soda and Hydrochloric Acid. Both products have current demand in industrial and energy sectors and future demand in the support of clean sustainable energy (Carbon Capture, Oil & Gas production, and lithium extraction).
Lithium Extraction	As a component of the field trial process and Initial Detailed Design, Wellspring Hydro will be able to develop the lithium extraction process of the "mother liquor" stream. There are multiple technology providers that have completed initial feasibility and will progress to Equipment proposals. Based on the new MOU partnership, Wellspring Hydro is set to produce 175 ST per Year of Lithium upon plant start-up.
Sustainable Use of Produced Water Waste	40+% reduction in produced water that enters the plant will be realized, along with the creation of all process fresh water needs from the treated condensate stream off the crystallizer. Value is created from what is currently wasted.
Financial Impact	The business is projected to have a year one of $86.4 M revenue and support fifty-three full-time employees. The current unleveraged financial returns yield a 21.3% IRR and $126.36 M NPV. Year 1 EBIDTA is expected to be $56.3 M with steady performance within +/- 5% consistency through year 5 EBIDTA at $58.8 M. The full-rate state tax on product sales is expected to be ~$5.5 M per year.

Duration:

The detailed design, construction and start-up is expected to take 24-26 months after the Financial Investment Decision, planned for September 2023.

Critical Milestones

Milestone	Milestone Date
FEL-3/DD Kick-off Meeting	15 Feb 23
FEL-3 Complete	15 Jun 23
Field Validation – Technology and Commercial	01 Nov 23
Financial Investment Decision (FID)	01 Jan 24
Procurement of Specialized Equipment	01 Mar 24
Detailed Design Engineering Start	01 Apr 24
Construction & Civil Mobilization	04 Jul 24
Detail Design Complete	20 Feb 25
All Major Equipment	03 Jul 25
Mechanical Completion	05 Oct 25
Start-Up & Commissioning	01 Jan 26

Wellspring Hydro guided by Hargrove Engineers and Construction partners believes that a 24-26 month execution timeline is achievable. In the Business Plan, there are additional details around contingencies of the schedule. There are several overlapping activities that provide flexibility in the schedule but ultimately a few key milestones that are highlighted in the request for CSEA funding. These key milestones to ensure schedule are:

- Procurement of specialized equipment
- Construction mobilization (civil)
- Hiring and training of operations personnel

Detailed Design – 12 Month Timeline

- The full scope of work identified in the appendix Hargrove Detailed Design Proposal – Wellspring Hydro, is expected to take 12 months. As this work is critical to installation and start-up, there will be ongoing activities with procurement and base construction.

Procurement of Specialized Equipment & Civil Construction – 9 Month Timeline

- The scope of procurement of specialized equipment and civil construction are immediate activities in 2024 to meet the overall execution timeline. The plan is to begin the procurement process in Q1 2024 and begin civil construction in Q2 2024 dependent on the weather.

Total Project Cost:

Capital Estimates	Cost in USD
Technical and Commercial Viability	$4,000,000.00
Front-End Engineering & Design	$6,000,000.00
Civil Construction	$20,936,939.00
Concrete Construction	$26,892,797.00
Structural & Steel	$5,547,290.00
Architectural & Buildings	$33,159,224.00
Mechanical Equipment	$18,364,784.00
Piping	$35,329,583.00
Electrical & Instrumentation	$11,095,365.00
Process & E/I Equipment - SWD	$8,000,000.00
Process & E/I Equipment - Front-End	$20,000,000.00
Process & E/I Equipment - Chlor-Alkali	$51,103,296.00
Detailed Engineering	$10,000,000.00
General Conditions & Indirect	$41,921,038.00
Contractor Fee's & Mark-ups	$10,945,210.00
Contingency & Escalation	$21,467,474.00
Total	**$324,763,000.00**

Indicates Grant Funds

Indicates Loan Funds

Participants: Identified partners for execution of Grant and Loan request. Additional partner information is available in the Business Plan, and specific technology partners are outlined in resources.

- Wellspring Hydro – Management Team - Williston, ND
- Hargrove Engineers & Constructors – Birmingham, AL
- Tormod Operators – Birmingham, AL
- Mastec Infrastructure - Coral Gables, FL
- FCI Constructors – Denver, CO
- InDemand – Bismarck, ND
- Produced Water Partner(s)
- Salt Crystallizer Partner(s)
- Lithium Extraction Partner(s)

PROJECT DESCRIPTION

Objectives:

Wellspring Hydro (WSH) intends to build a modern chlor-alkali plant in Williston, North Dakota which will use crystallized sodium chloride salt deriving from the Williston Basin oilfield brine (i.e., produced water); creating high quality sodium chloride salt and water from an oilfield waste stream to feed a chlor-alkali process will be a first of its kind.

Wellspring Hydro's cost to build and install a new greenfield 150 STPD membrane plant in Williston, North Dakota, is $324 million.

Finalize, execute, and deliver.

1. Detailed Engineering Plan
    a. Following Initial Detailed Design phase and in parallel of the procurement plan, Hargrove will continue to provide engineering services as required by the construction work to clarify or revise the engineering documents provided for the construction of the project. Hargrove will provide information requested to assist the contractors in the construction of the project and the coordination of their activities, including 3-D Model review assistance at the site.
    b. Detailed discipline engineering will continue for 10 months post FEED Phase and to achieve the engineering construction release dates.
    c. The detailed objectives and deliverables for Detailed Design are outlined in the Appendix – Hargrove Detailed Design Proposal – Wellspring Hydro. The Detailed Design areas of scope include Civil, Structural, Architectural, Process, Mechanical, Building Mechanical, Piping, Electrical, Instrumentation. Controls & Automation and Procurement.
2. Procurement Long-lead Equipment & Civil Construction
    a. Hargrove and Associates Purchasing Department will provide procurement support services for the Project. Hargrove will be responsible for the procurement of all major equipment, minor equipment, tagged instruments, fabricated materials.
    b. As a part of FEL-3 process, Wellspring Hydro and Hargrove have identified a bidder list, completed technical packages an Engineering Requisition Worksheet (ERW) for engineered equipment and issued Requests for Quotation (RFQ). The bids have been received and analyzed for technical and commercial consideration. These costs are utilized in the final cost estimate for FEL-3.
    c. The critical objective is to award specialized and long-lead item equipment to meet overall timeline. The objective will require early funds to complete "Issue for Purchase" (IFP) technical packages with vendors and make initial downpayments on equipment. Additionally, funds will be utilized to achieve the timeline with a focus on civil construction in 2024 to achieve weather constraints.
3. Construction & Plant Start-up
    a. Wellspring Hydro will work with Hargrove (Engineering and Design) and Mastec (Construction Management) to formulate the contract documents for the construction

contracts per the project contracting strategy. Hargrove will assist by providing technical and construction management support during the duration of project through mechanical completion.

b. Wellspring Hydro will formulate the Project Completion Plan and will assist with planning QA/QC functions to assure incremental acceptance of the plant and coordination with the start-up team. Wellspring Hydro will utilize Mastec to fulfill its construction obligations. Wellspring Hydro will manage all construction activities required to complete the work to the point of being ready for commissioning.

c. The critical objective is to execute engineering plans of all construction activities required from onsite mobilization through construction completion and pre-commissioning for a seamless implementation of the full-scale facility.

Methodology:

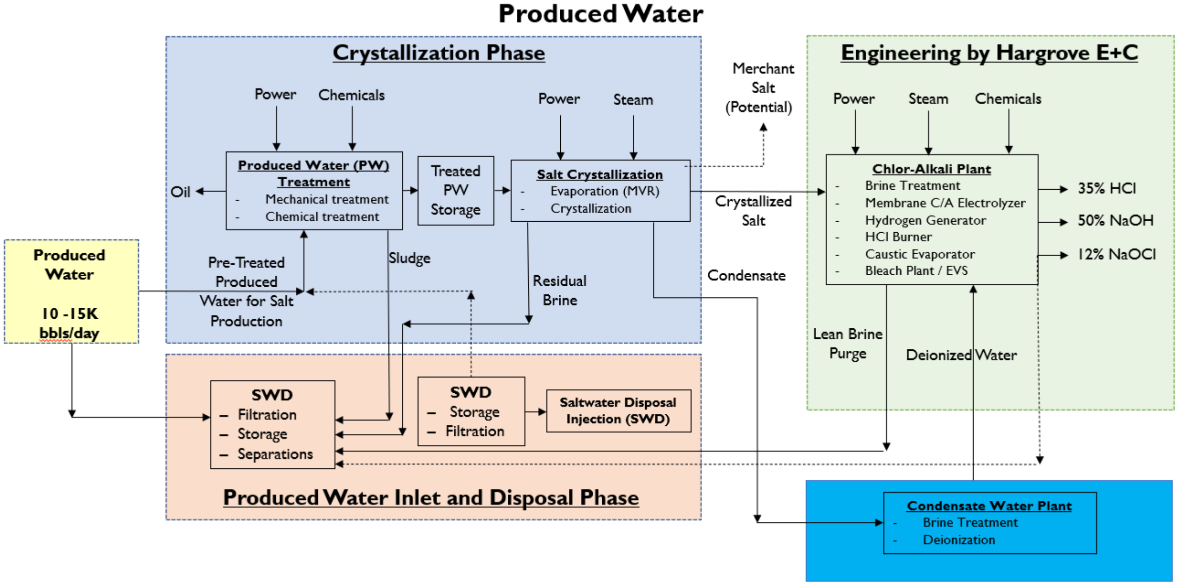
At the core of a Chlor-alkali facility is salt. Conveniently, at the core of the Williston Basin is salt. On average the Williston Basin oilfield operators dispose of up to 1,500,000 barrels of produced water brine per day, laden with salt and other valuable minerals. Conservative estimates place the salt tonnage beyond 30,000 tons per day of disposed salt contained in the water. Wellspring Hydro will utilize 0.01% of this highly valuable in-basin salt to supply the critical input needed to make commodity materials which will be the output and profit center for Wellspring Hydro.

While oil and gas operators work aim to keep the salt in the produced water to avoid surface issues, Wellspring Hydro has done numerous tests (5) to prove that the salt can be removed in a consistent cost-effective manner.

The high-level block flow diagram begins to show the Wellspring Hydro Process taking shape as many existing and currently successfully deployed technologies are brought together to leverage the full value of North Dakota's unique assets.

A high-level process flow from produced brine to product creation can be seen in the following diagram:

Paddlefish
Overall Project Block Flow Diagram
Produced Water



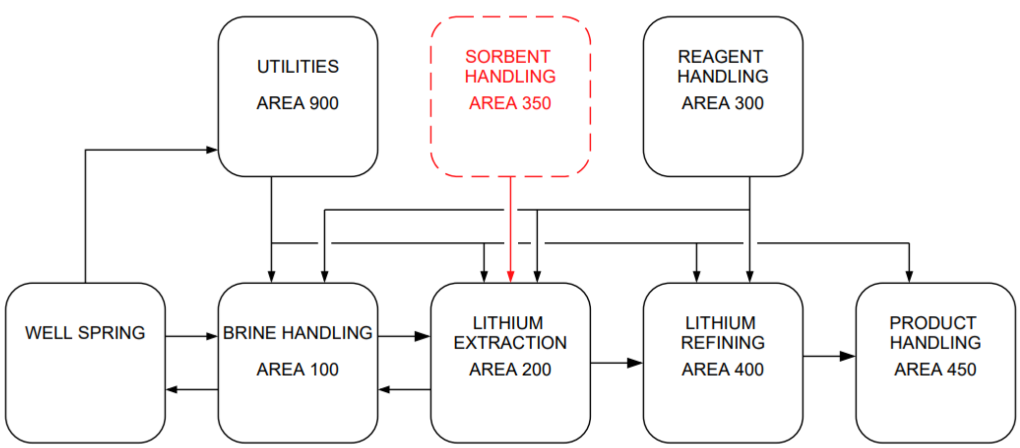
Salt Crystallization process creates 300 tons of high-quality salt per day, the system will include evaporators, preheaters, separating vessels, MVRs (mechanical vapor recompression units), recirculation pumps, instrumentation, valving, ducting, piping, and a control panel system.

Modern Chlor-Alkali technology includes sophisticated membrane cells to split apart the NaCl molecule via electrochemical reactions. The salt and water streams fed to the membrane cells must be highly purified to operate efficiently. Hargrove Engineering has designed and managed multiple chlor-alkali plant projects and will coordinate the overall project design for the entire Wellspring Hydro facility. There are currently 52 active Chlor-Alkali facilities in the US, utilizing this membrane technology.

Lithium Extraction:

In addition to valuable high quality sodium chloride salt (NaCl), North Dakotas oilfield produced water brine contains a multitude of value-added elements. These elements are value-added for research and development opportunities for North Dakota, industry partners and our investors. One element Wellspring Hydro has confirmed in the raw brine in attractive quantities is the valuable metal, Lithium.

Upon the removal of valuable NaCl (sodium chloride), and condensate from the oilfield produced water brine, it will be concentrated into an effluent stream referred to as “Mother Liquor.” This concentrated stream will contain a higher amount of lithium (2-3x) than what entered the Wellsrping hydro process, which we have confirmed though numerous to be around 50ppm on the low-end average. Given the concentration in the raw brine, testing has shown that nearly 175 tons per year can be produced in the facility. This Li will be targeted for DLE (direct lithium extraction) with a strategic technology partner who has developed proprietary technology specifically built for the removal of lower concentration higher volume Lithium brines such as the Wellspring Hydro effluent.



To define the methodology of the objectives;

1. Detailed Engineering Plan
    a. As the project progresses, Detailed Engineering will be an ongoing effort to support the installation and completion of the process. The system engineer will continue to “own” the P&ID and is responsible for the specification of all equipment, and coordination of all supporting discipline tasks necessary for the complete definition and documentation of the system. The system engineer is also responsible for the expenditure of resources (engineering manhours, budgeted dollars for materials, etc.) associated with those systems under his or her control.
    b. The methodology of the Detailed Design will include:
        i. Development of equipment specifications will be in parallel in certain cases with approval of P&ID’s and will commence upon client approval of all P&ID’s.
        ii. Detailed discipline engineering continues for 10 months post FEED Phase and to achieve the engineering construction release dates procurement PO dates as listed in the estimate basis will need to be committed during this phase of the project.
2. Procurement of Specialized Equipment & Civil Construction
    a. Hargrove will provide procurement assistance services for Wellspring Hydro. Each chlor-alkali unit operation is based on proven technology supplied by experienced and respected technology suppliers.
    b. The key methodology steps include:
        i. Upon receipt of a Wellspring Hydro approved Award Recommendation, Hargrove will enter the proposed purchase order and issue purchase order.
        ii. The Engineers will be responsible for revising the RFQ technical package to an “Issue for Purchase” (IFP) technical package. This represents the final agreed upon purchase specifications and will be made a part of the purchase order.
        iii. Purchase orders will require additional engineering support from vendors and require downpayments on equipment to expedite delivery schedule.
        iv. Hargrove will expedite receipt of the vendor data from the supplier based on the Vendor Data Requirements established by the originating Engineer.
        v. The Engineers will review and approve all vendor data for the items they originate regarding compliance with the requirements of the design.
        vi. Hargrove will expedite delivery of the equipment and materials.
3. Construction & Plant Start-up
    a. Wellspring Hydro and Hargrove will formulate the contract documents for the construction contracts per the project contracting strategy. Wellspring Hydro will administer these contracts as construction manager by providing technical and construction management support during the duration of project through mechanical completion.
    b. The basic methodology steps to execution will be in five basic phases:
        i. “Enabling civil work”—piling, underground piping & electrical.
        ii. “Get out of the ground:” Foundations, slabs, development.
        iii. “Install the equipment:” Steel erection, equipment erection.
        iv. “Bulk installation:” Piping, electrical and instrument work.
        v. “Project completion:” Testing, checkout, turnover by system.

Anticipated Results:

Lithium Extraction

As a component of the field trail process and Front-End Engineering & Design, Wellspring Hydro will be able to develop the lithium extraction process of the “mother liquor” stream. There are multiple technology providers that have completed initial feasibility and will progress to Equipment proposals. After Wellspring Hydro recovers salt and water from the produced water the lithium present in the produced water will be concentrated, making it a high potential feedstock to a lithium recovery process.

- Wellspring Hydro is seeking a process patent for removing salt from waste oilfield produced water which in turn concentrates the feed brine into a “mother liquor” stream. This concentrated mother liquor creates ideal feedstock as it increases the lithium by a factor of up to four times. This concentration allows for even more efficient extraction by Wellspring Hydro and its partner over the standard brine process. Due to this concentration upgrade, the potential for up to 3.5 tons of lithium extraction per week is achievable and will yield nearly 4M in accretive revenue and 91,000,000 gallons of water saved.

Production of High Value Commodity Products

Wellspring Hydro’s project will produce commercially essential commodity products Caustic Soda and Hydrochloric Acid. Both products have current demand in industrial and energy sectors and future demand in the support of clean sustainable energy (Carbon Capture, Oil & Gas production, and lithium extraction). The primary focus of the plant will be to produce and sell caustic soda (at 50% and 25% NaOH concentration), hydrochloric acid (at 35% HCl concentration). All products are currently imported into North Dakota with limited regional production. All products will meet industry standards.

- Caustic Soda - Caustic soda will be sold locally and regionally for use in various heavy industries such as refineries, power stations, pulp mills and for carbon capture projects. Wellspring Hydro’s products, specifically caustic soda, will be consumed in local and regional sustainable-clean-energy projects and designed to capture or sequester carbon from power generation. Wellspring Hydro will be a key chemical supplier to the burgeoning CCS/CCUS (Carbon Capture and Storage/Carbon Capture, Utilization and Storage) industry in North Dakota and surrounding states. Project Tundra at Milton R. Young station and Coal Creek Station will require substantial amounts of NaOH (caustic soda) to scrub sulfur dioxide (SO2) to zero. This need is driven by the Amine CO2 removal technology employed in large scale carbon capture such as those at power stations that utilize coal with sulfur content. Currently all Caustic Soda is imported into the State at a premium. Wellspring Hydro will be able to supply all the States projected needs.
- Hydrochloric Acid - The hydrochloric acid will be sold predominately into the local and regional oil and gas industry; other consumers include food processing and steel manufacturing industries in neighboring states. In North Dakota there is a significant opportunity to develop production enhancement acidification of existing wellbores and well recompletions to maximize the Williston Basins oil output. Many current producers utilize large acid jobs to open calcium carbonate scaled perforations and liners that restrict production. These large acid production

enhancement jobs are limited by cost and availability of HCl. WSH can help provide stability to production enhancement support the oil and gas industry through consistent supply.

- Optional Calcium Chloride Addition – Wellspring Hydro is also evaluating the production of a third product of liquid calcium chloride (35% $CaCl_2$). This proven process reacts hydrochloric acid with limestone, which would allow the business to maximize operating rates and diversify the product portfolio. Liquid calcium chloride has a strong regional demand in the Upper Mid-west US and Canada for dust control and snow removal/de-icing.

Sustainable Use of Produced Water Waste

The execution of this project will solidify a sustainable business model built on the use of produced water waste, as defined as the Wellspring Hydro original opportunity statement.

- Through a circular economy model, 10,000 BBL per day will be used as feedstock to the salt recovery system and the Chlor-alkali facility to make products. The current disposal zone of the Dakota formation is experiencing over pressurization in certain areas, this challenge will continue as infield development of the Williston Basin continues. Wellspring Hydro offers an environmentally useful solution to simple injection.
- With an initial scope of 10,000 BBL per day, Wellspring Hydro has a vision to use technology developments for the opportunity to expand the scope and utilize more produced water. Expansion opportunities could come in various scopes; from another full-scale facility to components of this process including lithium extraction, calcium chloride production from produced water and other emerging opportunities.

Financial Impact

The business is projected to have a year one of $86.4 M revenue, split between HCL at $34.7 M, Caustic at $47.4 M, and produced water/other at $4.2M. The production volumes and product price forecasts are (detailed in the Business Plan) are diversified into different markets both local and regional.

- The current unleveraged financial returns yield a 21.3% IRR and $126.36 M NPV. Year 1 EBIDTA is projected to be $56.3 M with steady performance within +/- 5% consistency through year 5 EBIDTA at $58.8 M. This is based on a flat price forecast to represent a conservative approach and provide opportunity of long-term contract capability.
- The full-rate state tax on product sales is expected to be $5.5 M per year. The facility will employ a total of fifty-three employees, forty-six employees to support the cost of product and seven employees supporting administrative and company operations.

Facilities:

The facility will include a pre-treatment, evaporator/crystallizer system, chlor-alkali electrolytic cells, caustic evaporator, a hydrochloric acid synthesizer, and a Saltwater Disposal (SWD) well, and all associated utility, storage and loading facilities for bulk shipments via truck and rail.

Wellspring Hydro has selected the Marley Crossing area of SW Willams County for the location of the facility. This is due to many compelling factors including: Strategic salt water partnerships for significant and consistent supply of produced water on a 10 year contract basis, existing salt water pipeline infrastructure, new salt water disposal facility built to specifications, ideal geological formation for disposal injection, large rail loop facilities on the BNSF line with capacity to rail out product, opportunity for attractive commercial agreements for power and gas.

Specific process facilities to include but not limited to:

- Salt Crystallizer & Evaporator
- Primary Brine Treatment: Brine Precipitation and Filtration
- Secondary Brine Treatment
- Brine Electrolysis
- Anolyte Handling and Dichlorination
- Catholyte Handling
- Excess Hydrogen Generation
- Chlorine Cooling & Demisting
- Cell Hydrogen Cooling & Demisting
- Hydrochloric Acid Synthesis
- Caustic Evaporation
- Sodium Hypochlorite Bleach Production & Emergency Vent System
- Liquid Calcium Chloride Production (Optional)
- Utilities

General and functional facilities include.

- Administration Offices
- Onsite Laboratory
- Storage Facilities: Water, Salt, Caustic Soda, Hydrochloric Acid

Resources:

Subject matter experts will assist in engineering, design, implementation, and construction.

Subject Matter Expert Resources	
Hargrove Engineers	Palmer Lawrence
Mastec Infrastructure	SHECO
FCI Constructors	Dixie Engineering
InDemand	Bertrams
Ekato	Verantis
DrM	TennyCo
Marmon Industrial Water	Mersen
American Crane	CEJCO
Applebee Church	Voigt-Abernathy
Verantis	Flowserve
BARR Engineering	ND Department of Environmental & Quality
North Dakota Industrial Commission	Grayson Mill Energy

Barr's role during this initial phase shall be to provide multi-media pre-permitting engagement and related strategic environmental consulting services. This engagement has already begun with permitting meetings with the NDIC and North Dakota DEQ (DEQ divisions represented were the Division of Water Quality, the Division of Air Quality, and the Division of Waste Management).

The Hargrove Detailed Design Engineering Team will include the following team. Resumes are available in Detailed Design Appendix.

Hargrove Detailed Design Team	
Resource Name	**Title**
Scott Cooper	Project Director
Jason Traylor, PE	Controls + Automation Technical Consultant
Adam Freund, PE	Senior Electrical Engineer
Andy Faulk, PE, LEED AP	Civil/Structural Engineering Lead
Glen Carter, PE	Civil/Structural Engineering Lead
Michael Gear	Mechanical Engineer
Jeff Haslam	Mechanical/Piping Technical Specialist
Reggie Chambliss	Process Engineer
Andrew Johnson	Project Controls Manager
Bill Johnson	Project Manager

Techniques to Be Used, Their Availability and Capability:

Independent, credible third-party resources will be utilized as identified in earlier sections. The subject matter expert resources will license their technology and services as a part of the procurement process to be implemented in the Wellspring Hydro design.

The availability of specialty process equipment is a critical component of the schedule with lead times of equipment reaching 14-16 months due to market constraints on key materials. As outlined in the loan fund request, Wellspring Hydro will utilize funds to secure availability with early downpayments on key items.

Environmental and Economic Impacts while Project is Underway:

On September 13th, 2023, Wellspring Hydro and Barr Engineering presented to the North Dakota DEQ with the purpose of providing updates and a continuation of previous communication on the project. The DEQ divisions represented were the Division of Water Quality, the Division of Air Quality, and the Division of Waste Management. Following this meeting the DEQ provided an update letter to the North Dakota Industrial Commission highlighting that the DEQ sees Wellspring Hydro as eligible to apply for all appropriate permits to construct and operate the proposed facility in the Trenton, ND area. The letter is attached in the appendix.

During the meeting with the DEQ, the question of permitting for produced water injection was reviewed. The Division lead for the Department of Water Quality reviewed the documentation available and had initial feedback that the proposed facility would be classified as a Class II injection well. This is due to the fact that the facility will only dispose of oilfield waste and while a significant amount of the sodium chloride salt, lithium and condensate fresh water will be removed from the produced water brine, no other waste streams from outside sources will be added into the disposal stream nor will significant amounts of additive chemistry be used. To further this determination, Wellspring Hydro followed up with the Underground Injection Control department of the NDIC, they preliminarily agreed with the DEQs direction. As the application is drafted with BARR engineering support Wellspring Hydro will continue to test this point and ensure that the most logical, safe, and appropriate route is taken for the local community, State and Facility.

Wellspring Hydro is committed to avoiding accidents and unplanned occurrences that may result in injury to employees, interruption of production, or damage to equipment or property. This policy, applies to every task undertaken, is to take every action necessary in engineering, planning, assigning, and supervising all jobsite operations to establish and maintain safe and healthful working conditions on our projects and protect the public and the environment.

During the scope of this project, there must be interaction between the Wellspring Hydro, Hargrove, and the appropriate North Dakota regulatory agencies to communicate details about the plant design including specific plans to address environmental and safety concerns. Wellspring Hydro, Hargrove and Mastec will work together to interpret and communicate the permit requirements so that the regulatory requirements are clearly and specifically understood by all the contractors. Williams County has taken an active role in establishing construction and operations phase employee counts along with traffic surveys and logistical needs.

Wellspring will employ up to 250 contractors at peak construction phase. Wellspring Hydro has communicated with local authorities and plans will begin months prior to peak phase to establish transportation logistics and housing requirements for the influx of staff required to accomplish construction in an efficient manner.

The Site Manager will work with the environmental department to develop procedures for isolation of the project site for storm water runoff, testing, pumping and disposal of storm water from excavations, and containment areas. Any temporary breach of containment structures will also be addressed to assure that no contamination will reach the storm water systems.

Fire water tank installment will be critical to establishment of the site for Wellspring Hydro. The size of the take will be appropriate for the development of the site and will be filled prior to operational start up. If other companies are building in the area a coordinated effort will be made to build out and support a local fire staff and EMS plan with local community leaders which will cover the entirety of the site build out.

Ultimate Technological and Economic Impacts:

This is a first of its kind process utilizing well known and understood chlor-alkali technology that has been available since the 1970's. While oilfield brine is becoming more commonly reused, recycled, and even crystallized to derive value driven products, to our knowledge there are no other chlor-alkali plants in the world that uses oilfield produced water as its feedstock for salt. We have patented a process to leverage this waste stream to create products which are used in the industry as well as create net new surface fresh water, water that did not exist as fresh water before. The new fresh water will be used exclusively by our plant as process water needs such as cooling, ultrapure brine, cathode dilution, and salt saturation.

The business is projected to have a year one of $82.6 M revenue and support 53 full time employees. The current unleveraged financial returns yield a 21.7% IRR and $170.0 M NPV. Year 1 EBIDTA is expected to be $54.0 M with steady performance within +/- 5% consistency through year 5 EBIDTA at $53.8 M. The full-rate state tax on product sales is expected to be ~$5.5 M per year. There will be partnership opportunities as highlighted in the Standards of Success that could have an even larger initial Economic Impact.

Why the Project is Needed:

This plant will be designed to enable recovery of more valuable salts and elements. All products to be made by Wellspring Hydro are presently consumed by businesses and industries in North Dakota but are imported from other states. This project represents a new industry for North Dakota, creating sustainable jobs and tax revenues in the state.

The output will benefit North Dakota by proving out a new concept to recover salt from a waste stream from the oil and gas fields and using it to make valuable products which are used in the industry, i.e. hydrochloric acid, caustic soda, with the potential of calcium chloride and a small amount of sodium hypochlorite (bleach) required in the State and region. All these products are used to some extent in the oil and gas industry, excess production will be exported out of state, thus generating new income for the state. In addition to the valuable commodities that will be recovered, the current disposal zone of the Dakota formation is experiencing over pressurization in certain areas, this challenge will continue as development of the Williston Basin continues. Wellspring Hydro offers an environmentally useful solution to over pressurization.

Wellspring Hydro will systematically manage our power, water, and carbon footprint to underpin North Dakota's goals as a multi-resource energy policy state. Our products support more efficient oil production, lower carbon capture costs, and resource attainment of previous waste streams. Overall Wellspring Hydro's proven concept may be utilized again as North Dakota's petrochemical industry grows.

1. Local Production of key products
2. Sustainable Produced Water Source
3. Lithium Production

STANDARDS OF SUCCESS

Various standards of success will be identified and employed to solve the technical hurdles herein. These standards examine both the technical and commercial aspects of the project while adding depth and outlining value.

Reduced Environmental Impacts

Oil and gas operations in the Williston Basin dispose of 1.5 - 1.8 million barrels (63-75 million gallons) of produced water per day. This is 25% more than all the industrial process water use in North Dakota. Wellspring Hydro's scope focuses on a portion of this current waste stream and our vision is to create valuable commodities and rare earth metals extraction through alternate water utilization.

Wellspring Hydro will separate salt and fresh water from produced water; the remaining concentrated stream (referred to as "mother liquor") will be sent to additional processes and eventually to SWD after all useful material can be economically derived. This process of crystallization, concentration and extraction will lead to a 40% reduction in produced water disposed and creation of net new freshwater, used as project process water.

The elevated concentration of remaining elements in the "mother liquor" such as lithium and magnesium along with other salts and metals, create potential for further value-added processing. Beyond the valuable commodity chemistries and essential elements, Wellspring Hydro being a first of its kind facility with healthy returns also sees itself as a champion for further process and product development in the areas of, Environmental Stewardship, Energy Efficiency, Sustainability, Economic Diversification, and Jobs Creation.

Increased Energy Efficiency

Wellspring Hydro will be a key chemical supplier to the burgeoning CCS/CCUS (Carbon Capture and Storage/Carbon Capture, Utilization and Storage) industry in North Dakota and surrounding states. The Northern Plains are known for their vast coal reserves and critical baseload power generation, however changing climates both political and environmental related are now signaling the importance of CCS/CCUS. Technological advances, tax incentives, and attractive geologic CO_2 target zones in North Dakota are leading to testing for storage zones and will soon place North Dakota on top as the world leader in carbon capture. To achieve the status of the world's leading carbon capture State, projects such as Project Tundra at Milton R. Young station and Coal Creek Station will require large amounts of $NaOH$ (caustic soda) to scrub sulfur dioxide (SO_2) to zero. This need is driven by the Amine CO_2 removal technology employed in large scale carbon capture such as those at power stations that utilize coal with sulfur content. Currently all Caustic Soda is imported into the State at a premium. Wellspring Hydro will be able to supply all the States projected needs and will have 50% of its $NaOH$ as a net export for the state to surrounding states.

Specific to the Wellspring Hydro plant, a large part of the power demand will interruptible, a benefit in managing and balancing North Dakota's electrical grid during periods of high demand. As of the submission of this document, no less than four potential partner companies have expressed interest in striking deals for natural gas Co-Gen power generation to use stranded in-basin natural gas that may otherwise hamper oil production. Micro-grid wind, solar, heat pumps and battery backup are part of the office facility build out scope pending tax incentive confirmation and financial justification.

While Wellspring Hydro itself will have the ability to invest in a small carbon capture facility totaling up to 23,000 tons per year (as an added scope), it will not benefit from the Q45 tax credit initially due to size. Two potential partners have reached out to WSH to better understand potential carbon capture and fit. Both companies have expressed interest in "testing current technologies" in conjunction with the chlor-alkali facility.

Energy Sustainability

Lithium extraction in North Dakota by Wellspring via Brine Extraction is attractive for the Williston Basin area and North Dakota for many reasons; it does not require the surface area needed when compared to traditional solution mining which demands large evaporation ponds. The potential for carbon neutrality is feasible with further partnerships focused on natural gas combustion stream aggregation or direct air capture (DAC) technologies of which Wellspring Hydro is engaged in multiple conversations with companies offering both. The water used in Wellspring hydro's process is water that is recycled from the influent produced water stream. The process does not need the 500,000 gallons of water traditionally required to extract a single ton of lithium, Lastly, the process requires hydrochloric acid and caustic soda which Wellspring Hydro will produce at its plant. This synergistic effect further reduces the production cost of North Dakota lithium.

Wellspring Hydro's patented process of removing salt from oilfield produced water waste concentrates the feed brine into a "mother liquor" stream. This concentrated mother liquor creates ideal feedstock as it increases the lithium by a factor of up to 4x. This concentration allows for even more efficient extraction by Wellspring Hydro and its partner over the standard brine process. Due to this concentration upgrade, the potential for up to 3.5 tons of lithium extraction per week is achievable and will yield up to $4M in accretive revenue and 91,000,000 gallons of water saved. Lithium production in North Dakota will provide sustainable energy and local supply chain to meet the growing lithium demand – specifically in electric vehicles.

Value to North Dakota

This project can lead to significant environmental, technological, and economic impacts to the state of North Dakota. Through the successful implementation of this project, Wellspring Hydro will help demonstrate the value of produced water from Oil & Gas operations while allowing for further innovative testing onsite. The ultimate standard of success would be to provide North Dakota with a key piece in a future petrochemical strategy.

Explanation of How the Public and Private Sector will make use of the Projects Results, and when, and in What Way

By the end of 2025, carbon capture projects, oil and gas and other local industries will enjoy up to a 30% cost reduction and consistent supply of essential commodities. This is driven by a subsidized feedstock of produced water from oil and gas production and/or salt cavern development. Caustic soda (carbon capture, crude refining, bio refining, gasification water process treatment, power generation water treatment, lithium extraction), Hydrochloric Acid (oil and gas operations, lithium extraction), and North Dakota Counties (Calcium Chloride – dust control, oil and gas) will all benefit from Wellspring Hydro's strategic location, differentiated feedstock, and low operating cost in Western North Dakota. These products which are all purchased outside of North Dakota currently will immediately realize a large logistical cost savings over current suppliers who rely on rail and trucking to bring current products in from thousands of miles away. Caustic soda is essential in water treatment performed as a part of routine preventative maintenance at many industrial plants in North Dakota, however the largest use of caustic will be sulfur dioxide scrubbing at the planned carbon capture projects at Milton R. Young Station and Coal Creek Station power plants. These projects will together consume nearly half of Wellspring Hydro's caustic soda production. Current supply chains are not set up for this increase in use by North Dakota which would only lead to higher than projected operating costs or potential delays and shutdowns due to lack of consistent supply without Wellspring Hydro to fill the increased caustic need by these essential projects.

Currently oil and gas completions and operations are finding it difficult to locate consistent hydrochloric acid streams and most transloading companies are looking to bring in product from as far away as Texas where they must compete with the Permian Basin demand. This adds delays and significant cost increases due to long logistics routes and creates supply-demand constraints on the limited existing streams. Wellspring Hydro's plant would eliminate the need for North Dakota oil and gas producers to go outside the State for hydrochloric acid and furthermore would allow for North Dakota to become an exporter of HCl to the surrounding region.

Wellspring Hydro will evaluate an expansion into Calcium Chloride production, which has significant value to both the private and public sector. Like oil and gas operators, the counties in North Dakota purchase many commodity products that must be trucked or railed in from out of state. Magnesium Chloride ($MgCl_2$) and Calcium Chloride ($CaCl_2$) both come exclusively from out of state production. North Dakota and surrounding states (SD, MT, MN) utilize a high volume of these products for dust control. The annual consumption of calcium chloride for North Dakota is 5.6 thousand metric tons, and 18.1 thousand metric tons for the surrounding states. In addition, the US and Canada are large consumers of deicing products due to harsh winter conditions. $CaCl_2$ outperforms $MgCl_2$ and has a lower environmental impact. Wellspring Hydro has the operational flexibility to produce a large portion of the $CaCl_2$ used by North Dakota and export to the surrounding states.

How the project will enhance the research, development and technologies that reduce environmental impacts and increase sustainability of energy production and delivery of North Dakota's energy resources.

Wellspring Hydro will enhance the development and operations of technologies that reduce environmental impact by suppling crucial raw materials to processes used in carbon capture. Materials that will have the lowest environmental footprint of any commodities on the market. This is due to extremely short supply chains, a zero-emission production facility, and use of a current waste stream for a feedstock.

With its own facility, Wellspring Hydro will work to create a proposed test facility to implement and trial new and emerging technologies and processes. The focus of which would be threefold in a nonspecific order, first to reduce environmental impact, second to lower cost associated with WSH and adjacent projects, third to remain on the forefront of developments in the energy and commodity sectors.

To date Wellspring Hydro has discussed partnerships with companies covering.

Partnership Requests (30 total)

- Lithium Extraction (6)
- Carbon Capture (4)
- Salt cavern deveoplent and support (3)
- Natural gas Co-Gen (4)
- Magnesium chloride production (2)
- Potash solution mining (1)
- Calcium chloride production (2)
- Customized commodity chemical blending (2)
- Water recycle and reuse for industrial process water supply(3)
- Water recycle for Ag reuse (1)
- Alternate SWD zone development (2)

It is important to remember the listed partnership opportunities will be completely stand-alone partnerships, JVs, or licensing opportunities. These will only represent the upside on the current business plan and financial outlook through combined synergies. The opportunities listed show the strategic nature of looking at our assets in North Dakota from a different vantage point which allows for the investigation of innovative ideas in a field environment following laboratory confirmation.

How it will preserve existing jobs and create new ones.

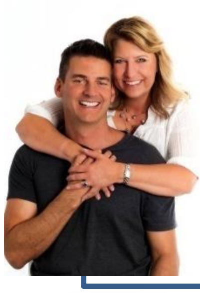
Wellspring Hydro will preserve existing jobs by supporting the oil and gas industry through lower costs, readily available commodities to ensure wells can be completed and produced at a $/barrel that is in line with that of competing states. The Wellspring Hydro production plant will create fifty-three full-time high-paying jobs ranging from front office to production crews.

As detailed in the previous section, Wellspring Hydro's unique intersection of industrial process, commodities production, and oil and gas water reuse it will present an opportunity for further testing and expansion for innovation in an environmentally sustainable format due to the inherent natural assets in Northwestern North Dakota.

BACKGROUND/QUALIFICIATIONS

Leadership Team

Wellspring Hydro management team is supported by industry and local resources to develop a robust business plan and positioned to execute with investment.



Steve and Carla Kemp, Founders, Wellspring Hydro.

- Steve and Carla are local entrepreneurs that founded Wellspring Hydro in 2016 and are based in Williston, ND. Steve and Carla have started multiple ventures in IT, real estate, and financial markets.

Mark Watson, CEO, Wellspring Hydro.

- Mark has over 14 years-experience in acquisitions/mergers, project management, and entrepreneurial start-ups. Mark, MBA, specializes in developing business plans, financial modeling, marketing analysis, and valuation/capital funding.

Mat Hirst, COO, Wellspring Hydro.

- Mat has over 16 years-experience in developing sales and operations teams in the oil and gas industry. Mat, based in Bismarck, ND, specializes in water technologies with expertise in executing sales strategies, people management, and driving operational efficiencies.

Norm Christensen, Technical Advisor, Wellspring Hydro.

- Norm's career has spanned more than 40 years, including direct involvement in the chlor-alkali industry in both North and South America. A chemical engineer, Norm has held senior positions in both Fortune 100 and small companies in engineering, operations, sales and marketing and general management roles. Norm recently (2015) oversaw on the construction of a chlor-alkali facility in San Antonio, TX.

Wellspring Hydro Consultants:

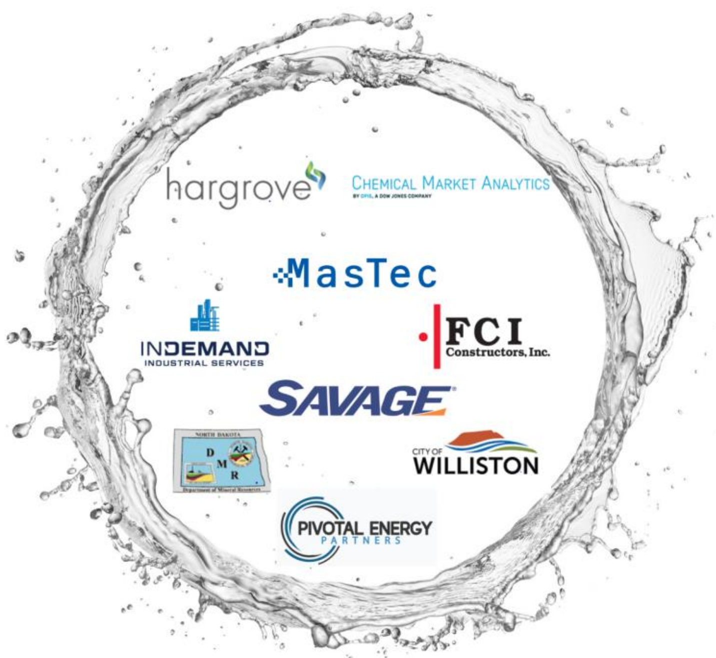
- Chris Wunz, Consultant. Subject Matter expert on Water Treatment and Salt Crystallization. Chris has 20+ years of experience in salt crystallizers and produced water operations.
- Bob Martin, Consultant. Expert on Chlor-Alkali mechanical and process. Bob has 40+ Years of Industry experience on Chlor-alkali facilities around the globe.
- Bob Schmidt, Consultant. Expert on Chlor-Alkali electrical and instrumentation. Bob has 30+ Years of Industry experience on Chlor-alkali facilities around the globe.

Partners & Suppliers

Wellspring Hydro has worked with subject matter experts to validate components of the business plan from our engineering leads and local partners.

A few key leads from the project team consists of the following individuals:

- **Scott Cooper,** Project Lead, Hargrove Engineers + Constructors. Scott has thirty years of experience working in project management and design engineering. Has established project procedures, coordinates changes in scope, monitors and controls engineering activities, cost analysis, planning, scheduling, estimating, procurement of process equipment. Scott is the project lead for the Wellspring Hydro FEL-2 and upcoming FEL-3 projects.
- **Justin C Merritt**, P.E, Hargrove Engineers + Constructors. Justin has over eighteen years of experience in a variety of process industries, including chlor-alkali, petrochemicals, minerals processing, biofuels, and lithium. Project experience includes work on six chlor-alkali plants.
- **Amanda Hayes**, Process Engineer, Hargrove Engineers + Constructors. Amanda has over fifteen years of experience as a Process Engineer in the chemical industry. Experience in writing procedures, process safety management, root cause analysis, and process studies.
- **Bill Johnson**, Project Manager, Hargrove Engineers + Constructors. Bill has over twenty-five years of experience as a Process Engineer in the chemical industry. Experience in writing procedures, process safety management, root cause analysis, and process studies.
- **Chuck Carr**, VP Strategic Insights, Chemical Market Analytics (Formerly IHS Markit). Chuck serves as the group lead for consulting projects, primarily responsible for the sale and execution of consultant engagements in the Americas region.



MANAGEMENT

Wellspring Hydro will operate a steering team consisting of the Wellspring Hydro management team, Hargrove project and engineer leads and Tormod operations group. The steering committee will meet monthly to review the strategic process of execution including project timeline, cost projections, regulatory approvals and other critical item highlighted by the working team.

Monthly Steering Team Meetings

Executive Review with the steering team to evaluate progress and assess critical actions, risk register and schedule.

The project will be organized as an integrated team, containing representatives from both Wellspring Hydro, Mastec and Hargrove. The Activities of the project will be coordinated by a core Project Team, the main members of which will be: (full role descriptions available for reference in business plan)

Weekly Project Meetings

During the kick-off meeting for Initial Detail Design, an agreement for the time, place and format of the weekly project meeting will be agreed upon. The purpose of this meeting is to maintain an open line of communication between all parties. These meetings will be transitioned to the field during the construction phase. The agenda will be as follows:

- Upcoming Safety Reviews
- Design Safety Concerns
- Calendar of Events
- Planned Field Trips
- Last Week Accomplishments
- Key Milestones for the Coming Week
- Outstanding Action Items
- Schedule
- Current week releases
- Events

Weekly Reports and Meetings

The Project Manager will issue weekly progress reports which will describe the progress of Hargrove services and of other project participants and will evaluate the progress and performance of the project team against the project plan. The weekly meeting format will be changed to focus on issues that need attention and should publish meaningful and useful metrics that update everyone on progress versus plan.

Wellspring Hydro Steering Team			
Mark Watson			
Scott Cooper			
TBD - Investor Appointed Lead			
TBD - Third Party Industry Expert			
Engineering Stage		Construction Stage	
Role	Lead	Role	Lead
Operations Lead – Mat Hirst			
Wellspring Project Manager	TBD	Construction Manager	Mastec
Hargrove Process Principal	Scott Cooper	Site Manager	Mastec
Hargrove Project Engineer	Bill Johnson	Quality Manager	Mastec
Wellspring Process Lead	Norm Christensen	Field Materials Supervisor	Mastec
Wellspring Start-Up Manager	TBD	Controls Manager	Mastec

Wellspring Hydro Operations Lead – Mat Hirst

Finalize the plant data by the development of the Engineering contractor's data to include commissioning and other records required for the future operation of the plant. Identify system start-up requirements.

Wellspring Hydro Project Manager – TBD

Accountable to the Steering Committee; acquire, direct, and control all the resources required to implement the project from development through to beneficial manufacture so that the business intent, as expressed in the Project Proposal or subsequent amendments, can be achieved.

Hargrove Project Principal – Scott Cooper

Accountable to the Wellspring Hydro Project Manager, the role holder will be responsible for the provision of Hargrove resources to deliver the project scope of work.

Hargrove Project Engineering Manager – Bill Johnson

Accountable to the Hargrove Project Principal, and responding to the Wellspring Hydro Project Manager, the role holder will be responsible for the coordination of design activities to meet the project time, cost, and quality targets.

Wellspring Hydro Process – Norm Christensen

Responsible for the production review of process packages including PFDs, P&IDs, equipment data sheets and process description.

Wellspring Hydro Start-up Manager – TBD

Define and implement a start - up plan, detailing Plant Systems, procedures, resources, and responsibilities for all stages of plant turnaround and commissioning by setting and monitoring measures of performance in order to achieve the agreed schedule.

Construction Manager – Mastec

Mastec will utilize its construction management organization to fulfill its construction obligations. Mastec will manage all construction activities required to complete the work to the point of being ready for commissioning.

Site Manager - Mastec

The site manager will report to the project manager on the project and will coordinate all functions with the Wellspring Hydro Operations Manager for all construction-related matters. The site manager will be responsible for:

Quality Manager - Mastec

The Project Quality Manager will perform or cause to be performed those inspections required by the project specifications. He will also review and approve the Quality Plans of all the subcontractors and audit the quality control records of the contractors (e.g., welder certifications).

Field Materials Supervisor - Mastec

The field materials supervisor will be responsible for all field procurement-related activities including receiving, inspecting, and warehousing all engineered items at the site. Field purchasing of bulks will be performed by the individual trade contractors.

Controls Manager - Mastec

During construction, the project controls manager will be responsible for coordinating cost, planning, and scheduling activities of all subcontractors to provide the management tools for controlling construction cost and schedule. Reporting will be provided to Wellspring Hydro which will be appropriate to the form of contracts and as determined the project controls plan.

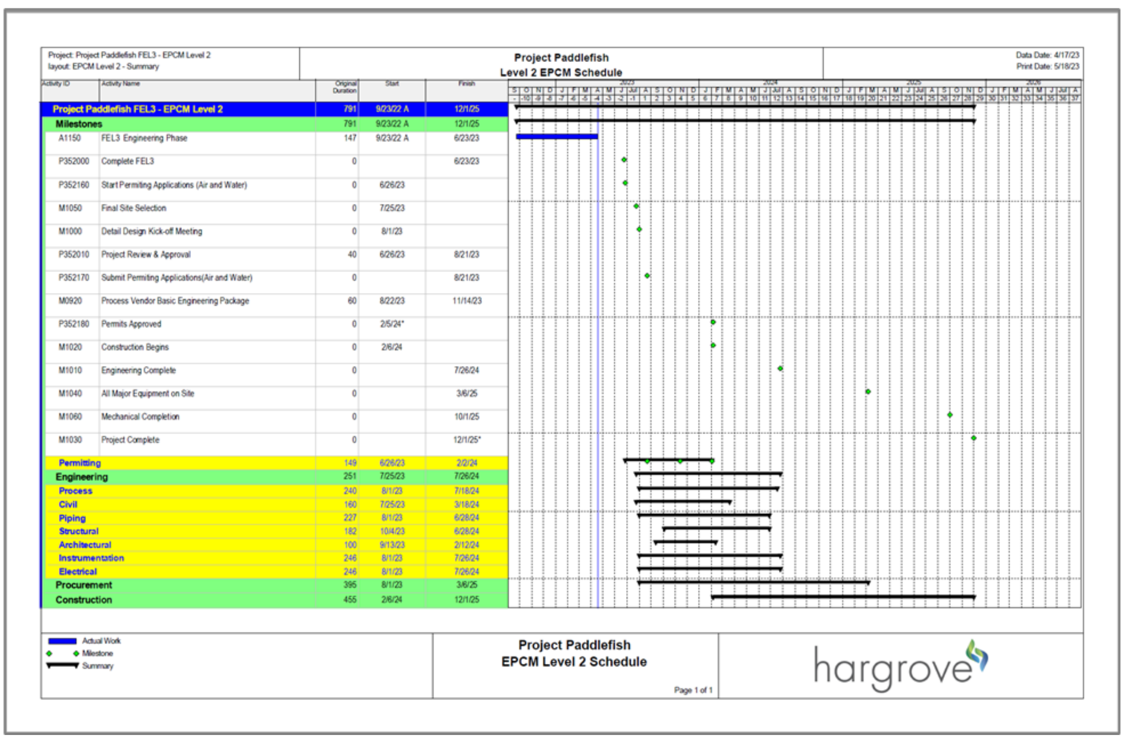
TIMETABLE

The timeline is based cumulative outlook for the FEL-3 study, market research study and the combined output analysis.

Critical Milestones:

Milestone	Milestone Date
FEL-3/DD Kick-off Meeting	15 Feb 23
FEL-3 Complete	15 Jun 23
Field Validation – Technology and Commercial	01 Nov 23
Financial Investment Decision (FID)	01 Jan 24
Procurement of Specialized Equipment	01 Mar 24
Detailed Design Engineering Start	01 Apr 24
Construction & Civil Mobilization	04 Jul 24
Detail Design Complete	20 Feb 25
All Major Equipment	03 Jul 25
Mechanical Completion	05 Oct 25
Start-Up & Commissioning	01 Jan 26

Full Project Timeline:



BUDGET

As referenced in the management section, Wellspring Hydro will have monthly updates on cost/budget reports in addition to the criteria set by the CSEA process.

Project Associated Expense	NDIC's Share	Applicant's Share (Cash)	Applicant's Share (In-Kind)	Applicant's Equity Investment	Total
Technical and Commercial Viability	$2,000,000*			$2,000,000	$4,000,000
Initial Detailed Design	$3,000,000*	-	-	$3,000,000	$6,000,000
Detailed Design	$5,000,000**			$5,000,000	$10,000,000
Process Equipment	$25,000,000***			$25,000,000	$50,000,000
Chlor-Alkali Facility				$254,760,000	$254,763,000
Total	$35,000,000	-	-	$289,763,000	**$324,763,000**

***Designates grant fund budget from CSEA grant award in Aug. 2023 - $5,000,000 USD**

- Technical and Commercial Viability - $5,000,000 USD
  - Consultants and Technical Support - $506,550 USD
  - Stage 1 Field Trial - $650,000 USD
  - Stage 2 Field Trial - $3,843,350 USD
- Initial Detailed Design - $5,000,000 USD
  - Quoted by Hargrove as first 6 months of detailed design for required engineering and technical support to make procurement decisions.

**** Designates grant fund request on Nov. 2023 - $10,000,000 USD ($5,000,000 USD grant request)**

Detailed Design - $10,000,000 USD
  - Quoted by Hargrove and represented in the scope of work in the exhibit of Hargrove Detailed Design Proposal – Wellspring Hydro.
  - A 12-month scope of final design to support the building and operation of the facility prior and during construction.

***** Designates loan fund budget - $50,000,000 USD ($25,000,000 USD loan request)**

- Specialized Process Equipment - $40,480,594 USD
    - Critical long-lead equipment that has been quoted at 1-2 year lead time based on orders. To meet the timeline, these items will need to be ordered immediately to avoid installation and start-up delays. The items listed below have been quoted and ready for order at an average of 12-14 months.

WBS	Type	Name	Vendor	Description	FEL3 Estimated $	Estimate Source
U1-2000	PKG	Salt Crystallizer	Alfa Laval	MVR	$ 15,000,000	+/-30%
U2-5000	PKG	HCl Synthesis Unit #1	Mersen	70 MTPD skid	$ 3,012,000	+/-10%
U2-5000	PKG	HCl Synthesis Unit #2	Mersen	70 MTPD skid	$ 3,012,000	+/-10%
U2-3000	RX	Chlor-Alkali Electrolyzer #1	INEOS	Ineos BICHLOR - 2 packs, 57 modules per pack	$ 2,459,195	+/-10%
U2-3000	RX	Chlor-Alkali Electrolyzer #2	INEOS	Ineos BICHLOR - 2 packs, 57 modules per pack	$ 2,459,195	+/-10%
U2-4000	PKG	Caustic Evaporator	Bertrams	Triple Effect Falling Film Evap Plant - 172 STPD	$ 2,294,155	+/-10%
U2-2000	PKG	Brine IX Skid	Marmon Industrial Water	(3) Brine IX sized for 320 gpm brine throughput. S	$ 1,720,000	+/-10%
ER	PKG	North Electrical Room	Harvard Integrations	ER01	$ 1,365,395	+/-10%
ER	PKG	South Electrical Room	Harvard Integrations	ER02	$ 1,465,395	+/-10%
ER	PKG	480/410VDC POLARIZATION RECTIFIER A	FRIEM	480/410VDC	$ 120,245	+/-10%
ER	PKG	480/410VDC POLARIZATION RECTIFIER B	FRIEM	480/410VDC	$ 120,245	+/-10%
ER	PKG	10.76MVA TRANSFORMER/RECTIFIER A	FRIEM	10.76MVA	$ 1,402,000	+/-10%
ER	PKG	10.76MVA TRANSFORMER/RECTIFIER B	FRIEM	10.76MVA	$ 1,402,000	+/-10%
ER	PKG	MVSWGR-1000 (ER01)	Eaton	13.8V SWITCHGEAR	$ 597,654	+/-10%
ER	PKG	4160V MV VFD	Rockwell	4160V	$ 339,038	+/-10%
ER	PKG	XFMR-1001 - 12.8v/480v TRANSFORMER (er01)	Eaton	W/DISCONNECT SWITCH	$ 446,000	+/-10%
ER	PKG	XFMR-1002 - 12.8v/480v TRANSFORMER (er01)	Eaton	W/DISCONNECT SWITCH	$ 446,000	+/-10%
ER	PKG	XFMR-2001 - 12.8v/480v TRANSFORMER (er01)	Eaton	W/DISCONNECT SWITCH	$ 446,000	+/-10%
ER	PKG	XFMR-1001 - 12.8v/480v TRANSFORMER (er01)	Eaton	W/DISCONNECT SWITCH	$ 446,000	+/-10%
ER	PKG	LVSWGR-1001 480 SWITCHGEAR	Eaton	MAGNUM PXR	$ 638,992	+/-10%
ER	PKG	LVSWGR-2001 480 SWITCHGEAR	Eaton	MAGNUM PXR	$ 644,542	+/-10%
ER	PKG	LVSWGR-2002 480 SWITCHGEAR	Eaton	MAGNUM PXR	$ 644,542	+/-10%
			Total		**$ 40,480,594**	

- Civil Construction - $9,517,406 USD
    - Early civil construction will allow Wellspring Hydro to avoid any weather constraints. Civil construction will position buildings to be constructed prior to weather in order to streamline the installation of process equipment.
    - This represents about 50% of civil construction, as the focus is foundation and base infrastructure to construct buildings. Other key components like Rail Infrastructure do not have critical milestones or dependencies on the full execution.

CONFIDENTIAL INFORMATION

A person or entity may file a request with the Commission to have material(s) designated as confidential. By law, the request is confidential. The request for confidentiality should be strictly limited to information that meets the criteria to be identified as trade secrets or commercial, financial, or proprietary information. The Commission shall examine the request and determine whether the information meets the criteria. Until such time as the Commission meets and reviews the request for confidentiality, the portions of the application for which confidentiality is being requested shall be held, on a provisional basis, as confidential.

If the confidentiality request is denied, the Commission shall notify the requester and the requester may ask for the return of the information and the request within 10 days of the notice. If no return is sought, the information and request are public record.

Note: Information wished to be considered as confidential should be placed in separate appendices along with the confidentiality request. The appendices must be clearly labeled as confidential. If you plan to request confidentiality for **reports** if the proposal is successful, a request must still be provided.

To request confidentiality, please use the template available at http://www.nd.gov/ndic/CSEA-app-doc-infopage.htm.

Wellspring Hydro has submitted for the attached Business Plan as confidential information by CSEA and the state of North Dakota. This document holds confidential and proprietary information around the research, development, and execution of the novel Wellspring Hydro project.

PATENTS/RIGHTS TO TECHNICAL DATA

Any patents or rights that the applicant wishes to reserve must be identified in the application. If this does not apply to your proposal, please note that below.

This is a first of its kind process utilizing well known and understood technology that has been around since the 1970's. As included in the CSEA Grant scope from December 2021, Wellspring Hydro will complete the process patent application with the results of the FEL-3 defined engineering and design study. This process patent will illustrate a process to leverage this waste stream to create products which are used in the industry as well as create net new fresh surface water. This process is expected to begin in June 2023.

STATE PROGRAMS AND INCENTIVES

Any programs or incentives from the State that the applicant has participated in within the last five years should be listed below, along with the timeframe and value.

Wellspring Hydro has a long-standing partnership with North Dakota from the original concept stage supported by UND, NDIC and City of Williston. The support from the state has allowed Wellspring Hydro to fund the research and development into this novel process (patent pending).

Agreement	Company/Division	Investment	Commentary
Research Grant	NDIC	$110,000	Concept support with UND partnership starting in 2016
Grant Match	City of Williston Star Fund	$225,000	Investment into Concept Stage and FEL-2 Engineering with development in Trenton
Promissory Note	ND Dev Fund	$250,000	Investment into successful FEL-2 engineering and design work in 2020
Promissory Note	ND Dev Fund	$750,000	Investment into commercial and technical development, highlighted by Veolia Pilot Lab
Grant	NDIC – CSEA Fund	$1,000,000	CSEA Grant awarded in December 2021 for FEL-3 engineering & design
Grant	NDIC – CSEA Fund	$5,000,000	CSEA Grant awarded in August 2023 for field validation & initial detailed design
Total Investment		**$7,335,000 USD**	

*Promissory notes and grant detail can be provided upon request.

APPENDIX

Tax Liability Statement

Industrial Commission

Tax Liability Statement

Applicant:
Wellspring Hydro, dba Triple 8 LLC

Application Title:
Unlocking the Full Potential of Produced Water as a Key Component of Clean Sustainable Energy

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

CEO
____
Title

11/1/2023
____
Date

Tax Standing Letter

STATE OF NORTH DAKOTA
OFFICE OF STATE TAX COMMISSIONER
BRIAN KROSHUS, COMMISSIONER

May 15, 2023

Ref: L1420911744

TRIPLE 8 LLC
WELLSPRING HYDRO
PO BOX 884
WILLISTON ND 58802-0884

I, Brittany Herberholz, Supervisor of Tax Registration for the North Dakota Office of State Tax Commissioner, certify that the records in the North Dakota Office of State Tax Commissioner do not show any indebtedness owed to the State of North Dakota by TRIPLE 8 LLC, with respect to income taxes, sales and use taxes, or any other taxes collected by and payable to the Tax Commissioner's office. This company is, therefore, in good standing with the North Dakota Office of State Tax Commissioner. This certification does not include ad valorem property taxes collected by the respective county treasurers.

Dated this May 15, 2023 at Bismarck, North Dakota.

Brittany Herberholz
Supervisor, Tax Registration

TAX.ND.GOV | TAXINFO@ND.GOV
600 E. BOULEVARD AVE., DEPT. 127 | BISMARCK, ND 58505-0599
PHONE: 701-328-7088 | TTY: 800-366-6888
ND Tax NORTH DAKOTA

Primary Sector Certification

NORTH Dakota | Commerce
Be Legendary.™

July 15, 2020

Steve Kemp
Wellspring Hydro
PO Box 884
Williston, ND 58802

Dear Steve:

Thank you for your application for primary-sector certification by the North Dakota Department of Commerce, Economic Development & Finance Division. We have reviewed your application and determined that ED&F can certify your company, **Wellspring Hydro**, as primary sector and a new wealth creator in the economy of North Dakota. This certification is valid for **four years** from today's date (expires 7/14/2024).

Most of North Dakota's economic development programs, tools and incentives are targeted toward primary-sector clients. You may be requested to provide a copy of this primary-sector certification letter when you apply for certain economic development incentive and funding programs.

This certification does not guarantee the receipt of any North Dakota business incentive. For example, there are additional qualification criteria for the Seed Capital Investment and Agricultural Business Investment personal income tax credits, and it is critical that investments **NOT** be made prior to the business receiving certification for these two credits. If you are pursuing certification for investment tax credits and need to know the criteria required for qualification, contact Joe Cicha 701-328-7283.

This certification is not the application process for the North Dakota New Jobs Training Program administered by Job Service North Dakota. To apply for the North Dakota New Jobs Training Program, you must contact Job Service North Dakota for the required application forms. Application forms for other programs that require primary sector certification are available from the agency administering the program.

Also, companies and individuals pursuing the investment tax credit incentive are reminded there is a cap on available dollars. Please visit with the ND Office of the Tax Commissioner regarding the remaining balance for investment tax credits. The credits are available on a first-come-first-serve basis until the law-defined cap is met.

North Dakota appreciates your contribution to the citizens and economy of our state. If there is anything further we can do to assist your company, please contact us at 701-328-5300.

Sincerely,

James Leiman, Director
Economic Development & Finance Division

1600 E Century Avenue, Suite 2 | P.O. Box 2057 | Bismarck, ND 58502-2057

PHONE: 701-328-5300 | TOLL-FREE: 1-866-4DAKOTA | ND RELAY TTY: 1-800-366-6888 | VOICE: 1-800-366-6889 | NDCommerce.com

Letter of Support – City of Williston 1

CITY OF
WILLISTON
ADMINISTRATION

May 17, 2023

Clean Sustainable Energy Authority
600 East Boulevard Ave
Bismarck, ND 58505

Subject: Letter of Recommendation for Wellspring Hydro's Chlor Alkali and Lithium Mining Project

Dear Members of the Clean Sustainable Energy Authority,

I am writing on behalf of the City of Williston to express our robust support for the May 2023 Application for Clean Sustainable Energy Authority submitted by Wellspring Hydro for their Chlor Alkali and Lithium mining project.

As a city that thrives on the energy sector, we understand the crucial importance of innovation, sustainability, and diversification for the longevity and prosperity of our regional economy. We firmly believe that Wellspring Hydro's project will be a cornerstone in this context, providing a sustainable and cost-effective solution that is crucial for the continuation of traditional oil and gas operations.

Wellspring Hydro's pioneering approach to Chlor Alkali and Lithium mining promises not only to secure a dependable supply of hydrochloric acid, which is fundamental for well completion, but also to ensure a consistent provision of caustic soda, which has wide-ranging industrial applications. By driving down the costs of these key resources, the project could significantly enhance operational efficiency and cost-effectiveness within our industry.

Furthermore, the emphasis on Lithium mining echoes the global shift towards clean energy. As Lithium is a key component in the production of batteries for electric vehicles and renewable energy storage systems, the project's potential to strengthen the domestic Lithium supply chain aligns with our aim to diversify and fortify our regional economy, while reducing dependence on foreign resources.

www.cityofwilliston.com T. 701-713-3800 F. 701-577-8880 | 22 East Broadway Mailing Address: PO Box 1306 Williston, ND 58802

Letter of Support – City of Williston 2

May 17, 2023
Page Two

The City of Williston is therefore proud to endorse Wellspring Hydro's Chlor Alkali and Lithium mining project. We are convinced that their innovative approach, coupled with their commitment to sustainability and economic diversification, will make a lasting and positive impact on our region and the broader energy industry. We strongly recommend that the Clean Sustainable Energy Authority approve their May 2023 application and extend the necessary support for this transformative project.

Thank you for considering our recommendation. Please do not hesitate to contact us if you need any further information or clarification.

Sincerely,

Shawn Wenko
Interim City Administrator

www.cityofwilliston.com
T. 701-713-3800
F. 701-577-8880
22 East Broadway
Mailing Address: PO Box 1306 Williston, ND 58802

Letter of Support – UND

UNIVERSITY OF NORTH DAKOTA
COLLEGE OF ENGINEERING & MINES

UND.edu

Office of the Dean
Upson II, Room 165
243 Centennial Dr Stop 8155
Grand Forks, ND 58202-8155
Phone: 701.777.3411
Fax: 701.777.4838
Website: engineering.UND.edu

May 19th, 2023

To Whom it May Concern

Re: Letter of Support for Wellspring Hydro to the Clean Sustainable Energy Authority

This letter provides support for Wellspring Hydro's continued effort to build a chlor-alkali plant in North Dakota that will convert produced water from the Bakken into commodity chemicals with high market potential in North Dakota and the surrounding region. The proposed plant provides an excellent alternative to disposing of the produced waters while simultaneously producing feedstock chemicals that can be used to support the continued development of the oil industry in the state. The electric power industry and the transportation sector also represent significant market opportunities. We have explored several treatment options for produced water, including the chlor-alkali option. As a subcontractor in the preliminary work done in conjunction with Barr Engineering, we performed a variety of bench-scale tests and modeling efforts to help determine both the technical and economic viability of the approach proposed by Wellspring. Through this team effort, a process scheme was developed that used proven technology to produce caustic soda and hydrochloric acid as the primary products, taking advantage of the high sodium chloride level in the Bakken brines. The results of the feasibility study performed under the Barr Engineering contract have demonstrated the technology represents a good investment opportunity.

We applaud Wellspring Hydro for their pending completion of the FEL-3 study that now provides the detailed information needed by Wellspring to raise the capital required to build the plant. The plant will provide a lower-cost option for dealing with the produced water than the current disposal methods, with the added advantage of improved public perception availed by reducing the amount of deep-well injection required. The HCl can be used locally, and likely be made available to the industry at a price lower than that currently paid as Wellspring will avoid the premiums attached to the current supply due to trainload, rail, and distribution fees from the current suppliers. The recovered salts also provide opportunities for additional product development, such as caustic soda to be used in carbon capture at our critical coal fired power plants, calcium chloride for dust control, and lithium recovery to be used in battery production.

I am happy to provide my endorsement to their business plan as it represents a good opportunity for the State of North Dakota and a good investment opportunity.

Sincerely,

DocuSigned by:
Daniel Laudal

Daniel Laudal, Ph.D.
Executive Director
College of Engineering & Mines Research Institute
University of North Dakota
daniel.laudal@und.edu

Letter of Support – Commerce

NORTH Dakota | Commerce
Be Legendary.

May 19, 2023

Subject: Letter of Support for Wellspring Hydro's Chlor Alkali and Lithium Mining Project

Dear Members of the Clean Sustainable Energy Authority,

I am writing to express the North Dakota Department of Commerce's support for Wellspring Hydro's Chlor Alkali and Lithium mining project in their Application to the Clean Sustainable Energy Authority. Wellspring Hydro has demonstrated an impressive commitment to innovation within a mature industry, paving the way for economic growth and environmental sustainability. By manufacturing traditionally imported products locally, Wellspring Hydro will contribute to the generation of net new revenue for the State of North Dakota. Specifically, the production of Hydrochloric Acid (a key commodity in the oil industry) and Caustic Soda (a critical commodity in carbon capture) will help keep two key parts of the energy industry in North Dakota competitive.

Wellspring Hydro's project encompasses the mining of Lithium from produced water. As the demand for Lithium continues to soar within the renewable energy sector, this aspect of the project uniquely bridges the traditional oil and gas industry with the emerging renewable energy sphere. It presents an extraordinary opportunity for North Dakota to establish its relevance and prominence in the renewable energy landscape.

The North Dakota Department of Commerce fully recognizes the significance and potential impact of Wellspring Hydro's Chlor Alkali and Lithium mining project. We believe that this venture is well aligned with our state's vision for economic diversification, job creation, and sustainable practices. The project addresses supply constraints, contributes to the local economy, and fosters collaboration between different sectors.

Sincerely,

Richard Garman

Richard Garman, Director
Economic Development & Finance Division
North Dakota Department of Commerce

1600 E Century Avenue, Suite 6 | P.O. Box 2057 | Bismarck, ND 58502
PHONE: 701-328-5300 | TOLL FREE: 1-866-4DAKOTA | ND RELAY TTY: 1-800-366-6888 | VOICE: 1-800-366-6889 |
NDCommerce.com

Letter of Support – Pivotal

DocuSign Envelope ID: 8F332CCF-D8EB-4B30-9056-3EB761097BE5

PIVOTAL ENERGY PARTNERS

Pivotal Energy Partners Inc.
Suite 510, 736 – 6th Avenue SW
Calgary, AB T2P 3T7
Pivotalenergy.ca

May 16, 2023,

Dear Members of the Clean Sustainable Energy Authority,

I am writing to express Pivotal Energy Partners enthusiastic support for the May 2023 Application for Clean Sustainable Energy Authority submitted by Wellspring Hydro for their Chlor Alkali and Lithium mining project in Northwest North Dakota. As an innovative energy company, we recognize the significance of this project and its potential to transform and support both traditional oil and gas operations as well as the clean energy sector.

One of the most compelling aspects of Wellspring Hydro's project is their innovative approach to resource utilization. Pivotal is a trusted midstream company that strategically bridges the logistical and financial gap between our partners and the target marketplace for their products. Through a cooperative, transparent approach, we work with our partners to increase netbacks, lower operating costs, and maximize margins. We strive to provide partnerships that are fueled by an unparalleled level of trust and transparency in all that we do. We have intentionally designed our services to provide a model that is flexible and adds value in a safe and economical manner. Our fully scalable, modular facilities are built to meet capacity demand for our partners. We have aligned with industry-leading technology developers to further optimize our services for our partners.

Pivotal is also dedicated to the highest environmental protection and safety standards throughout all levels of our organization. This level of commitment ensures a workplace that protects the health and safety of our employees, contractors, and the communities in which we operate.

We see Wellspring Hydro as a potential partner for future projects of our own and strongly feel that they fit in with many of our core initiatives. Local manufacturing will create opportunities to increase plant netbacks while lowering local logistics, operating cost in North Dakota remain attractive due to lower energy costs and inexpensive land. The environmental components of Wellspring are game changers as they allow for the beneficial use of a current waste stream and the potential to generate lithium for the renewable energy sector. Water consumption will be significantly lower than current mining operations and near zero when the plant is running optimally.

Pivotal is proud to endorse Wellspring Hydro's Chlor Alkali and Lithium mining project. We believe that their innovative approach and dedication to sustainability, coupled with our collaboration, will make a lasting and positive impact on the energy industry. We strongly encourage the Clean Sustainable Energy Authority to approve their May 2023 application and provide the necessary support for this transformative project.

Thank you for considering our recommendation. Please do not hesitate to contact us if you require any additional information or clarification.

Sincerely,

DocuSigned by:
Chris Boulanger
9EF0D3C8CDFF476...
Chris Boulanger, President – Pivotal Energy Partners USA

Letter of Support – OneCor

OneCor SERVICES

May 16, 2023,

Dear Members of the Clean Sustainable Energy Authority,

OneCor Services would like to show our support for the Wellspring Hydro project to build a chlor alkali facility in Northwest North Dakota. The need for local industrial commodity chemicals manufactured in a sustainable manner that cuts down significantly on logistical cost will help continue the extensive development of the Williston Basin.

At OneCor Service we are a Williston, ND based company with offices in Watford City, ND, Odessa, TX, and San Antonio, TX. We pride ourselves as community members who are a premium provider of several crucial services that support the oil and gas industry. Including Hydrochloric acid supply, logistics, and custom blending, Geoprobe Drilling, Environmental services, Weed Control and Pressure pumping.

A challenging and oftentimes limiting factor that all services companies experience in the Williston Basin are limited availability of products and significantly higher logistical costs when compared with other basins that we operate in. This has a trickle-down effect that touches every component of the drilling, completions and production life cycle in the oil and gas production. Hydrochloric acid typically must go through several other companies to arrive in basin at which point the end uses sees a premium to their P&L. Innovations which Wellspring Hydro are working towards will allow ND operators to achieve reduced operating costs due to lower priced in basin logistics.

There are also many ways OneCor sees Wellspring Hydro impacting our local economy by bringing in up to 55 high paying jobs, 80M in annual revenue as an exporter of low carbon chemicals manufacturing. This all leads to greater recognition on a global scale for the innovation we see every day in North Dakota.

In summary, we at OneCor strongly support Wellspring Hydro and their goal of utilizing Williston Basin waste salt water to supply an innovative chlor alkali facility and extract lithium.

Thank you for considering our recommendation. Please do not hesitate to contact us if you require any additional information or clarification.

Sincerely,

Tom Bachmeier

Chief Executive Officer

Letter of Support – Cerilon

CERILON

NDV-2010-LTR-0001
2023-MAY-18

Clean Sustainable Energy Authority
14033 - 49 Street NW
Williston, ND, 58801

Dear Members of the Clean Sustainable Energy Authority,

I am writing to express Cerilon Inc.'s support for Wellspring Hydro's innovative Chlor Alkali and Lithium Mining Project. As a company deeply embedded in the energy sector, we understand the pressing need for sustainable practices, and believe in the potential of their project.

At Cerilon, we support the numerous benefits that Wellspring Hydro's project offers, specifically the production of caustic soda, an important chemical in our operations. By securing a stable and cost-effective supply of this chemical, the Cerilon GTL project will enhance production efficiency and drive down operational costs. The Wellspring Hyrdo's Project aligns with our commitment to sustainably obtain essential production materials in an environmentally conscious manner.

By endorsing this project, we align ourselves with Wellspring Hydro's vision for a diversified, robust, and sustainable regional economy. We urge the Clean Sustainable Energy Authority to recognize the potential of this project and provide it with the necessary support and approval.

Sincerely,

Duursema

Nico Duursema
Chief Executive Officer

CERILON INC.
First Canadian Centre
350 - 7 Avenue SW, Suite 2900
Calgary, Alberta, Canada T2P 3N9

+1.403.264.8044
Info@cerilon.com
Cerilon.com

Letter of Support – Grayson Mill

GRAYSON MILL
ENERGY

May 15, 2023,

To Whom It May Concern,

Grayson Mill Energy LLC(GME) supports the efforts of Wellspring Hydro (WSH) to build a produced water recycling facility in Northwestern North Dakota that is focused on the concentration of produced water through crystallization and subsequent extraction of high value minerals including sodium chloride (NaCl) and Lithium (LiCl). We believe that Wellspring Hydro's alternate extraction process is crucial for North Dakota's continued position as a global market leader in oil and gas production while adding in the environmental benefits of water recycle, alternate reuse and renewable feedstock development. A project like Wellspring Hydro will help lead the way in North Dakota's advancing economy of carbon capture and storage, commodities manufacturing, and rare earth element security for the United States.

Grayson Mill is a leading North Dakota oil and gas producer with nearly 300,000 acres and 90,000 BOE/day production in 2023. Our core mission is to stay committed to generating value through disciplined acquisitions of oil and gas assets and improving cash flow and net asset value. GME's returns-focused strategy aims to acquire the best rock, operate as efficiently as possible and drill industry-leading wells. The company's strategic objectives target a return on capital to its investors through positive cash flow and net asset value growth in a safe and reliable manner. Every one of GME's employees are aligned to accomplish this through enhanced base production levels, reduction of costs, and the pursuit of production growth through efficient and safe operations all while striving to embody our core values of humility, integrity, passion, accountability, and collaboration.

To highlight our support for Wellspring Hydro, we see value in the ability to look differently at our assets and work with a company like WSH to make environmental stewardship a focus while not abandoning our strategic objectives. WSH's work not only enhances the environmental footprint of the area but also offers real fiscal opportunity for GME through reduction of disposal well costs & injection pressures, lessening of produced water trucking, utilization of excess natural gas in basin (both for co-Gen and to supply directly to WSH for operations) and the execution of supply agreements in return for valuable products such as Hydrochloric Acid and Calcium Chloride routinely utilized in fracturing and production enhancement of our base assets.

To further underscore our support of Wellspring Hydro, Grayson Mill Energy is currently exploring commercial agreements and reviewing land options. It is our strong belief that North Dakota's ongoing support of projects such as Wellspring Hydro are what continue to make it a place to invest and grow our already significant market position.

Please reach out to me with any questions or clarification requests regarding the above comments.

Sincerely,

Blake Sullens, Chief Operating Officer

840 W. Sam Houston Pkwy. N.| Suite 300| Houston, TX 77024

Lithium MOU

Wellspring has executed a Memorandum of Understanding ("MOU") with a Lithium partner to evaluate, trial and execute the lithium extraction process. For purposes of confidentiality, Wellspring Hydro can provide additional details and the MOU contract upon request.

Wellspring is the original developer of a pre-construction produced water pretreatment facility, saltwater disposal, salt crystallization plant, and chlor-alkali facility in Western North Dakota. The lithium partner will be the developer of a to-be-built Direct Lithium Extraction system capable of but not limited to lithium extraction from minimally treated "produced water" streams and concentrated "Mother Liquor" streams generated by Wellspring Hydro.

The lithium partner will provide DLE process equipment and testing to Wellspring upon the completion of Bench and Pilot testing, as outlined in this application.

Engagement Letter – Department of Environmental Quality

NORTH Dakota | Environmental Quality
Be Legendary.™

September 25, 2023

Reice Haase
Clean Sustainable Energy Authority
State Capitol 14th Floor
600 E. Boulevard. Dept. 405
Bismarck, ND 58505-0840

Re: NDDEQ Meeting with Wellspring Hydro

Dear Mr. Haase:

The North Dakota Department of Environmental Quality (NDDEQ) held an early engagement informational meeting with Mat Hirst, Chief Operating Officer for Wellspring Hydro on September 13, 2023. NDDEQ representation in the meeting included the Division of Water Quality, Division of Air Quality, and Division of Waste Management. The meeting regarded the potential Wellspring Hydro project to be located near Trenton, North Dakota.

Based on the preliminary information discussed during this meeting, NDDEQ representation believes Wellspring Hydro is eligible to apply for the approvals necessary to construct and operate the proposed facility (e.g., an air quality Permit to Construct pursuant to Chapter 23.1-06 of the North Dakota Century Code and the Air Pollution Control Rules of the State of North Dakota (Article 33.1-15 of the North Dakota Administrative Code)).

The eligibility to apply for the necessary approvals should not be construed as a guarantee that the required approval will be issued, this determination is made during NDDEQ's application processing. That said, based on the information shared in the meeting, NDDEQ believes the Wellspring Hydro project could comply with all applicable state and federal environmental regulations.

Should you have any questions, concerns, or comments for NDDEQ, please reach out to David Stroh at (701)328-5229 or destroh@nd.gov.

Sincerely,

Karl Rockeman, P.E.	Chuck Hyatt	David Stroh
Director	Director	Environmental Engineer
Division of Water Quality	Division of Waste Management	Division of Air Quality

DES:lc

xc: L. David Glatt, Environmental Quality, Director
James L. Semerad, Division of Air Quality, Director
Mat Hirst, Wellspring Hydro, Chief Operating Officer

4201 Normandy Street | Bismarck ND 58503-1324 | Fax 701-328-5200 | deq.nd.gov

Director's Office 701-328-5150	Division of Air Quality 701-328-5188	Division of Municipal Facilities 701-328-5211	Division of Waste Management 701-328-5166	Division of Water Quality 701-328-5210	Division of Chemistry 701-328-6140 2635 East Main Ave Bismarck ND 58501

Engagement Letter – BARR Engineering

resourceful. naturally.
engineering and environmental consultants

BARR

September 11, 2023

Mat Hirst
Chief Operating Officer
Wellspring Hydro

Sent via email to mat@wellspringhydro.com

Re: Proposal for Pre-Permitting Engagement and Environmental Compliance Strategy Support for the Proposed Chlor-Alkali Facility

Dear Mat:

On behalf of Barr Engineering Co. (Barr), I am pleased to submit this proposal for professional consulting services to Wellspring Hydro regarding the proposed chlor-alkali facility to be located near Trenton, North Dakota. This proposal is in response to your September 7, 2023, email request and follow-up call with Amanda Gravseth.

Understanding of the Project

Wellspring Hydro and its partners are evaluating the construction and operation of a greenfield chlor-alkali facility near Trenton, ND. Barr's role during this initial phase shall be to provide multi-media pre-permitting engagement and related strategic environmental consulting services as directed by you.

This authorization request is for the following pre-permitting engagement activities over the next four months (approx.) in support of this role:

1. Provide pre-permitting engagement and correspondence to Wellspring Hydro for interaction with investors and engineers as the proposed project progresses.
2. Participate in project meetings with investors, engineers, agencies, as requested by you. Barr will provide input and follow-up activities from environmental/permitting items that arise during these meetings.

Subsequent permitting work as the facility engineering design progresses will be covered under a separate or amended authorization request.

Scope of Work

Barr's scope of work activities and corresponding cost estimate on a time-and-materials basis is described below for the two tasks.

<u>Task 1: Pre-permitting engagement and correspondence. [$3,000] – 15 staff hours</u>

The primary objective of this task is to leverage our experience and expertise in environmental permitting for industrial facilities in North Dakota, led primarily by staff in our Bismarck office. We will provide guidance to you as you continue to engage with potential investors and engineering teams as the project progresses.

<u>Task 2: Participate in project meetings. [$2,000] – 10 staff hours</u>

This task provides an estimated 10 staff hours for Barr to participate in meetings with you to provide input and nominal follow-up activities related to permitting and environmental compliance of the proposed project during this work authorization.

Service Assumptions and Compensation

The budgetary cost on a time-and-materials basis is $5,000. The project will be billed on a time-and-materials basis in accordance with the Barr fee schedule that is in effect at the time the work is performed. Invoices will be provided on a four-week basis. Payment terms are net 30 days. Should the project take less time than what is assumed, Barr will only bill for hours worked. Conversely, if certain subtasks require more time than identified in this proposal, Barr shall communicate any needed revisions to the scope of work prior to exceeding this budget.

Schedule

We will begin work immediately upon your authorization. The project cost estimate assumes a four-month work duration.

Project Team

Amanda Gravseth and I will be your key points of contact. If necessary, other Barr team members will be leveraged for support and expertise.

Thank you for the opportunity to provide Wellspring Hydro with this proposal. If you would like to discuss this proposal in further detail, please contact Amanda Gravseth (agravseth@barr.com, 701.221.5424) or me (adriscoll@barr.com, 952.832.2791).

Sincerely,

Adam Driscoll
Vice President

cc: Mark Watson, Wellspring Hydro
Amanda Gravseth, Barr

Hargrove Detailed Design Proposal – Wellspring Hydro

Attached as a separate document in the CSEA submission due to size.

Response to Request for Proposal

Chlor-Alkali 150 STPD Greenfield Plant

Detail Design

Trenton, North Dakota

Submitted to

Wellspring Hydro

Attn: Mr. Mark Watson

mark@wellspringhydro.com

Hargrove Ref. No. HRBH213095 Rev. 0

Submittal Date: October 26, 2023

October 6, 2023

Subject: **Chlor-Alkali 150 MPD CL_2 Greenfield Plant**
Hargrove Reference No.: HRBH234040

Dear Mark,

Hargrove and Associates, Inc. (Hargrove) is pleased to present this proposal to provide engineering services for the Chlor-Alkali 150 STPD CL_2 Greenfield Plant Detail Design at a plant location to be determined later. We are confident that our knowledge and demonstrated success with similar projects, experience working with Wellspring Hydro, and overall alignment with your needs and priorities,

Why Hargrove?

- **Safety First** – Like Wellspring Hydro, Hargrove is committed to doing whatever it required for all who are touched by our work to go home safely every day. We are committed to an incident-free project execution. Our commitment starts on the first day of project design and continues through the end of startup with a focus on safety in design, planning, constructability, and operational safety once the project is completed and turned over. Our Team's safety statistics, awards, and Teammates' attitudes in support of safety leadership prove our commitment.
- **Understanding of Wellspring Hydro's Needs** – Hargrove has proven capabilities of performing all facets of needed services, starting with project FEL Engineering services through Execution, including EPC capabilities. These capabilities have been demonstrated on a continuous basis. Hargrove will work very closely with WELLSPRING HYDRO's project team to align on all project objectives, priorities, and execution plan. Any change will be reviewed with WELLSPRING HYDRO as soon as it is identified.
- **Right Size Company and Team** – We continuously focus on having the right people, in the right place, at the right time. Our Hargrove Teammates working on WELLSPRING HYDRO projects have significant experience, both in and out of the field and employ a "One Team" approach ensuring a well-executed project. We understand your expectations and expect no surprises as the project advances.
- **Value Creation** – Hargrove is committed to creating value for Well Spring Hydro, by partnering with entire project teams to identify scope optimization and FEL opportunities which reduce overall project TIC and schedule. We are a relationship-based company and work as an integrated team to drive value with our clients. From our experience with projects and portfolio alliances, we know that strong communication and practicing collaborative teamwork are pillars in delivering value to Wellspring Hydro.

We hope you find our proposal responsive to your request and look forward to meeting with you to review and ensure that our response is in complete alignment with your expectations.

Please contact or our me if you should you have any comments or questions regarding our proposal. We look forward to a successful, collaborative project working closely with your Team.

Regards,

J. Scott Cooper | Director- Chlor-Alkali
Hargrove and Associates, Inc. | Birmingham, AL
p: 205.484.0241| c: 205.901.7887

www.hargrove-epc.com

1.0 Project Understanding

As part of the Detail Design of the project, Hargrove will perform the following activities:

- Define infrastructure requirements to facilitate the expansion
- Define equipment scope required
- Assist Wellspring Hydro with identification of long-lead equipment and materials to be prioritized due to the current global supply-chain situation
- Develop a priced equipment list containing the process/electrical equipment needed to support the plant requirements
- Develop IFP Quality Equipment Packages for long-lead equipment items for Wellspring Hydro to purchase

2.0 Execution Plan

The project will begin with a kickoff meeting to align Wellspring Hydro and the Hargrove project Team on the project expectations, deliverables, and overall project schedule. An engineering milestone schedule will be developed and issued to Wellspring Hydro early in the project. Throughout the project Hargrove will hold weekly Team meetings and provide weekly reports, which will include completed and upcoming tasks, project needs or concerns, as well as man-hours and cost spent to date.

2.1 Project Kickoff

The project will be led from our Birmingham, Alabama office, as it is the home office for the majority of our veteran Chlor-Alkali engineering staff. Once the project is awarded, the first critical activity will be to hold the project kickoff meeting to provide an opportunity for alignment of the Wellspring Hydro and Hargrove project teams. We suggest the following as key topics for the kick-off meeting:

1. Complete review of project scope and objectives of the project
2. Identify key contacts and interfaces between WELLSPRING HYDRO/and Hargrove
3. Project Communications
4. Project Controls requirements
5. Schedule development and reporting
6. Project Milestone Dates
   - Kick off Meeting (KOM) – TBD
   - IAP (Interactive Planning Session) – 1 week after KOM- Birmingham Offices
   - Additional Dates will be established and agreed to during IAP
7. Project deliverables (both Wellspring Hydro and Hargrove)
8. Document Control Review including Document Distribution Matrix Development
9. Change Management
10. Discuss Wellspring Hydro project funding and cash flow requirements
11. Meetings and Weekly / Monthly Reports
12. Discuss project responsibility matrix

2.2 Interactive Planning and Schedule Development

Within days of the Kick-Off meeting, the Hargrove Team will schedule a team (Hargrove & WELLSPRING HYDRO) Interactive Planning (IAP) session considering the Project Milestone Dates reviewed in the project Kickoff meeting. The Hargrove Team will use the results of this IAP to develop a preliminary schedule of detail design activities. The goal will be to first identify key milestone dates followed by the development of discipline activities needed to achieve the milestone dates according to each of the work areas. The development and review cycles of the TIC Estimate will be included along with the re-bidding activities associated with Detailed Design and the associated estimated durations.

2.3 Project Controls

Scheduling

Upon completion of the IAP described above, our scheduling Team will develop a resource loaded schedule using the latest version of Primavera. Schedule development begins with a detailed scope of work and defined Work Break Schedule (WBS). From this the lead engineers develop their engineering packages that support the project construction plan. All the engineering packages are loaded in the Hargrove Progress Tracking Tool (PTT). We use the PTT to track engineering based on the earned man hour method. We also track productivity using the PTT.

Schedules will be updated on a weekly basis. The critical path is reviewed as required to determine bottlenecks and work around plans. Milestones can also be included for decisions needed for risk register items.

Our Project Controls Team will develop and maintain a resource loaded critical path schedule in accordance with Hargrove standard procedures and incorporate client guidelines and expectations. The proposed schedule (see Appendix B) was developed to help our Team map out the Detailed Design durations for the project. This schedule will be further refined via a focused schedule interactive session at the start of the project and will be reviewed and communicated weekly or as major milestones change to reflect actual completed activities and incorporate input from our design Team and vendors alike as the project progresses.

Earned Value and Progress Reporting

An earned value analysis will be performed each time progress is reported. Productivity (earned workhours / actual workhours) is tracked to assess the work hours required to complete the project.

2.4 Constructability Analysis and Review

During detail design, Hargrove will facilitate constructability review meeting with the constructor as agreed to upon engagement with the constructor.

2.5 High Value Engineering Partner

Hargrove maintains a partnership with a High Value Engineering Center locations in Caracas, Venezuela and / or Monterrey, Mexico. Hargrove understands that High Value Engineering (HVE) fits the project's best interests and will include an HVE delivery strategy in the overall project execution plan. In our experience, Electrical, Instrumentation, Piping, and Civil/Structural are well suited for HVE project execution. We are accustomed to working within horizontal or vertical split scope and typically determine the best approach based on project type, scope, and level of integration with an operating facility.

Hargrove's philosophy of project execution utilizing HVE partners is designed to create a successful project team that is seamless and transparent to the Owner. Hargrove will maintain the role of leader and facilitator for the HVE team and maintain full responsibility for 100% of the designated HVE project scope. The Hargrove / HVE team applies the same practices and procedures to ensure quality, consistency, and execution in the most efficient manner possible. Documents and drawings developed by HVE Teammates are regularly reviewed and approved by the corresponding Hargrove Professional Engineer providing Responsible Charge for each discipline. Value engineering will be a focus for the engineering and design Team to ensure our collective Team is identifying and seeking ways to optimize project scope, schedule, and cost.

2.6 Model Reviews

Three reviews (30%, 60% and 90%) will take place during the Detailed Design phase. These reviews will be conducted at our Birmingham office with attendance of key Hargrove personnel. Other contributing parties will attend "virtually" via Microsoft Teams, as necessary. Hargrove will submit in-progress design documents for review in advance of the model reviews. Hargrove's Discipline Leads will also be available to review directly with WELLSPRING HYDRO's Team. These reviews will allow the WELLSPRING HYDRO Team (i.e., operations, maintenance, construction, etc.) an opportunity to review and provide feedback early in the design development process so that their concerns and recommendations are addressed efficiently and without significant cost impact. Hargrove's key leads will be present for the model reviews and actions will be documented and confirmed in future reviews.

2.7 Change Management

If there is a scope deviation, this will trigger the Hargrove Change Management procedure. Requested changes to scope or schedule cannot be implemented, or work progressed, until they are defined and approved by Wellspring Hydro. Further, change must be defined and presented to the WELLSPRING HYDRO project management Team immediately upon identification in the form of a Rough Order of Magnitude (ROM) Change Notice. Once the ROM is approved, a firm Project Change Notice can be developed. Hargrove will openly review potential changes in weekly coordination meetings. In keeping with our procedures, change will be presented for WELLSPRING HYDRO consideration within two (2) days of identification. The Hargrove project controls Team will assist in preparation of the engineering cost and schedule impacts as well as the estimated overall TIC cost and schedule impacts related to each scope change, upon receipt of approval from WELLSPRING HYDRO to implement the change. However, the Hargrove Team, first and foremost, will evaluate each change and seek ways to negate the change or assess the effectiveness of the change as well as determine the overall project impact of the requested change (cost and schedule). If the scope change is not deemed necessary, the Hargrove Team will present our findings to the WELLSPRING HYDRO Team and mutually agreed upon decision to either proceed or cancel the need for the said change.

2.8 Document Control

Hargrove utilizes Newforma Project Center for project management and document control needs. The program was created by engineers and is geared towards the work processes that we use every day. Below are some of the ways that we use Newforma to efficiently send and track information.

Document Transmittals - Our transmittals are sent via the Newforma Info Exchange. This method allows us to transmit very large amounts of information without being limited by the size of the outgoing or incoming email box. An email is sent to the recipients with a link to our secure server (Only those listed on the transmittal can access the information.) The recipient can then download all or partial contents of the transmittal. For Approval transmittals, the system allows the client team member to reply back directly through the Newforma Info Exchange website, attaching any files with markups.

Submittals - The vendors will also utilize the Newforma Info Exchange Website to send any documents for review and/or approval. The documents are logged in and tracked throughout the entire review process then transmitted back to the vendor with any comments.

Action Items - The action item process allows us to send action items to both Hargrove and Client team members using the Newforma system. This allows the project manager to easily track all action items.

RFIs (Construction Phase Only) – The outside team member (Construction Manager, etc.) can send RFIs through the Newforma Info Exchange website directly to the Hargrove Project Manager who in turn assigns the request to the proper internal team member to answer. The system allows for a very quick turnaround on the RFIs and provides a means for establishing a record of all requests and answers.

Additionally, Hargrove has incorporated the use of Bluebeam into the document control system to create a session to allow all reviewers or approvers to collaboratively view or work on a project document at the same time. Bluebeam sessions can be set up with either no closure date or a specified due date to suit the project needs.

The Newforma Project Management Information system has proven to be efficient, effective, and easy to use for the Hargrove and Client Team.

3.0 Scope of Work

The following activities are included in the Hargrove scope of supply as per this proposal:

3.1 General/Project Services

The Hargrove Team will engage a Project Manager, Project Engineer, Project Controls (Cost and Schedule), Procurement and Expediting, Project Administration and Project Document Control resources to ensure that weekly project progress reporting is provided in a timely manner to WELLSPRING HYDRO's Project Manager. The Hargrove Project Manager will issue a weekly status report and will conduct a weekly virtual coordination meeting to help resolve project needs/issues and reach decision on open items to ensure timely resolution to support the project schedule objectives. Procurement Status Reports and Expediting Status Reports will be issued periodically during Detailed Design to provide vendor data status for all equipment.

3.2 Process

Heat & Material Balance - A heat and material balance will be developed to coordinate with the required production rate and any future increases. Once the H&MB is complete, PFDs with stream tables will be developed and will finalize the project process production considerations.

P&IDs - The Hargrove Process Team will lead the P&ID development effort. Process will perform continuity checks on the P&IDs as they are developed and evolve into Issued for design (IFD) level documents. Process will conduct P&ID review meetings prior to each P&ID release. The P&IDs will be issued by Area to best facilitate construction and start-up aspects. During the Detailed Design phase, Process will continue to facilitate the effort to progress the P&IDs to IFD status.

Equipment Packages - The Process Team will be responsible for process equipment packages development. The Process Team will develop IFP quality equipment packages for long-lead equipment items early in the detail design phase (20 packages). A detailed breakdown of equipment packages being handled by the Process and Mechanical groups along with the planned development progress of Detailed Design can be found in the deliverables section.

IFQ Packages - The Process team will begin by developing IFQ packages for the long lead equipment. The Process Engineering Team will work closely with the Mechanical Engineering Team and Wellspring Hydro to ensure the packages contain all the pertinent information necessary to fully define the equipment packages including process data, materials of construction, client standards, industry standards, required vendor submittals, etc. The packages will be submitted to Wellspring Hydro for review and approval. Any comments received will be incorporated prior to issuing to the Wellspring Hydro preferred vendor(s) for bid. Once all bids are received, the Process Engineering Team will review each bid for technical compliance. The Process Engineering Team will also coordinate with Procurement and provide the support needed for the commercial bid tabulations being created and issued to Wellspring Hydro. These findings will be summarized on a bid tab form for each equipment package and issued for information to Wellspring Hydro. Once a technically acceptable bidder is selected and agreed upon, the Process Engineering Team will develop a purchase requisition package (IFP) to be issued to Wellspring Hydro so that purchase order can be submitted to the successful bidder. Balance of equipment will be handled in a similar manner and will be prioritized to support the construction installation schedule.

Vendor Data - Hargrove's Process Engineering Team will facilitate a kickoff meeting with each selected vendor to confirm drawing schedule deliverable, set clear expectations for vendors, and gain alignment on the vendor data submittal and review process. Once vendor data is received, the Process Team, along with other Hargrove disciplines and Wellspring Hydro, will review the vendor data and make comments as necessary. This will continue until vendor drawings are reviewed without comment, which should take no longer than the third pass review. Hargrove's Document Control Coordinator will work closely with the Project Team to ensure all vendor data is received and submitted per the agreed upon terms included in the IFP IFQ.

Mechanical Equipment List - The Process and Mechanical Teams will collaborate and maintain the mechanical equipment list. This list will be updated throughout the project to serve as a concentrated reference for all pieces of mechanical equipment. At project completion, the equipment list will be issued for construction. The mechanical equipment list will be submitted intermittently during the project.

Instrument Datasheets and PSVs - Additionally, the Process Team will coordinate with the instrumentation Team to provide the process data for the inline instrument datasheets to allow progression of those packages during detail design. Process will support the development of the instrument datasheets for the non-inline devices at the start of detailed design. In parallel, preliminary PSV calculations will commence utilizing Hargrove's Relief System Checklist, revision 1, for the approximately 30 unique new relief valves identified on the project. At the start of detail design, the PSV packages will be updated with Wellspring Hydro approval comments and broken into PSV packages prior to submittal to Wellspring Hydro's preferred vendor for bid. Upon receipt of bids, Process will review and confirm technical acceptance prior to issuing the RFQ to WELLSPRING HYDRO for Procurement. Dispersion modeling will be performed on the PSVs to verify the discharge is routed to a safe location after the piping is routed but prior to stress calculations are performed to prevent rework. The Issued for Construction PSV packages will be issued following the piping construction package issuance.

The Process Team will remain engaged, as necessary, to support the entire project Team for the duration of the Detailed Design phase to provide any remaining process data needs, perform vendor document reviews, and participate in the PHA facilitated by WELLSPRING HYDRO. Any changes resulting from the PHA will be redlined on the P&IDs and issued to the project Team to ensure discipline scope alignment. Process will coordinate with the Piping Design Team to ensure all PHA comments are accurately incorporated prior to issuing for design.

3.3 Architectural

Hargrove's Architectural Team will begin by establishing the design basis. Once the design basis is confirmed the Team will work with Civil and Piping teams to begin progressing the site prep package for Code separation distance requirements between structures and property boundaries. The Team will work with other Hargrove teammates to develop a comprehensive 3D model for issuing Wellspring Hydro approval.

Architectural team will develop a basis of design package that describes the minimum building footprint size and interior space requirements for each process and occupied site structures, so a design build firm could provide the final layout design and code review summaries.

3.4 Civil/Structural

Hargrove's Civil/Structural Team will begin by establishing the design basis and issuing a Design Criteria Document. This will include a review by the EOR of the geotechnical information (provided by Wellspring Hydro) to confirm its adequacy for the project needs. Once the design basis is confirmed the Team will begin progressing the site prep package.

The Civil/Structural Design Team will work with Piping to build a comprehensive 3D model. The Team will utilize this 3D model to incorporate all design development. Additionally, the Civil/Structural Team will support the planned 15% model review where area site work plans will be reviewed prior to the package issuing for Wellspring Hydro approval.

Hargrove's Civil/Structural Team commence Detail Design work fronts to support planned construction priority efforts. Therefore, the Team will work closely with Piping Engineering to confirm loads as soon as available. Additionally, equipment vendor data will be needed for all critical equipment at the start of Detail Design and will be assumed adequate to progress engineering and design of all piles and foundations. As necessary and as described in this proposal, the Hargrove Structural Engineer will perform structural assessments of structures to support loads from new additions. Multiple construction work packages are planned to issue during Detail Design for the Civil/Structural Team:

- Site Work
- Pile Package
- Major Foundation Package (pile caps & critical equipment foundations)
- Area Paving & Minor Foundation Package (pump foundations, etc.)
- Concrete Protective Coatings
- Major Structural Steel Package
- Minor Structural Steel Package (MPS / MES)

A construction scope of work document will be developed and submitted with each package. The planned project model reviews will contain Civil/Structural scope for review.

Where necessary and as described in this proposal, the Hargrove structural engineer will perform structural assessments to confirm adequacy to support loads. Scope of work documents will be issued for entire scope, except for the Site prep package which will be take to IFC during as an early release.

3.1 Mechanical

Hargrove's Mechanical team will be responsible for a total of 14 equipment packages, the equipment items contained in the equipment list provided as part of this proposal. Mechanical will perform sizing calculations to support development of IFD quality equipment datasheets to be used to obtain firm pricing.

During Detailed Design, the Mechanical team will begin by developing IFQ packages for the equipment. The Mechanical Engineering Team will work closely with the Process Engineering Team and Wellspring Hydro to ensure the packages contain all the pertinent information necessary to fully define the equipment packages including process data, materials of construction, client standards, industry standards, required vendor submittals, etc. The packages will be submitted to Wellspring Hydro for review and approval. Any comments received will be incorporated prior to issuing to the Wellspring Hydro preferred vendor(s) for bid. Once all bids are received, the Mechanical Engineering Team will review to determine if each bid is technically acceptable or not. The Mechanical Engineering Team will also coordinate with Procurement and provide the support needed for the commercial bid tabulations being created and issued to Wellspring Hydro. These findings will be summarized on a bid tab form for each equipment package and issued for information to WELLSPRING HYDRO. Once a technically acceptable bidder is selected and agreed upon, the Process Engineering Team will develop a purchase requisition package (IFP) to be issued to Wellspring Hydro for inclusion with the Purchase Order.

Hargrove's Mechanical Engineering Team will facilitate a kickoff meeting with each selected vendor to confirm drawing schedule deliverable, set clear expectations for vendors, and gain alignment on the vendor data submittal and review process. Once vendor data is received, the Mechanical Team, along with other Hargrove disciplines and WELLSPRING HYDRO, will review the vendor data and make comments as necessary. This will continue until vendor drawings are reviewed without comment, which should take no longer than the third pass review. Hargrove's Document Control Coordinator will work closely with the Project Team to ensure all vendor data is received and submitted per the agreed upon terms included in the IFP IFQ.

The Mechanical and Process Team will collaborate to utilize and maintain the mechanical equipment list. This list will be updated throughout the project to serve as a concentrated reference for all pieces of mechanical equipment. At project completion, the equipment list will be issued for construction.

3.2 Piping

Hargrove's Piping Team will coordinate with Process and Wellspring Hydro to review and finalize process requirements to develop the piping service index. The Piping Team will coordinate with Process and Mechanical to develop a line list to align with the P&IDs as well as populate with process conditions to develop the list to an "Issued for Design" status. In conjunction, Piping will coordinate closely with Process to update and maintain the P&IDs capturing any updates as required following the hydraulic studies and PHA.

3D modeling activities will commence soon after the project kick-off and following confirmation piping service requirements. A master 3D model will be created. This model will be used to facilitate the constructability meeting/model review as well as ensure pipe rack space is properly accounted for and pipe routing overlap is eliminated. Equipment modeled will be validated following the receipt of Wellspring Hydro's approval comments to the mechanical and process mechanical IFQ packages and receipt of vendor bids. The Team will focus on modeling all large bore piping (3" and above) with 2" & below to be field routed by the constructor.

Hargrove's Piping Engineering Team will coordinate closely with the Piping Design Team to support the development of the line list, including the identification of lines requiring computational stress analysis, valve list, and specialty item list, as required. Concurrently, the Piping Engineering Team will begin reviewing the modeled pipe routings and will identify modifications needed to the piping design. The necessary modifications will be communicated to the piping design group as required to ensure piping layouts pursuant to ASME B31.3 piping code and Hargrove standards. The Piping Design and Engineering Teams will work closely to ensure all piping is designed properly and safely. Hargrove's Piping Engineering Team will also support the Civil/Structural design effort by providing reaction loads, determined during pipe stress analysis in Detailed Design. During Detailed Design, Piping Engineering will also develop and maintain an engineered supports list (per Hargrove Procedures, Structural Group maintains engineered support list with input from Electrical and Piping). If during pipe stress analysis it is determined that engineered supports are required to properly support a piping system, Piping Engineering / Design will coordinate with the Structural Engineering to design the appropriate support needed and capture it on the engineered supports list. The Piping Engineering Team will support development of the specialty items list by selecting the appropriate specialty items for each service, getting vendor cutsheets of each item, and updating the description of each item on the list.

The Piping Team will also develop a plot plan of the entire site which includes a general arrangement of equipment, create 3D models of equipment when vendor models are not provided, and review/comment on vendor supplied drawings.

As the project progresses the Detail Design, immediately following the "Issued for Design" control documents, the Piping Team will begin progressing the 3D model in preparation of a 30% model review. This model review will focus on the major pipe routings, as modified from the previous review, any additional lines added, piping identified as long lead MOC, constructability, laydown, safety shower, and utility station locations. This model review is critical in obtaining Wellspring Hydro's approval. As the phase progresses the Piping Design Team will work closely with all disciplines to ensure an integrated 3D model is being maintained and to verify that control documents are being managed and updated through the master-mark up procedure. A 60% model review is planned to review the overall scope in more detail, specifically the lines from start to finish, except for high and low point vent/drains. This model review will be more detailed and will benefit from the attendance of Wellspring Hydro's key project stake holders. The planned 90% model review will serve as piping's issued for approval package and will be facilitated following the completion of single discipline check and incorporation of computational stress analysis. The comments received during the model review will serve as WELLSPRING HYDRO's approval comments and will be documented as such with a project note itemizing each line reviewed and any associated comments captured. Following this review all comments will be incorporated into the package prior to being issued for construction.

3.3 Electrical

The Electrical Team will progress the electric load list as the equipment list is finalized and has identified the required electrical loads and finalize the overall electrical system design by sizing the power cables, cable tray, and developing the lighting design for the plant. Subsequently, the Team will begin modeling all cable tray and electrical equipment; however, modeling will not be finalized until receipt of electrical equipment vendor drawings. Concurrently with the 3D modeling effort, the Team will develop the schedules, details, schematics, and wiring diagrams. Cable tray major electrical equipment will be modeled and included in the 60% and 90% reviews. Once the 3D model design is approved by WELLSPRING HYDRO during the planned multi-discipline model reviews, the power, cable tray sections and details will be developed along with the remaining detailed design deliverables and issued to WELLSPRING HYDRO for approval. All approval comments received from WELLSPRING HYDRO will be incorporated prior to the package issuing for construction.

3.4 Instrumentation

The Team will review P&ID's and update the instrument index to document the scope for the project. Budgetary pricing will be solicited and provided for all new instrumentation. The Team will confirm I/O requirements to provide to a third party for development of the DCS requirements. All instrument design will be progressed into Detailed Design resulting in IFA and IFC packages that will support procurement, safe fabrication/assembly and installation by the selected contractors. Participation in the PHA during detailed design is planned for an Instrument Engineer. Any revisions to the process data as a result of the PHA, P&ID approval cycle, or equipment evaluations, including PFD and H&MB updates, may result in the reevaluation of instrumentation leading to the procurement of additional devices. Following PHA the instrument index will be updated with I/O requirements as needed to support delivery of information to WELLSPRING HYDRO's third party DCS vendor.

3.5 Procurement

During Detailed Design, a procurement agent will be assigned to facilitate bid invites, bid reviews, and final recommendations for all equipment packages. Procurement will expedite vendor data for long lead tagged equipment. Procurement estimate assumes all PO's will be issued by Wellspring Hydro. The Team will expedite vendor data and material/equipment delivery throughout the duration of the project. Procurement Status and Expediting Status reports will be issued within the weekly project report during Detail Design.

4.0 Deliverables

The following items are the anticipated deliverables associated with the scope of services for Chlor-Alkali 100 MTPD Cl_2 Greenfield Plant as described herein. These deliverables will be submitted electronically to the Wellspring Hydro Team via our Document Control system (NEWFORMA). The deliverables are:

4.1 Civil

1. 30%/60%/90% Design Review
2. Develop a scope of work for underground and topographic survey
3. Evaluate the Geotechnical data (By Wellspring Hydro)
4. One (1) Cover Sheet
5. One (1) General Notes Sheet
6. One (1) Existing Conditions & Demolition Sheet
7. Five (5) Civil Site Plans sheets (Area Specific)
8. Three (3) Erosion Control Plan Sheets
9. Five (5) Grading, Drainage and Paving Sheets
10. Six (6) Stormwater Plan and Profile Sheets
11. Four (4) Railroad Geometry Plan and Profile Sheets
12. Two (2) Railroad Cross Sections
13. Four (4) Civil Site and ECP Details
14. Five (5) Utility Plan Sheets
15. Two (2) Civil Site Geometry and Points Tables Sheets

4.2 Structural

1. 30%, 60% & 90% Model Reviews
2. 3D Modeling of Steel & Concrete
3. IFC General Notes & Standard Details for Concrete (10)
4. IFC Steel Drawings for Miscellaneous Pipe Supports (10)
5. IFC Foundation Drawings for Admin. Bldg., Guard House, Maintenance Bldg., Shipping/Loading Bldg. (7)

6. IFC Steel Drawings for Utility Racks (12)
7. IFC Foundation Drawings for Utility Racks (8)
8. IFC Foundation & Pit Drawings for Salt Storage Pile & Saturator (4)
9. IFC Foundation Drawings for Primary Brine Purification (10)
10. IFC Steel Drawings for Primary Brine Purification (10)
11. IFC Foundation Drawings for Secondary Brine Purification (14)
12. IFC Steel Drawings for Secondary Brine Purification (10)
13. IFC Foundation Drawings for Electrolyser, MCC, Control Room Buildings (10)
14. IFC Steel Drawings for Electrolyser Building (8)
15. IFC Foundation Drawings for De-Chlorination (8)
16. IFC Steel Drawings for De-Chlorination (8)
17. IFC Foundation Drawings for Caustic Dilution & Concentration (8)
18. IFC Steel Drawings for Caustic Dilution & Concentration (6)
19. IFC Foundation Drawings for Chlorine Gas Washing, Drying & Cooling (8)
20. IFC Steel Drawings for Chlorine Gas Washing, Drying & Cooling (8)
21. IFC Foundation Drawings for Chlorine Gas Liquefaction & Vaporization (8)
22. IFC Steel Drawings for Chlorine Gas Liquefaction & Vaporization (8)
23. IFC Foundation Drawings for Chlorine Gas Absorption (6)
24. IFC Steel Drawings for Chlorine Gas Absorption (6)

4.3 Architectural

1. IFC Architectural Packages (lead sheets, floor plans, life safety plan, elevations, sections, details, door & finish schedules) for the following buildings:
   - Electrolyser Building
   - Shipping/Loading Building
   - Administration Building
   - Control Room/QC Lab/Locker Room Building
   - Utility/Storage Building
   - Maintenance Building
   - Guard House

4.4 Process

1. Product/Plant Capacity Design Basis
2. Heat and Material Balance
3. Utility Balance
4. Development of PFDs (estimated 10)
5. Line Sizing Calculations
6. Development of Process P&IDs (74) to IFC Status (Drafting by Piping/Mechanical)

7. Development of Process/Mechanical Equipment List (for handover to Hargrove Mechanical group for ownership)
    - Estimated quantity of (195) line items anticipated based on similar projects broken down into (34) equipment packages
    - Vendor information updates for major equipment packages by Process listed in item 8 below (balance of equipment updates by Hargrove Mechanical):
8. Equipment Sizing Calculations for:
    - Pumps – Estimated 10 unique hydraulic calculations
    - Tanks – Sizing Calculations for estimated 8 unique tanks
    - Heat Exchangers – Sizing calculations for estimated 17 unique exchangers (15 P&F, 2 S&T)
    - Dechlor Tower
    - H2 Stack??
9. IFP Quality Equipment Specifications for twenty (20) Major Process Equipment Packages
    - Caustic Evaporation – Written Specification + Data Sheets
    - Ion Exchange Unit & Resin – Written Specification + Data Sheets
    - Brine Candle Filters – Written Specification + Data Sheets
    - EVS Package – Written Specification + Data Sheets
    - Chlorine Compression / Drying / Vaporization -Written Specification + Data Sheets
    - Brine Clarifier – Written Specification + Data Sheets
    - Deaeration Tower – Written Specification + Data Sheets
    - Dechlor Tower – Written Specification + Data Sheets
    - Demisters – Written Specification + Data Sheets
    - Fans & Blowers – Written Specification + Data Sheets
    - Filter Press – Written Specification + Data Sheets
    - H_2 Gas Scrubber – Written Specification + Data Sheets
    - HCl Unit – Written Specification + Data Sheets
    - Cl_2 Pumps – Written Specification + Data Sheets
    - Plate & Frame HX and Shell & Tube HXs – Written Specification + Data Sheets
    - Sulfate Removal System – Written Specification + Data Sheets
    - Vacuum Pumps – Written Specification + Data Sheets

      * *Complete procurement bid packages for these items to be developed by Hargrove Mechanical*
10. Process Data input to Hargrove Mechanical for development of IFP Quality Data Sheets and/or Specifications for inclusion in 14 additional bid packages:
    - Agitators (6 Unique Items)
    - Std Centrifugal Pumps (19 Unique Items)

- Chiller Package (1 Unique Item based on utility balance)
- Cl_2 Bullet Tanks
- Diaphragm Pumps (1 Unique Item)
- Field Erected Tanks (15 Unique Items)
- Mag Drive Pumps (9 Unique Items)
- Metering Pumps (1 Unique Items)
- Overhead Crane
- Salt Handling
- Shop Fab FRP Tanks (15 Unique Items)
- Shop Fab Metal Tanks (15 Unique Items)
- Truck Loading and Unloading (3 Unique Items)
- Rail Loading & Unloading (2 Unique Items)

11. Development of Technical Bid Tabulations for twenty (20) process equipment packages – Assumes 3 bids per package
12. Process input to Technical Bid Tabulations for fourteen (14) mechanical packages
13. Vendor drawing reviews for all purchased major process equipment
14. Hydraulic Case Scenario evaluations for instrument process data (3 cases per pump calculation)
15. Equipment Layout assistance to Mechanical
16. Process data input for line list
17. PHA Participation in Birmingham
18. PSV Engineering Packages – Actual quantity TBD during design (estimated 29)

4.5 Mechanical

1. IFB Equipment Packages (34)
2. Priced Equipment List
3. IFP Packages (34)
4. Mechanical Construction Scope of Work (SOW)

4.6 Building Mechanical

1. Building Mechanical Packages (lead sheets, spec sheets, fire protection coverage plan, duct work plan, plumbing plan, details, equipment schedules, airflow diagram, control diagram) for the following buildings:
   - Electrolyser Building
   - Shipping/Loading Building
   - Administration Building
   - Control Room/QC Lab/Locker Room Building
   - Utility/Storage Building
   - Maintenance Building
   - Guard House

I. Piping

1. 30%, 60% & 90%: Design Reviews (1per).
2. 3D Model.
3. Model process and mechanical equipment in CADWorx
4. P&ID CAD (74)
5. Integration of vendor models into the project
6. Plot Plan Drawing (1)
7. General Arrangement Drawings (10)
8. One (1) Line List -Total Line Count of (884) comprised of (388) large bore and (353) small bore lines
9. Development of Piping/Manual Valve Specifications
10. Engineered Supports List (1) Per Hargrove Procedure
11. Piping Isometrics for (388) large bore lines
12. Pipe Support Details- Standards.
13. Stress Analysis
14. Valve List. (1)
15. Specialty Item List (1)
16. Construction Scope of Work Packages (1)

4.7 Electrical

1. 30%, 60% & 90%: Model Reviews (1)
2. IFC-Cable and Conduit Schedule
3. IFC-Electrical Load List
4. IFC-Electrical Equipment List
5. IFI-Electrical Drawing List
6. IFI-Preferred Vendors List
7. IFI-Power Study Report with Load Study, Short Circuit, and Arc Flash results (1)
8. Specifications, Bid Reviews, Bid Tabs of the following electrical equipment:
    - Prefabricated Electric Centers
    - 15kV Switchgear
    - 5kV Switchgear
    - Low Voltage Power Transformers
    - 5kV MCCs
    - 600V Switchgear
    - Bus Duct
    - 5kV Variable Speed Drives
    - Medium Voltage Transformers
    - 600V Motor Control Centers

- 600V Variable Speed Drives
- Transformer-Rectifier System
- Automatic Transfer Switch
- Standby Generator
- Fire Alarm System
- Communication System
- UPS System
- Temporary Power System
- DC Voltage Systems
- DC Switches
- Substation Protection System
- Badging-Security System
- Voltage Monitoring
- Electric Heat Trace
- Polarization Rectifier System
- Capacitor Bank
- Bus
- Packaged Equipment E&I Requirements

9. IFC-Construction Electrical Scope of Work (1)
10. IFC-Single Line Diagrams (35)
    - Site Overall Single Line Diagram
    - 15kV Single Line Diagram
    - 480V MCCS Single Line Diagrams
    - 480V Switchgear Single Line Diagrams
11. IFC Temporary Power Plans, Elevations, & Sections Drawings (10)
12. IFC Communications Power Plans, Elevations, & Sections Drawings (10)
13. IFC Motor Elementary Drawings (28)
14. IFC Mechanical vendor package Interconnection/Elementary Drawings (45)
15. IFC Transformer/Rectifier vendor package Interconnection/Elementary Drawings (40)
16. IFC Standby Generator vendor package Interconnection/Elementary Drawings (1)
17. IFC Fire Alarm & Signal Plans, Elevations, & Sections Drawings (10)
18. IFC Electrolyzer DC Switch System Interconnection/Elementary Drawings (2)
19. IFC DC Voltage Systems Interconnection/Elementary Drawings (2)
20. IFC Harmonic Filter Vendor Package Interconnection/Elementary Drawings (1)
21. IFC Automatic Transfer Switch Interconnection/Elementary Drawings (1)

22. IFC Communications, Fire Alarm & Signal, Security, and Substation Protection System Vendor Packages Interconnection/Elementary Drawings (4)
23. IFC Power Transformer/Switchgear/MCC Interconnection/Elementary Drawings (35)
24. IFC Circuit Panel Interconnection/Elementary Drawings (20)
25. IFC Power Distribution Center Vendor Package Interconnection/Elementary Drawings (1)
26. IFC System Architecture Diagram – Security (1)
27. IFC Building Electrical - Panel Schedules (7)
28. IFC UPS Systems Interconnection/Elementary Drawings (2)
29. IFC System Architecture Diagrams for the following
    - Fire Alarm & Signal (1)
    - Communications (1)
    - Substations Protection System (1)
30. IFC Power / Instrument Plans, Elevations, & Sections Drawings (10)
31. IFC Capacitor Bank Interconnection/Elementary Drawings (2)
32. IFC Equipment Arrangements (Power Distribution Center, Transformer/Rectifier Room, Electrolyzer Cell Room, Electrolyzer Cell Renewal Room, and Control Room) (5)
33. IFC Plans, Elevations, & Sections Drawings for the following:
    - Lighting (10)
    - Grounding (10)
    - Lightning Protection (10)
    - Duct Bank (10)
    - Security (10)
    - Cable Tray (10)
    - Area Classification (10)
    - Heat Trace (5)
34. IFC Building Electrical (Small Power, Lighting, and Systems) Plans (21)
35. IFC Electrical Standards and Installation Details (10)

4.8 Instrumentation

1. 30%, 60% & 90%: Model Reviews (1)
2. IFC - Instrument Index with I/O (1060 Device Tags) (1)
3. IFP – Data Sheets (424)
4. IFC – Instrument Drawing Index (1)
5. IFC – Instrument Location Plans (20)
6. IFC - Remote I/O Panel Wiring Drawings (20)
7. IFC - Field Junction Box Wiring Drawings (20)
8. IFD - Field Junction Box Layout Drawings (2)

9. IFC – Loop Sheets (848)
10. IFC – Installation Details (14)
11. IFD – Scope of Work for Detail Design Report (1)
12. IFC – Bid Construction Package (1)
13. Participation in PHA

4.9 Controls and Automation

1. SIL Calculations (56)
2. SIS Functional Specifications (56)
3. BPCS Functional Specifications (1)
4. BPCS Control Narrative (1)
5. 3rd Party Interface Specification (1)
6. I/O list (1)
7. Alarm List (1)
8. Communication I/O list (1)
9. Control Narratives (744)
10. Cause & Effect Matrix (1)
11. Network Architecture Drawing (1)
12. BPCS Configuration File (1)
13. SIS Configuration File (1)
14. Graphics Package (1)
15. BPCS FAT Procedure (1)
16. SIS FAT Procedure (1)
17. BPCS SAT Procedure (1)
18. SIS SAT Procedure (1)
19. Participation in PHA

4.10 Procurement

1. Weekly Procurement Status Report (1)
2. Weekly Expediting Status Report (1)
3. Bid Tabs for Mechanical Equipment, Non-Long Lead
4. Mechanical RFQ's, Non-Long Lead
5. Instrumentation RFQ, Non-Inline Devices
6. Bid Tabs for Instrumentation, Non-Inline Devices
7. Expedite Mechanical Equipment Vendor Data
8. Instrumentation Equipment Vendor Data (1 Lot)
9. Expedite PSV Vendor Data & Equipment (1)

4.11 General/Project Services

1. Level 3 Schedule
1. Weekly/Monthly Status and Cost Reports
2. Change management
3. Construction Package
4. Management of RFIs

6.0 Project Team

The Hargrove Team proposed for your project is highly skilled in technical capability, project experience, and operational background. This Team is committed to implementing a design that allows for a safe and undisrupted operation and meets all your project drivers.

Resumes are located in Section 14.0 – Appendix A.

7.0 Client Provided Items

1. Site location.
2. Geotechnical information.
3. Existing Code reviews for the buildings.
4. Access to the area, facilities, equipment, software, and documentation needed to complete the assigned task.
5. Internet access suitable for VPN connection for on-site Hargrove personnel to connect to the Hargrove network.
6. Any required permits to document/assist in engineering efforts.
7. Access to engineering, operations, and maintenance personnel who can address questions and issues.

8.0 Clarifications & Assumptions

8.1 General

1. The Detailed Design duration assumed to be 14 months (60 weeks).
2. Estimate assumes weekly coordination meetings and model reviews will be held virtually.
3. Proposal excludes fire suppression system; assumed to be "By Others".
4. Commissioning and Startup support is not included, but Hargrove can self-perform and hence provide this service as needed, upon request.

8.2 Process

1. Equipment scope for quantity of specifications, bids, and bid evaluations defined by the equipment listed. Vendor documentation reviews to be conducted for all purchased equipment during detailed design.
2. Hargrove proposes to use two-week duration for Wellspring Hydro IFA review for all engineering work packages. This duration can be reduced, as needed, with WELLSPRING HYDRO's support to improve on schedule performance.

8.3 Architectural

1. Architectural package is a basis for design build firm to provide final design, code summary and detail design documents.

8.4 Building Mechanical

1. Building mechanical to provide HVAC, fire protection and plumbing design basis.
2. Building electrical to provide convenience power, fire alarm and lighting.
3. Structural to provide foundations, footing and slab design for all buildings.

8.5 Civil

1. Hargrove will not be responsible for environmental, land development, stormwater, and utility permitting.
2. Hargrove assumes general contractor will be responsible for building permits.
3. Hargrove has excluded the development of the Construction Stormwater Pollution Prevention Plan (SWPPP) and State Notice of Intent (NOI).
4. Hargrove assumes the public utilities (water, sewer, etc.) are available at the project or property lines and have sufficient capacity and adequate pressure to support the planned project.
5. Civil design will be performed in AutoCAD Civil3D.

6. The project will be designed using a Plant Coordinate System. Civil has not included time associated with converting drawings to State Plane Coordinate (real coordinate systems) for permitting use. A PCN would be developed for this effort if required.
7. Client to provide a recent boundary, topo, and utility survey. All survey data provided shall be in State Plane Coordinates.
8. Proposal does not include civil discipline construction services, but these services can be provided at an additional fee.
9. Hargrove assumes client will provide all existing drawings in CAD format.
10. Hargrove excludes the development of project specific specifications (i.e., Specification Book).
11. Hargrove is not providing Leadership in Energy and Environmental Design (LEED) and/or other Sustainability Certification.
12. Hargrove assumes all waste lines (process and/or sanitary) will be gravity.
13. Hargrove has excluded landscaping and irrigation plans.
14. Hargrove assumes firewater systems will be designed by third party fire protection engineers. This service can be provided by Hargrove at an additional cost.
15. Hargrove assumes client has performed its due diligence and the target property is suitable for use.
16. Hargrove assumes the project site will be in Brunswick, Georgia.
17. Civil assumes duct bank will be designed by Hargrove Electrical and Structural Departments.
18. Civil assumes site lighting will be designed by Hargrove Electrical.
19. Civil will coordinate with process/building mechanical on sizing firewater mains. Process/building mechanical to provide the firewater modeling.
20. This proposal assumes four (4) sheets per section for scale.
21. Client SOW document lists Fencing plans; this proposal assumes fencing may be shown on drainage and grading sheets.

8.6 Structural

1. Truck loading / unloading structures are to be provided by the vendor as a package. Hargrove's responsibility is for the foundation design only.
2. Construction support is excluded.
3. Time is not included for visiting the site under the assumption a site visit is not required.
4. THE MISCELLANEOUS PIPE SUPPORT (MPS) SCOPE IS CURRENTLY UNDEFINED. AS A BASELINE, HARGROVE ASSUMES NO MORE THAN 100 ENGINEERED MISCELLANEOUS PIPE SUPPORTS WILL BE REQUIRED.

8.7 Piping

1. Piping design estimate does not include hours for fire protection.
2. This proposal assumes underground obstructions do not exist in the areas of our design.
3. All piping 2" in diameter and smaller will be field routed and not included in the 3D model.
4. Proposal is based on the following P&ID count for the project: Area 1000 (Salt Dissolving) - 2, Area 2000 (Brine Treatment) - 13, Area 3000 (Electrolysis) - 12, Area 7000 (Bleach) - 9, Area 9000 (Utilities) – 35.
5. One combined piping Line List and Valve List (incorporating all areas) will be controlled by Birmingham office with other offices having access to update it.
6. AREA 9000 - All vendor skid packages, and major equipment shall include a model that will be compatible with the project model. No equipment modeling hours are provided for Major Equipment or Skid Packages. Equipment not being modeled: Cooling Tower, Cell Transformer, Cell Rectifier, Cooling Water Treatment Package, Tepid Water System Package, D.I. Water System (including after Filter Package) Package, Air Compressor System Package, Nitrogen System Package, Cell Room Heaters, Laboratory Flume Hood, Package Boiler System, Neutralization Waste Caustic and Acid Pump Skids, Chilled Water System (Chiller Evaporator, Chiller Compressor, Chiller Condenser).

7. All small-bore piping (2" and below) shall be field routed, and field supported, unless it is an engineered line (steam, condensate, FRP, etc.). Assumed all steam and condensate piping 2-1/2" and less will not be engineered.
8. Proposal assumes no field trips required since this is a Green Field site.
9. Proposal assumes two (2) review cycles for each vendor package submitted.
10. Proposal assumes no construction support.
11. Standard details or installation details are not included.
12. Plans, Elevations, or Sections are not included, except for GA.
13. AREA 9000 – Proposal is based on modeling and extracting 166 Large Bore Lines.
14. Piping Lists (Line List and Valve List) will only be issued once.
15. There are no tie-ins since this is a Green Field site.
16. Bi-weekly internal model reviews will be held.
17. Proposal is based on 35 Unique Pipe Specifications.
18. 2D Piping Plan Drawings to not be issued, only isometrics.
19. Vibration Analysis, Pulsation or Acoustical Studies are not required.
20. Vendor or client to provide allowable nozzle loads for all equipment.

8.8 Mechanical

1. Hargrove assumes a maximum of three (3) bidders per equipment package.
2. It is assumed that only one round of clarifications (during bid evaluations) will be sufficient to determine if a vendor is technically acceptable or not.
3. 197 individual pieces of equipment were identified on the equipment list, it is assumed that duplicate items (for example an A/B pump pair or an X/Y exchanger pair) can be defined on one datasheet.
4. Equipment datasheets and specifications will not be issued as individual deliverables but will be issued as part of equipment requisition packages.
5. Requisition packages will be issued for approval (IFA), for bid (IFB) and then for purchase (IFP).
6. Estimate assumes it is acceptable to use Hargrove standard templates for datasheets, requisition packages, bid tabs, etc.
7. Hours for vendor data review assumes three (3) review cycles max per document.
8. Hours for vendor data review assume upon initial receipt of a vendor supplied submittal, all Hargrove disciplines and Wellspring Hydro will be included on that review. Except in the event of significant changes or major revisions, all subsequent submittals of the same document will only be reviewed by the Hargrove Mechanical team.
9. Mechanical's estimate excludes fire protection scope.
10. Mechanical assumes an average one (1) week review cycle for IFA submittals to WELLSPRING HYDRO. Hargrove will break review packages into project areas where possible to maintain reasonably sized packages for review. Review cycle durations for packages containing a larger quantity of documents will be discussed and agreed upon in advance of submittal.
11. Hargrove assumes mechanical equipment inspections will be addressed by others. This includes approval of manufacturing and testing procedures. Our RFQ packages will not contain equipment specific inspection and test plans; however, we will require vendors to submit these as part of their vendor data submittals.
12. The mechanical construction work package will serve as a Scope of Work document for a contractor to bid on for the installation of mechanical equipment associated with the project. This document will not be a step-by-step guide on how to install each individual component. Instead, it will define the equipment to be installed and provide the information necessary for a contractor to plan their work.

8.9 Electrical

1. Client to provide electrical preferred vendors for new site vendor list.
2. No MTO check estimates included.

3. No Project Job Data Books included.
4. No time for pre-bid and award meeting for constructors.
5. No site trips included.
6. No Construction Support included.
7. No As-Builts included.
8. No Medium voltage (4160V or 2400V) motors included in electrical distribution design. All site loads except for Transformer/Rectifiers assumed to be 480V or less.
9. No Conduit plans included.
10. Utility will provide 15kV or 25kV directly to site boundary. Duct bank will be designed from site boundary to new switchgear.
11. No conveying system for Area 1000 salt saturator, assumed salt brought in by truck.
12. Breaker settings programming onsite during commissioning is excluded. Hargrove will provide protective relay settings only.
13. Lighting contactors will be prewired by prefab building vendor and will be on lighting panels schedules.
14. Substation will be close to the site. Substation design is responsibility of Utility.
15. Harmonic study excluded. By harmonic filter vendor.
16. Safety training is not required for the Greenfield site.

8.10 Instrumentation

1. Communication and Alarm System is excluded.
2. The hours for Instrument Location Plan include the extraction from the model.
3. Off-line instruments will not be shown in the model.
4. All the instruments in the vendor package are provided by vendor.
5. Instruments assumed to be issued to a maximum of three (3) bidders during detailed design with one review cycle.
6. 3D modeling will be limited to new junction boxes, where applicable, and inline instruments only, which will be modeled by the Piping Design Team.
7. Hours for review of vendor packages are not included.
8. Hours for site trip are not included.
9. Hours for PHA/HAZOP are not included.
10. Hours for P&ID markup/collaboration are not included.
11. Hours for procurement of instrumentation are not included.
12. MTO check estimates are not included.
13. Project Job Data Books are not included.
14. As-Builts are not included.
15. Conduit plans are included.
16. Conveying system for Area 1000 salt saturator is not included.
17. Vendor supplied devices assumed prewired; not shipped loose.
18. Interface for controls integration is assumed for vendor packages; no individual wiring in DCS included for vendor packages.

8.11 Procurement

1. Procurement will expedite vendor data. Per Hargrove procedure, the Discipline Lead and Document Control will be responsible for tracking vendor document submittals and notifying Procurement when vendor submittals are incomplete.
2. Procurement Estimate assumes one (1) Round of Technical reviews per package.
3. Hours are not included for DCS hardware and software specification.
4. Hours are not included for communication, alarm system, and security system specifications.

8.12 Controls and Automation

1. Hargrove is not responsible for issues with plant scheduling or delays caused by operations, contractors, or weather that may delay the project schedule. Delays or additional site time spent resulting from schedule changes outside of Hargrove's control may result in additional time and rate expenses.
2. Unless otherwise specified, meetings associated with this project will be attended virtually via a teleconference service such as Microsoft Teams.
3. Action items assigned to the Wellspring Hydro Corporation team will be resolved in a timely manner.
4. One (1) review cycle is included in this Scope of Work. Any documents submitted to the Wellspring Hydro Corporation team for review will be returned to Hargrove within five (5) working days.
5. The included scope addresses the programming of an emergency shutdown system. A SIL rated system is not currently expected. As such, documentation for Safety Functions, to include SIL calculations, have not been included as part of this proposal. Hargrove has the capability to develop all required safety documentation. Pricing for those services will be provided upon request.
6. Control panels are not included in our proposal; however, our award-winning panel shop can provide the equipment upon request.

9.0 Schedule

The Chlor-Alkali effort will take approximately 12 months and can begin immediately after receipt of PO.

10.0 Commercial Offering

Hargrove and Associates, Inc. is pleased to provide this proposal for engineering and design services on a lump sum basis. Based on the recommendation from Wellspring Hydro, this offering is broken down into six (6) separate engineering deliverable packages, shown below.

This proposal is valid for 30 days.

10.1 Engineering Cost

The Balance of Engineering portion of this offering includes all multi-discipline Issued for Construction (IFC) drawings and documentation. Not included will be E&I specifications, data sheets, bid packages and bid evaluations.

For Balance of Engineering there are an estimated XX,XXX workhours to complete the work, which equates to a fee of **$XX,XXX,XXX** with the appropriate breakdown of discipline and support services noted below.

Table 1. Balance of Engineering Workhours:

Discipline	Workhours
Architecture	
Building Mechanical	
Piping	
Civil	
Structural	
Mechanical	
Instrumentation	
Electrical	
Process	
Project Management	
Project Controls	
Admin, Document Control	
Total	

10.2 Controls and Automation

The Controls and Automation portion of this offering includes all engineering and documentation needed to provide automation services. C&A will provide documentation, configuration, graphics, PHA, factory acceptance test (FAT), PSSR & site acceptance test (SAT), and startup support.

For Controls and Automation there are an estimated X,XXX workhours to complete the work, which equates to a fee of **$XXX,XXX** with the appropriate breakdown of discipline and support services noted below. NOTE: The Controls & Automation price assumes that Hargrove E&C will be performing all other disciplines.

Table 1. Controls and Automation Workhours:

Discipline	Workhours
C & A	
Total	

Please refer to Section 15.0 for information about Hargrove's Controls and Automation Group and Control Panel Shop.

11.0 Terms & Conditions

Terms of this proposal will be governed by the attached MSA between Hargrove and Associates, Inc., and Wellspring Hydro. Its terms and conditions apply to any purchase order accepted by Hargrove and Associates, Inc.

Any changes to this proposal/contract may constitute a "Change Order" to the contract that must be agreed upon by both parties before any work related to the change begins.

In the event the project is cancelled after notice to proceed (or signed contract or PO) has been received, Hargrove will be paid for its progress to date on the project.

<u>Detailed Design (DD) Payment Schedule:</u>

- Award/Kick Off Meeting - 20% of Cost
- DD baseline Schedule Release and Acceptance (Allowing 5 days for approval of the schedule. If approval is not received, invoice will be submitted on the 5th business day) = 5% of Cost
- IFC Pile Construction Package = 5% of DD Cost
- 30% Model Review = 15% of Cost
- IFC of Area Paving & Minor Foundation Construction Package = 15% of Cost
- 60% Model Review = 20% of Cost
- 90% Model Review = 15% of Cost
- IFC of final Engineering Work Package = 5% of Cost

Invoice payment processing shall be Net-30, unless otherwise noted.

12.0 Closing & Contact Information

Thank you for allowing Hargrove to submit its proposal for this project. We look forward to continuing to work with you on this and future projects. If this proposal is acceptable, please send a Purchase Order to: purchaseorders@hargrove-epc.com and scooper@hargrove-epc.com.

I look forward to meeting with you to discuss this proposal. If you have any questions in the meantime, please contact me.

Sincerely,

J. Scott Cooper | Director- Chlor-Alkali + Lithium
Hargrove and Associates, Inc. | Birmingham, AL
office: 205.484.0241 | c: 205.901.7887 | email: scooper@hargrove-epc.com

13.0 Appendix A - Resumes

13.1 Jason E. Traylor, PE

Controls + Automation Technical Consultant

Summary

Over fifteen years of experience in designing and programming industrial control systems, estimating, instrument specification, and control valve sizing. Also experienced with database management and design supervision. Industry experience includes chemical, Chlor-Alkali, pulp & paper, and other industrial projects. The scope of services in support of these projects included FEL studies, detail design, construction assistance, system checkout, and start-up.

Education

Bachelor of Science, Electrical Engineering

Auburn University, Auburn, AL

Professional Certifications

Professional Engineer, Alabama #308199

Professional Engineer, South Carolina # 1142334

Professional Engineer, Mississippi #30637

Experience

Hargrove Engineers + Constructors – Birmingham, AL
Controls + Automation Technical Consultant

- Enviva, Pellet Mill, Lucedale, MS – Lead Controls Engineer on the project. Responsible for work process scheduling, I/O list, control narratives, control system architecture design, network design, Rockwell Plant PAx configuration. Project goal greenfield pellet mill facility.
- WestRock, Brown Stock Washer, Panama City, FL – Lead Controls Engineer on the project. Responsible for P&ID development, work process scheduling, I/O list, control narratives, control system architecture design, Rockwell Plant PAx and Yokogawa Centum VP configuration, construction support, startup/commissioning support. Project goal was to install a new brown stock washer and increase pulp mill through put. As part of the production increase control and scheduling modifications were required to the batch digesters.
- Sabic, BPA VCU, Burkville, AL – E&I Engineer / Lead Controls Engineer / Project Engineer on the project. Responsible for P&ID development, work process scheduling, I/O list, control narratives, control system architecture design, motor elementaries, loop sheets, instrument index, Yokogawa ProSafe configuration, construction support, startup/commissioning support.
- CarbonFree, Caustic Evaporation Expansion, San Antonio, TX – Lead Controls Engineer on the project. Responsible for control narratives and Emerson DeltaV configuration.
- WestRock, Pulp Mill DCS Migration, Panama City, FL – Controls Engineer / Project Engineer on the project. Responsible for P&ID development, work process scheduling, I/O list, control narratives, control system architecture design, Rockwell Plant PAx configuration, construction support, startup/commissioning support.

- SCS, Plant Miller PLC to DCS Conversion – E&I Engineer on the project. Responsible for Electrical design to replace the existing PLC for Units 3 & 4 SCR and Top Ash systems with an ABB DCS.
- Ascend, Adipic Controls Modernization Project, Pensacola, FL - Controls Engineer on the project. Responsible for DeltaV configuration, and startup/commissioning support.
- Sabic, HCL BMS Conversion Project, Burkville, AL - Controls Engineer on the project. Project driver was to replace obsolete equipment. New equipment installation required NFPA and ISA84 compliance. Responsibilities included verification that configuration and instrumentation met NFPA requirements, drawing modifications, construction management, and startup/commissioning.

Engineering Consulting Firm - Birmingham, AL

Senior Discipline Engineer – Instrumentation and Controls

- WestRock, PB4 DCS Conversion Project, Florence, SC - Controls Engineer / Design Leader / Project Engineer on project. Responsible for P&ID development, work process scheduling, instrument index, I/O list, SAMA development, functional descriptions, control system architecture design, Honeywell Experion R430 configuration support, construction, support, startup support, commissioning.
- Molycorp Minerals, Mountain Pass, CA - Controls Engineer on project. Responsible for instrumentation functional descriptions and P&ID development.

Engineering Consulting Firm – Birmingham, Al

Principal Technical Professional – Instrumentation and Controls

- Molycorp Chlor-Alkali Project, Mountain Pass, CA - Controls Engineer on the project. Responsible for Allen Bradley Control Logix Configuration, Supplier Control System FAT
- Olin Chlor-Alkali Products Membrane Conversion Project, Charleston, TN - Controls Engineer on the project. Responsible for DeltaV configuration, DeltaV SIS configuration, I/O List, DCS Hardware specification, I/O Room Layout, Control System Architecture, Design/Implementation/Troubleshooting, Network Setup/Implementation
- PPG Membrane Conversion FEED Study, Natrium, WV - Instrument Design Leader on the project. Responsible for Instrument Pricing, Instrument Index, P&ID Development, Task Scheduling, Manpower Loading Projections
- Olin Chlor-Alkali Products, St. Gabriel, LA - Controls Engineer on the project. Responsible for interconnects for existing installations, Power Plans, Loop sheets for existing installations, Fiber Optic Network Layout and Termination List, P&ID design/revisions, Network Setup/Implementation, Yokogawa DCS Configuration, Rectifier controls, Construction support, Ctrl System Architecture Design/ Implementation/ Troubleshooting.
- Nova Chemicals, Bayport NOx Project, Bayport, TX - Instrument Engineer on the project. Responsible for loop Sheets, Cable Schedules, Interconnects, Motor Elementaries

- Bowater, Pulp Dryer Rebuild, Coosa Pines, AL - Instrument Engineer on the project. Responsible for location Plans, Cable Schedules
- Temple-Inland, OCC Production Increase, Orange, TX - Instrument Engineer on the project. Responsible for motor Elementaries, Power Plans, Interconnects
- Trinity TCP Project, Hamlet, NC - Instrument Engineer on the project. Responsible for valve Sizing, Instrument Specifications, Loop Sheets
- International Paper B-Grade Transfer, Courtland, AL - Instrument Engineer on the project. Responsible for instrument Specifications, Valve Sizing
- Owens Corning, Irving, TX - Instrument Engineer on the project. Responsible for instrument Specifications, Loop Sheets, Location Plans
- OCI Wyoming Alt. Energy Project, Green River, WY - Instrument Engineer on the project. Responsible for instrumentation specifications, cable schedules, Foxboro DCS I/O assignments, location plans, loop sheets, and cable length takeoffs.

Software and Training

- AutoCAD
- ProjectWise
- SmartPlant Instrumentation
- Control Networks: Ethernet I/P; DeviceNet; Modbus TCP/IP & RTU
- Control Systems: Emerson Delta V; Honeywell Experion; Rockwell ControlLogix; Rockwell Plant PAx; Yokogawa Centum VP; Yokogawa ProSafe

13.2 Adam "AJ" Freund, PE

Senior Electrical Engineer

Summary

Leader of design teams that consistently produced high quality products on time and under budget. Extensive CAD experience and proficient in Microsoft Office Suite with extensive knowledge with Excel including developing spreadsheets used company-wide to expedite electrical design.

Education

Bachelor of Science, Electrical and Computer Engineering

Ohio State University – Columbus, OH

Professional Certifications

Professional Engineer, Georgia

Professional Engineer, Ohio

Professional Engineer, Pennsylvania

Professional Engineer, Texas

Professional Engineer, Utah

Experience

Hargrove Engineers & Constructors – Birmingham, AL
Senior Electrical Engineer

Lead Electrical Engineer supporting single and multi-discipline projects, including project definition and detailed design phases. Responsible for planning and coordinating the work of the electrical design in a specific small, medium, or large-sized projects. Performs all aspects for complete design of electrical and instrumentation engineering tasks on client projects. Recent projects include:

- Westlake Chemical, GEIS Chlor-Alkali Expansion Project, Geismar, LA – FEL3 and Detailed Design effort to expand the capacity of the plant by 110 KTPA ECU.
- Olin Chlor Alkali Products, CHAS #9 Rectifier Replacement, Charleston, TN - FEL-3 engineering services in support of the rectifier replacements including timing and resource requirements to facilitate the FEL-3 in support of the installation of the rectifiers.
- MP Materials Corp., Storage & Unloading Project, Mountain Pass, CA – Detailed Design. Refurbishment of 2 large (168,000 gallon) HCL tanks, scrubber, 2 unloading stations, containment modifications, required piping and safety facilities as required.

Engineering Consulting Firm – Columbus, OH & Temperance, MI
Senior Electrical Engineer

- Electrical discipline engineering and design team leader on projects for new and existing industrial facilities.

- Projects ranged from less than 100 electrical engineering and design man hours to over 5,000. Typically, responsible for multiple projects with overlapping schedules.
- Developed strategy for project completion, coordinated detailed aspects of engineering and design work, and coordinated tasks among engineers and designers.
- Electrical representative in project meetings with project management, clients, contractors, and others.
- Developed project specific design criteria and specifications for equipment procurement and construction.
- Designed highly available low and medium voltage power distribution systems.
- Designed and programed protective relaying schemes to enhance equipment and personnel protection.
- Performed short circuit analysis, motor starting analysis, protective device coordination, and arc-flash analysis.
- Specified and designed grounding and bonding systems for equipment and structures.
- Facility lighting design to applicable standards and client specification using lighting design software.
- Performed facility Area Classification analysis to determine classification based on applicable standards.
- Heat Trace specification and design for freeze protection and process related applications.
- Experienced in supporting electrical construction and commissioning in the field

Engineering Consulting Firm – Toledo, OH
Electrical Project Engineer

- Responsible for the electrical and controls design on projects for new and existing wastewater facilities
- Produced design drawings and specifications

American Municipal Power – Columbus, OH
Power Dispatcher

- Forecasted municipality electrical loads, based on historical data, for electrical power market strategies
- Effectively communicated verbal orders to carry out critical directives and assign orders.
- Worked in an isolated environment; had to make critical decisions independently.

Software and Training

- Microsoft Office Suite
- EasyPower
- ETAP
- CAD
- NEC

13.3 M. Andy Faulk, PE, LEED AP

Civil/Structural Engineering Leader

Summary

Over twenty years of experience as a senior level engineering, construction, and management professional with over 10 years' experience in evaluating and designing physical infrastructure in areas such as water treatment, site-civil, transportation and wireless communications.

Education

Bachelor of Science, Civil Engineering

University of Alabama at Birmingham

Professional Certifications

Professional Licensure State of Alabama (PE), License #28719

Professional Licensure State of Arkansas (PE), License #20373

Professional Licensure State of Georgia (PE), License #047891

Professional Licensure State of Illinois (PE), License #62.072972

Professional Licensure State of Kentucky (PE), License #36438

Professional Licensure State of Louisiana (PE), License #46667

Professional Licensure State of Rhode Island (PE), License #0014339

Professional Licensure State of Tennessee (PE), License #114339

Professional Licensure State of Texas (PE), License #143784

Professional Memberships

American Society of Civil Engineers

American Water Works Association

Engineers Without Borders

Experience

Hargrove Engineers & Constructors – Decatur, AL
Civil/Structural Engineering Leader

Responsible for the management of the Decatur and Memphis Civil/Structural Teams; Resource Leader to a twelve-person Team of civil and structural engineers and designers. Representative projects:

- Daikin MCC Expansion Detailed Design, Decatur, AL – Responsible for the survey and civil site design for a new motor control center. The project entailed a new access road, stormwater mitigation, site grading and a grade wall for the new facility.

- Daikin Industrial Water Infrastructure Detailed Design, Decatur, AL – Responsible for the survey and civil site design of a new 10-inch industrial water line and two, large section, HS20 rated trenches.
- Boeing, St. Charles Tract 5 Expansion Detail Design, St. Charles, MO – Responsible for civil site design and specifications package for a large testing facility. Design included bunkers, roadways, storm water/flood mitigation and utilities.
- Ascend, Fire Protection Infrastructure Detailed Design, Decatur, AL – Responsible for system modeling, testing, and planning for maintenance and upgrades. Was a phased replacement of deteriorated lines within the facility.
- Aquatech, Wastewater Treatment Plant Detailed Design, Huntsville, AL – Responsible for civil site design and utility coordination for a new wastewater treatment facility planned for a new automotive facility.
- Chemours, Trade Waste Infrastructure Remediation, Memphis, TN – Responsible for the inspection and remedial design of two large settling ponds and the diversion structure used in the wastewater pretreatment train at the facility.
- Peroxychem, Maxson Facility Flood Mitigation Study, Memphis, TN – Responsible for the evaluation of the facilities flood potential and review of the large contact basin's potential for uplift due to the river's flood stages.
- Huntsman, Earthen Dam Rehabilitation, Conroe, TX – Inspection and design of rehabilitation for overflow structure that water was bypassing.

Madison Utilities, Madison, Al

Water System Engineer

Responsible for managing the engineering and mapping for the utility, as well as was the liaison to the City of Madison. Responsible for water quality and regulatory compliance. Manager for the water system maintenance and construction crew. Representative projects:

- Highland Lakes Sewer System Expansion Detailed Design
- Palmer Road Sanitary Sewer Rehabilitation
- Bradford Creek Sanitary Sewer Rehabilitation
- Western Area Sewer Master Plan

Consulting Engineer, Hartselle, Al

Contract

Provided infrastructure and site design, construction cost estimates to clients. Representative projects:

- ALDOT Safe Routes To School projects in Perry County, Macon County, Mobile County and Lowndes County.
- Verizon Cell Phone Tower Evaluation and Site Designs in Dyersburg, TN, Chickasaw, TN and Trenton, TN.
- Life Church of Hartselle Building Expansion Detailed Design
- Tara Manufacturing Facility Expansion Detailed Design

Key Engineering, Inc., Decatur/Huntsville, AL

Department Manager for the civil engineering and survey group, also the branch office manager for the Huntsville office. Representative projects:

- Hampton Cove School Cueing Lanes and Site Improvements Detailed Design
- Whitesburg Elementary School Ceuing Lanes and Site Improvements Detailed Design
- Providence Elementary School Site Improvements Detailed Design

Wiser Company, LLC, Birmingham, AL

Senior Project Engineer

Managed a design team for transportation and site development projects.

- Performed collector and arterial roadway designs
- Designed residential site and utility plans
- Provided planning, permitting and logistics designs for mining

Malcolm Pirnie, Inc.(ARCADIS), Birmingham, AL

Environmental Consultant

- Developed erosion control plans and grading plans
- Designed upgrades to potable water distribution systems
- R&D and Regulatory Projects
- Designed process piping and controls integration for treatment plants

Publications

Finalist for 2008 Young Engineer of the Year, Engineering Council of Birmingham

Filter Performance – What Should a Good Filter Look Like? – Co-Author Featured at the 2005 AWWA, San Francisco, CA

Design and Operation of Water Storage Tanks for Optimum Mixing – Co-Author and Presenter; Featured at the Alabama/Mississippi Section, AWWA 2006

Software and Training

- Microsoft Project
- Autodesk Storm and Sanitary
- Project Management Certification
- Autodesk Civil 3D
- Project Management Skills of the Future

13.4 Glen A. Carter, PE

Civil/Structural Engineering Leader

Summary

Professional engineer with over 30 years of experience in structural design and construction. Expertise and knowledge gained through various industrial markets including coal power plants, nuclear power plants, manufacturing facilities, pulp and paper and chemical plants.

Education

Bachelor of Science, Civil Engineering

University of Alabama – Tuscaloosa, AL

Professional Certifications

Professional Engineer, Alabama #25720

Professional Engineer, Arkansas #17109

Professional Engineer, Kansas #26396

Professional Engineer, Kentucky #33849

Professional Engineer, Louisiana #38224

Professional Engineer, Mississippi #25005

Professional Engineer, Tennessee #121392

Professional Engineer, Texas #130148

Professional Memberships

American Institute of Steel Construction, Member

Experience

Hargrove Engineers & Constructors – Birmingham, AL
C/S Engineering Leader

- BASF, Chemical Plant, West Memphis, AR - Design of 140-foot span pipe bridge and spread footing foundations for plant located in a high seismic region.
- Dow-Corning Silicon Metal Plant, Mount Meigs, AL - Evaluation of existing furnace building for increased loading of refractory lined ductwork.
- Dow-Corning Silicon Metal Plant, Mount Meigs, AL – Support steel and foundation mat design for new Dust Collection System.
- Georgia Pacific Woodyard Project, Alabama River Cellulose (ARC) – 530' Diameter Concrete Ring Beam design for Stacker/Reclaimer.
- Georgia Pacific Fiberline Upgrade Project, Monticello, MS – Design of Roll Storage Building and MCC Building.
- Honeywell Phenol Storage Project FEL3, Hopewell, VA – Design of foundation and containment for 60' diameter Phenol storage tank.

- WestRock Printkote Conversion Project, Demopolis, AL. – Design of Roll Storage Building extension.
- GEO Specialty Chemicals, Coosa Pines, AL - Design of ore silo roof and access walkway replacement.
- Johns Manville, Fiberglass Insulation Plant, Etowah, TN - Design of access platform and monorail systems.
- Valspar Coatings, Manufacturing Plant, Birmingham, AL - 20,000-gallon tank anchoring system evaluation
- Syngenta, Chemical Plant, St. Gabriel, LA - Concrete Floor calculations for 75,000 lb. ISO Container Unloading.

Engineering Consulting Firm – Birmingham, AL
Design Engineer

- Solid Waste Authority of Pal Beach County, Boiler Support Structure, West Palm Beach FL

Engineering Consulting Firm – Birmingham, AL
Design Engineer

- Florida Power and Light, Turkey Point Nuclear Plant, Florida City, FL - Responsible for evaluation and modification of Turbine Building Operating Floor for EPU (Extended Power Up-Rate) Project.
- Progress Energy, Crystal River Nuclear Plant, Crystal River, FL - Responsible for evaluation and modification of existing beam and bracing connections for Auxiliary Building Crane Upgrade.
- University of Arizona, Reactor Decommissioning Project, Tucson, AZ - Responsible for design of steel support system for removal of contaminated portion of concrete Reactor Tank.

Engineering Consulting Firm – Birmingham, AL
Design Engineer

- WE Energies AQCS Project, South Oak Creek, WI - Structural engineer for the design of Selective Catalytic Reduction (SCR) and Gas-to-Gas Heater (GGH) support structure.
- Monsanto Seed Corn Facility, Boone, IA - Structural engineer for the design of Sheller Building and Yard Conveyor support trusses.

Southern Company Services – Birmingham, AL
Design Engineer

- Gorgas Steam Plant, Parrish AL—Flue Gas Desulfurization (FGD) Project - responsible for design of FGD ductwork. Components of design included duct plate, external stiffeners, internal bracing, turning vanes, support legs, expansion joints, and slide bearings.

- Plant Gaston, Wilsonville AL - Balanced Draft Conversion (BDC) Project; responsible for strengthening of existing FGD ductwork due to increase in internal design pressure. Components included duct plate, external stiffeners, internal bracing, and support system.

ALSTOM Power – Knoxville, TX
Design Engineer

Responsible for performing and checking structural calculations for flue gas ductwork, flue gas ductwork support steel, SCR access steel, and fabric filter support steel.

Structural Design Solutions – Birmingham, AL
Design Engineer

Performed structural calculations and detailed design sketches of bolted and welded connections, reviewed fabricator's shop drawings for compliance with connection design. Reviewed stair and handrail shop drawings for compliance with building codes.

- Structural Steel Services, Steel Fabrication Plant, Meridian, MS
- Knauf Fiberglass, Fiberglass Manufacturing Facility, Opelika, AL
- Dixie Arc, Manufacturing Facility, Birmingham, AL

Engineering Consulting Firm – Greenville, SC
Design Engineer

Performed structural calculations for paper machine support structure.

ABB Environmental Systems – Birmingham, AL
Design Engineer

Performed structural calculations for flue gas ductwork, flue gas ductwork support steel, piping, and cable tray support steel, provided on-site troubleshooting for FGD building construction, performed structural inspection of electrostatic precipitators, estimated steel tonnage, and structural man hours for proposals.

Software and Training

- AISC
- ACI 318
- ASCE 7
- Mathcad
- IBC
- RISA
- STAAD Pro
- GT STRUDL

13.5 Michael Gear

Mechanical Engineer

Summary

Broadly experienced leader with manufacturing, continuous improvement, quality, engineering, and maintenance management background. Experience gained with leading high performing engineers and maintenance technicians with organized troubleshooting tools, design engineering to reduce maintenance time, and leading OEE teams using Six Sigma tools and methods. Involvement includes developing plant metrics, PM compliance metrics, OEE metrics, product design, manufacturing and test engineering, and customer service.

Education

Bachelor of Science, Mechanical Engineering

University of Alabama – Tuscaloosa, AL

Experience

Hargrove Engineers & Constructors – Birmingham, AL
Mechanical Engineer V

GAF – Tuscaloosa, LA
Technical Services / Maintenance Manager

- Provided direction, coordination, and support for the daily execution of the maintenance department's operating plan with the primary objective of continuous OEE improvement and maintaining the plant's equipment and facilities.
- Ensured that all safe work practices were implemented and followed by the department and instilled GAF's safety culture into the daily work environment of the maintenance/process engineering and quality department.
- Provided technical and managerial leadership to the functions of equipment reliability, maintenance planning and scheduling, facility maintenance, training, computerized maintenance management systems (CMMS), and root cause failure analysis. Launched and championed the OEE team program and improved OEE from 80% in 2021 to 87% average in 2022 with a goal of 90% in 2023.
- Established maintenance metric program that improved PM compliance from 65% to 90%. Launched and champion the RCFA program that reduced special cause events by 30%. Optimized maintenance scheduled downtime to meet the goal of 6.5MM squares for 2022.
- Directed and coordinated design, construction, and maintenance of equipment and machinery. Coordinated development, submission, and approval of annual capital plan. Evaluated and designed new equipment systems and recommended modifications for continuous improvement in an effort to minimize cost, optimize maintenance and production capabilities, and enhance safety. Maintained an overall quality system that guarantees customer satisfaction and for driving process improvement activities for the facility.

- Supported the Operations group in meeting or exceeding budgeted production rates and uptime targets. Sought out ways that the Quality and Process Engineering teams can help increase OEE (scrap rate, slow time, and uptime) and deploy resources accordingly. Ensured 100% compliance with all environmental permitting and regulations. Ensured all reporting requirements were completed as required.

Process Engineer III

Promoted product/process improvement changes by using daily plant interactions, review of online testing, process data review, equipment inspections, and claims feedback. Submitted and implemented changes in procedures and processed to support productivity, process, cost, reliability and quality improvement. Resource for process technical knowledge and participates in plant problem solving and debottlenecking

efforts. Provided support for on call requirements or daily problems on the floor as needed. Completed high level technical reporting for activities including changes in plant operating conditions, changes in raw materials, quality performance, trial activities, variation reduction activities, and process improvement activities. Include abbreviated results of these activities in the department monthly summary. Developed operating instructions, troubleshot guides or process target guidance for all manufacturing

processes or new equipment as needed. Provided training of new procedures approved through the PCN system.

TAMKO Building Products – Tuscaloosa, LA
Process Engineer

Promoted product/process improvement changes by using daily plant interactions, reviewed online testing, processed data review, equipment inspections, and claimed feedback. Submitted and implemented changes in procedures and process to support productivity, process, cost, reliability and quality improvement. Researched, studied, and executed statistical analysis of process improvements to gain optimal performance of

processes, equipment, and reliability initiatives. Requested and executed CAPEX projects, ranging from $25k - $14 million, for continuous process improvement and automation. Developed, improved, and trained operations personnel on new and revised operating procedures, including processes and equipment. Designed, tested, and troubleshot various types of equipment as the subject matter expert for key

improvement initiatives. Lead Root Cause Problem Elimination for special cause and common cause incidents.

Southern Nuclear Operating Company – Birmingham, AL
Senior Mechanical Design Engineer

Maintained the design basis calculations through plant modifications, simulated scenarios, and developed equipment specifications to maintain the plant systems performance requirements. Performed, maintained, and improved calculations, specifications, and other documentation supporting the nuclear fleet's design and licensing bases. Developed and launched new engineering processes, policies, and programs to improve engineering effectiveness. Investigate/resolve engineering issues in accordance with the corrective action program. Provided guidance and direction to plant engineers regarding design calculations, performance requirements, and equipment requirements.

NACCO Materials Handling Group – Sulligent, AL
Manufacturing Engineer

Manufacturing Engineer responsible for the performance and optimization of the machining department for forklift components using lean manufacturing and Kaizen methodology. Design Engineering of production tools, fixtures, and machines. Oversaw installation of new equipment; ensure satisfactory performance of new and existing equipment and instruct employees on operation of all equipment. Coordinated launch of new products with clients, product engineering, and other departments within the organization to sustain the company's competitive edge.

Southern Heat Exchanger – Tuscaloosa, AL
Senior Project Design Engineer

Mechanical and thermal design of heat exchangers, steam generators and pressure vessels per customer specifications, TEMA standards, and ASME pressure vessel codes. Performed mechanical calculations to provide client with maximum operating conditions. Generated and maintained bill of materials and technical drawings. Provided direction and oversight to fabricators to ensure testing compliance with ASME codes and regulations.

13.6 Jeff R. Haslam

Mechanical/Piping Technical Specialist

Summary

Mechanical and piping designer with over 40 years of engineering design experience. Expertise in equipment layout, piping design, machine design, material specifications, construction field support, fabrication/manufacturing techniques, laser scanning, procurement, purchasing, and piping support system requirements.

Education

associate degree-Applied Science/Mechanical Design

Texas State Technical Institute-Waco, TX

Experience

Hargrove Engineers + Constructors - Birmingham, AL
M/P Technical Specialist III

- 5E Advanced Materials Mining Chemical Processing Plant
- Li-Cycle Battery Recycling Plant FEL3, Rochester, NY
- Carbon Free Chemicals, San Antonio, TX - 50% Caustic Evaporator
- Hunt Refinery, Tuscaloosa, AL - Rail Unloading, Tank 16, and Truck Loading Stations
- Georgia Pacific, Monticello, MS - New Liquor Tanks
- CVR Energy, Coffey, KS - PSV Replacement Projects
- Chevron, Pascagoula, MS – Fluid Catalytic Cracking (FCC) Upgrade
- Carbonfree – Caustic Evaporation Project
- Verso – Quinnesec FEL Study
- Kimberly-Clark – Tissue Machine / OCC Conversion Detailed Design
- Olin – Install Rectifier, Infrastructure, and Facilities

Southern Company Services - Birmingham, AL

Piping Design Leader

- NCCC Testing Facility - Wilsonville, AL - Refitting of experimental Carbon Capture systems. Design, procurement, and construction direction

Engineering Consultant - Birmingham, AL

Piping Design Leader

- Graphic Packaging International - W. Monroe, LA and Macon, GA
- Georgia Pacific - Big Island, VA
- Green Back Packaging-Morrilton, AR
- Molycorp - Mountainpass, CA

Engineering Consulting Firm-Birmingham, AL

Mechanical Department Manager

Piping Design Leader

- RockTenn Hodge - LA
- Bowater-Coosa Pines, LA
- Voith Tissue Machine
- ILIM Group-Kotlas Russia
- Inland-Bogalusa, LA
- Inland-Rome GA
- MeadWestvaco Corporation-Wycliffe, KY
- Potlach Corporation-McGehee, AR
- International Paper-Jay, ME
- International Paper-Selma, AL
- Gulf State Paper Corporation-Demopolis, AL
- Georgia-Pacific-Cedar Springs, GA
- Weyerhaeuser-Valiant, OK
- Packaging Corporation of American-Counce, TN
- Carter Holt Harvey-Tokoroa, New Zealand
- Westvaco Corp.-Covington, VA
- Gulf State Paper Co-Demopolis, Al
- Vulcan Chemicals, Integrated Chlorine dioxide plant

Texas Instruments-Dallas, TX

Equipment, Manufacturing, Field Testing Designer

Led design projects for the Military products division

Software and Training

- CADWorx
- Navisworks
- Plant 3D AutoCAD
- Bentley-Intergraph MicroStation
- Microcadd
- CADDCentre's Plant Design and Management System
- Cyra Cyclone

13.7 Reggie Chambliss

Process Engineer

Summary

Over nine years of experience in chemical process engineering design and project engineering, including Chlor-Alkali and Lithium. Engineering career has been equally split between office and field assignments. Process work includes P&ID development, equipment specification and pricing, vendor bid and drawings evaluation, PSV calculations, and hydraulic calculations. Onsite project engineering capabilities include managing small Capex projects, system walkdowns, vendor and client coordination, change order initiation, PSSRs, and EHS compliance. Successfully executed FEL and detailed design projects as process design lead and team support.

Education

Bachelor of Science, Chemical Engineering

Tuskegee University—Tuskegee, AL

Experience

Hargrove Engineers & Constructors – Birmingham, AL
Process Engineer III

- Chemicals Client During Detailed Design
  - Upgraded inadequate equipment for pH adjustment step in process
  - Performed bid evaluations on equipment.
  - P&ID management and PHA participation
- Chemicals Client, HCl Storage & Unloading DD - Lead equipment specification effort.
- Chemicals Client, Pump Spare Program DD
  - Created pump datasheets for quote and purchase.
  - Trained newer teammate in Hargrove standards and policies
  - Provided checking for datasheets, lists and P&IDs
- Chlor-Alkali Client, Caustic Evaporator FEL3
  - Revamp current two-effect evaporator to three-effect system
  - Close coordination with the other design disciplines
- Lithium Client Project
  - P&ID management
  - Spec development and datasheet creation
  - Hydraulic calculations
- Chemicals Client, P&ID Development
  - Verified and marked P&IDs in production units during onsite assignment.
  - Coordinated P&ID revisions and equipment drawing updates from Client to Hargrove team.
- Chlor-Alkali Client, Cl_2 Liquefaction FEL2
  - Supported Cl_2 Liquefaction Upgrade project by developing P&ID sketches in Bluebeam and performing rough vessel and line sizing calculations
- Chemicals Client, Utilities Expansion DD
  - Performed PSV calculations on Incinerator project as Design Lead
  - Completed bid tabulations on various pieces of equipment on Incinerator project
- Advanced Materials Client During FEL2

  - Developed Engineering Requisition Worksheets and equipment list to provide various equipment pricing estimate
  - Supported Title III project by completing redlines to P&IDs and quoting metal analyzer
- Advanced Materials Client During Detailed Design - Supported PMI project (HELIX Integration Team) as onsite Project Engineer.
- Specialty Chemicals Client, Therminol Vaporizer FEL3/DD
  - Supported project at Mobile office and onsite
  - Coordinated P&ID revisions and equipment drawing updates from Client to Hargrove team
  - Initiated PCNs for changes to the P&IDs, equipment drawings, and process-related design and information
- Tire Manufacturing Client, Wastewater Study FEL - Performed wastewater study after site walkdown and coordination with Client.
- Chlor-Alkali Client, Cl_2 Liquefaction FEL2 - Performed process study on the Diaphragm Chlorine Stripper control system which included Aspen modeling and heat & material balance optimization.

Hargrove Engineers & Constructors – McIntosh, AL (BASF)
Process Engineer II (Technical Services)

- Developed project scopes, generated, and obtained cost estimates, and prepared appropriation funding requests.
- Managed and tracked project milestones, made necessary adjustments to project and communicated project status with stake holders.
- Developed and maintained all project deliverables throughout the project lifecycle.
- Ensured compliance with EHS requirements to promote a safe working environment.
- Requested and coordinated required discipline engineering and design resources.
- Maintained SAP project data entries, monitored project progress, and performed status reporting.
- Developed and maintained partnerships with project manufacturing representatives and vendors to execute projects.
- Provided technical training for newly hired project engineers.

nextSource – McIntosh, AL (BASF)
Maintenance Engineering Support

Verified sites inventory of rupture discs. Worked on team to complete vessel inspections.

Process Engineering Support (BASF)

- Verified piping & instrumentation diagrams in production units throughout the plant site.
- Project Engineer for small capital projects to support process improvement.
- Used process drafting (MicroStation), design (PSV_Calc) and simulation (Aspen) software.
- Performed calculations for pressure/vacuum relief vents and valves.

- Developed process flow diagrams and piping & instrumentation diagrams.
- Generated equipment specifications and material safety data sheets.

Software and Training

- Revu Bluebeam
- AFT Fathom & Arrow
- Aspen
- MicroStation Power Draft V8i
- SAP for Project Management
- INTools—SmartPlant Instrumentation
- PSV Calc
- EKATO Corp Mixing 101 Training
- 3EPLUS by North American Insulation Manufacturers Association (NAIMA)
- Citrix
- Microsoft Office
- CPR, First Aid and AED Training

13.8 Andrew B. Johnson

Project Controls Manager

Summary

Forty-two years of experience in and Project Controls and project coordination in the Power, Pulp & Paper, foods, manufacturing, aluminum, and chemical industries. Background includes cost control, budget preparation, and scheduling for industrial engineering and construction projects. Served as a cost engineer, scheduling engineer, safety supervisor, resident project engineer, start-up coordinator, and contracts administrator. Experienced in budget preparation, monitoring, and projections. Knowledgeable in subcontract scheduling, shutdown scheduling, and schedule updating. Familiar with computerized systems, including earned value reporting, cost and commitment reports, forecasts, cash flow curves, workforce schedules. Experienced in providing coordination of engineering, general contractors, and subcontractors.

Education

Associate of Science, Business Administration

Roane State Community College – Harriman, TN

Experience

Hargrove Engineers + Constructors – Birmingham, AL
Project Controls Manager

Responsible for Project schedule development and Maintenance for DFS, Detail Engineering, Procurement and Construction Management.

- Li - Cycle – Commercial Hub – Rochester, NY

Power Experience

- Southern Company, Birmingham, AL – Outage Planning and Scheduling - Developed and maintained Spring 2021 outage schedules for Alabama Power's Central Alabama, Combined Cycle 3x1, Hot Gas Pass and Mississippi Powers Plant Ratcliffe, 2x1 Combine Cycle HRSG Bundle Replacement, and CT Rotor replacement.
- Interstate Power & Light, Marshalltown, IA - EPC Project Controls Manager - Combined Cycle Project. Responsible for day-to-day management of project controls personnel assigned to the project. Responsible for supervision and coordination of construction cost engineering, procurement scheduling, and construction planning, and engineering planning on assigned projects. Supervised budget preparation, estimate-to-complete projections, job progress, overall scheduling and cost reporting for labor and materials, along with total materials management in accordance with project requirements.
- Kentucky Utilities, Ghent, KY - EPC Project Controls Manager - Environmental air compliance project. Responsible for day-to-day management of project controls personnel assigned to the project. Responsible for supervision and coordination of construction cost engineering, procurement scheduling, and construction planning, and engineering planning on assigned projects. Supervised budget preparation,

estimate-to-complete projections, job progress, overall scheduling and cost reporting for labor and materials, along with total materials management in accordance with project requirements.

- Enercon Services, Kennesaw, GA - Project Controls Manager - Responsible for Project Controls Department development. Developed and implemented project controls methods and procedures. Developed project schedules and earned value reporting systems and format. Responsible for developing resources and for hiring and expanding the project controls group.
- Wisconsin Energies, Oak Creek, WI - Project Controls Manager - Engineering planning for SCR project.

Heavy Industrial Experience

- PEMEX, Dos Bocos Pariso, Mexico, Master Project Planner - Gas Roots Refinery - Utilities
- International Paper, Riverdale, AL - Master Project Planner, Project Bridge – PM Rebuild and OCC
- Ashland, Calvert City, KY, EPC Project Planner - VP Project
- Solvay, Greenville, TX, Augusta, GA, Greenville, SC, EPC Project Planner - RTM Project & M7 Project; HMDA Project & PGA Project; Primospire Project
- International Paper, Vicksburg, MS - Construction Planner - PM Rebuild (Press), Drives & OCC Upgrade Project
- International Paper, Maysville, KY - Engineering CM Planner - Capacity Increase and New OCC Project
- International Paper, Various Locations - Master Project Planner - REO Projects; Prepare Project Master Schedules for projects as required.
- Molycorp, Mountain Pass, CA - EPC Project Controls Manager - Project Phoenix for a Chlor-Alkali facility. Responsible for day-to-day management of project controls personnel assigned to the project. Supervised and coordinated construction cost engineering, procurement scheduling, construction planning, and engineering planning on assigned projects; supervised budget preparation, estimate-to-complete projections, job progress, overall scheduling and cost reporting for labor and materials, along with total materials management in accordance with project requirements.
- Georgia Gulf Chemicals & Vinyl, Plaquemine, LA - Project Controls Manager - Modernization and expansion project at a polyvinyl chloride (PVC) resins production plant.
- Gerber, Ft. Smith, AR - Project Controls Manager - Baby food processing facility.
- Solutia, Decatur, AL - Project Controls Manager - New Co-Gen boiler project.
- Yoplait, Murfreesboro, TN & Carson, CA - Project Controls Manager - New yogurt facility.
- General Mills, Martel, OH - Project Controls Manager - Perrier, Houston, TX - Project Controls Manager
- Weyerhaeuser, Columbus, MS - Project Controls Manager - Boiler outages.
- MeadWestvaco, Mahrt, AL - Project Controls Manager - Boiler outages.

- Solutia, Decatur, AL - Project Controls Manager - Co-Gen project.
- Gilman Paper Company, St. Mary's, GA - Project Controls Manager - Cluster Rules compliance project.
- U.S. Alliance, Coosa Pines, AL - Project Controls Manager - No. 1 paper machine rebuild.
- International Paper, Riegelwood, NC - Project Controls Manager - Cluster Rules compliance project.
- Great Lakes Pulp & Fiber, Menominee, MI - Project Controls Manager - New Drinking facility.
- International Paper, Mansfield, LA - Project Controls Manager - No. 1 paper machine rebuild.
- St. Joe Paper Co., Port St. Joe, FL - Project Controls Manager - No. 2 paper machine rebuild.
- Timken Bearings, Canton, OH - Project Controls Manager - New bearings facilities.
- Newsprint South Paper Co., Grenada, MS - Project Controls Manager - Project control engineer responsible for cost and scheduling for a grassroots newsprint paper mill.
- Great Southern Paper Co., Cedar Springs, GA - Project Controls Manager - Planned and scheduled retrofit of Nos. 1, 2, and 3 paper machines.
- Great Northern Paper, Nekoosa Corp. - Project Controls Manager - Lead planner-scheduler for 41 projects in seven locations, including retrofits and major expansions of pulp and paper mills.
- SD Warren Co., Muskegon, MI - Project Controls Manager - Master planner Lead Development and maintain Overall Construction Schedule – Emergency Response Team - Following Fire at Coater caused significant damage to PM building.
- SD Warren Co., Muskegon, MI - Project Controls Manager - Construction management for a new power boiler; field resident engineer.
- Great Lakes Pulp & Fiber, Menominee, MI - Project Controls Manager - New Recycle facility.
- Union Camp Corp., Franklin, VA - Project Controls Manager - Recycle facility.
- Post Cereal, Jonesboro, AR - Project Controls Manager - Major plant expansion to install two complete process/packaging lines.
- General Foods, USA, Tarrytown, NY - Project Controls Manager - Alliance with General Foods; included work at various foods plants.
- Bowater Southern Paper Co., Calhoun, TN – Planner/Scheduler/Cost - Engineering/construction for No. 1 paper machine rebuild. Responsible for development and implementation of master project schedule and detail schedule for major 29-day shutdown of a newsprint machine, including a detail time-scaled CPM schedule of 1000 activities for the 24 hour/day, 29-day schedule.
- SD Warren Co., Skowhegan, ME - Planner/Scheduler/Cost - Construction for No. 1 paper machine at Somerset mill. Responsible for setting up material and labor cost reports.
- Mead Corp., Escanaba, MI - Planner/Scheduler/Cost - Mill outage and shutdown; scheduling engineer.

- Monsanto Chemical Co., Pensacola, FL – Planner/Scheduler/Cost - Distributed controls revamp project.
- Bowater Southern Paper Co., Calhoun, TN - Planner/Scheduler/Cost - Construction management services for No. 1 recovery boiler rebuild.
- Tennessee Valley Authority, Murphy Hill, AL - Planner/Scheduler/Cost - Assistance in developing a comprehensive proposal for construction management services for a commercial-scale coal-to-methanol project.
- International Coal Refining Co., Newman, KY - Planner/Scheduler/Cost - Engineering of utilities and off sites for solvent-refined coal demonstration plant. Responsible for compiling and developing information for engineering estimates; prepared estimate for travel and associated expenses for the duration of the project; maintained computer database in accordance with C/SCSC.
- Aluminum Co. of America, Alcoa, TN - Contracts Administrator - Construction management services for a new cold rolling mill facility. Responsible for subcontractor bid package from preparation to contract award; daily administration of construction activities with contractors' supervision, quantity take-offs, tracking of quantities in-place, review and approval of monthly billing, and interpretation of contract documents and drawings.
- Bowater Southern Paper Co., Calhoun, TN - Subcontracts Administrator/Scheduling Engineer - Engineering/construction for thermomechanical pulping (TMP) facility and No. 2 paper machine rebuild. Responsible for administration of siding, build-up roofing, painting, and insulation contractors, including responsibility for bid package preparation, administration of construction activities and coordination with contractors and direct-hire crafts. Developed and implemented master project schedules, detail system schedules, and start-up schedules using CPM methods.
- Bowater Southern Paper Co., Calhoun, TN - Scheduling Engineer/Safety Supervisor/Start-up Coordinator - Coal conversion project. Developed and implemented master project and detail system schedules using CPM methods, responsible for on-site safety inspections, implementation of safety programs, safety instructional meetings, and investigation of accidents. As start-up coordinator, worked with engineers to coordinate between construction and start-up assistance requirements.
- Union Carbide Corp., Oak Ridge, TN - Cost Engineer - Controlled and monitored material and labor costs; estimated field change orders, tracked quantities in place from the field; coded material requisitions. Specialized in field change orders; checked estimates for accuracy before computer input.
- Fluor Corp., Irvine, CA - Cost Engineer - Petrochemical complex in Al Jubail, Saudi Arabia. Responsible for processing scope changes and trends on a 656,000-MTA ethylene plant and 281,000-MTA crude industrial ethanol plant; also responsible for preparation of Saudi Arabian jobsite and modular fabrication yards, located in Japan, and field progress reporting systems.

Software and Training

- Primavera P6
-

13.9 William "Bill" Johnson

Project Manager

Summary

EPC Project Manager and Project Controls Manager with over twenty-four years' experience in the Pulp and Paper and Industrial markets with focus in Engineering, Safety, and Construction management. Expertise includes scoping, change management, key project indications, value engineering, cost and schedule tracking, and lifecycle project planning. Expertise includes managing programs of projects for clients and leading the project controls effort on projects up to $500MM TIC. Expertise in industrial process and ventilation air systems

Experience

Hargrove Engineers + Constructors – Birmingham, AL
Project Manager / Project Controls Manager

- Responsible for supervision and technical direction over a team of project controls professionals.
- Provide detailed engineering schedules, logically tied, resource loaded and critical path management
- Provide cost management and earned value analysis for all projects in the Birmingham office
- Led / supported small to midlevel projects for Hunt, Olin, Southern Company, Westlake, Georgia Pacific, Greif, and PowerSouth.
- Set up and maintained High Value Engineering (HVE) budget and cost for all projects utilizing HVE support.

Engineering Consulting Firm – Birmingham, AL
Project Manger

- Responsible for all phases of planning and execution on pulp and paper engineering projects
- Responsibilities included managing multiple engineering disciplines, overall planning throughout the project lifecycle, contracting strategy development, cost and schedule tracking, managing construction contractors, project execution plan development, quality review, and safety atmosphere among other important roles and responsibilities
- Worked with the International Paper Regional Engineering Office, (REO).
- International Paper, Pensacola, FL Pulp mill
- International Paper, Cedar Rapids, IA
  - After a fire in the OCC Warehouse, defined the scope and schedule for the roof replacement as well as several fire mitigations projects, TIC 6.5MM.
- International Paper, Newport, IN
  - Winder drive replacement
- International Paper, Henderson, KY

- Managed detail engineering for new winder trim and safety system. Also asked by IP to be the mill's project manager for this project. TIC $6 MM.
- Assumed the project management role on multiple projects during detail design consisting of a Freeness Tester, Trim
- Squirt System, Felt Cleaning Shower, Press Doctor, Press Steam Box, Flue Gas Heat Exchanger and Boiler Feedwater Pumps.
- Worked with Georgia Pacific Company as part of a master services agreement.

- <u>Georgia Pacific, Cedar Springs, GA</u>
  - Managed projects in various study phases for Water
  - Reservoir Replacement, New Water Softener, and Soap System.
- <u>Georgia Pacific, Perry, FL</u>
  - Managed detail engineering for a new line 3 Bale Press to improve bale density and size consistency with a TIC of $4.5MM
  - Managed detail engineering for No. 1 and No. 2 Bark Boiler
  - MACT dual fuel conversion, bark dryer bypass, air to water economizer and burner management system (BMS) implementation with a TIC $22.5MM.
  - Assumed the project management role halfway through the Line 1 Brown Stock Washer project consisting of the addition of 4th & 5th stage washers and new filtrate tank with a TIC of $17.4MM.
  - Managed projects in various study phases for Water
  - Reservoir Replacement, New Water Softener, and Soap System.
  - Worked with Saudi Paper Manufacturing Company as part of a mill capital project renovation.
- <u>Saudi Paper, Dammam, Saudi Arabia</u>
  - Managed FEL 3 studies for the No. 2 tissue machine rebuild with a TIC of $55MM and No. 4 tissue machine upgrade with a TIC of $6.2MM and travel to Dammam, Saudi Arabia to present them to the client

Senior Estimator

- Responsible for calculating estimates by using processes, labor availability and productivity, and material prices, based on historical data. Tabulated cost studies, cash flows and prospect analysis master schedule
- Estimated all engineering and construction indirect cost for all EPC estimates.

Engineering Project Controls – Cost/Scheduling

- Responsible for coordinating the identification of the required activities to be performed by each discipline participating in the execution of the project.
- Responsible for engineering earned value system maintenance and reporting, engineering cost reporting, equipment cost reporting, cost performance curves and total project cost reporting
- <u>RockTenn Paper Company, Hodge, LA</u>
  - Engineer, procure, and construct (EPC) of the paper machine and pulp mill areas by performing a capacity increase on both paper machine 5 & 6, the installation of a new OCC plant, and a rebuild of the continuous digester; TIC of $90MM.
- <u>Olin Chlor Alkali Products, Augusta, GA</u>

- Engineer, procure, and construct modernization of a chloralkali facility, using state of the art membrane technology, to the requested capacity of 200 MTPD of chlorine, with a TIC of $30MM.

- ILIM Group, St. Petersburg, Russia
  - Engineer, procure, and construct modernization of three pulp and paper mills and expand their capacities by 25% at a TIC of $1.5 Billion. Served as project controls manager for the U.S. office while communicating with our affiliate office and Russian HVE engineering office.
- Mascoma Corp., Lebanon, NH
  - Engineer, procure, and construct Mascoma's first commercial plant, MASCOMETH1, with a TIC of $500MM. The plant will have a nominal production capacity of 20,000,000 gpy of denatured ethanol based on 700 BDMT/D of hardwood chip feedstock. Responsible for engineering scheduling and earned value.
- Georgia-Pacific Corp, Port Hudson, LA
  - Construct tissue machine rebuild of Georgia-Pacific's proprietary "E-TAD" technology, with a TIC of $18MM.
- International Paper, Memphis, TN
  - Lead Cost for International Paper REO. Handled all projects set up / close outs, change orders, cost reporting and analysis for 13 different Mills. Also set up cost structure for HVE support

JHK Systems Inc – Birmingham, AL
Engineering Manager / Vice President

- JHK Systems is a mechanical engineering firm, primarily selling industrial process and ventilation air systems to the pulp and paper industry throughout the United States and South America.
- Managed an engineering department of approximately 15 designers / draftsmen
- Managed multiple projects simultaneously from inception to completion.
- Ensured overall project safety program was within compliance with all regulatory requirements.
- Responsible for calling on customers and prospects, offering total design, engineering, fabrication, and turnkey installation services to the pulp and paper industry
- Developed bids, coordinated proposals, and made sales presentations.
- Paper Machine Hoods
- Aluminum 3" tongue and groove panel with tending side cylinder lift doors and drive side slide doors, designed for a 700-800 grain pickup
- Enclosed hoods can reduce steam usage to the dryers, assist in leveling the profile, and improved operating comfort conditions at several Rittman Paper Board, Boise Cascade, Norampac, International Paper, Champion Paper, PCA, Fitchburg Paper, and Corrugated Services mills.
- Heat Recovery
- Utilized hood exhaust or package boiler exhaust through air-to-air or air-to-water economizers to preheat water or air to reduce the amount of energy required to produce steam at several Visy Paper, Augusta Newsprint, Corrugated Services,

Weyerhaeuser, and Jefferson Smurfit mills. Brown Stock Washer Hoods*Fiberglass or stainless-steel low-flow washer hoods for Cluster rule

- Completed with butterfly access doors with air over oil cylinder for complete access to the washer drum at Green Bay Packaging, Donohue, Alabama River, MeadWestvaco, and Jefferson Smurfit Corporation.
- Dust collection headers installed on key points of the machine between the Yankee dryer and winder to reduce dust in the building and on the product at Erving Industries, Irving Tissue, and International Paper.
- Former exhaust systems installed on vat formers to increase production by providing a more even suction across the roll at several U.S. Gypsum locations.
- Trim systems are used to convey trim from the winder to the wet or dry end pulpers, repulped, or bailer, eliminating the need for producing butt rolls and forklifting rolls to the pulper at Gulf States, Georgia-Pacific, Rand Whitney, Corrugated Services, RockTenn, E.B. Eddy, International Paper, Wausau-Mosinee, Weyerhaeuser, Visy Paper, Michigan Paper, and Mosinee
- Evaluated the building, developed an air balance, and installed air systems to maintain building balance to reduce humidity and improve personnel comfort at International Paper, Appleton Paper, Gulf States, Boise Cascade, Corrugated Services, Champion Paper, Weyerhaeuser, RockTenn, Visy Paper, Jefferson Smurfit Corp., Garden State, Georgia-Pacific, Potlatch, Champion International, and MidAmerican Energy

Software and Training

- Microsoft Office Suite
- Mas 90
- JD Edwards
- AutoCAD
- AutoCAD Mechanical
- SAP
- Deltek Vision
- Adobe Pro
- BlueBeam
- Primavera P6

13.10 Scott Cooper

Project Director

Summary

Over thirty years of extensive experience in the management of engineering projects. Experienced in the process chemical, pulp and paper, automotive, hydro-electric, and aircraft industries. Thirty years of experience working in project management and design engineering. Has had responsibility for safety in design and completion of all other assigned contractual responsibilities within budget and on schedule. Has established project procedures, coordinates changes in scope, reports status of project to the client, monitors and controls engineering activities, cost analysis, planning, scheduling, estimating, procurement, and expediting of process equipment. In addition, manages appropriations grade estimates utilizing the front-end loading (FEL) processes.

Education

Bachelor of Science, Mechanical Engineering

University of Alabama – Birmingham, AL

Professional Certifications

Occupational Safety Councils of America (OSCA) Certified

Process safety management (PSM)

Six Sigma Black Belt

Six Sigma Green Belt

TWIC

Professional Memberships

Chlorine Institute

Experience

Hargrove Engineers + Constructors – Birmingham, AL
Project Director

Responsible for supervision and technical direction over a team of engineers and designers engaged in the total delivery of the services on time, within performance budget and quality expectations. Representative projects include:

- Olin Chlor Alkali, 675 to 940 Expansion, St. Gabriel, LA – TIC $120MM Engineering service. As Project Manager, executed FEL-1 & 2 to expand the St. Gabriel Plant from 675 to 940 SMTPD chlorine production. This required development of a Scope of Work to satisfy the requirements of the 940 SMTPD production.
- Olin Chlor Alkali, R4A Rectifier Replacement, Plaquemine, LA – TIC $10MM Engineering service. Project Manager responsible for the execution of FEL-3 & detail design for a project to replace the Olin Plaquemine Rectifier R4, the replacement unit being designated as Rectifier MET R4A. Olin purchased the rectifier unit under a

separate project. This project provided FEL-3/DD engineering services for the infrastructure and facilities that were required to install the new MET R4A Rectifier.

- Olin Chlor Alkali, #9 & 10 Rectifier Replacement Charleston, TN – TIC $15MM Engineering Services. Project Manager. Execution of a FEL-3 Engineering Services in support of the replacement and installation of #9 & #10 Rectifier and infrastructure modifications.

K2 Pure Solutions – Pittsburg, CA

Project Manager

- K2 Pure Solutions, Chlor-Alkali Brine Treatment Retrofit, Pittsburg, CA – TIC $20MM EPCm Services. The plant was experiencing issues with brine quality. Hargrove executed a process design that mitigated the issue. The project include detail design and construction management.

K2 Pure Solutions – Pittsburg, CA

Engineering Manager

- K2 Pure Solutions, Chlor-Alkali Plant Expansion, Pittsburg, CA – TIC $40MM EPC Services. The plant was designed to manufacture hydrochloric acid, bleach, sodium hydroxide, and liquid chlorine. The expansion took the plant from 200 MTPD to 300 MTPD chlorine. The addition included new electrolyzer, brine filters, IX bed, caustic evaporation system, HCL burner, Bleach production with hypo destruct system and cooling tower. The expansion required several intricately coordinated outages to support the final conversion to the expanded rate. The expanded capacity was online in 4Q 2017, within budget and schedule.

Olin Chlor-Alkali Products – Charleston, TN

Engineering Manager

- Olin, Cell Manufacturing Facility, Charleston, TN – TIC $178MM. Provided engineering manager for a new state-of-the-art membrane cell manufacturing facility that converts 260,000 tons of mercury cell capacity at the Olin Chlor-Alkali Charleston facility. The new facility was targeted to produce the highest quality chlorine, caustic soda and related products and have a new capacity of 200,000 tons, including an expansion of the plant's production of potassium hydroxide (KOH). The technology change was projected to allow the plant to meet the growing need for KOH that is important to the production of food, fertilizers, herbicides, soaps, detergents, airplane de-icing fluids and other key products. After installation of the new technology at the Charleston plant in 2012, mercury was not a component of the manufacturing process resulting in a positive impact to the local environment.

Olin Chlor-Alkali Products – St. Gabriel, LA

Engineering Manager

- Olin, St. Gabriel Facility Expansion, St. Gabriel, LA – TIC $175M. Provided engineering and procurement. Scope included the increase chlorine production from 540 MTPD to a nominal 675 MTPD expandable to 940 MTPD chlorine. This retrofit converted the plant from a mercury cell technology to a membrane technology, which had a positive environmental impact to the local community. The St. Gabriel facility utilized chlorine as the product with sodium hydroxide (NaOH) and hydrogen as co- products. Chlorine will be liquefied, stored, and shipped. Additional compression and liquefaction equipment had been added as a result of this project, but all storage and shipping facilities were adequate without further expansion.

U.S. Magnesium – Rowley, UT

- Magnesium Facility Expansion, Rowley, UT – TIC $50M. Provided engineering and procurement. This expansion increased chlorine production from 35,000 lb/hr to 70,000 lb/hr. The increase impacted existing chlorine gas cleaning, drying, purification, compression, and liquefaction systems. This project required the addition of a new chlorine compressor, wash towers, acid drying towers, and wet/dry brink mist elimination system.

Olin Chlor-Alkali – Augusta, GA

Engineering Manager

- Olin, Mercury Cell Technology Conversion, Augusta, GA – TIC $40MM. Performed engineering and procurement of the Olin facility in Augusta Georgia. The Scope of Work involved conversion of the mercury cell technology with a capacity of 330 short tons per day to membrane technology with a capacity of 200 MTPD. The plant was configured to eliminate the storage and shipment of liquid chlorine. Main products from the plant were hydrochloric acid (HCl) and bleach serving local markets. Caustic was not concentrated but sold as 32% (or diluted as required) to local customers. Hydrogen was used to make HCl and as make up fuel to the boiler. There were no capacity changes in the bleach or HCl units, which are currently rated for 100 gpm (200 gpl) and 60 MTPD HCl operating in two units.

SCE&G – Columbia, SC

Engineering Manager

- Saluda, Dam Remediation, Columbia, SC – TIC $250MM. Provided engineering and procurement of a dam remediation project for a 250-megawatt hydro-electric facility located near Columbia, South Carolina on Lake Murray. Due to the advancement of seismic evaluation technology, it was determined that the existing earthen dam could not sustain an earthquake. Scope of Work included the design assist of a 1.3M cubic yard roller compacted concrete (approx. 1.5 miles long). Performed design and procurement of all drainage systems to support the new runoff flows from the new structure, new baghouse, several sediment ponds to handle the new ash flows, and modifications to the existing turbine- generator.

Rand Whitney – Montville, CT

Engineering Manager

Assistant Construction Project Manager

- 435 MTPD Recycle Linerboard Facility – TIC $100M. Provided engineering, procurement, and construction management. The project included a new 500 MTPD OCC plant and warehouse, stock preparation, a new paper machine with Bel Bond and extended nip press, and new winder, roll handling and finishing, and a finished product warehouse.

Carter Holt Harvey – Tokoroa, New Zealand

Mechanical Design Leader

- Kinleith Mill Modernization Project – Upgraded the woodyard, pulp mill, and pulp machine areas. Managed mechanical engineering team through the project design.

Westvaco – Covington, VA

Mechanical Discipline Leader

- New #2 Paper Machine – Served as Mechanical design leader for dry end of new #2 paper machine. Supervised all mechanical engineering which includes pump calculations, P&ID development, and equipment layout, piping detail design and piping stress analysis.

13.11 Greg R. Blankenship, PE

Vice President – Eastern Divisional Operations

Summary

Over thirty years of experience in design engineering and project management primarily in the Pulp and Paper industry. Expertise and knowledge include all areas of an integrated Pulp and Paper mill with emphasis on woodyard, chemical pulping, bleach plant, recovery boilers, paper machines, and roll handling. Additional expertise includes fiberglass mat process equipment and packaging, power and process piping systems, machine design, hydraulics, HVAC, and material handling. Over seventeen years of management experience. Managed start-up of consultant firm and grew to 15-person team. Managed 16-man onsite engineering team to execute capital projects. Direct management of a 70-person multi-discipline engineering/consulting office in Decatur and Regional Manager of five other multi-discipline offices in TN, GA, SC and PA.

Education

Bachelor of Science, Mechanical Engineering

University of Alabama – Tuscaloosa, AL

Professional Certifications

Professional Engineer, Alabama # 23085

Professional Engineer, Ohio # 80331

Experience

Hargrove Engineers + Constructors – Decatur, AL
Vice President – Eastern Divisional Operations

Operations Leader / Senior Project Manager

Responsible for overall operations and P&L for Eastern Division – Decatur, Memphis, Atlanta, Savannah, Greenville, and Philadelphia.

- Responsible for leading the Decatur office, serving as project sponsor and relationship manager for North Alabama clients, and ensuring Hargrove's projects are executed successfully
- Tissue Machine Upgrade – Served as Project Manager and Mechanical Lead for Tissue Machine Upgrade Project that included stock screening, cleaning, two new additives, and machine showers
- Fiberglass Mat Machine Rebuild – Project Manager responsible for rebuild that included replacement of the former section, thin stock system, applicator and weir, dryer, winder, roll handling, new fiber feed, binder mix, and machine utilities.
- Chemical Plant Piping Upgrade – Project Manager on various piping projects
- New Tissue Converting Line – Project Manager responsible for new tissue/towel converting line including unwind, embosser, accumulator, log saw, wrapper, carton packer, palletizer, dust collection, trim handling, and glue make-down station

International Paper Company – Courtland, AL
Capital Project Manager

- Managed FEL studies for new 3,000 MTPD Woodyard project

- Designed new mill water pumping system for energy savings
- Upgraded lamb roll lowerator from a hydraulic drive to an electric drive
- Developed project to replace the hardwood digester's steaming vessel

Engineering Consulting Firm – Birmingham, AL
Project Manager, Site Lead at Courland Mill

- Managed on-site team of engineers, designers, and construction managers to support the client's capital plan and maintenance issues
- Replacement Alstom Steam Turbine controls and upgrade MCC/Control Room to IP's ERAC Standard
- FEL-1 study to add 3,000MTPD woodyard—A series of projects to improve hardwood continuous digester which included new extraction screens, third wash extraction screens/header, third lower cooking extraction screens/header, new flash tank with extraction controls, and new turpentine condenser
- Multi-year rebuild of the hardwood bleach plant from two independent 3-stage bleach lines with diffusion and drum washers to a single 3-stage bleach plant with press washers
- Addition of two chlorine dioxide mixers for the hardwood DO and D1 stages. Relocation of roll wrap line from the Franklin Mill to C35 complex
- Upgraded the dryer bearing lube oil system for C30
- Replaced diesel firewater pump and controls

Engineering Consulting Firm – Athens, AL
President Principal Partner

- Worked with other partners to grow Civil/Mechanical engineering firm from 4 employees to 15 employees and $1.6MM in sales. Developed accounts for 21 clients. Key projects include the following:
- International Paper – Courtland
  - Replace the Softwood Oxygen Reactor
  - DiamondRoll Chip Thickness Screens (hardwood and softwood)
  - Hardwood Primary and Secondary Knotter Replacement
  - No. 3 Lime Kiln Chain Section and Refractory Modifications
  - Hi-Brite Grade Phase I Modifications
  - 15 Waste Heat/Energy Conservation Projects
  - 1300PSI Recovery Boiler Steam Drum
  - Bleach Plant MC Pumps
  - Tri-Nip Ceramic Center Roll Installation
  - 10 Pocket Cutsize Line upgrade to 325 TDP
  - 12 Vehicle Automated Guided Vehicle system
- Saint-Gobain – Russellville
- Designed modifications to existing winder for 100" dia rolls

Engineering Consulting Firm – Decatur, AL
Senior Engineer

Site manager and lead engineer at International Paper Courtland Mill. Led team of engineers and designers on various on-site projects. Project Manager for steam distribution repairs during the 2002 Cold Mill Outage. This consisted of 350+ tasks during a four-day outage. Other key projects include:

- Waste Heat Recovery Project
- 1,400MTPD conversion of Kamyr Continuous Digester

Champion International Paper / International Paper – Courtland, AL
Project Engineer

- Provided project management and mechanical engineering services for projects in all areas of the Courtland Mill. Designed the capital management portion of the Avantis installation and managed the training for 800+ mill employees
- Project Manager and Lead Mechanical Engineer for the emergency installation of a 750,000 #/hr. boiler with superheater and economizer sections. The new unit was delivered, erected, and tied into the 450psig steam header in 18 days.
- Press Section Steam Boxes No. 33 & No. 35 Paper Machines
- 1250 Ton/Day, Chip Barge Unloading Facility
- Rebuild of 600 MTPD Kamyr Hydraulic Digester for Extended Modified Continuous Cooking
- No. 3 Pulp Mill Expansion Project (Field Engineer Lime Kiln area

14.0 Appendix B – Controls and Automation

15.0 Appendix C – MSA Contract

TECHNICAL REVIEWERS' RATING SUMMARY

C-05-E

Blue Ammonia Facility
Submitted By: Catalyst Midstream (USA) LLC
Date of Application: November 2023

Request for $10,000,000 Grant
Total Project Costs $960,000,000

		Technical Reviewer			
		E1	**E2**	**E3**	
Rating Category	**Weighting Factor**	**Rating**	**Rating**	**Rating**	**Average Weighted Score**
1. Objectives	3	5	5	5	15
2. Impact	9	4	5	4	39
3. Methodology	9	5	5	5	45
4. Facilities	3	3	5	5	13
5. Budget	9	3	4	5	36
6. Partnerships	9	3	4	5	36
7. Awareness	3	3	3	4	10
8. Contribution	6	4	5	4	26
9. Project Management	6	2	4	3	18
10. Background	6	4	5	5	28
	315	228	285	285	266

OVERALL TECHNICALLY SOUND	E1	E2	E3
GOOD (IF > 214)	☒	☒	☒
FAIR (200-213)	☐	☐	☐
QUESTIONABLE (IF< 200)	☐	☐	☐

Mandatory Requirements	E1		E2		E3	
Diversification Delivery:	Yes	No	Yes	No	Yes	No
Project enhances the production of clean sustainable energy, to make the State a world leader in the production of clean sustainable energy, and/or to diversify and grow the State's economy.	✓		✓		✓	
Commercialization or Development/Expansion:	Yes	No	Yes	No	Yes	No
Concept will lead to the **large-scale development and commercialization** of projects, processes, activities, and technologies that reduce environmental impacts and/or increase sustainability of energy production and delivery.	✓		✓		✓	

In State Requirement:	Yes	No	Yes	No	Yes	No
The funds distributed from the financial assistance are to be applied to support in-state activities and must have other sources of financial support.	✓		✓		✓	

1. **The objectives or goals of the proposed project with respect to clarity and consistency with Clean Sustainable Clean Energy Authority goals of projects, processes, activities, and technologies that reduce environmental impacts and increase sustainability of energy production and delivery are: 1 – very unclear; 2 – unclear; 3 – clear; 4 – very clear; or 5 – exceptionally clear.**

Reviewer E1 (Rating 5)
The objectives and goals of this proposed project are well presented and are consistent with the Clean Sustainable Clean Energy Authority goals and objectives. Extremely well presented.

Reviewer E2 (Rating 5)
The objectives of the Catalyst Midstream proposal are very clear and exceptionally well stated. The objectives to produce 3,000 tons of blue ammonia while utilizing carbon capture to sequester 2.5 million tons/year are very consistent with the goals of the Clean Sustainable Energy Authority.

Reviewer E3 (Rating 5)
Objectives for the project are exceptionally clear. The proposal is extremely well written and explained, with no need for inference by the reader. Also, the objectives provide items that should be measures for completion of objectives.

2. **The objectives will make a difference in the near term to the state's economy: 1 – no impact; 2 – small impact; 3 – likely impact; 4 – most likely impact; or 5 – significant impact.**

Reviewer E1 (Rating 4)
If the project timeline as presented is achieved, the project will have a significant impact on the state's economy. The project construction phase will have a significant impact on the local economy and the operation of the plant would create a very beneficial value add to the natural gas produce in the state, which would have a significant benefit to the state through additional tax revenues.

Reviewer E2 (Rating 5)
The proposal estimates $244 million in GDP growth during the construction period from 2024-2027 while creating up to 200 good paying jobs. These forecasts seem accurate for a project of this size and budget and is consistent with the impacts realized from similar projects.

Reviewer E3 (Rating 4)
The processes used in the project will reclaim 95% of the carbon dioxide produced. In addition, the design will enable up to 25% of the total H2 needs of the process to come from 'green H2', meaning hydrolysis of water to I-hand 02 via wind generated electricity, further advancing project goal of decreasing C emissions and energy requirements.

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

Reviewer E1 (Rating 5)
The very high level of detail was provided for the proposed facility and the applicant has started the process of securing key contracts to ensure feed stock to the facility as well as finding transportation and markets for the finished product.

Reviewer E2 (Rating 5)
The quality and clarity of the methodology of this proposal is exceptional. It provides clear objectives, reasonable and realistic timelines for project milestones. The partnerships established, including one with KBR who is one of the leading manufacturers in the world for this type of project, an excellent design, and well defined budget are effectively communicated in the proposal and achievable.

Reviewer E3 (Rating 5)
The methodology is extremely well explained through a concise narrative, supplemented by figures. The description of methods used in the process designed to reduce energy consumption and C emissions is particularly well described.

4. The facilities and equipment available and to be purchased for the proposed pilot or commercialization strategy is: 1 – very inadequate; 2 – inadequate; 3 – adequate; 4 – notably good; or 5 – exceptionally good.

Reviewer E1 (Rating 3)
There was not a lot of detail provided on the actual procurement and lead times on key equipment. However, the applicant has significant background in the building and operating said facilities and has the background to acquire the necessary equipment. The applicant provided a very detailed summary of the equipment specifications.

Reviewer E2 (Rating 5)
The infrastructure already purchased for this project is an incredible asset to the potential success of this project and the well demonstrated technical design for the remaining infrastructure to be purchased is incredibly well defined and consistent with industry leading designs. The rail spur already acquired has the ability to process full unit trains and the loadout facility will require little retrofitting. The existing abandoned well on the property also makes it ideal for carbon capture and storage. It's location in proximity to rail infrastructure for export and major highways, local natural gas distribution, and larger population centers make it ideal. I don't believe there is a better location in the state for this project to be successful.

Reviewer E3 (Rating 5)
The facilities available and to be purchased, including their design and feed-stock deliver and end-product delivery is extremely well documented, explained, complete with images showing important structures/designs of key components and processes.

5. The proposed budget is comprehensive and sufficient relative to the outlined work and the timetable: 1 – not sufficient; 2 – possibly sufficient; 3 – likely sufficient; 4 – most likely sufficient; or 5 – certainly sufficient.

Reviewer E1 (Rating 3)
The applicant did not provide a detailed summary of the budget and spending timeline to complete the project. The application did not go into detail on the funding of the major portion of the project. As outlined in the application, the grant request and the loan from the state were the only two funding sources identified, the applicant only showed $200k in cash. The remaining funding source was not presented. It appears the applicant plans to use the $37 million in state grant and loan to do front-end engineering, permitting, and land procurement. The applicant is not showing a 50% cost share for this stage of the project, which is a concern.

Reviewer E2 (Rating 4)
Given the location, existing infrastructure, and established partnership commitments, the budget and timetable for completion seem very sufficient and reasonable. The project will also be able to take advantage of the 45q tax credit generating $120 million per year in stable revenue that is not prone to price large swings in pricing like the commodity produced. That will greatly help reduce the risk of the project. Since the 45q is guaranteed for the next 12 years that will help greatly to increase earlier returns on investment.

Reviewer E3 (Rating 5)
The budget is well explained, reasonable and its need is well described.

6. **The appropriate strategic partnerships are in place for short and long term plans to be successful: 1 – very limited; 2 – limited; 3 – adequate; 4 – better than average; or 5 – exceptional.**

Reviewer E1 (Rating 3)
The partners are adequate for the project and the applicant has a robust history of executing projects of this type.

Reviewer E2 (Rating 4)
The partnerships established are very strategic and necessary for this project to be successful. The commitment from WBI to provide the feedstock is essential for the project to be feasible. KBR is an industry leading company that has built similar facilities around the globe and their pre FEED technical report details a robust, proven, and reliable design. TERRACOH, Inc. is also going to be an essential partner for the carbon capture component of this design which is also a critical component. The agreement with BNSF is also an essential component to the feasibility of this project. The project is well positioned to be successful.

Reviewer E3 (Rating 5)
Catalyst Midstream has partnered with KBR (Kellogg, Brown & Roots) as a producer/builder of anhydrous ammonia facilities, in business since 1943. Substantial improvements in their process have resulted in significant advances in plant safety, longevity, energy efficiency, and hours operational between maintenance shut-downs. These claims are evidenced by data from their existing modem facilities world-wide. Within KBR is their Sustainable Technology Solutions Business (STSB) whose technologies are responsible for> 95% C capture in their process. This is an excellent partnership and appears to provide evidence that the project will be completed in a timely manner and with end-products described in the proposal.

7. **The likelihood that the project approach (time & budget) will achieve its technical and market goals is: 1 – not achievable; 2 – possibly achievable; 3 – likely achievable; 4 – most likely achievable; or 5 – certainly achievable.**

Reviewer E1 (Rating 3)
Per the information provided, the project timeline and budget seem aligned for the magnitude of the proposed project. The one key risk to the project is the procurement of the major project funding.

Reviewer E2 (Rating 3)
Given the proposed budget, established partnerships, existing infrastructure, and solid design make this project very likely to come in on time and budget. However, the environmental permitting process, pipeline to be constructed, and carbon capture well to be drilled lend uncertainty to the timeline as they all need permitting and approval and are subject to other constraints that could foreseeably create delays and unseen additional costs to the project.

Reviewer E3 (Rating 4)
The partnership between Catalyst Midstream, KBR and STSB, together with IIBR' s expertise and experience in building anhydrous ammonia manufacturing facilities provide confidence that the project will be completed on time and on budget.

8. **The scientific and/or technical contribution of the proposed work to specifically address Clean Sustainable Energy Authority goals of impacting technology used in North Dakota's energy industries will likely be: 1 – extremely small; 2 – small; 3 – significant; 4 – very significant; or 5 – extremely significant.**

Reviewer E1 (Rating 4)
If this project is completed it will have a very significant impact on North Dakota and North Dakota's energy industry. The project would be a long-term investment in the future of North Dakota's energy industry.

Reviewer E2 (Rating 5)
The scientific and technical contributions of the proposed project could be extremely significant for North Dakota and the transition towards clean and sustainable energy development. To have production, CCS, and unit train product load out all within one site would make this an incredible model of efficiency. The design technology is proven and reliable and utilization of nearby adjacent gas sources also further increases the efficiency of the technical synergies created within this project. Utilizing key infrastructure to create industrial parks with synergistic value chains without a carbon footprint could be the model for future large scale industrial production projects in the state. The world is moving quickly to alternative energy sources and ammonia/hydrogen is a leading technology since it is the next densest energy carrier to oil and gas. This project could position North Dakota as an early producer of clean ammonia to help power the world in the clean energy transition. There is also a steadily increasing demand for fertilizer around the globe while the current supply sources have been diminishing. The global clean ammonia market is forecasted to grow by as much as 500% by 2050.

Reviewer E3 (Rating 4)
The project proposal describes the use of technologies not currently used in the state to produce anhydrous ammonia with lower energy requirements and much lower C emissions than facilities operating in the region. In addition, the ability of the facility to use up to 25% green I-12 through wind-powered water hydrolysis further addresses Clean Sustainable Energy Authority goals through reduction of hydrocarbon fuel stock and resulting C emissions.

9. The project management plan, including budgeting projections, partner connections and well-defined milestone chart is: 1 – very inadequate; 2 – inadequate; 3 – adequate; 4 – notably good; or 5 – exceptionally good.

Reviewer E1 (Rating 2)
The application did not provide much detail on the budgeting process for the project and the milestone chat information was not very detailed.

Reviewer E2 (Rating 4)
The plan overall including the budget, partner connections and milestones is very well defined and realistic across all phases of development and much of the very important feasibility scoping work has already been completed.

Reviewer E3 (Rating 3)
The project description notes that an executive board is being or soon will be established to oversee the progress and direction of the project. The proposal indicates an 'Exhibit B' of Edward W. Merrow's 'Industrial Mega Projects', which I could not find in the application I was provided. Regardless, the proposal indicates that it is being addressed, so I rated management 'Adequate'.

10. The background and experience of the project principals with regards to technical qualifications and competence is: 1 – very limited; 2 – limited; 3 – adequate; 4 – better than average; or 5 – exceptional.

Reviewer E1 (Rating 4)
The applicant very clearly has the knowledge, technical qualifications and background to execute a project of this nature; however, there is the concern of the project budget and funding sources.

Reviewer E2 (Rating 5)
The established partners have top level expertise and competency in their respective fields with many established successful projects of similar scope. The project is very well positioned to be successful.

Reviewer E3 (Rating 5)
The background and experience of the partners, particularly KBR as a principal is exceptional. The experience is evidenced by the number of anhydrous ammonia facilities built successfully

around the world, and the evidence for safety, longevity, energy savings over competing technologies as well as continuous performance between maintenance shut-downs is impressive.

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 the project is technically sound.

Reviewer E1

The project would be a have significant impact on the state of North Dakota's energy industry and would have a very positive tax revenue impact. The project would also have a major positive impact on the local and regional economies. The only glaring concern is the funding sources for the initial front-end work, with all the funding coming from the state through a grant and loan.

The project is technically very sound.

Reviewer E2

Strengths of the Proposed Project:

1. Location:
   a. The proximity to main line rail, local gas feedstock, CCS storage geology formation, and local population centers for employees has the project perfectly positioned within the state.
2. Proven Technology Design:
   a. KBR has proven technology and a long history of building successful plants around the world.
3. Alignment with Clean Energy Goals:
   a. Will utilize CCS technology to make ammonia without a neutral carbon footprint is essential to reach stated policy net zero goals.
4. Economic and Employment Opportunities:
   a. The proposal's potential to create jobs and stimulate the local economy is significant.
   b. The project may also stimulate growth in ancillary industries, including manufacturing and services, leading to a multiplier effect in the regional economy.
   c. These types of plants have a useful lifespan of roughly 50 years- the plant could provide stable revenue and jobs for decades.
5. Stable Revenue Model:
   a. Will export roughly 90% of production to pacific rim countries.
      i. Countries like Japan are rapidly moving towards ammonia for energy generation and will need a steady supply of ammonia.
   b. Access to 45q revenue stream provides stable source of ongoing subsistence.

Weaknesses of the Proposed Project:

1. The project does not plan for large scale product storage.
   a. The plant will be entirely dependent on timely shipments from the railroad which have proven to not always be reliable.
2. The business plan depends on ongoing demand from Asian markets.

a. Decreased demand, canceled contracts or market competition with competitive advantage in those markets could greatly affect their business model.

Recommendations:
The proposed project has significant merit and a high likelihood of success that could provide significant impacts to the North Dakota economy and create many jobs. The defined partnerships, robust plan and design, and ideal location with existing critical infrastructure make it an ideal project. It will provide for local utilization of North Dakota gas production, creating a value-added product to complement our oil and gas industry. The amount of gas that will be utilized is significant and could allow for increased oil production. Furthermore, it will capture a large amount of CO2 that could provide a future source to be utilized for enhanced oil recovery in the area. Moreover, the project will contribute to clean and sustainable production, helping achieve the stated goal of net zero emissions. The project plan should build contingency plans for rail or export demand constraints that could affect production operations. Local emergency offtake partnerships could possibly be created with existing large scale ammonia storage terminals in the state that have rail offloading capacity.

Reviewer E3
This is an exceptionally well written and well explained project. It provides very well described methods that will lead to accomplishment of project goals of reduced energy requirements and substantial C capture and recycling through hydrogenation. I was very impressed by the project and the ease of reading and understanding the chemical engineering required for project completion.

Catalyst Midstream (USA) LLC
3877 E Caley Ln
Centennial, Colorado 80121
303-842-5551

November 1, 2023

Clean Sustainable Energy Authority
North Dakota Industrial Commission
600 East Boulevard Avenue
Dept 405, 14^{th} Floor
Bismarck, ND 58505-0840

Re: CSEA Application

Dear Clean Sustainable Energy Authority:

Find attached the formal CSEA application for your review. An original and one (1) copy will be submitted via mail.

Catalyst Midstream (USA) LLC is ready, willing, able and committed to complete this project on time and on budget. Permitting for the project including the CCS facility was started in October 2023 and the Front End Engineering and Design (FEED) will begin in November 2023. Therefore, the timeline as shown in the application is on schedule.

Please call with any questions.

Kind regards,

Edward Neibauer
President & CEO

Clean Sustainable Energy Authority

North Dakota Industrial Commission

Application

Project Title: BLUE AMMONIA FACILITY

Applicant: CATALYST MIDSTREAM (USA) LLC

Date of Application: NOVEMBER 1, 2023

Amount of Request
Grant: $10,000,000
Loan: $27,500,000

Total Amount of Proposed Project: $960,000,000

Duration of Project: 40 MONTHS CONSTRUCTION PHASE. 25+ YEARS PROJECT LIFE.

Point of Contact (POC): EDWARD NEIBAUER

POC Telephone: 303-842-5551

POC Email: eneibauer@catalystmidstream.com

POC Address: 3877 E CALEY LN, CENTENNIAL, COLORADO 80121

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Please use this table to fill in the correct corresponding page number.

ABSTRACT

Objective: Catalyst Midstream (USA) LLC (Company), a North Dakota limited liability company formed in 2019, purposes to design, build, own and operate a 3000 MTPD (1.08 million tons/yr) Blue Ammonia Facility in Berthold, ND. The natural gas feedstock supply of 120,000 dekatherms per day will be sourced from various Bakken oil and gas producers in the Williston Basin and transported to the site by WBI Energy Transmission, Inc (WBI) from their Tioga, ND pipeline terminal. The Company has executed a Natural Gas Transportation Agreement and an Interconnect Agreement with WBI. The Company has secured an existing 330-acre rail terminal owned by Enbridge Inc. which includes an office building, 2 warehouse buildings and a load-out building with 14 Loading Arms and double loop rail track located on the western side of Berthold.

The primary market for the Blue Ammonia product is the Asia Pacific region to be used as a clean burning fuel with Japanese entities having expressed the most interest in a long-term contract for the Blue Ammonia. Japan is projected to be requiring 4 million tons of ammonia as a clean burning fuel in 2030 and growing to 30 million tons by 2050.

BNSF has agreed to rail the Blue Ammonia product to the Rivergate Terminal in the Port of Portland, OR where it will be loaded onto Very Large Gas Carriers (VLGC) and exported to these markets. The secondary market of approximately 250,000 tons/year will be the North Dakota agricultural industry.

KBR (Houston, TX) has been selected to license their PurifierPlus™ Blue Ammonia proven technology to the Company and has completed a Pre-FEED feasibility study on the project. KBR is ready, willing and able to begin the detailed engineering FEED work and estimates that a 9-month period would be acceptable to completing the work. The FEED work will include the design for the Carbon Capture and Storage (CCS) facility as 96% of the carbon dioxide (2.5 million tons/year) will be captured and stored into a permitted underground formation. TERRACOH, Inc. has been retained to obtain the Class IV injection permit for the CCS plant which will be located on the property site.

The Catalyst Midstream (USA) LLC Blue Ammonia project will demonstrate strong economic GDP growth for the State and diversification by the manufacturing of ammonia as a clean sustainable energy source to the Asia Pacific marketplace making North Dakota a world leader. The CCS facility will capture and sequester approximately 2.5 million tons per year of carbon dioxide emissions from the production of Blue Ammonia. The estimated GDP growth for the period of 2024-2027 during the construction period is $244 million (see attached REMI Model).

Expected Results: 3000 MTPD (1,080,000 tons/yr) Blue Ammonia resulting in a GDP of $830 million in 2027, job growth to 150-200 of skilled and unskilled laborers and additional local and state tax revenues.

Duration: The expected duration of the construction phase is 40 months. The project life of the facility is expected to be 25+ years.

Total Project Cost: The total pre-FEED estimated project cost is $960,000,000. Once Front End Engineering and Design (FEED) is completed a detailed cost estimate will be obtained.

Participants: Catalyst Midstream (USA) LLC owns 100% of the project.

PROJECT DESCRIPTION

Objectives: The primary objectives in spending $37.5 million in pre-construction funding are the purchase of the Berthold Terminal and obtaining the construction, air quality and carbon capture and storage (CCS) permits. Once these permits have been secured, project financing is readily available to build the 3000 MTPD Blue Ammonia facility and place it into production.

Methodology: The methodology in investing $37.5 million in development funding for the period of 2023-2025 is shown below on Table 1:

TABLE 1

Description	2023	2024	2025	Total
KBR FEED	$1,000,000	$2,000,000		
CCS Permit	$3,000,000	$10,000,000*		
Ramboll Air Permit	$600,000	$600,000		
Terminal Acquisition	$9,200,000			
Management/Salaries	$1,400,000	$4,600,000	$4,900,000	
Working Capital	$200,000			
TOTAL	**$15,400,000**	**$17,200,000**	**$4,900,000**	**$37,500,000**

*Includes stratigraphic test well.

Anticipated Results: The anticipated results after the $37.5 million expenditure are obtaining the permits necessary to complete the project financing phase and start the construction phase. It is estimated the ground-breaking will occur on June 1, 2024 assuming FEED and Permitting is initiated in October 2023. The federal IRS 45Q tax credit program will generate in excess of $120 million/year in carbon sequestration and storage revenues towards the feasibility of the project. The estimated increase in GDP during the construction period 2024-2027 is $244 million.

Facilities: The facilities including property description, CCS site and asset list are shown in the attachments.

Resources: The list of resources including consultants retained for the project are as follows:

CCS Permit:	TERRACOH Inc
Air Quality Construction Permit:	Ramboll USA
FEED (Front End Engineering Design):	KBR LLC
Technology Provider and License:	KBR LLC
EPC Contractor:	TOYO USA Engineering

Techniques to Be Used, Their Availability and Capability: The techniques to be used, availability and capability is referenced in the attachments under the Blue Ammonia technology provider (KBR) pre-FEED Technical Report.

Environmental and Economic Impacts while Project is Underway: The environmental and economic impacts are as follows:

1. Reduction in carbon dioxide emissions of 2.5 million tons per year
2. GDP growth of $244 million during the construction period of 2024-2027

Ultimate Technological and Economic Impacts: The ultimate technological and economic impacts are the demonstration of blue ammonia manufacturing using carbon capture technology and the creation of up to 200 skilled and unskilled good paying jobs in Ward County, ND.

Why the Project is Needed: The project is needed to create a "value-added" revenue source for North Dakota using the existing natural gas resources that is currently being exported to other states and markets. North Dakota will benefit greatly from this project as it will provide a clean burning fuel primarily to the Asia Pacific marketplace but can easily grow to other world markets.

STANDARDS OF SUCCESS

The standards of success will be measured by the following:

1. Reduction of carbon dioxide emissions in the amount of 2.5 million tons/year
2. The 3000 MTPD of Blue Ammonia will increase energy sustainability by using the vast amount of Williston Basin natural gas reserves towards the manufacturing of a clean burning fuel.
3. This project will demonstrate its value to North Dakota in many ways such as an increase in GDP, creating new jobs, supply the world in clean burning fuels and provide a low cost source of anhydrous ammonia for the state agriculture sector.

BACKGROUND/QUALIFICIATIONS

Please provide a summary of prior work related to the project conducted by the applicant and other participants as well as by other organizations. ***This should also include summary of the experience and qualifications pertinent to the project of the applicant, key personnel, and other participants in the project.***

See attached Exhibit A

MANAGEMENT

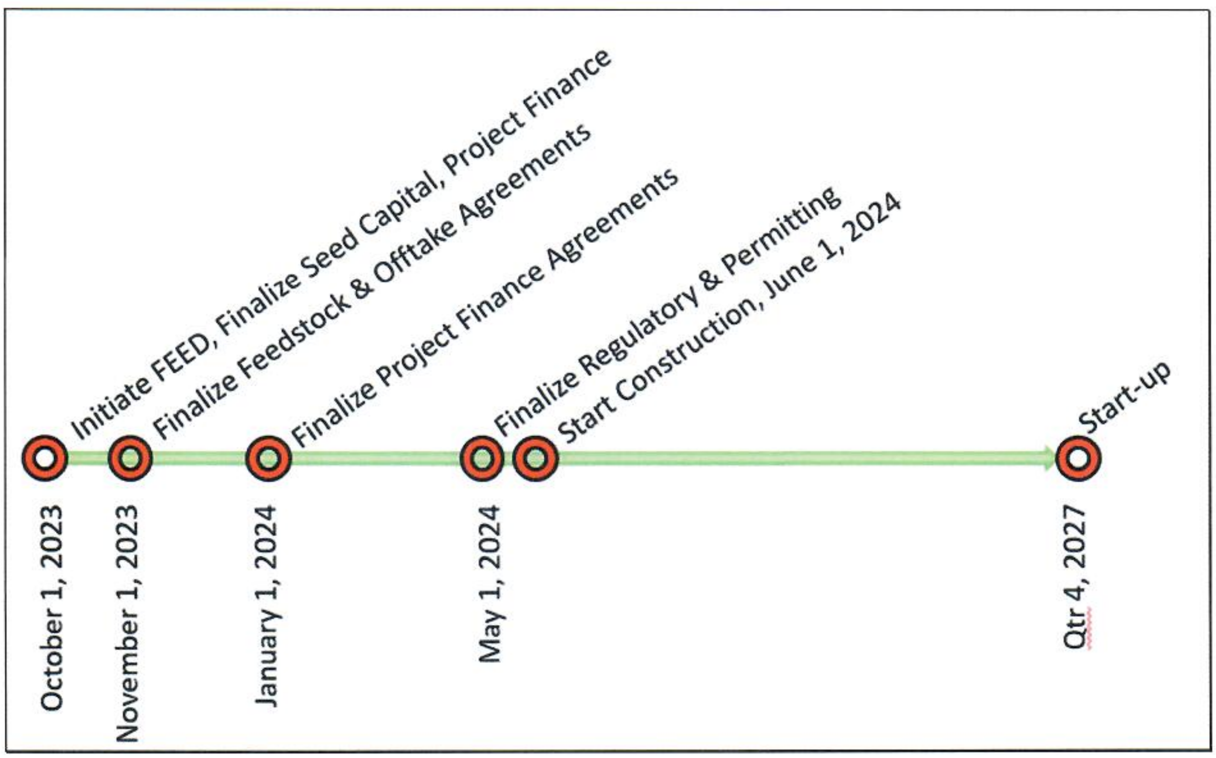
A description of ***how*** *the applicant will manage and oversee the project to ensure it is being carried out on schedule and in a manner that best ensures its objectives will be met,* ***and a description of the evaluation points to be used*** *during the course of the project.*

Applicant will strictly adhere to the management and construction rules and principles as outlined in Edward W. Merrow's "Industrial Mega Projects" and shown in attached Exhibit B. This management technique is a proven and successful model resulting in reduced capital costs and a reliable project timeline.

TIMETABLE

Please provide a project schedule setting forth the starting and completion dates, dates for completing major project tasks/activities, and proposed dates upon which the interim reports will be submitted.

Phase 1: **Project Development** **Q3/19 to Q3/23**	**Phase 2:** **Project Execution** **Q4/23 to Q3/27**	**Phase 3:** **Operations** **Q3/27**
• Secure Site/Utilities • Access Seed Capital ($37.5 million) • Initiate FEED • Set up Corporate Office • Licensing Agreements • Regulatory • Establish Board of Directors • 1st Institutional Round • Begin Commercial • Complete pre-FEED • Order Long Lead Items	• Receive Approvals • Execute Commercial Agreements • Execute Project Financing • 2nd Institutional Round • Initiate FEED • Initiate and Complete Construction • Create Operations team • Construction (40 months) • Natural Gas Feedstock Pipeline (40 months) • Commissioning	• Start-Up • Commissioning



BUDGET

*Please use the table below to provide an **itemized list** of the project's capital costs; direct operating costs, including salaries; and indirect costs; and an explanation of which of these costs will be supported by the financial assistance and in what amount. The budget should identify all other committed and prospective funding sources and the amount of funding from each source. **Please feel free to add columns and rows as needed.** Higher priority will be given to projects with a high degree of matching private industry investment.*

Project Associated Expense	NDIC Grant	NDIC Loan	Applicant's Share (Cash)	Other Project Sponsor's Share	Total
Equipment					$260,000,000
Material					$200,000,000
Construction					$300,000,000
Engineering					$ 38,000,000
Misc					$162,000,000
Total	$10,000,000	$27,500,000	$200,000	$922,300,000	$960,000,000

PATENTS/RIGHTS TO TECHNICAL DATA

Any patents or rights that the applicant wishes to reserve must be identified in the application. If this does not apply to your proposal, please note that below. **Any patents or rights are held by KBR on their Blue Ammonia PurifierPlus™ Technology.**

STATE PROGRAMS AND INCENTIVES

Any programs or incentives from the State that the applicant has participated in within the last five years should be listed below, along with the timeframe and value. **Catalyst Midstream (USA) LLC has made a loan application to the Department of Commerce.**

TECHNICAL REVIEWERS' RATING SUMMARY

C-05-G

Marathon Petroleum Dickinson Renewable Fuel Facility Expansion
Submitted By: Energy & Environmental Research Center (EERC)
Date of Application: November 2023
Request for $10,000,000 Grant
Total Project Costs $21,761,930

		Technical Reviewer			
		G1	**G2**	**G3**	
Rating Category	**Weighting Factor**	**Rating**	**Rating**	**Rating**	**Average Weighted Score**
1. Objectives	3	5	4	4	13
2. Impact	9	3	3	4	30
3. Methodology	9	5	2	5	36
4. Facilities	3	5	2	4	11
5. Budget	9	5	4	4	39
6. Partnerships	9	4	5	4	39
7. Awareness	3	4	4	5	13
8. Contribution	6	4	3	4	22
9. Project Management	6	5	5	4	28
10. Background	6	5	5	4	28
	315	279	234	264	259

OVERALL TECHNICALLY SOUND			
GOOD (IF > 214)	☒	☒	☒
FAIR (200-213)	☐	☐	☐
QUESTIONABLE (IF< 200)	☐	☐	☐

Mandatory Requirements	G1		G2		G3	
Diversification Delivery:	Yes	No	Yes	No	Yes	No
Project enhances the production of clean sustainable energy, to make the State a world leader in the production of clean sustainable energy, and/or to diversify and grow the State's economy.	✓		✓		✓	
Commercialization or Development/Expansion:	Yes	No	Yes	No	Yes	No
Concept will lead to the **large-scale development and commercialization** of projects, processes, activities, and technologies that reduce environmental impacts and/or increase sustainability of energy production and delivery.	✓		✓		✓	

In State Requirement:	Yes	No	Yes	No	Yes	No
The funds distributed from the financial assistance are to be applied to support in-state activities and must have other sources of financial support.	✓		✓		✓	

1. **The objectives or goals of the proposed project with respect to clarity and consistency with Clean Sustainable Clean Energy Authority goals of projects, processes, activities, and technologies that reduce environmental impacts and increase sustainability of energy production and delivery are: 1 – very unclear; 2 – unclear; 3 – clear; 4 – very clear; or 5 – exceptionally clear.**

Reviewer G1 (Rating 5)
The overall objective is to upgrade existing facilities at Marathon's Dickenson (ND) refinery: to enhance efficiency and flexibility of the existing facilities, to allow for usage of a wider portfolio of oleochemical feedstocks and more robust control of plant operations to produce biofuels and bioproducts (i.e., biobased aviation fuel and green diesel) at high carbon efficiency, at proportions deemed to be optimal strategically (e.g., to meet current market demands). The goal of this proposal is to complete a Front-End Loading Phase 3 (FEL 3) engineering design (i.e., full design of systems and instrumentation, Gantt chart, cost analysis, and applications for environmental compliance), to provide EERC and Marathon the necessary information to decide on moving forward with the overall objective (i.e., final investment decision).

Reviewer G2 (Rating 4)
No comments

Reviewer G3 (Rating 4)
The objectives and goals are clearly stated and include growing and diversifying Marathon Petroleum's renewable fuel production at their Dickinson North Dakota facility. In doing so, they would benefit from the growing fuel markets including the rapidly increasing market for Sustainable Aviation Fuel (SAF).

2. **The objectives will make a difference in the near term to the state's economy: 1 – no impact; 2 – small impact; 3 – likely impact; 4 – most likely impact; or 5 – significant impact.**

Reviewer G1 (Rating 3)
Achievement of the overall objective will result in the Dickinson facility being one of the largest suppliers of sustainable (i.e., low-carbon intensive) jet fuel in the country, leading to increased employment at the facility and temporary employment for the design and construction phases (~300 construction jobs), thereby enhancing the tax base. The agricultural sector may also receive benefit due to increased demand for oleochemical feedstocks.

Reviewer G2 (Rating 3)
No comments

Reviewer G3 (Rating 4)
The results for the proposed study would provide more detailed information on the near-term economic impact. Initial estimates are that if the project enters the construction phase it would

provide 300 jobs. The number of jobs will be reduced following construction, but the project would increase direct and indirect jobs as well as taxes and indirect economic activity.

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

Reviewer G1 (Rating 5)
The methodology was described clearly and fulfills the requirements of the FEL 3 design process.

Reviewer G2 (Rating 2)
No comments

Reviewer G3 (Rating 5)
The project plan including the scope of work are well laid out and explained. They are using traditional engineering and business techniques to reduce risks and get to a final investment decision.

4. The facilities and equipment available and to be purchased for the proposed pilot or commercialization strategy is: 1 – very inadequate; 2 – inadequate; 3 – adequate; 4 – notably good; or 5 – exceptionally good.

Reviewer G1 (Rating 5)
The facilities needed to complete the FEL 3 design within the EERC and subcontractees are excellent.

Reviewer G2 (Rating 2)
No comments

Reviewer G3 (Rating 4)
The bulk of the proposed work is for engineering and planning. Since the project is more of a paper study this category does not directly apply. Was scored as a 4 since equipment availability should not be a concern and existing equipment and operational experience should help reduce uncertainties.

5. The proposed budget is comprehensive and sufficient relative to the outlined work and the timetable: 1 – not sufficient; 2 – possibly sufficient; 3 – likely sufficient; 4 – most likely sufficient; or 5 – certainly sufficient.

Reviewer G1 (Rating 5)
The budget, as laid out in Tables 2 and F3, are reasonable to complete the FEL 3 design ($10 K from NDIC plus $11.8 K cost share from Marathon). All proposed costs have been justified in the proposal.

Reviewer G2 (Rating 4)
No comments

Reviewer G3 (Rating 4)
The budget appears to be adequate based on projects of similar size and complexity. The proposal states that the MPC cost-share will increase above the ratio reflected in the proposal as needed to ensure the work is completed.

6. **The appropriate strategic partnerships are in place for short and long term plans to be successful: 1 – very limited; 2 – limited; 3 – adequate; 4 – better than average; or 5 – exceptional.**

Reviewer G1 (Rating 4)
EERC (the applicants) and Marathon (the main subcontractee for the proposal and owner of the related Dickinson biofuel facility), have collaborated previously in the pursuit of the Prairie Horizon Hydrogen Hub. The other subcontractees for the proposed FEL 3 design in Tasks 2.0, 3.0, 4.0, and 5.0 have partnered with Marathon previously, and in most cases relating to the Dickinson biorefinery. The relationships between suppliers of oleochemicals (vegetable oils) and Dickinson must exist but are not discussed in the proposal. Several regional airports and the U.S. Military exist as customers for the sustainable aviation fuel to be produced from this project. The support and impact of the suppliers and customers for the decision to possibly pursue the expansion and upgrading of the Dickinson facility was not described in the proposal.

Reviewer G2 (Rating 5)
No comments

Reviewer G3 (Rating 4)
They have extensive expertise and a strong team to address project management, engineering and design, and all other aspects of the project needed to arrive at a final investment decision.

7. **The likelihood that the project approach (time & budget) will achieve its technical and market goals is: 1 – not achievable; 2 – possibly achievable; 3 – likely achievable; 4 – most likely achievable; or 5 – certainly achievable.**

Reviewer G1 (Rating 4)
The likeliness of the proposal's main deliverable, the FEL 3 design, being completed thoroughly and on-time is high, based on the strong reputation of EERC for managing and completing similar activities with other companies. The existing strong relationship between EERC and Marathon provides further support for this view. It will remain unclear whether the expansion project for the Dickinson biorefinery moves forward or not until after a decision is made by Marathon, based on the results from the FEL 3 design.

Reviewer G2 (Rating 4)
No comments

Reviewer G3 (Rating 5)
The budget, schedule and project team are set up well for success. The project already has a head start and the plan certainly seems achievable.

8. **The scientific and/or technical contribution of the proposed work to specifically address Clean Sustainable Energy Authority goals of impacting technology used in North**

Dakota's energy industries will likely be: 1 – extremely small; 2 – small; 3 – significant; 4 – very significant; or 5 – extremely significant.

Reviewer G1 (Rating 4)
If the expansion of the Dickinson facility is pursued, the facility will be a leader in the state-of-the-art production of low-carbon intensive sustainable aviation fuel, addressing the goal of net-zero carbon emissions by 2030 set by the North Dakotan government, for an industry where carbon dioxide generation is significant, aviation, amounting to ~2% of global energy-related emissions (International Energy Agency). Topsoe, a collaborator for the FEL 3 design (reactor and catalyst design; Task 4.0), is an innovator for catalytic production of green biofuels, including aviation fuel (e.g., Hydroflex platform, per https://www.topsoe.com/sustainable-aviation-fuel-technology).

Reviewer G2 (Rating 3)
No comments

Reviewer G3 (Rating 4)
Helps address North Dakota's carbon neutrality by 2030 goals while addressing growing market opportunities resulting from federal goals. The demand growth forecasts for SAF and other low-carbon fuels create opportunities that can be addressed in part by this project. The project works toward CSEA goals of commercial projects that increase the energy industry products while reducing environmental impacts.

9. The project management plan, including budgeting projections, partner connections and well-defined milestone chart is: 1 – very inadequate; 2 – inadequate; 3 – adequate; 4 – notably good; or 5 – exceptionally good.

Reviewer G1 (Rating 5)
The project management plan, as laid out in pp 14-15 of the proposal and the Gantt chart (Fig. 5), is excellent. EERC is experienced in managing projects involving industrial partners.

Reviewer G2 (Rating 5)
No comments

Reviewer G3 (Rating 4)
They have a solid project management plan to track the project and maintain strong communication within the project team. As mentioned above the scope, schedule and project management plan all appear to match well and they should be achievable.

10. The background and experience of the project principals with regards to technical qualifications and competence is: 1 – very limited; 2 – limited; 3 – adequate; 4 – better than average; or 5 – exceptional.

Reviewer G1 (Rating 5)
The leadership team at EERC and Marathon have the necessary experience, credentials, and skills to lead the proposed FEL 3 design process.

Reviewer G2 (Rating 5)

No comments

<u>Reviewer G3 (Rating 4)</u>
A very strong project team including EERC in project management and Marathon Petroleum leading the commercial engineering and design work with a great supporting cast.

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 the project is technically sound.

<u>Reviewer G1</u>
Strengths: The overall project's objective, the proposed expansion of Marathon's Dickinson, ND, facility, nearly doubling the production of biofuels and enabling the production of sustainable aviation fuel, is a strong fit to the NDIC program and would play a significant role in aiding the ND State Government's goal of net-zero carbon emissions. The expansion will allow for greater versatility in oleochemical feedstock utilization and expand the capability nearly two-fold, to produce a portfolio of biofuel products that meet market demands. The research plan for the proposed activity to be funded by this proposal, an FEL 3 design, is thorough and well detailed. The applicants, EERC and Marathon, and their subcontractees represent a strong team.

Weaknesses: It is not clear if suppliers of vegetable oils and purchasers of the increased levels of biofuel products, especially aviation fuel, have been lined up to meet the anticipated increase of capacity. Letters of support along these lines would have addressed this minor concern. However, there is a good likelihood of increased demand for sustainable jet fuel because of the U.S. Department of Transportation's Aviation Climate Action Plan.

Summary statement: I find the applicant's case for requesting of NDIC funds to support the FEL 3 design step to be strong and worthy of consideration for acceptance. I appreciate the high quality of grantsmanship represented by this well-written and organized proposal.

<u>Reviewer G2</u>
- Marathon Petroleum Dickinson Refinery Expansion for SAF
- Explore expanding the Dickinson refinery to include SAF
- Increase overall capacity to 22.5 KBPD
- SAF would displace RD, but the plan could swing between SAF and RD
- A study has previously been conducted on 16.5KBPD
- Next step, update study to 22.5KBPD, which might take 6-8 months to complete
    - Estimated cost is $16-$20M
- Marathon Petroleum is requesting a $10M grant
- What results would the FEED study show for MPC to move forward with the investment?

If MPC would outline what steps need to be taken to move this $20MM study into development, the examiner would recommend funding their request.

Reviewer G3

This is a strong proposal that matches the objectives of CSEA well. If it proceeds to commercialization the project would expand and diversify the products from MPC's Dickinson, ND facility with a focus on reduced environmental impacts including lowered carbon intensity. The project would be expected to create 300 jobs during construction, based on the proposal. The system is expected to bring 10 to 15 additional long-term jobs, increase demand for locally produced agricultural products and waste oils, increase state tax revenue, and many other direct and indirect economic benefits, all while capturing and storing CO_2.

Energy & Environmental Research Center
15 North 23rd Street, Stop 9018 • Grand Forks, ND 58202-9018 • P. 701.777.5000 • F. 701.777.5181
www.undeerc.org

November 1, 2023

North Dakota Industrial Commission
ATTN: Clean Sustainable Energy Authority
State Capitol – 14th Floor
600 East Boulevard Avenue
Bismarck, ND 58505

Dear Clean Sustainable Energy Program:

Subject: EERC Proposal No. 2024-0031 Entitled "Marathon Petroleum Dickinson Renewable Fuel Facility Expansion"

Enclosed for your consideration is the Energy & Environmental Research Center's (EERC's) proposal, in partnership with Marathon Petroleum Corporation (MPC) and MPC's subcontractors, Burns & McDonnell, Technip Energies, Topsoe, Smith & Burgess, and BARR Engineering, to complete a front-end engineering and design feasibility study for enhancement of the MPC renewable fuel facility in Dickinson, North Dakota. Thank you for considering our proposal.

If you have any questions, please contact me by phone at 701.777.5273 or by email at cwocken@undeerc.org.

Sincerely,

DocuSigned by:
Chad Wocken
4A1E2E3014A6467...
Chad A. Wocken
Assistant Director, Clean Energy Solutions

Approved by:

DocuSigned by:
29499751F2B84D7...
…ki, CEO
Energy & Environmental Research Center

CAW/bjr

Enclosures

UNIVERSITY OF NORTH DAKOTA

Clean Sustainable Energy Authority

North Dakota Industrial Commission

Application

Project Title: Marathon Petroleum Dickinson Renewable Fuel Facility Expansion

Applicant: Energy & Environmental Research Center

Date of Application: November 1, 2023

Amount of Request
Grant: $10,000,000
Loan: $0

Total Amount of Proposed Project: $21,761,930

Duration of Project: 24 months.
(March 1, 2024 – February 28, 2026)

Point of Contact (POC): Chad A. Wocken

POC Telephone: 701.777.5273

POC Email: cwocken@undeerc.org

POC Address: 15 North 23rd Street,
Stop 9018, Grand Forks, ND 58202-9018

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ABSTRACT

In 2021, Governor Burgum announced a North Dakota goal of carbon neutrality by 2030 and at the national level, the federal government set a goal of net-zero carbon emissions by 2050. To achieve these goals and maintain North Dakota leadership in clean, sustainable energy, substantial investment will be required in fuel production and carbon capture and storage infrastructure. Currently, total annual sustainable aviation fuel (SAF) production in the United States is less than 100 million gallons. The United States Aviation Climate Action Plan released in 2021 set a goal of net-zero greenhouse gas emissions from the aviation industry by 2050, with a 2030 production goal of 3 billion gallons and a 2050 production goal of approximately 35 billion gallons, enough to fuel 100% of domestic aviation fuel demand. The proposed project will support these goals by expanding clean energy production in North Dakota while reducing emissions associated with both fuel production and its use.

Objectives: The Energy & Environmental Research Center (EERC) and Marathon Petroleum Corporation (MPC) have embarked on the initial stages of a front-end engineering and design (FEED) study to expand renewable fuel production at the MPC Dickinson facility and diversify its product mix to include SAF. This proposal outlines the project and how Clean Sustainable Energy Authority (CSEA) funding will be used to support the "definition" stage (front-end loading [FEL]-3) and provide the detailed information needed to make a final investment decision (FID) prior to project implementation. The proposed project is needed to catalyze meaningful investment in the enhancement of renewable fuel production in North Dakota that will diversify the state's economy and leverage and expand use of North Dakota's vast resources (both energy and agricultural) while reducing the carbon intensity (CI) of the locally produced products.

Expected Results: The project will support CSEA's mission to develop and deploy large-scale commercial projects (commercial-scale renewable fuel facility expansion and diversification) to reduce environmental impacts and increase the production of sustainable low-CI fuels while also adding carbon capture to further reduce the CI of fuel manufacturing. The proposed FEED study will generate information needed to enable MPC to make an FID to expand the capacity of its Dickinson renewable fuel facility by up to 90%, diversify its renewable fuel products to support emerging clean fuel demands including SAF, implement a pretreatment unit to accommodate the use of a variety of low-carbon feedstocks, and enhance the hydrogen production facility with carbon capture technology to further reduce the CI of renewable fuel manufacturing.

If successful, the project will increase the facility's demand for locally produced agricultural and waste oils; decarbonize regional aviation by adding SAF to its existing renewable product slate; reduce plant emissions by capturing and storing CO_2 from the largest source in the plant; achieve greater economy-of-scale benefits while entering new markets with increased operating flexibility and adaptability to changing market conditions, thus improving its economic viability; increase plant revenues and skilled labor head count which will increase state tax revenues and provide worthwhile job opportunities for its residents; expand industry presence and demonstrate carbon capture opportunities in the state that could attract other companies to North Dakota; and, leveraging these new assets, provide a potential platform for other MPC initiatives.

Duration: 24 months (March 1, 2024 – February 28, 2026)

Total Project Cost: $21,761,930, consisting of a $10,000,000 CSEA grant and $11,761,930 in cash from MPC.

Participants: The project will be managed by the EERC, with participation and sponsorship from MPC. The project will be conducted in partnership with the North Dakota Industrial Commission (NDIC) through CSEA, supported by MPC subcontractors, Burns & McDonnell, Topsoe, Smith & Burgess, Technip Energies, and BARR Engineering.

PROJECT DESCRIPTION

In 2021, Governor Burgum announced a North Dakota goal of carbon neutrality by 2030 and at the national level, the federal government set a goal of net-zero carbon emissions by 2050. To achieve these carbon reduction goals and maintain North Dakota leadership in clean, sustainable energy, a substantial investment will be required in infrastructure related to fuel production and associated carbon capture and storage (CCS). The Energy & Environmental Research Center (EERC) (proposal lead organization) is assisting Marathon Petroleum Corporation (MPC) in its effort to expand the capacity of its Dickinson renewable fuel facility by up to 90%, diversify its renewable fuel products to support emerging clean fuel demands including sustainable aviation fuel (SAF), implement a pretreatment unit to accommodate the use of a variety of low-carbon feedstocks, and enhance the hydrogen production facility with carbon capture technology to further reduce the carbon intensity (CI) of renewable fuel manufacture. To support these goals, MPC has embarked on initial stages of a front-end engineering and design (FEED) study, including preliminary feasibility and design activities, and is seeking Clean Sustainable Energy Authority (CSEA) funding to support the "definition" stage (front-end loading [FEL]-3) to provide the detailed information needed to make a final investment decision (FID) prior to project implementation.

Objectives: The proposed project will generate information required for an FID to add a major fuel to MPC Dickinson Renewable Fuel Facility's existing renewable product slate and expand its capacity by as much as 90% while reducing both plant CO_2 emissions and the CI of its products by more than 20%.

If successful, the project will increase the facility's demand for locally produced agricultural and waste oils by nearly double; decarbonize regional aviation by adding SAF to its existing renewable product slate; reduce plant emissions by capturing and storing CO_2 from the largest source in the plant; achieve greater economy-of-scale benefits while entering new markets with increased operating flexibility and adaptability to changing market conditions, thus improving its economic viability; increase plant revenues and skilled labor head count which will increase state tax revenues and provide worthwhile job opportunities for its residents; expand industry presence and demonstrate carbon capture opportunities in the state that could attract other companies to North Dakota; and, leveraging these new assets, provide a potential platform for other MPC initiatives. These benefits are aligned with the CSEA mandate to enhance production of clean sustainable energy, increasing the state's standing as a leader in clean sustainable energy.

Methodology: FEED can be categorized into four phases defined as FEL-1–FEL-4. FEL-1 typically consists of planning and screening studies. FEL-2 (feasibility design) consists of feasibility studies and preliminary design. FEL-3 (definition design) includes a complete system design with sufficient detail to enable a business decision to invest in the project. FEL-4 consists of project execution consisting of procurement, construction, and operation.

The MPC team previously began the FEED process, investing approximately $8 million to date to preliminarily assess project feasibility at FEL-1 and FEL-2 phases. This proposal requests funds to perform FEL-3 activities, consisting of a detailed process design; capital and operating cost estimates; project schedule; and a project execution plan describing permitting, procurement of equipment and materials, transportation and logistics, construction, commissioning, and start-up of the facilities sufficient to enable investment decisions for this innovative clean renewable fuel project.

Six tasks have been identified to execute this work and include project management and planning, engineering design for facility expansion, hydrogen production facility with carbon capture design, fuel production reactor design and catalyst selection, process safety studies, and environmental permitting. Additional, detailed methodology can be found in Appendix B, which contains the detailed cost proposals from Burns & McDonnell (BMcD), Technip Energies, and BARR Engineering, and Appendix F, which contains the business plan and business-sensitive information related to each task.

Task 1.0 – Project Management and Planning: The planning and management of project activities will be performed by EERC personnel in close collaboration with MPC project managers. The EERC has a successful track record with similarly structured projects. Specific activities will include:

- Coordination and performance monitoring of all proposed tasks.
- Securing and tracking of cost-share funds.
- Managing budget resources.
- Planning and facilitation of status meetings.
- Preparation and submittal of progress and milestone reports to MPC.
- Preparation and submittal of progress reports and a final report according to North Dakota Industrial Commission (NDIC) requirements.

Upon award, the EERC will facilitate a kickoff meeting with all participants to reaffirm proposed goals, establish points of contact, review roles and responsibilities, review individual scopes of work, and discuss schedule and milestones. Weekly project update meetings/conference calls will be facilitated to verify tasks are on schedule, identify and mitigate anticipated challenges to the schedule, and discuss next work tasks.

Task 2.0 – Fuel Production Engineering Design: The FEED/definition study for the MPC Dickinson Renewable Fuel Facility expansion and associated infrastructure will be performed by BMcD, a qualified engineering company that has completed multiple projects at MPC facilities, including previous work completed at the Dickinson facility. Previous successful projects and knowledge of the existing site provided significant justification for collaborating on this potential project. Lower-level FEL design efforts have been initiated for several subtasks and will conclude in Quarter (Q) 1 2024. Task 2.0 consists of the FEL-3 FEED for the facility expansion. The subtasks for Task 2.0 are as follows:

- Subtask 2.1 – BMcD Task Management
- Subtask 2.2 – Process Design
- Subtask 2.3 – Equipment, Mechanical, and Piping Design
- Subtask 2.4 – Civil and Structural Design
- Subtask 2.5 – Electrical Design
- Subtask 2.6 – Instrumentation and Control Design

Detailed descriptions of each activity are outlined in Appendix F – Business Plan.

Task 3.0 – Hydrogen Production Facility with Carbon Capture Design: Task 3.0 consists of the FEL-3 FEED design for the hydrogen production facility with carbon capture and will be performed by Technip Energies, a qualified engineering company that has previously supported the existing hydrogen plant design at Dickinson. This familiarity with the site provided justification to the partner on a potential expansion project. The subtasks for Task 3.0 are as follows:

- Subtask 3.1 – Technip Task Management

- Subtask 3.2 – Process Design
- Subtask 3.3 – Equipment, Mechanical, and Piping Design
- Subtask 3.4 – Civil and Structural Design
- Subtask 3.5 – Electrical Design
- Subtask 3.6 – Instrumentation and Control Design
- Subtask 3.7 – Carbon Capture Process Design

Detailed descriptions of each activity are outlined in Appendix F – Business Plan.

Task 4.0 – Fuel Production Reactor and Catalyst Selection: Task 4.0 consists of FEL-3 FEED design for the fuel production reactor and catalyst selection and will be performed by Topsoe. MPC and Topsoe have partnered at multiple MPC sites on technologies including the existing catalyst utilized in the Dickinson facility. MPC completed an initial request for proposal (RFP) to multiple licensors for SAF yields, and Topsoe was selected as part of that process. The subtasks for Task 4.0 are as follows:

- Subtask 4.1 – Fuel Production Reactor Design
- Subtask 4.2 – Final Catalyst Formulation Selection

Detailed descriptions of each activity are outlined in Appendix F – Business Plan.

Task 5.0 – Process Safety Study: Task 5.0 consists of FEL-3 FEED design for the process safety study and will be performed by & Burgess (S&B). MPC and S&B have an extensive history of collaboration across MPC sites and have worked on analysis for the Dickinson site previously. The subtask for Task 5.0 is as follows:

- Subtask 5.1 – Facility Relief System Limitation Study

Detailed descriptions of each activity are outlined in Appendix F – Business Plan.

Task 6.0 – Environmental Permitting: This task will include the development of the permitting strategy and filing permit applications for construction and operation. Task 6.0 FEL-3 FEED design for the environmental permitting will be performed by BARR Engineering. BARR Engineering and MPC have collaborated on multiple projects across MPC sites and worked together previously on the Dickinson facility. The subtasks for Task 6.0 are as follows:

- Subtask 6.1 – Permit Strategy Development and Ongoing Project Communications
- Subtask 6.2 – Project Emissions Inventory
- Subtask 6.3 – Federal and State Air Quality Regulatory Evaluations
- Subtask 6.4 – Best Available Control Technology (BACT) Evaluations
- Subtask 6.5 – Air Quality Impacts Analysis (dispersion modeling)
- Subtask 6.6 – Additional Impacts Analysis
- Subtask 6.7 – PSD Application Package
- Subtask 6.8 – Postapplication Agency Communications and Negotiations

Detailed descriptions of each activity are outlined in Appendix F – Business Plan.

Anticipated Results: The proposed FEED study and partnership of MPC, the EERC, and NDIC CSEA will support the development of the deployment of the commercial-scale expansion of the MPC Dickinson Renewable Fuel Facility for SAF production. This expansion project further diversifies North Dakota's energy sector, offers value-added opportunities for the state's agricultural oil seed production, reduces environmental impacts of aviation fuel production, and supports CSEA's mission to develop and deploy large-scale commercial projects that reduce environmental impacts and increase the sustainability of energy production. The proposed FEED study will provide the necessary information for the project sponsors to make an investment decision regarding this commercial project. Work products resulting from the proposed FEED study will include the following:

1. Design basis memorandum describing the scope of the proposed facilities
2. Cost estimate summarizing all material and labor costs
3. Detailed schedule consolidating the timelines of all scopes
4. Project execution plan describing permitting, procurement of equipment and materials, transportation and logistics, construction, commissioning, and start-up of the proposed facilities

Upon completion of the FEED study these work products will be used to provide a nonconfidential summary report that can be shared with NDIC and the public without compromising the business-sensitive information acquired through the project. Project status reports will be provided to NDIC as defined in the contract documents. Appendix F provides additional information regarding specific target values related to the anticipated results of the project, including emissions and environmental impact, expanded and diversified production targets, and economic impact.

Facilities and Resources: The EERC has over 254,000 square feet of facilities for technology demonstration, process modeling, and project execution. MPC owns and operates several facilities across the United States, including a renewable diesel facility (the subject of this proposal) in Dickinson, North Dakota. MPC has several hundred engineers who support projects throughout the United States.

A team of industry experts will perform all project activities, with the primary project administrative services provided by the EERC. For over 70 years, the EERC has conducted research, testing, and evaluation of fossil and renewable fuels, emission control technologies, and CCS technologies. The EERC manages over 200 contracts a year, with more than 1300 clients in 53 countries. Systems are in place for EERC project managers regarding fund accounting, budget reporting, contract milestone tracking, and contract services. The EERC is committed to providing all necessary personnel and resources to ensure the timely completion of all activities outlined in this proposal.

Project sponsor MPC has a long history of safe operations in North Dakota, extensive project development experience dedicated to large critical petroleum, natural gas, renewable fuels, and infrastructure projects, and subject matter experts to aid in the technical design of project assets including integrity, engineering, field services and planning, and operations. Additional strength is added to the project team from BMcD, Technip Energies, Topsoe, Smith & Burgess, and BARR Engineering, which have established business relationships with MPC and are recognized as leaders in their fields, of engineering design and consulting services across technical areas and geographies.

Techniques to Be Used, Their Availability and Capability: Design and cost data generated within this project will be acquired using recognized and best-available engineering practices and cost-estimating techniques. The key aspects of this design project include new renewable fuel-manufacturing and industrial-scale carbon capture technologies. While carbon capture technologies are not unique, carbon capture is not widely utilized in industry. The technologies are commercially available, but their economical integration into existing facilities represents commercial risk. This risk is reduced through partnership with NDIC CSEA, while providing the state of North Dakota a leadership role in deploying clean energy technologies that add value to its energy and agricultural sectors. The proposed project team with support from the specific vendors possess decades of experience in their respective fields, spanning fuel production, infrastructure, storage, industrial facility design, environmental studies, and permitting. MPC has committed the necessary resources to execute this project, as evidenced by the letter of support in Appendix C. MPC has been a part of several engineering design projects for similar systems within North Dakota and around the country.

Environmental and Economic Impacts while Project Is Underway: The proposed FEED study consists of engineering design and project planning. It will not result in any environmental impacts to the study area or partner facilities. Limited travel to prospective site locations and partner offices will occur over the course of the project. Economic impacts during the FEED project will include jobs associated with performing the design and permitting work. Economic impacts during project execution include the jobs required to perform the FEED tasks.

Ultimate Technological and Economic Impacts: Upon successful completion of the proposed FEED study, and assuming a decision to proceed with development, project construction would create approximately 300 jobs and procurement of equipment, materials, and labor to support the construction phase. The construction phase would provide an impactful boost in local wages and spending. Appendix F contains additional information regarding specific target values related to the environmental and economic impacts of the project.

Once operational, the proposed SAF production capacity will be one of the largest in the United States compared with other announced SAF projects. The facility design will maximize SAF production while providing future flexibility in a quickly evolving market. Results of the proposed FEED study will provide more detailed information about the ultimate technological and economic impacts to North Dakota. Initial estimates of Increased job opportunity at the Dickinson Renewable Fuel Facility as well as related agricultural production and transportation (feedstock and fuel products) and other labor impacts are provided in Appendix F.

Why the Project Is Needed: Federal and state decarbonization targets include measures to reduce the CI of all transportation fuels. Unlike gasoline and diesel, which have alternative decarbonization measures (electric vehicles [EVs], biodiesel, ethanol, renewable diesel, renewable natural gas, hydrogen, etc.), aviation has fewer pathways to decarbonization. Currently, total annual SAF production in the United States is less than 100 million gallons. The U.S. Department of Transportation Aviation Climate Action Plan, released in 2021, set a goal of net-zero greenhouse gas emissions from the aviation industry by 2050, with a 2030 production goal of 3 billion gallons and a 2050 production goal of approximately 35 billion gallons, enough to fuel 100% of domestic aviation fuel demand. Hydrotreatment of esters and fatty acids (HEFA) is the most likely near-term option to support the aviation industry's decarbonization goal. Once completed, MPC's facility will be one of the largest HEFA SAF producers in the United States, providing an industry-leading facility located in North Dakota.

The proposed project is needed to provide the necessary technical and economic data to support MPC's decision to proceed with the construction and operation of the proposed facility expansion. The infrastructure within this project will diversify North Dakota's energy economy by producing new value-added products from the state's diverse renewable and fossil resources, and expansion into renewable fuel technology represents a significant positive step toward low-CI energy with significant growth potential. Completing the proposed FEED study provides the cost information needed to make business decisions based on sound technical and economic information, thereby assuring the long-term viability of the business, and is required to engineer the optimal project to maximize the yield of SAF per barrel of feedstock.

STANDARDS OF SUCCESS

The proposed scope and partnership of MPC, the EERC, and NDIC CSEA will result in a FEED study for large-scale expansion, increase in processing capacity of up to 90%, diversification of low-carbon fuels manufacturing to include SAF, implementation of a pretreatment unit to accommodate the use of a variety of low-carbon feedstocks, and an upgraded hydrogen production facility paired with carbon capture. Successful completion of the proposed FEED study will be measured primarily by the creation of a technically sound design package, including associated cost and schedule estimates for the enhancement of renewable fuel production and subsequent FID. The investment and subsequent construction and operation will generate additional low-carbon fuel sources for transportation in North Dakota and the region, increased jobs and economic development, reduced emissions from fuel manufacture, and enhanced markets for North Dakota's agricultural products, leading to economic and environmental benefits consistent with CSEA goals. The proposed project is expected to result in CO_2 reduction, with a carbon capture estimate of approximately 300,000 metric tons/yr of CO_2. Additionally, during facility design, measures to further reduce the facility's CI scores will be evaluated.

The proposed Dickinson Renewable Fuel Facility expansion represents a significant investment and commitment by MPC in the diversification and sustainability of the energy industry in North Dakota and a major economic development opportunity for the state. MPC's proposed investment in equipment, materials, and labor expected for construction will provide a boost in local wages and spending during both the construction process and long-term operation. Projected economic impacts include increased tax revenue for North Dakota, increased job opportunity both in the short-term during construction and the long-term for operation, and creation of a new local demand for North Dakota oils, agricultural products, and animal/food waste. The project is estimated to bring approximately 10–15 permanent jobs created for operation and management of the project. Appendix F contains additional information regarding specific target values related to the standards of success for the project.

BACKGROUND/QUALIFICATIONS

The EERC has led several engineering design projects, including a retrofit pre-FEED study of a CCS system at Coal Creek Station, a retrofit pre-FEED study of a CCS system at Milton R. Young Station, and a FEED study that led to the implementation of a CCS system for Red Trail Energy. In addition, the EERC is currently leading a FEED study for the Coal Creek Station retrofit and continues to work with Red Trail Energy to validate performance and explore opportunities for increased carbon capture. Finally, the EERC, with partners MPC and TC Energy, is conducting a FEED study for the Prairie Horizon Hydrogen Hub, formerly known as the Liberty Hydrogen Hub, to evaluate creation of a comprehensive clean hydrogen production, infrastructure, and use project in North Dakota. In each of these projects, the EERC has managed multimillion-dollar contracts involving multiple engineering firms, industry partners, and public funding agencies. These projects have provided the EERC with real-world experience in identifying and managing the intricate needs and schedules for the engineering design of large-scale carbon capture facilities, and they have proved invaluable for assessing best methods for efficiently executing important design studies that are necessary to progress to commercial deployment of novel clean energy technology.

The EERC also has over 60 years of experience collaborating with industry and government on H_2 technology development and is recognized for its role in advancing commercial deployment of technologies for producing, purifying, and utilizing H_2 from coal, natural gas, and renewables. In 2004, the EERC was designated the National Center for Hydrogen Technology by the U.S. Department of Energy (DOE).

MPC is the largest refining company in the United States, with over 2.9 million barrels of crude oil capacity per calendar day. MPC's refining footprint extends from the Midwest as far east as Ohio, to the U.S. Gulf Coast (USGC), Los Angeles, the Pacific Northwest, and Alaska. MPC's 13 petroleum refineries are spread throughout 12 different states. MPC's renewables footprint similarly spreads from the newly operational renewable diesel facility in Martinez, California, to the renewable diesel facility in North Dakota, and MPC is a joint venture partner at five ethanol plants within the Midwest. In 2022, the renewables sector of MPC produced roughly 400 million gallons of renewable fuels. MPLX, a master limited partnership (MLP) formed by MPC, contains significant terminal, fractionation, and logistics assets across the United States.

Committed to North Dakota, MPC has a proven track record of successfully executing major projects, which include environmental, safety, and cost and schedule management. Specific North Dakota assets include the following:

- Mandan Refinery processes 71,000 bpd of crude primarily from North Dakota and manufactures gasoline, distillates, propane, and heavy fuel oil.
- Figure 1 depicts the location of the Mandan Refinery as well as all MPC refineries around the United States.
- Dickinson Renewable Fuel Facility produces 13,600 bpd of 100% renewable diesel from refined soy oil and other organically derived feedstocks.
- Green Bison Soy Processing near Jamestown, North Dakota, has processing capacity of 150,000 bushels/day of soybeans. Oil from the plant can produce 75 million gallons/yr of renewable diesel.
- Mandan Terminal distributes diesel, gasoline, and jet fuel for market and ethanol offloading located at Mandan Refinery (Figure 2).
- Dickinson Rail Terminal possesses offloading/loading capabilities for feedstocks and refined products.
- Patterson Rail Terminal, operated by MPLX, receives renewable products and loads manifest and unit train railcars for delivery across the country.
- MPC has two retail brands, including the MPC and ARCO brands. ~7200 stores stretch across the United States, including the North Dakota region (Figure 3).

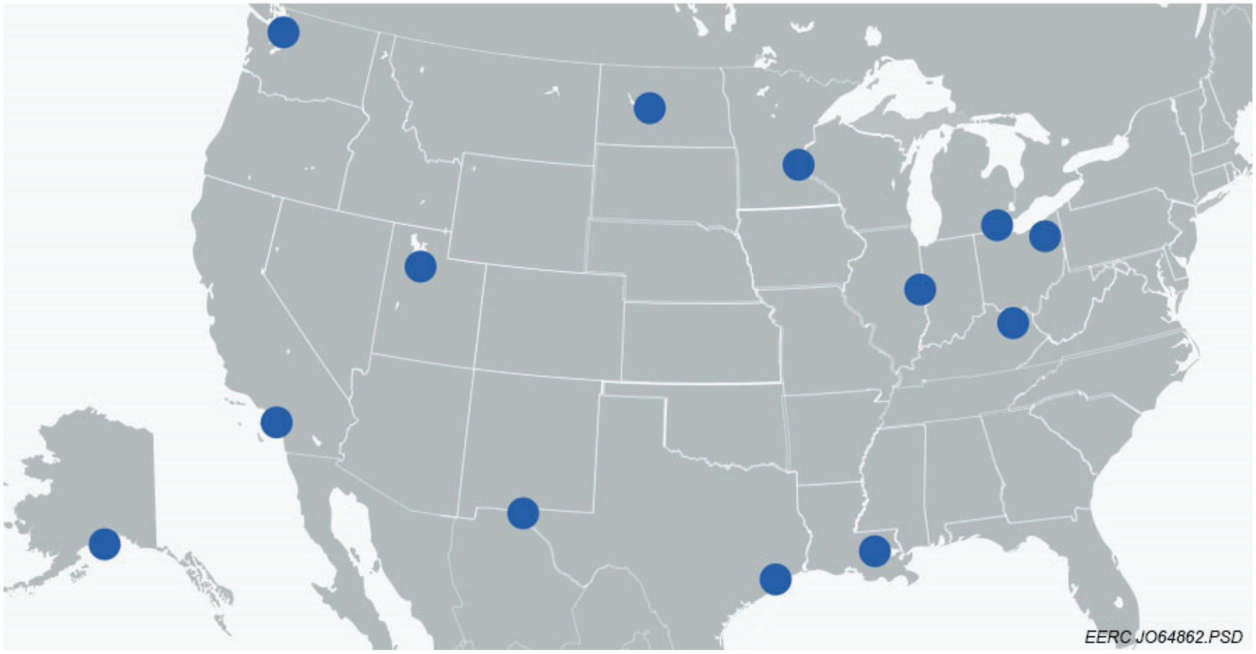

Figure 1. Geographical depiction of MPC refinery asset resources.

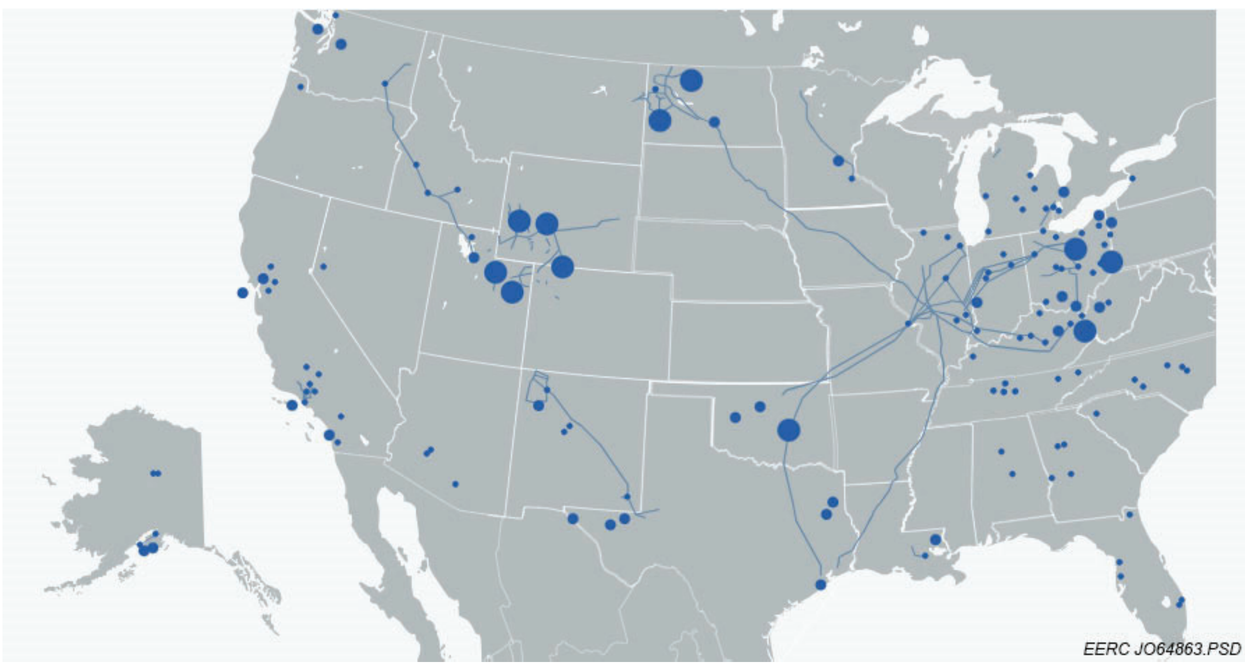

Figure 2. Geographical depiction of MPC Terminal asset resources.

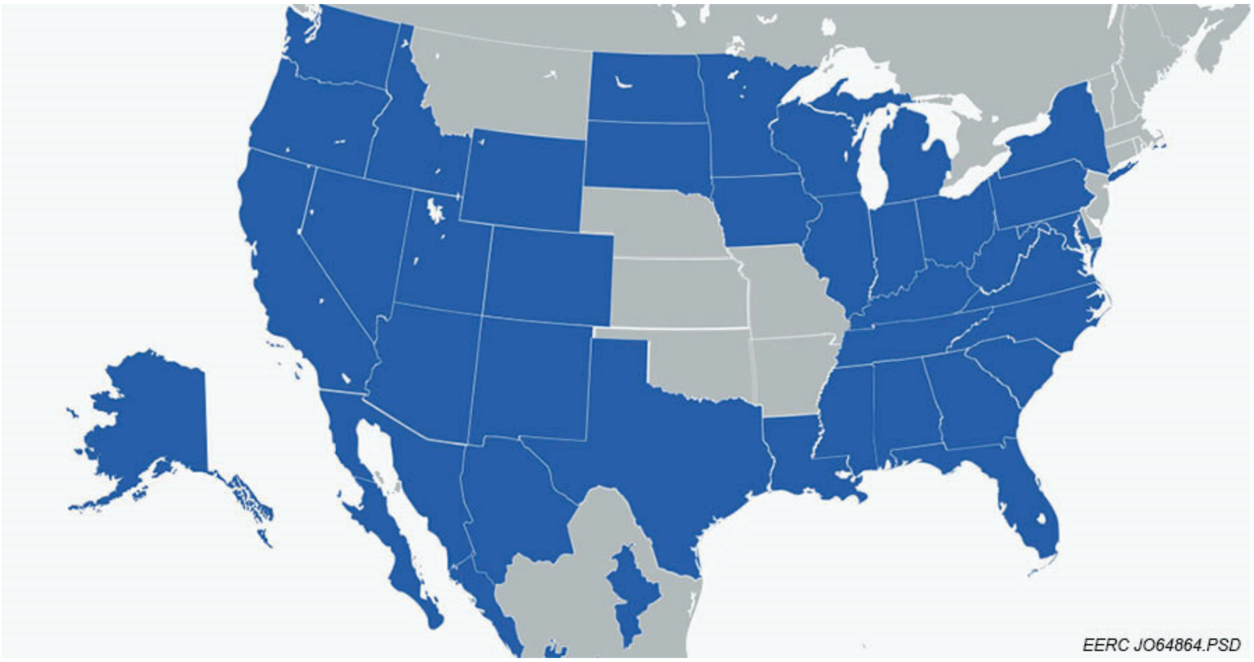

Figure 3. Geographical depiction of U.S. states with MPC and/or ACRO retail assets.

Project Team: The EERC will serve as the lead organization for this project, with Jasmine Oleksik, Senior Research Engineer as the overall project manager. Ms. Oleksik will ensure the overall success of the project by providing experienced management and leadership to all activities within the project, managing budget, schedule, and scope according to the proposed plan. Ms. Oleksik will also be responsible for communication with project participants and EERC project personnel. Other key personnel from the EERC include Chad Wocken, Brad Stevens, Steven Schlasner, and John Harju (project advisor). Resumes of key personnel can be found in Appendix D. An organizational chart is shown in Figure 4.

MPC will be a project sponsor and will be responsible for leading Task 2.0: Engineering and Design, Task 3.0: Hydrogen Production Facility with Carbon Capture Design, Task 4.0: Fuel Production Reactor and Catalyst Selection, Task 5.0: Process Safety Studies, and Task 6.0: Environmental Permitting. Task 2.0 will include the engineering and design for the FEL-3/definition phase. Key personnel from MPC include Andrew Dee, David Whitman, Mitchell Braegelmann, and Paul Dofton. MPC has a diverse, experienced team of technical experts and project management professionals with over 100 years of combined experience.

BMcD is a leading resource for project delivery in the renewable fuels industry. BMcD has planned, designed, and built renewable fuel projects from the ground up and completed retrofits for many existing facilities, giving BMcD the ability to provide quick solutions to complex issues. BMcD has extensive experience with heavy revamp projects and understands the need for accurate scope definition. BMcD will be the contracted vendor for Task 2.0.

Technip Energies is a world-leading engineering and technology company and a market leader in refinery engineering, with expertise in biofuels projects from concept and basic design, including capital expenditure (CAPEX) estimates, to engineering and turnkey delivery. Technip Energies will be the contracted vendor for Task 3.0.

Topsoe regularly provides engineering services for new units, products, getting plants off the ground, or to revamp or upgrade existing plants. Topsoe designs, engineers, and licenses a broad range of units, plants, and processes across an even broader range of industries and applications. From evaluation and design to detailed engineering and on-the-ground construction support, Topsoe has the in-depth chemical-processing expertise and experience needed to deliver the complete package, with a track record of developing innovative solutions for clean, competitive fuels from renewable feedstock dating to 2004. Topsoe will be the contracted vendor for Task 4.0.

Smith & Burgess provides process safety management solutions, having over 100 employees across five offices located strategically to help clients accomplish their safety and compliance goals as effectively as possible. Smith & Burgess will be the contracted vendor for Task 5.0.

BARR Engineering is an industry-leading provider of engineering and environmental consulting services, helping navigate regulatory requirements and find innovative and economical ways to achieve sustainability and business goals. BARR Engineering will be the contracted vendor for Task 6.0.

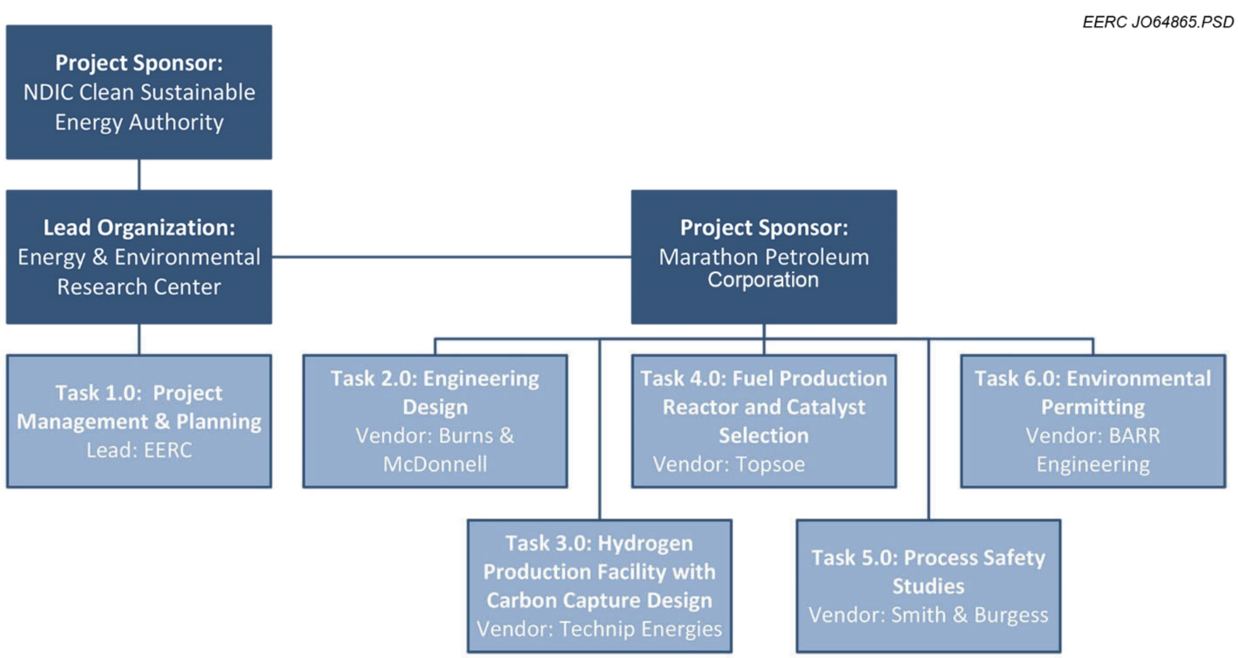

Figure 4. Project organizational chart.

MANAGEMENT

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

Once the project is initiated, the project team will engage in weekly conference calls to review project status and future directions. Periodic progress reports will be prepared and submitted to project sponsors for review. Regular meetings will be held with relevant stakeholders to review the status and results of the project and discuss directions for future work. A broad team approach is key to successful execution of this project.

Project progress will be measured by completion of milestones and deliverables as noted in the project timeline in Figure 5. The deliverables are indicated where key design documents and reports are noted, while the milestones are noted as key accomplishments during the project's progress.

TIMETABLE

Project Schedule: The project timeline can be found in Figure 5 and consists of a 24-month duration and a projected start date of March 1, 2024. Project milestones are indicated within the project timeline and are based on anticipated accomplishment of key tasks.

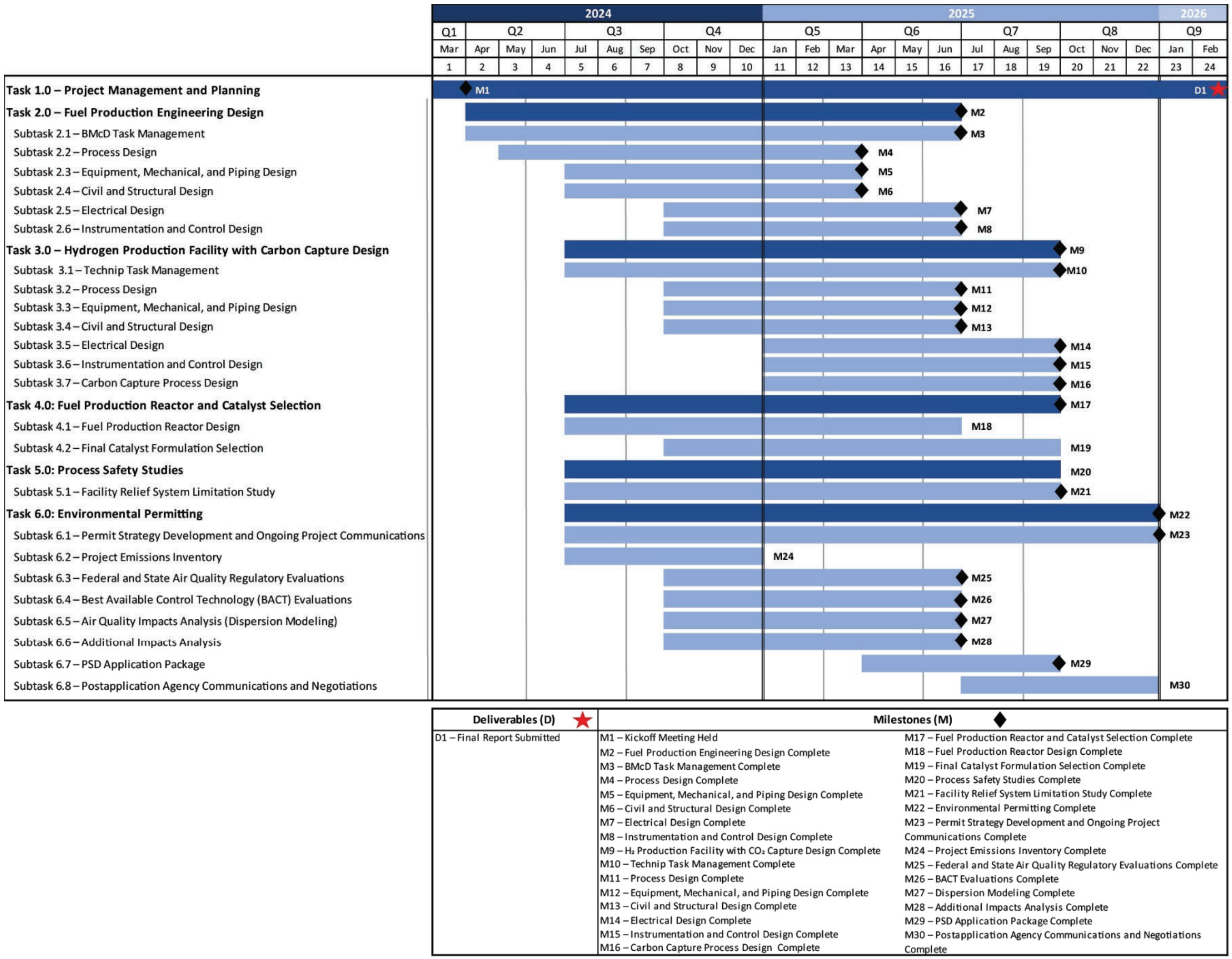

Figure 5. Project timeline.

BUDGET

The total cost of the proposed project is $21,761,930, which includes $10,000,000 from CSEA and $11,761,930 cash from MPC. The budget contains a proposed contract with BMcD, Technip Energies, Topsoe, Smith & Burgess, and BARR Engineering. Travel dollars are included to support site visits and project review meetings in Bismarck and field trips to multiple locations in western North Dakota. The detailed breakdown is presented in Table 2. It should be noted that the cost estimates used in Table 2 represent conservative estimates and the proposal team is committed to performing the work proposed. As such, actual cost share provided by MPC will likely exceed the 1.2:1 MPC:NDIC ratio reflected here. Appendixes B and F contain more detail regarding proposed subcontractor budgets. The budget notes can be found in Appendix E.

Table 2. Estimated Costs

Project Associated Expense	NDIC Share (Cash)	MPC Cost Share (Cash)	Total Project
Labor	$438,651	$0	$438,651
Travel	$6,749	$0	$6,749
Subcontractor - MPC	$9,253,070	$11,761,930	$21,015,000
Printing & Duplicating	$992	$0	$992
Laboratory Fees & Services			
Document Production Service	$22,247	$0	$22,247
Technical Software Fee	$9,011	$0	$9,011
Engineering Services Fee	$8,562	$0	$8,562
Total Direct Costs	$9,739,282	$11,761,930	$21,501,212
Facilities & Administration	$260,718	$0	$260,718
Total Cash Requested	**$10,000,000**	**$11,761,930**	**$21,761,930**

MPC has a strong track record of living up to its fiduciary duty to manage the capital of its stakeholders. The capital barrier to entry into emerging technologies is significant, as demonstrated by the cost estimate above; however, it represents a massive investment on behalf of the proponents over and above the proposed grant value. MPC is dedicated to innovation and to bringing carbon reduction services to industry, despite the significant risk involved in being a first mover. Government incentives such as the 45V or 45Z tax credit, premium SAF price, and CSEA partnership are imperative to commercializing these emerging technologies. CSEA's participation will solidify the commitment between all stakeholders to proceed through the FEED process. Appendix C contains a Letter of Support from MPC committed to the proposed FEED study.

TAX LIABILITY

The EERC, a department within the University of North Dakota, is a state-controlled institution of higher education and is not a taxable entity; therefore, it has no tax liability to North Dakota or any of its political subdivisions. The signed Tax Liability form is contained in Appendix J.

CONFIDENTIAL INFORMATION

Appendix A contains a confidential information request. This proposal includes a summary application for public release and confidential information that has been provided in Appendixes A, B, E, F, G, and H to this proposal.

PATENTS/RIGHTS TO TECHNICAL DATA

Not applicable.

STATE PROGRAMS AND INCENTIVES

The applicant has participated in several programs administered by NDIC, including the Lignite Research, Development, and Marketing Program; the Oil and Gas Research Program; the State Energy Research Center; and the Renewable Energy Program. Table 3 lists funding received by the EERC from these state programs in the last 5 years.

Table 3. Summary of EERC Funding from State Programs over the Past 5 years

Project Title	Start Date	End Date	Value
FERR-1.3 – Integrated Carbon Capture and Storage for North Dakota Ethanol Production	12/01/18	05/31/20	$500,000
State Energy Research Center	07/01/19	06/30/23	$10,000,000
Underground Storage of Produced Natural Gas – Conceptual Evaluation and Pilot Project(s)	06/01/19	06/30/23	$6,000,000
Assessment of Bakken and Three Forks Natural Gas Compositions	11/01/19	06/19/20	$300,650
Improving EOR Performance Through Data Analytics and Next-Generation Controllable Completions	01/27/20	09/30/24	$500,000
Wastewater Recycling Using a Hygroscopic Cooling System	01/31/20	09/30/22	$100,000
PCOR Initiative to Accelerate CCUS Deployment	02/01/20	09/30/24	$2,000,000
FERR-3.2 – Produced Water Management Through Geologic Homogenization, Conditioning, and Reuse	02/01/20	01/31/22	$300,000
Bakken Production Optimization Program 3.0	05/01/20	04/30/23	$6,000,000
EERC Technical Support for RTE CCS Activities – November 1, 2019	06/01/20	11/30/21	$500,000
Flue Gas Characterization and Testing	07/01/20	11/30/21	$3,741,450
Laboratory-Scale Coal-Derived Graphene Process	09/01/20	04/30/23	$162,500
H_2 Energy Development for North Dakota	07/01/21	06/30/23	$500,000
Ammonia-Based Energy Storage Technology	04/01/21	03/31/23	$101,390
Field Study to Determine the Feasibility of Developing Salt Caverns for Hydrocarbon Storage in Western North Dakota	07/01/21	06/30/23	$9,400,000
Unitized Legacy Oil Fields: Prototypes for Revitalizing Conventional Oil Fields in North Dakota	07/01/21	06/30/24	$3,000,000
Williston Basin CORE-CM Initiative	02/01/22	05/31/23	$750,000
FEED for CO_2 Capture at Coal Creek Station	02/01/22	08/31/23	$7,000,000
iPIPE 2.0: The intelligent Pipeline Integrity Program	01/01/22	12/31/23	$400,000
Adv. Processing of Coal and Waste Coal to Produce Graphite for Fast-Charging Lithium-Ion Batteries	02/01/22	01/31/25	$500,000
Liberty H_2 Hub Front-End Engineering and Design	11/01/22	10/31/24	$10,000,000
Redundancy Study for CO_2 Capture at Coal Creek Station	05/26/23	03/31/24	$837,313
Williston Basin CORE-CM Initiative	07/01/23	09/30/24	$1,050,000
Coal Creek Carbon Capture: Geologic CO_2 Storage Complex Development	07/01/23	09/30/26	$6,119,690
Bakken Production Optimization Program 4.0	07/28/23	10/31/25	$4,000,000

APPENDIX C

LETTERS OF SUPPORT

BURNS & McDONNELL

October 31, 2023

Mr. Chad Wocken
Assistant Director, Clean Energy Systems
Energy & Environmental Research Center
15 North 23rd Street, Stop 9018
Grand Forks, ND 58202-9018

Re: Letter of Commitment Regarding the Dickinson Renewable Fuels Project – 22.5 KBPD Sustainable Aviation Fuel

Dear Mr. Wocken:

On behalf of Burns & McDonnell, this letter expresses our support for and commitment to the Dickinson Sustainable Aviation Fuel (SAF) project for which a proposal is being submitted to the North Dakota Industrial Commission.

Burns & McDonnell is a family of companies bringing together a team of more than 13,500 consultants, engineers, architects, construction, and support professionals to design and build critical infrastructure. We have an integrated construction and design mindset and offer full-service capabilities. Founded in 1898 and working from 70 offices globally, Burns & McDonnell is 100% employee-owned.

We understand the importance of this project to the overall renewable fuel efforts at the Dickinson refinery and we are committed to supporting Marathon, the Dickinson Refinery, and the EERC in making this project a success. The following key factors distinguish our firm from others, contributing to the success of this partnership:

- Safety is our Top Priority: We believe all incidents are preventable, and we are committed to providing a safe and secure working environment for our employees, clients, and subcontractors. Our safety commitment begins in the early phases with a focus on designing a plant that is safe to build and safe to operate.

  We are extremely proud of our safety rating as an engineering, procurement, and construction (EPC) contractor. It is our expectation that everyone working on our projects goes home safely to their families every night. That is why our safety statistics are considerably better than both industry standards and our competition. As a full-service EPC company, our depth of experience in safe project delivery across the US has resulted in 125 million hours over five years with a total recordable incident rate of 0.16. Our construction sites are among the safest in the industry, and we rank in the top 5% of contractors in the US.

- Extensive Renewables Experience: Burns & McDonnell is a leading resource for project delivery in the renewable fuels industry, executing over 100 renewable fuels and chemicals projects over the last 25 years. Our recent experience includes several projects to evaluate production of sustainable aviation fuel for multiple confidential clients. We have planned, designed, and built renewable fuel projects from the ground up and completed retrofits for many existing facilities, giving us the ability to provide quick solutions to complex issues. We also have extensive experience with heavy revamp projects such as this one and understand the need for accurate scope definition.

- Project History: Burns & McDonnell supported the Dickinson refinery through a Tallow Unloading project as well as the initial SAF Feasibility study. We will be a primary contributor to the Feasibility update effort for the SAF project and intend to continue supporting the project through the proposed Definition phase. Our past experience at the site enables us to leverage our knowledge of the site and history of this project.
- Proven Team: Our project leadership team has extensive Marathon experience and familiarity with the goals for this project. We plan to carry over several of the team members from the Feasibility update effort for the proposed Definition phase. Our proposed project team was selected because of their significant renewable and refining backgrounds, technology evaluation experience, knowledge of Marathon's systems and units involved on this project, and construction-oriented estimating capabilities.
- Commitment to Marathon: We are strongly committed to Marathon and the Dickinson refinery. Over the past 15 years of working together, Burns & McDonnell has executed over $2B in total project value for Marathon. As always, our goal is to create value during a robust engineering effort with an efficient cost and schedule.

We appreciate the opportunity to offer our services for this project and look forward to participating with the Energy and Environmental Research Center and Marathon. If you have any questions or need any additional information, please contact me at (816) 807-8559.

Sincerely,

David D Nispel

David Nispel
Managing Director, Refining
Oil, Gas & Chemical

Marathon Petroleum Company LP

539 South Main Street
Findlay, OH 45840

October 31, 2023

Mr. Chad Wocken
Assistant Director, Clean Energy Systems
Energy & Environmental Research Center
15 North 23rd Street, Stop 9018
Grand Forks, ND 58202-9018

Subject: Cost Share Commitment Related to EERC Proposal Entitled "Dickinson Refinery Expansion"

Dear Mr. Wocken:

Marathon Petroleum Company LP (together with its affiliates, "MPC") is writing to express its cost share commitment and support for the efforts of the Energy & Environmental Research Center ("EERC") to secure funding through the North Dakota Industrial Commission ("Funding Opportunity"). EERC's proposed project, the Dickinson Refinery Expansion, will investigate the potential expansion of MPC's renewable diesel production facility located in Dickinson, North Dakota. MPC has been evaluating opportunities to expand its existing renewable diesel production and assessing alternative production options for other renewable fuels.

MPC is a leading, integrated, downstream energy company headquartered in Findlay, Ohio. The company operates the nation's largest refining system. MPC's marketing system includes branded locations across the United States, including Marathon brand retail outlets. MPC also owns the general partner and majority limited partner interest in MPLX LP, a midstream company that owns and operates gathering, processing, and fractionation assets, as well as crude oil and light product transportation and logistics infrastructure. MPC also operates a number of renewable fuels facilities, including the Dickinson, North Dakota renewable diesel production.

As outlined in the Funding Opportunity, and in support of the EERC's proposal, MPC commits to provide combined cash cost share of at least fifty percent (50%) of the allowable costs associated with EERC's proposal related to the Dickinson Refinery Expansion, with allowable costs projected to total $21,761,930. This commitment is conditioned upon the successful negotiation of the final funding award with the North Dakota Industrial Commission.

Sincerely,

Marathon Petroleum Company LP
By: MPC Investment LLC, its general partner

Brad Levi (Oct 30, 2023 12:21 EDT)
By: Bradley J. Levi
Title: Senior Vice President

WA
Approved as to Form

MARATHON

Marathon Petroleum Company LP

539 South Main Street
Findlay, OH 45840

October 31, 2023

Mr. Chad Wocken
Assistant Director, Clean Energy Systems
Energy & Environmental Research Center
15 North 23rd Street, Stop 9018
Grand Forks, ND 58202-9018

RE: Letter Agreement – Conditions for EERC's Proposal Entitled "Dickinson Refinery Expansion"

Dear Mr. Wocken:

Marathon Petroleum Company LP ("MPC") is pleased to offer this letter agreement to the Energy & Environmental Research Center ("EERC") in furtherance of EERC's grant application titled *"Dickinson Refinery Expansion"* (the "Proposal") to secure funding from the North Dakota Industrial Commission ("NDIC"). MPC is providing a cost share commitment letter associated with the Proposal, and this letter includes a commitment of fifty percent of allowable costs associated with the Proposal up to $21,761,930. Such commitment is conditioned on the following items:

(i) EERC's final Proposal project plan being acceptable to MPC;
(ii) NDIC's award of the Proposal; *and*
(iii) EERC's grant to MPC and its affiliates of all licenses, authorizations, and similar rights, including rights to any intellectual property, related to the scope of work under the Proposal as those granted to the NDIC or any third party under any cooperative agreement or similar arrangement.

MPC looks forward to joining TCEDH and the EERC in this effort.

Sincerely,

Marathon Petroleum Company LP
By: MPC Investment LLC, its general partner

WA

Brad Levi (Oct 30, 2023 12:21 EDT)
By: Bradley J. Levi
Title: Senior Vice President

Acknowledged and agreed as of the date first written above:

Energy & Environmental Research Center

By:
Title:

APPENDIX D

QUALIFICATIONS OF KEY PERSONNEL

CHAD A. WOCKEN
Assistant Director for Clean Energy Solutions
Energy & Environmental Research Center (EERC), University of North Dakota (UND)
15 North 23rd Street, Stop 9018, Grand Forks, North Dakota 58202-9018 USA
701.777.5273, cwocken@undeerc.org

Education and Training
B.S., Chemical Engineering, University of North Dakota, 1994

Research and Professional Experience
2001–Present: EERC, UND.
Assistant Director for Clean Energy Solutions (September 2019–Present).

- Leads multidisciplinary team of engineers and scientists focused on applying scientific principles to address challenges to energy production.
- Team's applied research activities include process modeling; engineering studies; and technology evaluation and development at bench, pilot, and demonstration scale.
- Has over 25 years of experience spanning work in oil and gas production, fuel processing, electricity generation, emission control, environmental remediation, and process engineering.
- Drawing on engineering training and diverse experience, enjoys defining problems and developing innovative solutions to promote clean energy solutions.

Principal areas of research include developing alternative fuel and chemical processes and innovative energy technologies. Currently, leads projects focused on developing and advancing alternative chemical and fuel production processes at bench, lab, and pilot scale and optimizing processes associated with oil and gas production and midstream operations. In addition, manages a group of researchers and a lab facility containing batch and continuous reactor systems capable of testing a variety of thermochemical processes.

Principal Engineer, Transformational Energy Group Lead (2015–August 2019); Senior Research Manager (2009–2015); Research Engineer (2001–2009).

<u>Project/Program Management</u>

- Developed new research program and managed design and fabrication of facility to test and evaluate solid-oxide fuel cells with variety of gaseous fuels including actual syngas produced from EERC's pilot-scale gasification systems.
- Led process-modeling team within EERC's Bakken Production Optimization Program, focused on applying computational modeling expertise to crude oil production processes and addressing emission reduction and gas flaring while also reducing crude oil volatility.
- Directed EERC's associated gas-flaring mitigation activities, aiding industry partners in their efforts to identify technologies to reduce flaring. These efforts led to creation of Flaring Solutions Database, clearinghouse of business and technology solutions that have potential to utilize gas at wellhead and reduce flaring.
- Managed a Defense Advanced Research Projects Agency (DARPA)-funded project that successfully developed technology to produce drop-in-compatible jet fuel for military from renewable feedstock.

Activities included planning work activities, developing and executing risk-based project management plan, coordinating activities of five project partners to meet project goals, and communicating with DARPA project manager.

- Managed scale-up and design of 300-barrel/day renewable fuel pilot plant capable of producing specification-compliant jet and diesel fuels from renewable oil feedstock.

Technology Development and Research

- Designed and executed oil and gas gathering pipeline leak detection demonstration project, resulting in tangible performance improvements for three pipeline operators.
- Conducted technical and economic assessment of alternative uses for associated gas in effort to reduce amount of gas being flared in Williston Basin. Technologies evaluated included gas-processing operations to recover natural gas liquids, gas-fired power generation, transportation fuel, and traditional petrochemical unit operations.
- Performed system-level engineering evaluation of integrated algae production at coal-fired power plant to assess carbon uptake, emission control requirements, relative scale, and viability of water and waste heat utilization.
- Designed, fabricated, and operated several fixed-catalyst bed reactor systems to evaluate variety of thermocatalytic processes to produce renewable fuels and chemicals.
- Conducted testing at coal-fired power plants and developed control technologies to reduce atmospheric emission of particulate matter, mercury, and other contaminants.

1995–2001: Project Engineer, URS/Radian International, Salt Lake City, Utah (1997–2001), and Milwaukee, Wisconsin (1995–1997).

Process Design, Operation, and Optimization

- Designed remediation systems to remove BTEX compounds and chlorinated solvents from groundwater. Project tasks included site evaluation, technology selection, system design, and creation of specifications.
- Performed start-up and long-term operations of groundwater remediation systems. Responsibilities included troubleshooting equipment/system malfunctions, process optimization, writing operations and maintenance manuals, establishing performance verification criteria, defining operational cost, and directing technicians' work.
- Conducted detailed reviews of industrial wastewater treatment systems to identify alternative treatment technologies, process optimizations, and water reuse alternatives.

Construction Oversight

- Provided on-site oversight for several construction projects consisting of mechanical equipment installation, instrumentation and process control, building and road construction, excavation, and underground utility installation. Daily responsibilities included evaluating work for conformance with construction drawings and specifications; coordinating work activities; and facilitating communication between design firm, client, and contractors.

Project Management

- Served as project manager for several large projects that were completed successfully. Activities included developing cost proposals, managing budget and schedule, equipment and subcontractor acquisition, and maintaining effective communication with client.

1994–1995: Process Engineer, Archer Daniels Midland, Clinton, Iowa.

Plant Operation

- Supervised operations and personnel at wet corn mill oil extraction and refining plant. Tasks consisted of prioritizing work activities, scheduling maintenance of process equipment, monitoring product quality, and extensive system troubleshooting and failure analysis.

Publications

Has authored or coauthored numerous publications.

BRADLEY G. STEVENS, P.E.
Principal Research Engineer, Civil Engineering
Energy & Environmental Research Center (EERC), University of North Dakota (UND)
15 North 23rd Street, Stop 9018, Grand Forks, North Dakota 58202-9018 USA
701.777.5293, bstevens@undeerc.org

Education and Training
B.S., Civil Engineering, University of North Dakota, 1989.
Registered Professional Engineer – North Dakota No. PE-4340.

Research and Professional Experience
2022–Present: Principal Research Engineer, Civil Engineering, EERC, UND.
- Responsibilities include managing variety of projects and tasks in areas of oil and gas production and processing, hydrogen production and utilization, electrical grid resiliency, and risk mitigation.
- Expertise includes soil, groundwater, and industrial process water remediation; process instrumentation and control; wind power generation; hydrogen production; and oil and gas production.

2021–2022: Senior Research Engineer, Civil Engineering Team Lead, EERC, UND.

2011–2021: Senior Research Engineer, EERC, UND.
- Responsibilities included execution of wide-ranging projects under EERC's Bakken Production Optimization Program, including study of alternative natural gas use, saline and hydrocarbon soil remediation, and statistical analysis of various oil and gas industry segments.

2005–2011: Research Manager/Engineer, EERC, UND.
- Responsibilities included management of the EERC's Plains Organization for Wind Energy Resources® (POWER®) wind energy program. POWER management duties included strategic planning, fiscal management, program presentation, proposal preparation, and personnel management. Technical duties included installation and setup of wind-monitoring equipment, assessment and analysis of wind resource data, wind turbine production estimates, and theoretical project economics.
- Other responsibilities included supervision of design, installation, and operation of electrolysis-derived hydrogen production and dispensing system.

1998–2005: Research Engineer, Remediation, EERC, UND.
- Responsibilities included management, testing, data analysis, and report preparation for commercial application of centrifugal membrane filtration; project management, specification, construction, and demonstration of freeze–thaw process for utilization of marginal waters; participation in Red River Water Management Consortium (RRWMC) as technical staff member advising RRWMC members regarding pertinent water supply and water quality issues; management and operation of and data analysis and report preparation for sorption and regeneration process for mercury removal from primary and secondary liquid wastes assessment; and data analysis activities related to wind energy.

1992–1998: Project Manager/Engineer, Summit Envirosolutions, Inc., Minneapolis, Minnesota.

- Responsibilities included specification and coordination of installation of remote data acquisition equipment for municipalities in Minnesota for use as aquifer resource management tools; specification, installation, and maintenance of groundwater flow control and flow measurement equipment in association with research and development cooperative agreement with NASA involving state-of-the-art methods of remote data acquisition, patented as RealFlow®; design, installation, and maintenance of permanent and mobile remediation systems in Minnesota, Wisconsin, Nevada, and Arizona, including groundwater pump-and-treat systems, soil vapor extraction systems, and coupled air sparging–soil vapor extraction systems; and management of 20 projects in Minnesota, Wisconsin, and Illinois involving mechanical and electrical control and data retrieval for remedial systems including telemetry-based remedial systems. Other pertinent experience included work with programmable logic controllers and ladder logic programming and training in the use of Intellution FIX DMACS human–machine interface software.

1990–1992: Project Engineer, Delta Environmental Consultants, Inc., St. Paul, Minnesota.

- Responsibilities included design, permitting, installation, and operation of treatment systems for remediation of contaminated groundwater and soils. Sites ranged from automotive service stations to railroad maintenance yards for projects located in a five-state region. Remediation technologies included subsurface air sparging and soil vapor extraction.
- Other project responsibilities included data interpretation and permit compliance for 14 remediation systems for a major oil company; supervising excavation of contaminated soils; and permitting and supervising in-place abandonment of 12,000-gal underground storage tank.

1988–1990: Research/Engineering Technician, EERC, UND.

- Responsibilities included design, construction, operation, maintenance, data collection and reduction, and formal report preparation for bench-scale treatability programs involving single-stage, two-stage, coupled nitrification–denitrification activated sludge systems, activated carbon adsorption, and ion exchange treatment of coal-processing waters. Maintained and operated pure oxygen plug flow reactor for biological treatment of synthetic wastewater. Assisted in production of pilot-scale wastewater treatment facility and design and analysis of bench-scale wastewater treatment models.

Patents

Barrett, D.P.; Davis, R.J.; Dustman, J.E.; Gibas, D.R.; Stevens, B.G.L.; Wilson, B.T. Measuring System for Measuring Real-Time Groundwater Data. U.S. Patent 5,553,492, Sept 10, 1996.

Publications

Has authored or coauthored numerous publications.

DR. STEVEN M. SCHLASNER
Senior Engineer
Energy & Environmental Research Center (EERC), University of North Dakota (UND)
15 North 23rd Street, Stop 9018, Grand Forks, North Dakota 58202-9018 USA
701.777.5479, sschlasner@undeerc.org

Education and Training
Ph.D., Chemical Engineering, The Ohio State University, 1987
M.S., Chemical Engineering, The Ohio State University, 1983
M.B.A., University of South Dakota, 1977
B.S., Chemical Engineering, South Dakota School of Mines & Technology, 1980
B.A., Chemistry and Mathematics, St. Olaf College, 1974
Diploma, Air War College (correspondence), Air University,1997
Professional Engineer (retired), Ohio and Oklahoma

Research and Professional Experience
2010–Present: Senior Engineer, EERC, UND, Grand Forks, North Dakota.
- Develops and analyzes clean energy and petrochemical technologies, systems, and markets by performing:
  - Technical, economic, and life cycle modeling, optimization, and assessment of energy, petrochemical, and carbon capture/transport technologies; their capabilities, functional performance, and efficiencies; their compatibility with and ability to integrate into existing industrial processes, infrastructure, supply chains, and other systems; and their associated economics.
  - Pilot-scale R&D of novel hydrogen production technologies.
  - Market assessment of energy, petrochemical, and carbon resources; production technologies and assets; and infrastructure with respect to supply, demand, distribution systems, value chains, and other systems focusing on North Dakota and regional systems and markets.

35-year career in chemical process engineering and R&D encompasses energy, bioprocess, and materials technologies, especially hydrogen, CO_2 capture/transport, petroleum-refining, and petrochemical technologies.

2006–2009: R&D Chief Engineer and Team Lead of the H_2 Production/CO_2 Capture Team, ConocoPhillips Company, Bartlesville Technology Center, Bartlesville, Oklahoma.
- Supervised the lead Downstream R&D team addressing climate change issues by directing multimillion dollars of internal and external research into H_2 production and CO_2 capture technologies.
- Managing internal R&D focused on company-specific needs and economics.
- Executive Board member and Work Package Leader in an international CO_2 capture ("CACHET") project: seven work packages; six precombustion technologies; 28 organizations from 17 countries; €13 million (CY2006).
- Industry Co-Lead of U.S. Department of Energy FreedomCAR and Fuel Partnership's Hydrogen Production Technical Team: a team of technologists from the U.S. Council for Automotive Research

and energy partner member companies, national laboratories, and DOE technology development managers responsible for developing R&D plans and road maps, identifying data gaps and R&D needs, reviewing research results, and evaluating technical progress toward hydrogen production research goals. Twice presented program updates to National Research Council reviewers performing biennial program assessments.
- Technical Team member of the CO_2 Capture Project's (Phase 2) Capture Team: $55 million (CY2004) consortium of eight major energy companies within which the Capture Team oversaw more than 20 contractors developing 12 carbon capture technologies.

2001–2009: R&D Senior Engineer, Long-Range Technology, ConocoPhillips Company, Bartlesville Technology Center, Bartlesville, Oklahoma.
- Company lead engineer in R&D joint ventures developing compact hydrogen and hydrocarbon fuel production technologies employing process intensification techniques.
- Member of Technical Team supervising development of a synthetic fuel process – five partners more than $50 million (CY2001) research investment.
- Technical representative to a joint venture developing a novel compact hydrogen production process – two partners more than $5 million (CY2002) investment. Dr. Schlasner's technical assessment led to termination of joint venture.

1992–2001: Refinery Senior Engineer, Sweeny Petrochemical Complex, Phillips Petroleum Company, Old Ocean, Texas.
- Advanced process control engineer for fluidized catalytical cracker (FCC), continuous catalytic reformer (CCR), naphtha hydrotreater and other petroleum refinery units. Oversaw control system operations, and supervised multimillion dollar control system upgrades to an FCC and a 60-mile regional olefin product pipeline, as well as construction of a new CCR.
- Process/operating engineer for benzene hydrogenation, pentane isomerization, two aromatic extraction and other refinery units. Debottlenecked the "hydro" and "isom" units, then set production records. #2 person on complex's largest operating team responsible for developing and executing more than $40 million (CY1997) budget. Resolved wastewater biotreater environmental Notice of Violation without incurring fine while reducing emissions by 85% and operating cost by $200 thousand annually.

1987–1992: Process Engineer, Phillips Petroleum Company, Bartlesville, Oklahoma.
- Corporate Engineering. Automated a linear high density polyethylene plant HYSYS® process simulation provide high-quality, quick-turnaround design information to Corporate Licensing in support of bid packages. Reduced time and cost of preparing the first design package by more than 60%.
- Advanced Composites. Developed unidirectional tape and stampable sheet thermoplastic composites processes and products for the industrial and aerospace markets.
- R&D Biotechnology Division. Performed high-density, microbial-based drug and enzyme R&D and toll fermentations in a Biological Safety Level 2 pilot plant.

1980–2004: Individual Mobilization Augmentee, Air Force Research Laboratory (AFRL), Wright-Patterson Air Force Base, Ohio and Tyndall Air Force Base, Florida.
- Colonel. Senior Reservist. Senior officer augmenting AFRL military leadership during war. Served as acting Deputy Director for Sensors, and Materials & Manufacturing Directorates with 500 to 1000

assigned personnel each. Advised Sensors management on use of its 31 reservists and AFRL as member of AFRL Reserve Board overseeing 210 Reservists.
- Field-grade officer. Division Senior Reservist. Served as acting Chief of Airbase and Environmental Technology Division and advised Division on management of its five Reservists. Member of 27-person Tiger Team that reviewed workforce management of AFRL's 5000+ scientists & engineers for the Secretary of the Air Force who implemented team's recommendations.
- Company grade officer. Developed microcomputer-based laboratory automation solutions supporting organic polymer and composite materials R&D. Advised Materials Directorate on microbial biotechnology R&D, e.g., microbial degradation of hazardous paint waste.

1974–1978: Lieutenant. U.S. Air Force, 44th Strategic Missile Wing (Strategic Air Command), Ellsworth Air Force Base, South Dakota.
- Assistant Wing Operations Scheduling Officer: Scheduled missile alert, training and other duties of 150 missile combat crewmembers – Second Lieutenant to Lieutenant Colonel.
- Missile Combat Crew Commander: Commanded Alternate Command Post crew certified to assume command of the Wing in event the Wing Command Post on base was disabled.
- Deputy Missile Combat Crew Commander: Deputy commander of a Wing Instructor crew.

Professional Activities

Member, National Hydrogen Association, Director (2006–2007)
Member, American Chemical Society
Member, American Society for Microbiology
Member, Tau Beta Pi
Member, Beta Gamma Sigma

Select Publications and Presentations

Jensen, M.D.; Schlasner, S.M.; Gorecki, C.D.; Wildgust, N. *Opportunities and Challenges Associated with CO_2 Compression and Transport During CCS Activities*; Plains CO_2 Reduction (PCOR) Partnership Phase III Task 6 Deliverable D85 for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-05NT42592; EERC Publication 2017-EERC-06-17; Energy & Environmental Research Center: Grand Forks, ND, May 2017.

Leroux, K.M.; Klapperich, R.J.; Azzolina, N.A.; Jensen, M.D.; Kalenze, N.S.; Bosshart, N.W.; Torres Rivero, J.A.; Jacobson, L.L.; Ayash, S.C.; Nakles, D.V.; Jiang, T.; Oster, B.S.; Feole, I.K.; Fiala, N.J.; Schlasner, S.M.; Wilson IV, W.I.; Doll, T.E.; Hamling, J.A.; Gorecki, C.D.; Pekot, L.J.; Peck, W.D.; Harju, J.A.; Burnison, S.A.; Stevens, B.G.; Smith, S.A.; Butler, S.K.; Glazewski, K.A.; Piggott, B.; Vance, A.E. *Integrated Carbon Capture and Storage for North Dakota Ethanol Production*; Final Report (Nov 1, 2016 – May 31, 2017) for North Dakota Industrial Commission and Red Trail Energy; Energy & Environmental Research Center: Grand Forks, ND, May 2017.

Energy & Environmental Research Center. *Liquids Gathering Pipelines: A Comprehensive Analysis*; Report for the North Dakota Industrial Commission and the North Dakota Legislative Energy Development and Transmission Committee; Energy & Environmental Research Center: Grand Forks, ND, Dec 2015.

Lord, D.; Luketa, A; Wocken, C.A.; Schlasner, S.; Aulich, T.R.; Allen, R.; Rudeen, D. *Literature Survey of Crude Oil Properties Relevant to Handling and Fire Safety in Transport*; Sandia Report No. SAND2015-1823; Sandia National Laboratories: Albuquerque, NM, and Livermore, CA, March 2015.Jensen, M.D.; Schlasner, S.M.; Sorensen, J.A.; Hamling, J.A. Operational Flexibility of CO_2 Transport and Storage. *Energy Procedia* **2014**, *63*, 2715–2722.

Jensen, M.D.; Schlasner, S.M.; Sorensen, J.A.; Hamling, J.A. *Subtask 2.19 – Operational Flexibility of CO_2 Transport and Storage*; Final Report (Feb 3 – Dec 31, 2014) for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-08NT43291; EERC Publication 2014-EERC-12-17; Energy & Environmental Research Center: Grand Forks, ND, Dec 2014.

Harju, J.A.; Wocken, C.A.; Stevens, B.G.; Almlie, J.C.; Schlasner, S.M. End-Use Technology Study – An Assessment of Alternative Uses for Associated Gas. Presentation for the North Dakota Pipeline Authority Natural Gas End-Use Technology Study Webinar, Nov 5, 2012.

Wocken, C.W.; Stevens, B.G.; Almlie, J.C.; Schlasner, S.M. End-Use Technology Study – An Assessment of Alternative Uses for Associated Gas; Topical Report for North Dakota Industrial Commission Contract No. G024-052; Energy & Environmental Research Center: Grand Forks, ND, Sept 2012.

Schlasner, S.M.; Almlie, J.C. *Demonstration of Pratt & Whitney Rocketdyne's Hydrogen Generator Technology – Phases I–III (Years 3–5 – Activity 3.2 – 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, March 2011.

Miracca, I.; Ingvar Åsen, K.; Assink, J.; Coulter, C.; Curran, L.; Lowe, C.; Torres Moure, G.; Schlasner, S. The CO_2 Capture Project (CCP): Results from Phase II (2004–2009). *Energy Proc.* **2009**, *1* (1), 55–62.

Garland, R.; Schlasner, S.M. Hydrogen Production: Pathways and Status. Presented at the 234th American Chemical Society National Meeting, Boston, MA, Aug 19–23, 2007.

Schlasner, S.M. Design and Implementation of a Flexible, Integrable DCS Based on a Real-Time, Message-Passing Networked Operating System. In *Proceedings of the Industrial Computing Conference;* Anaheim, CA, Oct 27–31, 1991; pp 469–478.

Luli, G.W.; Schlasner, S.M.; Ordaz, D.E.; Mason, M.; Strohl, W.R. An Automatic Online Glucose Analyzer for Feed-Back Control of Fed-Batch Growth of Escherichia Coli. *Biotechnol. Techniq.* **1987**, *1*, 223–228.

Schlasner, S.M. Strohl, W.R.; Lee, W.-K. On-Line Adaptive, Optimal Control of a Fed-Batch Fermentation of Streptomyces C-5. In *Proceedings of the 1987 American Control Conference*; Minneapolis, MN, June 10–12, 1987 ("Control and Optimization of Biochemical Processes" session best paper award).

Blackwell, J.V.; Schlasner, S.M.; Jivatadavirute, W.; Strohl, W.R. Computer-Controlled Gradient Feed Process for High-Density Fermentation of an Anthracycline-Producing Streptomycete. Presented at the 87th Annual Meeting of the American Society for Microbiology, Atlanta, GA, March 1–6, 1987.

Tsai, Y.-L.; Schlasner, S.M.; Tuovinen, O.H. Inhibitor Evaluation with the Use of Immobilized Cells of Nitrobacter agilis. *Appl. Environ. Microbiol.* **1986**, *52*, 1231–1235.

Strohl, W.R.; Schlasner, S.M.; Lorenson, P.L. Microcomputer-Control of Fermentation Processes. *Biotechniq.* **1986**, *4* (4), 336–344.

Strohl, W.R.; Schlasner, S.M.; Lorenson, P.L.; Blackwell, J.V. Computer Assisted Fermentation of Microorganisms. Presented at the 1985 International High-Technology Biomedical Conference, Pharmaceutical & Toxicological Institute of the Ohio State University, Columbus, OH, Nov 3–15, 1985.

JASMINE L. OLEKSIK
Senior Research Engineer
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Principal Areas of Expertise
Ms. Oleksik's principal areas of interest and expertise are syngas production, characterization, and storage; biofuel production process design and system operation; oil extraction from renewable sources and utilization; and waste conversion for chemical and fuel production.

Education and Training
Ph.D., Chemical Engineering, University of North Dakota, In progress (May 2022 – Present)
M.S., Chemical Engineering, University of North Dakota, 2020.
B.S., Chemical Engineering, University of North Dakota, 2017.
Proficient in the use of the following computer programs and simulation software: Microsoft Excel, Word, Project, and PowerPoint; ChemCad; Aspen Plus; Visio; Ansys Fluent.

Research and Professional Experience
April 2022–Present: Senior Research Engineer, EERC, UND. Ms. Oleksik work included chemical process design and development, operation of bench- and pilot-scale processes including combustion and gasification systems, syngas characterization, storage, and distribution, biofuel production process design and system operation, and waste conversion for chemical and fuel production. Ms. Oleksik contributes to the design, modeling, and fabrication of experimental equipment; oversees and operates equipment; interprets data; performs project management tasks and project oversite; preparation and contribution to for proposals, reports, and papers; and presents project results to clients and at national and international conferences.

July 2018–April 2022: Research Engineer, EERC, UND. Ms. Oleksik responsibilities included design and development of syngas storage, cleaning and blending system for solid-oxide fuel cell testing, biofuel process design and operation of systems, and laboratory work focused on chemical looping combustion, recovery of rare-earth elements from coal and coal by-products, and oil extraction for utilization in biofuels. Additionally, Ms. Oleksik contributed to the design, modeling, and fabrication of experimental equipment; oversees and operates equipment; interprets data; helps to prepare proposals, reports, and papers; and presents project results to clients and at national and international conferences.

August 2016 – July 2018: Graduate Research Assistant, Department of Chemical Engineering, UND. Ms. Oleksik transitioned a strain of algae chlorella vulgaris from autotropic to heterotrophic growing conditions and investigated various solvent extraction techniques to facilitated oil recovery and optimized the extraction of oil from both growing conditions for utilization for biofuels and replace for petrochemicals.

May 2015–August 2016: Undergraduate Research Assistant, Department of Chemistry, UND. Ms. Oleksik evaluated methods for the extraction and chromatographic analysis of lignin decomposition products, performed preliminary experiments on metal catalyst screening, performed detailed kinetic experiments on the most promising catalysts, and worked on data presentation and interpretation.

Professional Activities
Member, American Institute of Chemical Engineers

Relevant Publications
Voeller, K.; Bilek, H.; **Kreft, J**.; Dostálková, A.; Kozliak, E.; Kubatova, A. Thermal Carbon Analysis Enabling Comprehensive Characterization of Lignin and Its Degradation Products. *ACS Sustainable Chem. Eng.* **2017**, *5* (11), 10334–10341; DOI: 10.1021/acssuschemeng.7b02392.

Pourjafar, S.; **Kreft, J**.; Bilek, H.; Kozliak, E.; Seames, W. Exploring Large Pore Size Alumina and Silica-Alumina Based Catalysts for Decomposition of Lignin. *AIMS Energy.* **2018**, 6 (6), 993-1008; DOI: 10.3934/energy.2018.6.993.

Kreft, J.; Moe, E.; Garcia, N.; Ross, A.; Seames, W. Comparative Scoping Study Report for the Extraction of Microalgae Oil from Two Subspecies of *Chlorella Vulgaris*. *Clean Energy Journal* **2020**, in press.

Oleksik, J.L. *Waste Utilization for Bio-Based Alternatives to Chemicals and Fuels*; Final Report for State Energy Research Center; EERC Publication 2020-EERC-08-06; Energy & Environmental Research Center: Grand Forks, ND, August 2020.

Oleksik, J.L.; Schlasner, S.M.; Eckberg, A.A. *Corn Oil Extraction Efficiency Optimization*; Final Report for State Energy Research Center; EERC Publication 2021-EERC-04-14; Energy & Environmental Research Center: Grand Forks, ND, April 2021.

Foerster, I.; Seames, W.; **Oleksik, J.;** Kubatova, A; Ross, A. A Comprehensive Study of Techniques to Optimize the Extraction of Lipids from the Autotrophic Strain of the Microalgae *Chlorella Vulgaris*. *Life* **2023**, 13 (10) 1997 https://doi.org/10.3390/life13101997.

DR. JOHN A. HARJU
Vice President for Strategic Partnerships
Energy & Environmental Research Center (EERC), University of North Dakota (UND)
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Education and Training
Ph.D., Petroleum Engineering, University of North Dakota, 2022.
M.Eng., Petroleum Engineering, University of North Dakota, 2020.
B.S., Geology, University of North Dakota, 1986.

Research and Professional Experience
2002–Present: EERC, UND.
July 2015–Present: Vice President for Strategic Partnerships.
- Leads efforts to build and grow dynamic working relationships with industry, government, and research entities globally in support of the EERC's mission to provide practical, pioneering solutions to the world's energy and environmental challenges.
- Represents the EERC regionally, nationally, and internationally in advancing its core research priorities: coal utilization and emissions, carbon management, oil and gas, alternative fuels and renewable energy, and energy–water.

Principal areas of interest and expertise include carbon sequestration, enhanced oil recovery, unconventional oil and gas development, waste management, geochemistry, technology development, hydrology, and analytical chemistry, especially as applied to the upstream oil and gas industry.

2003–June 2015: Associate Director for Research.
- Led a team of scientists and engineers building industry–government–academic partnerships to carry out research, development, demonstration, and commercialization of energy and environmental technologies.

2002–2003: Senior Research Advisor.
- Developed, marketed, managed, and disseminated research programs focused on the environmental and health effects of power and natural resource production, contaminant cleanup, water management, and analytical techniques.

2017–Present: Adjunct Lecturer, Department of Petroleum Engineering, UND.

1999–2002: Founder/Vice President, Crystal Solutions, LLC, Laramie, Wyoming.
- Firm was involved in commercial E&P produced water management, regulatory permitting and compliance, and environmental impact monitoring and analysis.

1997–2002: Gas Research Institute (GRI) (now Gas Technology Institute [GTI]), Chicago, Illinois.
2000–2002: Principal Scientist, Produced Water Management.
- Developed and deployed produced water management technologies and methodologies for cost-

effective and environmentally responsible management of oil and gas produced water.

1998–2000: Program Team Leader, Soil, Water, and Waste.

- Managed projects and programs related to the development of environmental technologies and informational products related to the North American oil and gas industry.
- Formulated RFPs, reviewed proposals, and formulated contracts.
- Performed technology transfer activities.
- Supervised staff and contractors.
- Served as Manager of the Environmentally Acceptable Endpoints project, a multiyear program focused on rigorous determination of appropriate cleanup levels for hydrocarbons and other energy-derived contaminants in soils.
- Led GRI/GTI involvement with industry environmental consortia and organizations, such as PERF, SPE, AGA, IPEC, and API.

1997–1998: Principal Technology Manager (1997–1998) and Associate Technology Manager (1997), Soil and Water Quality.

1988–1996: EERC, UND.

1994–1996: Senior Research Manager, Oil and Gas Group. Served as:

- Program Manager for assessment of the environmental transport and fate of oil- and gas-derived contaminants, focused on mercury and sweetening and dehydration processes.
- Project Manager for field demonstration of innovative produced water treatment technology using freeze crystallization and evaporation at oil and gas industry site.
- Program Manager for environmental transport and fate assessment of MEA and its degradation compounds at Canadian sour gas-processing site.
- Program Manager for demonstration of unique design for oil and gas surface impoundments.
- Director of the National Mine Land Reclamation Center for the Western Region.
- Co-PI on project exploring feasibility of underground coal gasification in southern Thailand.
- Consultant to an International Atomic Energy Agency program entitled “Solid Wastes and Disposal Methods Associated with Electricity Generation Fuel Chains.”

1988–1994: Research Manager (1994), Hydrogeologist (1990–1994), Research Specialist (1989–1990), and Laboratory Technician (1988–1989).

Professional Activities

Member, National Coal Council (appointed 2018)
Member, National Petroleum Council (appointed 2010)
Member, Mainstream Investors, LLC, Board of Governors (2014–present)
Member, DOE Unconventional Resources Technology Advisory Committee (2012–2014)
Member, Interstate Oil and Gas Compact Commission (appointed 2010)
Member, Rocky Mountain Association of Geologists

Publications

Has authored or coauthored more than 100 professional publications and nearly 300 technical presentations.

Mitchell Braegelmann
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Dickinson ND, 58601
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Summary: Over 10 years of experience in manufacturing facilities with varied experience in supervision, process improvement, process safety management, and project management.

Experience:

2023–Present ***Marathon*** Dickinson, ND
Process Optimization Group

- Project Development
  - Site process engineering resource for decisions on major projects development.
  - Responsible for developing project backlog of high-return projects for site development and implementation.

2020–2023 ***Marathon*** Dickinson, ND
Technical Services and Engineering Supervisor

- Supervision
  - Led multidisciplined team of engineers through commissioning and start-up of $500 million retrofit of the Dickinson refinery to produce renewable diesel.
  - Managed multidisciplinary team of process, project, and controls professionals.
  - Adjusted resources as needed to achieve site goals through use of additional permanent employees, contractors, temporary employees, and interns.
- Business practice development
  - Established process-monitoring program to bring visibility to key performance indicators.
  - Implemented a capital and expense project review and prioritization process.
- Optimization
  - Worked with vendors and technical resources to increase hydrogen and renewable diesel production above design conditions.
  - Increased uptime of the facility by managing contaminants and better controlling chemical injection systems.

2015–2020 ***Dakota Prairie Refining/Tesoro/Andeavor/Marathon*** Dickinson, ND
Process Safety Management Engineer

- Process Safety Culture Development
  - Developed shared ownership in the process safety program by training employees on their specific impacts to an effective process safety program.
  - Routine auditing of process safety elements and their implementation.
- Process Safety Management (PSM) Program Development
  - Wrote standards for PSM-related programs including PHA, MOC, PSI, employee involvement, temporary portable buildings, and exclusion zones.
  - Reviewed and managed processes to ensure implementation was according to standards and that performance was sustained.
- Incident Investigation

- Lead investigator for incidents including data review, interviews, cause mapping, and report writing.
- Managed overall program implementation including management review and action item effectiveness review.
- Analyzed incident and near-miss data for trends in minor incidents. Identified areas of the facility and types of events likely to produce significant incidents if not mitigated.

2011–2015 ***Cargill Texturizing Solutions*** Cedar Rapids, IA
Food Starch Process Development Engineer

- Continuous Improvement
  - Led Kaizen events on starch production processes to reduce down time on batch changes while also decreasing off-specification material and manufacturing costs.
  - Responsible for monthly key process indicators.
  - Developed business case justification for capital projects within the starch department.
- Food Starch Manufacturing and Technology Lead
  - Responsible for technology selection for plant expansion. Worked with vendors to select the right partners, and led piloting efforts for dryers, agglomeration, grinding, sifting, and pneumatic transport technologies.
  - Led process modeling and batch scheduling efforts to ensure the expanded plant would meet project commitments for production, waste generation, and energy efficiency.

2010–2011 ***Cargill Corn Milling*** Cedar Rapids, IA
Project Engineer

- Capital Project Implementation
  - Safely managed complex construction projects.
  - Typically managed four to five small capital projects concurrently.

2009–2010 **Cargill Corn Milling** Blair, NE
Engineer Training Program/Project Engineer

- Developed basic understanding of a range of chemical processes.

Special Experience/Skills:

- Kaizen event leader
- Design of experiments/statistical analysis
- Process hazard analysis and layers of protection analysis facilitator
- Incident investigation leader trained in 5Y, ABS cause mapping, and tap root methodologies

Education

2003–2009 **University of North Dakota** Grand Forks, ND
Masters – Chemical Engineering

Bachelors – Chemical Engineering

David Whitman
Senior Project Engineer – Renewable Fuels
Marathon Petroleum Company
400 S Marathon Avenue, Robinson, IL 62454
(618) 553-6100, dwhitman@marathonpetroleum.com

Education: Rose-Hulman Institute of Technology
B.S. Mechanical Engineering May 2002

ESI/George Washington University
Masters Certificate in Project Management December 2006

Licenses: Licensed Professional Engineer – Illinois (2008–2013); Indiana (2013–present)
Certifications: PMI Certified Project Management Professional (2009–present)

Research and Professional Experience
2019–Present: Marathon Petroleum Company
<u>Renewable Fuels Senior Project Engineer</u>
Lead project engineer for development major renewable fuels projects. Responsibilities include the following:

- Coordinate design development with process group and engineering firms to meet novel process design requirements within equipment standards and constraints.
- Facilitate specification and standards reviews for renewables plant applicability.
- Complete project quality reviews.
- Evaluate project design and scope options to support renewable fuel and sustainability metrics.
- Support execution strategy development for greenfield project sites.

<u>Major Project Engineer</u>
Responsible for feasibility and definition project scope development for multimillion-dollar refinery revamp projects. Responsibilities include the following:

- Coordinate engineering firms and licensors on multiple projects to ensure projects meet company specs, follow project development process, and meet budget and schedule constraints.
- Work with local and corporate project team members to control scope and maximize project benefits while maintaining constructability and operability in the design.
- Responsible for project approvals and budgeting.

2013–2019: Duke Energy Edwardsport IGCC Station
<u>Project Engineering Manager</u>

- Led project engineering department at integrated gasification combined cycle (IGCC) power plant. The group was primarily responsible for development and execution of station improvement and capital maintenance projects, along with managing the station capital budget.
- Responsible for team development, performance, and work distribution
- Completed incident, project, and budget reviews as part of station management team.
- Member of station incident command team – Planning Section Chief (backup).
- Supported final start-up and commissioning of station following plant construction.

2002–2013: Marathon Petroleum Company Illinois Refining Division

<u>Project Manager</u>

- Managed multimillion-dollar projects from front-end development through implementation.
- Responsible for project budgeting, forecasting, and reporting.
- Managed engineering contractors and coordinated project team efforts.
- Managed construction scope and costs.

<u>Relief Systems Coordinator</u>

- Coordinated complete update of refinery's relief system design and documentation.
- Member of corporate team to develop relief systems standard for company.
- Developed local guidelines for managing and maintaining the relief system.
- Consulted on projects to evaluate relief systems impact.

<u>Area Project Engineer</u>

- Developed and implemented small- to mid-sized projects for refinery operating teams.
- Supported the operating teams in meeting process safety management requirements.
- Provided engineering assistance to maintenance for routine and shutdown-related work.

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SUMMARY OF QUALIFICATIONS

Offering 42 years domestic and international experience with increasing managerial responsibilities in project development, process design, project engineering, and technical management roles in oil refineries. Has held key management positions at six different refineries. Currently serving as Project Development and Engineering Manager, Major Capital Projects. Career highlights include the following:

- Refinery project development and economic justification
- Project engineering management and management of refinery capital programs
- Process engineering and technical management for routine operations support engineering as well as small to large capital projects
- Operations representative and engineering supervisor overseeing design, construction, and start-up of a large refinery upgrade project in Saudi Arabia
- Operations management at a variety of levels from refinery operations manager and front-line supervision to working as an operator during a strike
- Have held a variety of refinery leadership team positions
- Adept at refinery PSM programs including MOC, PHA, HAZOP, and incident investigation

Included in this experience are the processes and administrative support shown below:

REFINING	**UTILITIES**	**ADMINISTRATIVE**
Amine Treating	Boilers and Steam Production	Department Management
Crude Distillation	Fuel Systems	Refinery Economic Evaluation
Catalytic Reforming	Wastewater Treatment	Project Economic Justification
Distillate and LPG Treating	Sludge Dewatering and Handling	Project Management
Gas Recovery	Flare System and Safety Valves	Conceptual Process Design
Hydroprocessing	Tanks, Loading and Blending	Detailed Design
NGL Processing	Hydrogen Reforming	MOC, PHA, HAZOP, and PSSR
Solvent Deasphalting	**CONTROL SYSTEMS**	Facilities Commissioning, Start-Up
Sulfuric Acid Alkylation	Honeywell DCS	Operations Training Support
Sulfur Recovery	Analyzers and Field Instruments	Environmental Permit Support
Coking and Visbreaking	Logic Systems	Incident Investigation

WORK EXPERIENCE

Marathon Petroleum (formerly Andeavor and Tesoro Corporation), Los Angeles, CA, Refinery

Corporate Refining Renewables Technologist – 2020 to present

Responsible for vetting new and emerging renewables and sustainability technologies for potential application at the 15 refining locations to facilitate strategic investments that lower carbon intensity, improve energy efficiency, and meet sustainability objectives. Integrate involvement across the enterprise to develop the business case and initiate the conceptual studies that result in renewable and sustainability capital projects. Currently leading scale-up and implementation of novel organic oils pretreatment facility to support the Martinez Renewable Diesel Project. Other technologies currently being evaluated include carbon capture and sequestration for a hydrogen plant and several waste to fuels opportunities that utilize Fischer–Tropsch and pyrolysis biomass gasification to liquids.

Project Development and Engineering Manager, Capital Projects – 2016 to 2020

Led the development and engineering of a $515MM project to convert a small North Dakota refinery into the largest soy oil to renewable diesel plant in North America. Responsibilities included process technology and engineering contractor selection and interface with strategy and business development, commercial, procurement, logistics, and other organizations to align the process requirements with the business case. Took the project from a preliminary concept through appraise, select, and define stages (FEED). Supported start-up and troubleshooting at site. Led the activities that determined optimal plant capacity and location. Coordinated permitting, third-party logistics, and input of refinery personnel with project engineering, construction, and other departments such as commercial and logistics. Also responsible for Capital AFE package preparation and management of the engineering activities while embedded with the engineering contractor at its office.

Consulting Engineer, Capital Projects – 2015 to 2016

Managed appraise and select stage project engineering activities for capital projects larger than $30MM. Provided project managerial support for process engineering and operational activities for large capital projects during define and execute stages (PHAs, P&ID reviews, operability reviews, capital AFE package preparation, project technical objectives, etc.) Was responsible for supporting $460MM LARIC (LA Refinery Integration and Compliance) Project and roughly $500MM CPUP (Clean Product Upgrade Projects) for mixed xylenes production.

Manager Major Capital Synergy Projects – 2013 to 2015

Lead a multidisciplined team of seven professionals responsible for the business case and project development, appraise and select stage engineering of $460MM capital program to integrate a 104-MBD and 270-MBD Los Angeles area refinery sites into one integrated refining complex (LARIC). When completed, the combined site will be the largest and most complex refinery in the western United States.

Senior Manager of Engineering – 2012 to 2013

Responsible for the business case and project development, engineering, and execution of $150MM capital program at of 17.5 complexity 104-MBD Los Angeles area refinery. Managed over 40 on-site personnel comprised of project engineers, process engineers, design and drafting, document control, and field construction support. Helped develop the yearly capital budget. As part of the refinery leadership team, worked closely with operations, technical, and maintenance personnel to have operator-friendly, safe, environmentally compliant, low-cost projects integrated into the refinery during TAR and online construction.

Manager of Operations – 2011 to 2012

Responsible for the daily operation of 17.5 complexity 104-MBD Los Angeles area refinery. Accountable for $215MM annual operating budget. Managed over 200 employees, both hourly represented and salaried professionals. Oversaw the selection, hiring, and onboarding of 20 new hourly employees. As part of the refinery leadership team, also involved in setting refinery-wide safety, production, reliability, and gross margin improvement goals.

Manager of Operations Coordination – 2010 to 2011

Responsible for coordinating the refinery oils plan in a 17.5 complexity 104-MBD Los Angeles area refinery. Integrated the plan from the supply and optimization department with the refinery operations department to ensure smooth unit operation and margin optimization. Managed the refinery shift superintendents and hydrocarbon schedulers to operate the refinery according to plan or improve the plan upon opportunity. Also led the development of projects and initiatives to improve refining gross margin.

Technical Manager of Process Engineering, Control Systems, and Laboratory – 2008 to 2010

Managed 42 employees in the technical support department. Responsible for daily operations support and capital project development. Member of the refinery leadership team, participated in managing $230MM/yr expense budget and $200MM/yr capital program. Also led a seven-person maintenance improvement team to streamline the refinery turn-around work process.

Process Engineering Manager, Major Capital Projects – 2007 to 2008

Process Engineering Manager at Engineering Office in Long Beach, CA, for $1B capital program to upgrade and modernize Los Angeles refinery. Led a team of refinery and contract engineers to develop conceptual design and cost estimates for various refinery processes. Units impacted included coker, hydroprocessing, a new vacuum unit, boilers, cogeneration, sulfur plant, flare, amine, sour water, and other utility systems. Also supported environmental permitting activity and development of economic cases.

Tesoro Corporation, Anacortes WA, Refinery

Project Manager, Golden Eagle Coker Modification Project – 2006 to 2007

Seconded as project manager at Engineering Office in Long Beach, CA, for $500MM 50-MBD coker modernization project in San Francisco Bay area refinery. This was a fast-track, out-of-sequence project with a challenging environmental compliance deadline. Responsible for assisting lead project manager and director of capital projects in all facets of engineering and procurement activities including technical evaluations, material procurement, change order management and approval, HAZOP, and managing refinery input.

Staff Engineer and Operations Venture Manager, Anacortes Coker Project – 2005 to 2006

Led an OEM refinery team to integrate a $470MM coker project through FEL 1 phase into an existing refinery. Other units included a relocated amine unit, a SRU, and extensive pipeway. Facilitated conceptual and detailed design, staffing evaluation, training, PHA, utility studies, and environmental permit support. Saved over $20MM capital by deleting additional units and processing incremental H_2S from the amine unit in an adjacent facility. Also led a team of six employees to improve maintenance turnaround performance. Implemented a turnaround contractor QA/QC auditing program that identified ways to improve work planning.

Senior Process Engineer, Low-Sulfur Gasoline Projects – 2002 to 2005

Lead process engineer responsible for $12MM upgrade of an existing FCC gasoline splitter, NHT, and CR to meet low-sulfur gasoline regulations. Highlights included retrofitting an existing column into an amine contactor and other value engineering items, saving over $2MM in capital during a lean capital environment. Also supported environmental permitting to integrate various projects into overall refinery low-sulfur fuels program. Implemented $3MM project with less than a 1-year payback that saved energy and increased crude oil processing by lowering the pressure on the crude column.

Senior Process Engineer, ROSE Project Design and Start-Up – 2000 to 2002

Lead process engineer responsible for the detailed design, and commissioning, training, and start-up activities of over $55MM ROSE deasphalting unit. This fast-track project started up on schedule and was the smoothest start-up of the ten most recent ROSE units. Was integral part of a diverse project team during the transition from construction through on-stream operation. Also provided follow-up technical support as required during process upsets and other emergencies.

Saudi Aramco, Ras Tanura (Saudi Arabia), Refinery

Engineering Supervisor, Refinery Upgrade Project Start-Up – 1997 to 2000

Engineering Supervisor and operations support for training, commissioning, and start-up of $500MM refinery extension on a $1.2B refinery upgrade project. Units include 44-MBD HGO hydrocracker with H_2 plant, 60-MBD visbreaker, and sulfur treating with 300-LTD recovery unit. Responsible for supervision of a team of over 14 Saudi Arab engineers during the transition from construction through precommissioning, start-up, on-stream performance tests, and normal operations.

Senior Operations Representative, Refinery Upgrade Project – 1994 to 1997

On-site refinery representative at London-based E&C contractor's office for engineering, operations, maintenance, and management interests on a +$500MM refinery upgrade project. Responsible for all review, approval, and value engineering activities during project detailed design. Oversaw and coordinated construction and precommissioning work on location in Saudi Arabia. Supervised entry-level Saudi Arab engineers.

Process Specialist – 1991 to 1994

Provided operations engineering coverage for a 320-MBD NGL separation and LPG treating facility. Solved daily operations and engineering problems. Made major contributions in a fast-track demothballing and optimization project of 60-MBD idled NGL plant. Supervised entry-level Saudi Arab engineers. Developed HYSIM computer models of plant distillation sections.

Sun Refining and Marketing Company, Toledo Refinery

Senior Process Engineer – 1989 to 1991

Provided technical leadership for a variety of projects within this 125-MBD fully integrated refinery. Developed economic justification, strategy, and process design for solutions to complex problems. Involved with long-range planning and capital budgeting process.

The Standard Oil Company (BP America), Toledo Refinery

Operations Front Line Supervisor – 1987 to 1989

Supervised eight operators in 125-MBD integrated refinery. Responsible for daily operation of crude-vac., iso-cracker, reformer, sat. gas plant, flare system, pollution control and sulfur unit. Worked as an operator on a crude unit and iso-cracker during a 113-day strike in 1988.

Senior Special Projects Engineer – 1985 to 1987

Responsible for the development, design, justification, and project management of capital projects. Supervised field start-up and troubleshooting of installed projects.

Senior Control Systems Engineer – 1981 to 1985

Responsible for control systems projects, including economic evaluation, design, equipment selection, installation, and start-up. Provided technical service on boilers and safety valves.

EDUCATION

Bachelor of Science, Chemical Engineering, May 1981
Clarkson College of Technology (Clarkson University), Potsdam, New York
GPA in major: 3.4/4.0. GPA overall: 3.1/4.0
Dean's List three semesters. New York State Regents Scholarship

PUBLIC OUTREACH

Gang Alternative program board of directors – 2010 to present

Currently President of the board for a local $6MM/ year nonprofit that provides public outreach services and after school programs to prevent at-risk youth from joining gangs. GAP also provides community cleanup and graffiti removal services.

PROFESSIONAL AFFILIATIONS

Engineer-in-Training, State of New York
Stationary Engineer, State of Ohio
American Institute of Chemical Engineers
AIChE Toledo Section "1991 Young Chemical Engineer of the Year" Award

Matt J. Baebler
Marathon Mandan & Dickinson Refineries
Phone: (801) 244-9245 | E-mail: MGBaebler@marathonpetroleum.com

Education and Training

BS Mechanical Engineering Missouri S&T 1979

MS Engineering Management Missouri S&T 1980

Research and Professional Experience

40 years of professional petrochemical experience. Current position is Marathon Project Director focusing on renewable fuels projects at 3 locations. Employment includes working for Amoco, BP, Tesoro/Andeavor, and now Marathon. Experiences include plant responsibilities of Project & Maintenance engineering, Engineering Supervision, Technical/Process Manager, and Operations Manager across 6 domestic refineries. Corporate assignments include Project Management, Capital Project Director of Refining, Economics & Scheduling, Director for Operations, and Director of Energy & Green House Gas, mostly domestically but a couple years internationally with base in London.

Publications

none

Patents, Copyrights, and software systems developed

none

Synergistic Activities

none

Andrew Dee
10403 Bridgewood St. Perrysburg, OH, 43551
Mobile: (985) 212-0417 — Office: (419) 429-5487 — ajdee@marathonpetroleum.com

Qualifications Summary

Offering 8 years of experience within the oil and gas industry value chain. Key roles include technical service refining experience, logistics and distribution planning, and renewable fuels project development.

Work Experience

Marathon Petroleum Company, Findlay Ohio

Asset Development Renewable Engineer — ***July 2021 – Present***

- Complete technoeconomic analysis for renewables projects
  - Integration within existing MPC refining assets and new greenfield project development
  - Includes screening of new or emerging technology applicability to MPC
- Participate in multiple cross-organizational strategy teams to develop a strategy and associated project opportunities for MPC
  - Hydrogen, sustainable aviation fuel, circular plastics
- Support multiple renewables facilities yearly capital budget projections
  - Economic analysis, transparent economic build-up, and project idea generation
- Developed and evaluated logistics projects in collaboration with MPLX Terminaling, Business Development, Refining, Scheduling, and Trading

Operations Analysis — ***October 2020 – July 2021***

- Provide analytical support for the East Clean Product Value Chain
  - Marketing and Exchange class of trade focused
    - Economic model evaluations to determine netbacks, return on investment, and net present value for brand, wholesale and exchange classes of trade
    - Monthly and quarterly benchmarking and value-add tracking/presenting to the East Division Management
- East Division Brand pricing specialist back-up

SD&P Engineer Long-Term Strategy and Analysis — ***November 2018 – October 2020***

- Operated and maintained the Logistics Supply Chain Model
  - Model results were analyzed for capital project economic benefits and the yearly transportation budget
- Developed and evaluated logistic projects in collaboration with MPLX Terminaling, Business Development, Refining, Scheduling, and Trading
  - Projects included, Mt. Airy build-up scope development, Detroit Butane Rail Rack Modifications, Canton Refinery ACE Project
- Initiated and maintained terminaling storage and throughput contract agreements with MPLX and other outside third-party customers

- Mt. Airy TSA, LBC Sunshine Naphtha Tankage, Midwest Terminals Rail storage and transload agreement

Marathon Petroleum Company, Garyville, LA

Technical Services Area Process Engineer ***May 2015 – November 2018***

- Provided technical process support for the area team
  - Area teams include:
    - Tank Farm: May 2015 – June 2017
    - HF Alky, Butamer, Propylene Splitter: June 2017 – November 2018
  - Assisted in troubleshooting and daily unit optimization
  - Collaborated with Operations, Maintenance, Product Control, Engineering as well as other TS Engineers (Unit and Controls Engineers)
- Design and implementation of process optimization projects
  - Chemical injection systems (asphalt, export diesel, finished product corrosion inhibitor)
  - Alkylate unit hydraulic debottlenecking

Product Control Intern ***May 2014 – August 2014***

- Updated unit utility usage in the PIMS model for units across the refinery
- Calculated new bonus values for gasoline blending in the PIMS model
- Retrieved and input process data into the U12/U212 Platformer submodels used in refinery economic PIMS model

Engineering & Analytical Services Intern ***May 2013 – August 2013***

- Provided Excel Toolkit and unit performance monitor support to the refineries' technical service engineers
- Updated, flagged, and troubleshot unit process unit material balances at the multiple refinery locations

Education

Bachelor of Science, Chemical Engineering May 2015
Trine University GPA: 3.8/4.0

TECHNICAL REVIEWERS' RATING SUMMARY

C-05-H

Demonstration and Scale-Up of a Low-Cost Long-Duration Energy Storage Technology for Lithium-Ion Batteries

Submitted By: Dakota Lithium Materials

Date of Application: November 2023

Request for $4,000,000 Grant

Total Project Costs $10,250,000

		Technical Reviewer			
		H1	**H2**	**H3**	
Rating Category	**Weighting Factor**	**Rating**	**Rating**	**Rating**	**Average Weighted Score**
1. Objectives	3	5	5	5	15
2. Impact	9	4	3	1	24
3. Methodology	9	5	4	4	39
4. Facilities	3	5	5	4	14
5. Budget	9	5	4	4	39
6. Partnerships	9	5	5	3	39
7. Awareness	3	4	4	3	11
8. Contribution	6	5	4	4	28
9. Project Management	6	5	5	5	30
10. Background	6	5	5	4	28
	315	303	276	222	267

OVERALL TECHNICALLY SOUND			
GOOD (IF > 214)	☒	☒	☒
FAIR (200-213)	☐	☐	☐
QUESTIONABLE (IF< 200)	☐	☐	☐

Mandatory Requirements	H1		H2		H3	
Diversification Delivery:	Yes	No	Yes	No	Yes	No
Project enhances the production of clean sustainable energy, to make the State a world leader in the production of clean sustainable energy, and/or to diversify and grow the State’s economy.	✓		✓		✓	
Commercialization or Development/Expansion:	Yes	No	Yes	No	Yes	No
Concept will lead to the **large-scale development and commercialization** of projects, processes, activities, and technologies that reduce environmental impacts and/or increase sustainability of energy production and delivery.	✓		✓		✓	

In State Requirement:	Yes	No	Yes	No	Yes	No
The funds distributed from the financial assistance are to be applied to support in-state activities and must have other sources of financial support.	✓		✓		✓	

1. **The objectives or goals of the proposed project with respect to clarity and consistency with Clean Sustainable Clean Energy Authority goals of projects, processes, activities, and technologies that reduce environmental impacts and increase sustainability of energy production and delivery are: 1 – very unclear; 2 – unclear; 3 – clear; 4 – very clear; or 5 – exceptionally clear.**

Reviewer H1 (Rating 5)
The application discusses the 10 years that has gone into research on processes and materials to reach the point of building a demonstration plant at reasonable scale to prove the ability to commercialize this process.

Reviewer H2 (Rating 5)
The proposed project would build-on existing success within the state to commercialize novel technology to expand battery materials manufacturing. If successful, the project would clearly advance the objectives and purpose of CSEA.

Reviewer H3 (Rating 5)
The goals proposed are well-defined and logical to achieve the desired outcome of planting LFP battery manufacturing in North Dakota. The goals also seem well-aligned with the CSEA mission.

2. **The objectives will make a difference in the near term to the state's economy: 1 – no impact; 2 – small impact; 3 – likely impact; 4 – most likely impact; or 5 – significant impact.**

Reviewer H1 (Rating 4)
The raw material for this process even at full commercial scale are relatively small compared to other industries, however, the magnitude of Li batteries projected to be needed in the future is likely to make this process very successful since it does not have a competitive production in the US currently. The uncertainty is that the announcement and cancellation of battery manufacturing facilities and been very active lately so settling that production vs. need scenario could cause some uncertainty in supply line such as this product.

Reviewer H2 (Rating 3)
Creation of 11 new jobs, other economic impacts contingent on successful commercialization and scale-up of technology.

Reviewer H3 (Rating 1)
The reviewer does not see a clear link to near-term impact to the state's economy. Quoting from the proposal: "There are no anticipated environmental and economic impacts associated with the

proposed work as all the R&D activities will occur on the UND campus in Grand Forks." And, according to DLM's financial projections, full-scale production is not anticipated until 2030.

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

Reviewer H1 (Rating 4)
The raw material for this process even at full commercial scale are relatively small compared to other industries, however, the magnitude of Li batteries projected to be needed in the future is likely to make this process very successful since it does not have a competitive production in the US currently. The uncertainty is that the announcement and cancellation of battery manufacturing facilities and been very active lately so settling that production vs. need scenario could cause some uncertainty in supply line such as this product.

Reviewer H2 (Rating 4)
Methodology is clearly explained, including robust description of tasks.

Reviewer H3 (Rating 4)
The proposed pathway to development of the dry process for full-scale manufacture is well-described and logical. It is likely to result in technical success.

4. The facilities and equipment available and to be purchased for the proposed pilot or commercialization strategy is: 1 – very inadequate; 2 – inadequate; 3 – adequate; 4 – notably good; or 5 – exceptionally good.

Reviewer H1 (Rating 5)
The facilities at EERC have proven over and over the ability to add processes like this and carry the work thru to completion. The list of equipment required was thoughtfully prepared.

Reviewer H2 (Rating 5)
Application includes a detailed list of existing equipment, explanation of purpose, and list of new equipment and justification.

Reviewer H3 (Rating 4)
It is clear that much thought has been put into selection of appropriate equipment for purchase. Additionally, the EERC's analytical facilities are likely fit for this purpose.

5. The proposed budget is comprehensive and sufficient relative to the outlined work and the timetable: 1 – not sufficient; 2 – possibly sufficient; 3 – likely sufficient; 4 – most likely sufficient; or 5 – certainly sufficient.

Reviewer H1 (Rating 4)
The budget and schedule provided seem reasonable for the effort defined in the proposal.

Reviewer H2 (Rating 4)
Budget is detailed and allows for flexibility based on contract timing.

Reviewer H3 (Rating 4)

Sufficient budget justification was presented to convince the reviewer that this project has been thoroughly contemplated, and therefore its budget is likely sufficient, barring unforeseen hurdles.

6. **The appropriate strategic partnerships are in place for short and long term plans to be successful: 1 – very limited; 2 – limited; 3 – adequate; 4 – better than average; or 5 – exceptional.**

Reviewer H1 (Rating 5)
The parties listed directly as participants and the letters of support suggest success.

Reviewer H2 (Rating 5)
Convergence of state, federal, and private partnerships that build on existing long-term relationships.

Reviewer H3 (Rating 3)
Certainly, the R&D relationships are in place. With acknowledged limits in the reviewer's understanding of key commercial relationships, the proposal narrative seems convincing. However, the reviewer is cognizant of the rapidly changing dynamics in the lithium battery sector. It is hard to predict whether the assessment of the adequacy of today's commercial partnerships will hold for the 5-7 years projected to reach full production capacity.

7. **The likelihood that the project approach (time & budget) will achieve its technical and market goals is: 1 – not achievable; 2 – possibly achievable; 3 – likely achievable; 4 – most likely achievable; or 5 – certainly achievable.**

Reviewer H1 (Rating 5)
The work scope and the time frame in the schedule seem achievable to demonstrate the commercial scale up of this technology.

Reviewer H2 (Rating 4)
Assuming minimal lead-time and availability of proposed equipment, project will take advantage of existing facilities. Build risk appears minimal, allowing for prompt development and completion of proof of concept tasks and market analysis.

Reviewer H3 (Rating 3)
The reviewer is convinced that the proposed R&D approach will achieve the stated technical goals within three years. The question is, will the stated market goals maintain relevancy in such a rapidly changing lithium battery sector. While DLM has been working in secrecy for years, avoiding investor input, there are likely many other players working in equal secrecy, changing the fundamentals of this market sector.

8. **The scientific and/or technical contribution of the proposed work to specifically address Clean Sustainable Energy Authority goals of impacting technology used in North Dakota's energy industries will likely be: 1 – extremely small; 2 – small; 3 – significant; 4 – very significant; or 5 – extremely significant.**

Reviewer H1 (Rating 5)

The three primary materials utilized for this product provide opportunities for supply chain within the state of North Dakota and the process is demonstration of advances in technology that North Dakota is noted for.

Reviewer H2 (Rating 5)
Successful commercialization of technology would significantly advance energy storage technology by increasing efficiency and reducing costs, creating new opportunities for North Dakota to lead in this space.

Reviewer H3 (Rating 4)
Whether commercial success goals are attained or not attained, this work will certainly contribute substantially to the CSEA goals of building knowledge base and capacity for clean, sustainable energy industry growth in North Dakota. This knowledge base will likely result in additional work leading to application of advanced technology to North Dakota's energy industries.

9. The project management plan, including budgeting projections, partner connections and well-defined milestone chart is: 1 – very inadequate; 2 – inadequate; 3 – adequate; 4 – notably good; or 5 – exceptionally good.

Reviewer H1 (Rating 4)
The management plan, budgeting and partner connections as laid out in the application seem realistic and achievable.

Reviewer H2 (Rating 5)
The project management plan is highly-detailed and leverages existing partnerships and facilities. Milestones, timing, objectives, and tasks are clear.

Reviewer H3 (Rating 5)
The reviewer has reviewed many applications for NDIC funding over the past 10 years. Few applications have presented as comprehensive a project management plan as the current proposal. Great detail was presented regarding intentions for partnerships, impact of those intentions on commercial rollout, and insight into equipment and procedures needed to achieve technical success in R&D activities.

10. The background and experience of the project principals with regards to technical qualifications and competence is: 1 – very limited; 2 – limited; 3 – adequate; 4 – better than average; or 5 – exceptional.

Reviewer H1 (Rating 5)
The project principals are very well suited for this project. The participants from EERC are well aware and have been personally involved in other research that the State of North Dakota has funded and will know how to utilize that knowledge appropriately for this project.

Reviewer H2 (Rating 5)
Project partnership represents several decades of experience pertaining to project scope as well as demonstrated business development experience.

Reviewer H3 (Rating 4)
The project principles are well-versed in the technological methodology required to achieve success. History of the principals indicates a high likelihood of success.

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 the project is technically sound.

Reviewer H1
This project has potential to lead to commercial production of a superior and very cost competitive product that will contribute to the need for Li batteries in multiple aspect of our energy future.

Reviewer H2
The proposed project seeks to jumpstart a novel technology in a relatively short time period. However, the project is sponsored by an established organization with a demonstrated track record of success in this sector with strong partnerships and support. Based on information provided by the applicant, the project proponents are well positioned to leverage existing resources, facilities, and knowledgebase to quickly move to commercialization upon successful proof of concept. Would recommend that the project is technically sound.

Reviewer H3
This seems to be exciting, relevant, knowledge-base-expanding work in North Dakota. The project seems technically sound and worthy of state investment. There is a level of concern about the ability of DLM to manage the project from Seattle. DLM will need to maintain a high degree of day-to-day involvement in activities based at the EERC.

CLEAN REPUBLIC SODO LLC

DAKOTA LITHIUM

November 1, 2023

North Dakota Industrial Commission
ATTN: Clean Sustainable Energy Authority
State Capitol – 14th Floor
600 East Boulevard Avenue
Bismarck, ND 58505

Dear Clean Sustainable Energy Program:

Subject: Proposal No. 2024-0055 Entitled "Demonstration and Scale-Up of a Low-Cost Long-Duration Energy Storage Technology for Lithium-Ion Batteries"

Clean Republic SODO LLC (Clean Republic) doing business as Dakota Lithium Materials (DLM) is pleased to submit the subject proposal to the Clean Sustainable Energy Authority. DLM is committed to completing the project as described in the proposal if the Commission makes the requested grant.

If you have any questions, please contact me by telephone at (218) 791-3746 or by email at hou@dakotalithium.com.

Sincerely,

DocuSigned by:
Yong Hou
455745E54FF245E...

Yong Hou
Director of Research and Development

Approved by:

DocuSigned by:
Andrew Jay
1DB8F066FE6145C...

Andrew Jay/CEO
Dakota Lithium Materials

YH/br

Attachments

Clean Sustainable Energy Authority
North Dakota Industrial Commission

Application

Project Title: Demonstration and Scale-Up of a Low-Cost Long-Duration Energy Storage Technology for Lithium-Ion Batteries

Applicant: Dakota Lithium Materials

Date of Application: November 1, 2023

Amount of Request
Grant: $4,000,000
Loan: $0

Total Amount of Proposed Project: $10,250,000

Duration of Project: 3 years

Point of Contact (POC): Dr. Yong Hou

POC Telephone: (218) 791-3746

POC Email: hou@dakotalithium.com

POC Address: 5515 University Avenue
Grand Forks, ND 58203

TABLE OF CONTENTS

ABSTRACT

Objective: The primary objective of the project is to construct a 1000 tons/year production line facility at the University of North Dakota (UND) in Grand Forks to demonstrate and scale-up a novel dry-process technology based on resonant acoustic mixing (RAM) for large-scale manufacture of lithium iron phosphate (LFP) cathode materials suitable for use in lithium-ion battery (LIB) cell manufacturing. This objective is in furtherance of the Clean Sustainable Energy Authority's (CSEA's) mission to support production of large-scale clean sustainable energy technologies in North Dakota. The dry-process technology is easily scalable, highly sustainable, energy-efficient, cost-competitive, and has the potential to revolutionize the manufacturing process for LIB materials to mitigate U.S. domestic supply chain challenges for battery materials that are the core piece of state-of-the-art (SOTA) clean energy technologies. This project will be jointly conducted by Clean Republic SODO LLC, doing business as (DBA) Dakota Lithium Materials (DLM), and the Energy & Environmental Research Center (EERC) to leverage the synergistic capabilities of the EERC and DLM to rapidly advance the scale-up and commercialization of the dry-process technology for manufacturing LFP materials in North Dakota. If successfully commercialized, this technology not only has the potential to be a ground-breaking technology for large-scale LIB cathode materials manufacture in North Dakota but could also meet the U.S. Department of Energy's (DOE's) goal to develop long-duration energy storage (LDES) systems capable of 10+ hr at $0.05/kWh levelized cost of storage (LCOS).

Expected Results: The primary result of this project would be a successful demonstration of a production line based on the proposed dry-process technology, which is expected to deliver low costs and environmental sustainability to potentially revolutionize the manufacturing process for LIB electrode materials and facilitate achievement of DOE's LDES shot goal of 90% reduction in storage cost by 2030, with North Dakota serving as the base from which such a technology is propagated. Additional anticipated beneficial outcomes of the proposed dry-process technology include up to 99% reduction in water use, up to 51% reduction in electricity use, up to 47% reduction in labor and/or operational costs, a safer product, up to 51% reduction in CO_2 emissions, and about 15%–23% reduction in overall product market price per ton. These savings are calculated relative to current SOTA technologies based on wet-processing methods. Accomplishing these results also greatly advances the CSEA's mission to develop and deploy large-scale technologies that reduce environmental impacts and increase sustainability of energy production and delivery in North Dakota.

Duration: The anticipated project duration is 3 years or 36 months.

Total Project Cost: The proposed total cost is $10,250,000, with $4,000,000 from the North Dakota Industrial Commission (NDIC) CSEA program, $5,000,000 from DOE, and $1,250,000 from DLM.

Participants: The project includes DLM, EERC, DOE, and NDIC's CSEA program.

PROJECT DESCRIPTION

Objectives: The primary objective of the project is to construct a 1000 tons/year production line facility at the University of North Dakota (UND) in Grand Forks to demonstrate and scale-up a novel dry-process technology based on resonant acoustic mixing (RAM) for large-scale manufacture of lithium iron phosphate (LFP) cathode materials suitable for use in lithium-ion battery (LIB) cell manufacturing. This objective is in furtherance of the Clean Sustainable Energy Authority's (CSEA's) mission to support production of large-scale clean sustainable energy technologies in North Dakota. The dry-process technology is easily scalable, highly sustainable, energy-efficient, cost-competitive, and has the potential to revolutionize the manufacturing process for LIB materials to mitigate U.S. domestic supply chain challenges for battery materials that are the core piece of state-of-the-art (SOTA) clean energy technologies. This project will be jointly conducted by Clean Republic SODO LLC, doing business as (DBA) Dakota Lithium Materials (DLM), and the Energy & Environmental Research Center (EERC) to leverage the synergistic capabilities of the EERC and DLM to rapidly advance the scale-up and commercialization of the dry-process technology for manufacturing LFP materials in North Dakota. If successfully commercialized, this technology not only has the potential to be a ground-breaking technology for large-scale LIB cathode materials manufacture in North Dakota but could also meet the U.S. Department of Energy's (DOE's) goal to develop long-duration energy storage (LDES) systems capable of 10+ hr at $0.05/kWh levelized cost of storage (LCOS).

Methodology: The proposed project involves fabrication and operation of a production line facility to demonstrate and scale-up a novel dry-process technology for large-scale manufacture of LFP cathode materials. The methodology to accomplish this objective has been divided into separate task structures with specific activities described below.

Task 1.0 – Project Management, Planning, and Reporting [M1–M36]: The objective of this task is to conduct proper management and coordination of project activities and timely reporting to enable successful implementation and completion of proposed project goals and objectives. DLM will work closely with the EERC to oversee most of the reporting and planning activities. The EERC will also assist DLM with overall project management. Project management activities will include arranging a kickoff meeting, scheduling monthly project updates with the CSEA project manager, coordinating planning meetings and communications with project team personnel, financial management, data management, management of supplies and/or equipment, and risk management as well as fulfilling the reporting requirements set forth by the CSEA program.

Task 2.0 – Procurement of Equipment and System Design [M1–M6]
The objective of Task 2.0 is to procure additional equipment items and fabrication materials to support the project. Specific items to purchase will include accessory equipment for process control, data monitoring and acquisition, and fabrication pieces and fittings. Engineering design activities will include pipe and identification diagrams (P&IDs), process flow diagrams (PFDs), and overall system drawings of the production line. The expected outcomes of this task will include detailed system drawings and completed orders for various equipment, accessory parts, and fittings.

Task 3.0 – Fabrication of 1000 tons/year Production Line Facility [M7–M12]
The primary objective of Task 3.0 is to assemble and build a production line facility with 1000 tons/year capacity. The assembly line will include a dry-mixing unit, calcination unit, carbon coating unit, grinding/classification unit, and packaging unit as well as associated accessories for process control, monitoring, and data acquisition. The individual units will be integrated so that they operate in a

semicontinuous mode for a complete production line capable of producing about 1000 tons/year of LFP material. The key result of this task will be a completely fabricated production line facility with power turned on and ready for shakedown testing.

Task 4.0 – Shakedown Testing [M13–M16]
The objective of Task 4.0 includes shakedown testing of the production line system for the ability to successfully produce LFP cathode materials. Shakedown testing on the integrated system shall be conducted to verify proper operation and functionality of the different units of the assembly lines and to demonstrate system ability to operate in a semicontinuous mode. Various system controls, data acquisition, and process monitoring equipment shall be tested. During shakedown testing, the LFP raw material subsamples will be preprocessed by crushing to a suitable size range before feeding to the system. The results from this task will provide data to demonstrate that the production line facility can operate well in a semicontinuous mode.

Task 5.0 – Process Optimization Testing [M17–M24]
Additional testing will be performed in Task 5.0 to focus primarily on optimization of process parameters such as temperatures, pressure, flowrates, process gas and environment variables, system stability, etc. During this testing, raw material input streams, product output stream, and product quality will be optimized for steady production of up to 1000 tons/year LFP cathode materials. The production line will be operated for at least 7 months to fine-tune process parameters and product quality and optimize the system to maximize energy savings, CO_2 emission reduction, and overall product cost savings. The raw materials and product will be evaluated by a suitable combination of analytical techniques available at the EERC such as scanning electron microscopy (SEM), x-ray diffraction (XRD), x-ray fluorescence (XRF) spectroscopy, Fourier transform infrared (FTIR) spectroscopy, Raman spectroscopy, and other methods that may be deemed necessary during project implementation. Additional equipment will be purchased to augment the existing analytical capabilities at the EERC to focus on specific properties of the LFP manufacturing process. The primary outcome from this task will include processing data to demonstrate operability of the facility for manufacturing LFP by the new dry-process technology.

Task 6.0 – Product Evaluation and Marketing Plan [M25–M36]
Task 6.0 will focus primarily on evaluation of the LFP materials for their electrochemical performance attributes through testing of various LIB test articles from 2032 half-coin cells up to and including full cell configurations such as cylindrical 18650, pouch, or prismatic cells to optimize the full utility of the produced LFP materials in large-scale LIB cell manufacturing. Standard cell performance parameters, such as initial coulombic efficiency (ICE), galvanostatic charge–discharge profiles with specific charge capacities, etc., will be obtained to demonstrate electrochemical performance and suitability for use in LIB cell manufacture at large-scale. Additionally, an initial marketing plan will be developed to engage potential customers and establish a market for the produced LFP materials. Specific emphasis will be placed on applications in energy storage such as in electric grid systems and micro-electric grids for rural areas and isolated point consumption to include military bases. Additional markets in heavy-duty transportation vehicles where battery weight and size may be less consequential will be explored, especially given that the proposed batteries are expected to have LDES capability of up to 10+ hours at minimal cost of about $0.05/kWh or less LCOS.

Anticipated Results: The primary result of this project would be a successful demonstration of a production line based on the proposed dry-process technology, which is expected to deliver ultra-low costs and environmental sustainability to potentially revolutionize the manufacturing process for LIB electrode materials and facilitate achievement of DOE's LDES shot goal of 90% reduction in storage cost by 2030, with North Dakota serving as the base from which such a technology is propagated. Additional anticipated beneficial outcomes of the proposed dry-process technology include up to 99% reduction in water use, up to 51% reduction in electricity use, up to 47% reduction in labor and/or operational costs, a safer product, up to 51% reduction in CO_2 emissions, and about 15%–23% reduction in overall product market price per ton. These savings are calculated relative to current SOTA technologies based on wet-processing methods. Accomplishing these results also greatly advances the CSEA's mission to develop and deploy large-scale technologies that reduce environmental impacts and increase sustainability of energy production and delivery in North Dakota.

Facilities: This project will be hosted at UND and will have access to the available exceptional laboratory facilities, analytical capabilities, and demonstration facilities at the EERC. The EERC currently occupies a research complex consisting of 254,000 square feet of laboratories, fabrication facilities, technology demonstration facilities, a specialized machine shop, and offices. It houses eight analytical laboratories dedicated to research on coal combustion and utilization; coal by-product utilization; water resource characterization; conventional/unconventional petroleum resources; alternative fuels; environmental chemistry; and carbon capture, utilization, and storage.

DLM has an existing office complex in Seattle, Washington, where management of the current business activities is conducted, but also maintains a small factory in Grand Forks where battery pack manufacture takes place. Previous research and development (R&D) activities that have been conducted in collaboration with UND Institute for Energy Studies (IES) using its laboratory space have recently been relocated to the EERC facilities to provide better opportunities for rapid scale-up and commercialization. The production line facility being proposed in this project will serve as a dedicated R&D laboratory and demonstration facility for this project and for future developments to speed up commercialization of this technology. Existing equipment at DLM that will be used for the proposed project is listed in Table1.

Table 1. Existing DLM-Owned Equipment for the Proposed Project

Equipment	Quantity	Purpose/Use
Resodyn Mixer, Lab RAM-II	1	Material mixing and grinding
MSK-AFA-L Coater (MTI Corporation [MTI])	1	Coin-cell fabrication
YLJ-24TS Calendaring (MTI)	1	Coin-cell fabrication
MSK- 180SC Disk Cutter (MTI)	1	Coin-cell fabrication
MSK-160E Cell Sealer (MTI)	1	Coin-cell fabrication
MSK-110D Cell Breaker (MTI)	1	Coin-cell fabrication
16-200-412 Glove Box (Labconco)	1	Coin-cell fabrication
Coin-Cell Tester	20	Electrochemical performance testing
SP88850100 Stir Plate (Thermo Scientific)	1	Material synthesis
2-215-422 Vortex Mixer (Fisher)	1	Material synthesis
15-341-100 Homogenizer (Omni International)	1	Material synthesis
14-388-100 Pipette (Fisher Brand)	1	Material synthesis
01-919-151 Scale (Mettler Toledo)	1	Material synthesis

Proposed New Equipment/Facilities: To successfully build and demonstrate the proposed production line facility for LFP cathode powder manufacturing, additional equipment items beyond fabrication materials and fittings have been identified that are needed to support the effort. These items are listed in Table 2. The demonstration space will need to be retrofitted to accommodate the production line equipment and the necessary utilities. Process gas lines for nitrogen and compressed air will be plumbed and additional power transformers and connections will be installed for the project. Dust control and air circulation systems will be added.

Table 2. Proposed New Equipment and Justification

Equipment	Quantity	Justification
MSKAFAIIH B110 Coaster (MTI)	1	Enables precise electrode slurry casting onto the current collector.
MSK180 Die Cutter (MTI)	1	Provides accurate shaping of the electrode post-coating.
MSK111A-E Stacking Machine	1	Streamlines the integration of the anode, cathode, and separator in cell preparation.
MSK120 Pouch Cell Case/Cup Forming Machine	1	Facilitates the creation of laminated aluminum cell cases specifically for pouch cells.
MSK115III11 Hot Sealer	1	Ensures a secure seal on the laminated aluminum case after electrode insertion and electrolyte injection.
MSK E2300A Calendaring (MTI)	1	Achieves higher compact density by pressing the electrode.
MSK540 Slitting Machine	1	Allows precise slitting of both the electrode and the separator.
MSK30000w Welder	1	Facilitates the welding of nickel and aluminum tabs onto the anode and cathode respectively.
Interface 1010E Potentiostat	1	Empowers detailed electrochemical analyses, such as cyclic voltammetry and impedance spectroscopy, for various cell types.
Criterion Benchtop Temperature Chambers	1	Assesses cell performance under varying temperature conditions.
Full Cell Tester	5	Enables extensive testing of full cells under high current and voltage conditions.
Resodyn Mixer, RAM 5		Optimizes the mixing and milling process for cathode active material precursors.
Synthesis/Coating Furnace	1	Supports calcination of active material precursors and facilitates chemical vapor deposition of the active materials.
Jet Mill, LNJ-36A	1	Streamlines the milling and classification of the active material product.
Glove Box, 16-200-412	1	Ensures a controlled environment for cell assembly and electrolyte injection, minimizing contamination risks.

Resources: DLM will be the lead organization for this project and will work closely with the EERC to ensure the overall success of the proposed objectives. With assistance from the EERC, DLM will be responsible for effective communication with all project partners and sponsors to ensure that the project is carried out within budget, schedule, and scope. DLM and the EERC will collaboratively work to implement the technical aspects of the proposed project. DLM will oversee the whole project as the prime applicant, with about 91% commitment toward the project, while the EERC will serve as a collaborator and subrecipient with about 9% commitment to the project. During the development of this proposal, DLM has led the effort to seek and secure the necessary cost share, while the EERC led the effort to write the proposal with input from DLM personnel. During project implementation, DLM will be responsible for the overall design of the production line facility, with assistance from the EERC as needed. DLM will also lead the efforts to perform the technological process optimization and LFP cathode material manufacture. The EERC will provide R&D support during the implementation of the proposed scope of work and for future developments and scale up if the project is awarded. The EERC will provide the necessary oversight in process and product quality assurance and control via analytical characterization and testing. The EERC and DLM have also mutually agreed to work closely on overall project management and integration of the various components of the project, including any laboratory work and setting up of the production line facility. The EERC will also assist with reporting and engineering, procurement, and construction (EPC) to facilitate overall project success and fulfillment of the CSEA program objectives.

Techniques To Be Used, Their Availability and Capability: This project involves assembly and fabrication of a LFP cathode material production line as well as analytical characterization and testing of electrochemical performance of the produced materials. The EERC has several trained and certified professional engineers to work in collaboration with DLM staff for design, fabrication, and assembly of the components needed to build and test a complete production line facility.

The EERC currently has advanced analytical equipment and analysis techniques that are suitable and available for the proposed activities. A summary of key analytical techniques/equipment available for this project includes field emission SEM (FESEM), XRD, XRF spectroscopy, FTIR spectroscopy, Raman spectrometer, proximate/ultimate/CHN analyzers, thermogravimetric analyzer (TGA), surface area analyzer, and a controlled atmosphere glovebox. DLM has an existing electrochemical testing workstation, a 40-slot battery-testing system for battery test articles of various sizes from small CR2032 half coin-type cells to full-size 18650 cylindrical cells and for making battery packs up to 48 V as needed.

Environmental and Economic Impacts while Project is Underway: There are no anticipated environmental and economic impacts associated with the proposed work as all the R&D activities will occur on the UND campus in Grand Forks. The raw materials and finished products for the process such as lithium carbonate (Li_2CO_3), iron (II) phosphate ($Fe_3(PO_4)_2$), carbon coating additive, and lithium iron phosphate ($LiFePO_4$) are all environmentally benign chemicals, which is why the LFP chemistry for LIBs is considered the safest in the industry. However, the EERC has dedicated environmental, health, and safety (EH&S) personnel that oversee all R&D activities to ensure that any potentially environmentally harmful or toxic species are properly handled and disposed of according to local, state, and federal regulations.

Ultimate Technological and Economic Impacts: Preliminary estimates show that a successful deployment of the proposed dry-process technology is expected to deliver low costs and environmental sustainability to potentially revolutionize the manufacturing process for LIB technology materials and facilitate achievement of 90% reduction in storage cost by 2030, as stipulated in the DOE's LDES shot. Anticipated specific beneficial outcomes of the proposed dry-process include up to 99% reduction in water use, up to 51% reduction in power consumption, a safer product, up to 51% reduction in CO_2 emissions, up to 47% reduction in labor and/or operational costs, and about 15%–23% reduction in overall product market price per ton. These advantages suggest that a successful commercial deployment of the proposed technology could lead to substantial economic benefits to Americans desiring to transition to clean and sustainable energy options for electric vehicles (EVs) and energy storage for electric grid applications. Thus, the proposed technology holds great promise as a key technological solution for sustainable, cost-effective, large-scale manufacture of LFP materials in North Dakota for the LIB industry to mitigate U.S. domestic supply chain challenges.

Why the Project Is Needed: This project is needed to begin building the energy storage capacity to support the clean energy transition for North Dakota, where recovered energy from wind turbines and solar collectors can be stored in batteries for sustained power supply to local micro-electric grids and/or national electric grid systems where possible. The LIB is currently a critical connecting tissue for the clean energy transition grand challenge from fossil fuel-based to renewable energy options such as solar and wind as well as playing a critical role in technologies that are increasingly revolutionizing the way of life via emerging technologies for cell phones, next-generation medical devices, and the electronics application industry in general. Low-cost, high-capacity, and long-duration storage solutions could have been helpful for preventing or limiting the catastrophic impacts of the Electric Reliability Council of Texas (ERCOT) grid system failure in 2021 by providing a turnkey backup storage safeguard. Despite these dire needs and impending demand for LIBs, the U.S. supply chain has lagged that of other countries such China, thus posing a national security risk as LIBs and their components are manufactured abroad in potentially adversarial nations. Thus, development of the proposed technology, which is sustainable, scalable, and cost-competitive, is needed to provide an efficient large-scale manufacturing process for LIB materials to mitigate U.S. domestic supply chain challenges for battery materials needed for clean energy transition. Funding from the CSEA will provide the opportunity for this potentially ground-breaking technology to be developed and built in North Dakota and potentially place the state as a world leader in the production of clean, sustainable LIB energy technology, which also helps to diversify and grow the state’s economy.

STANDARDS OF SUCCESS

The proposed project is a demonstration of a dry-process technology that is expected to perform better than the conventional wet-processing approaches. Preliminary estimates based on comparing the SOTA wet-processing method and the proposed dry-process method show that the following metrics can be used to measure the success of the technology:

- ***Emissions Reduction***: Implementation of this technology is anticipated to cut CO_2 emissions by up to 51% and wastewater discharge by up to 99%.

- ***Reduced Environmental Impact***: There will be little to no waste discharge and raw and product materials and chemicals are environmentally benign.

- ***Increased Energy Sustainability and Efficiency***: The technology is expected to be highly sustainable and energy efficient, with up to 51% savings in electricity consumption and no hazardous waste streams.

- ***Value to North Dakota***: If the proposed production line demonstration is successful, it will place North Dakota on top of the world for a potentially revolutionary technology for large-scale manufacture of LIB cathode materials when they are commercialized in the next step of their development. A new LIB plant in North Dakota would help boost the economy, create good-paying jobs, and help to diversify North Dakota’s energy portfolio and build capacity for storage and use of renewable energy such as wind and solar generated in North Dakota.

- ***Explanation of How the Public and Private Sector Will Make Use of the Project's Results, and When and in What Way:*** This project will help create public and private sector awareness about this potentially game-changing technology for manufacturing LIB cathode materials. When commercialized, increased production of LIBs will lead to cheaper LIB-based devices because of cheaper LIB costs, which will be a benefit to public and private sectors.

- ***Potential Commercialization of the Project's Results***: It is expected that a successful demonstration of the dry-process method at full scale would place the technology on a fast-track to full commercial deployment in the next 5–10 years.

- ***How the Project Will Enhance the Research, Development and Technologies that Reduce Environmental Impacts and Increase Sustainability of Energy Production and Delivery of North Dakota's Energy Resources***: If successful, the dry-process technology would alleviate supply chain issues for LIB cathode materials and provide more opportunities to manufacture LIB batteries that are central to all clean and sustainable energy technologies with reduced environmental impacts.

- ***How It Will Preserve Existing Jobs and Create New Ones***: This project will create about 11 new jobs, including one salesperson, one warehouse attendant, one business manager, five operators, two engineers, and one technician.

- ***How It Will Otherwise Satisfy the Purposes Established in the Mission of the Program***: The proposed pilot-scale project satisfies the CSEA's mission to advance development of large-scale technologies to produce clean sustainable energy and delivery in North Dakota.

BACKGROUND/QUALIFICIATIONS

Background: DLM began development of LFP cathode materials for LIBs in 2008. During the initial stages of R&D, it was observed that the commercial LFP materials purchased from China had inconsistent compositions and sometimes possessed unacceptable levels of impurities and a specific capacity that was lower than 120 mAh/g. This sparked initial investigations into these issues, and a new synthetic procedure was developed that combines the simplicity of solid-phase and the homogeneity of liquid-phase reaction routes. To improve particle stability and electrochemical performance, North Dakota lignite-derived humic acid was used as the carbon source for coating the LFP particles. Recent and continuing development includes the use of food-grade agricultural products as a source of carbon used to coat the LFP particles after synthesis.

Based on literature review of $LiFePO_4$ performance attributes, reaching high-performance technical targets such as high energy density, cycling and calendar life, rate capacity, and low production cost requires developers and manufacturers to focus on controlling particle size and optimizing a synthesis route and carbon-coating techniques to improve conductivity. Accordingly, DLM engaged in a collaborative research effort with UND to develop its own LFP cathode material with improved performance attributes. Between 2015 and 2018, much of the development work sought to improve two key challenges: high purity and batch-to-batch quality consistency. The results were very promising, and the main technical objectives were achieved, with greater than 99% purity of the LFP powder, specific capacity higher than 120 mAh/g, and the relative standard deviation of other physical and electrochemical properties less than 15% and 5%, respectively.

With additional financial support from the North Dakota Department of Commerce, a scalable, environmentally benign, reproducible, lower-cost, and higher-performance process was developed to achieve a target specific capacity of 120–130 mAh/g, which is comparable to or better than that of commercial LFP materials. Attention then turned to improvement of the electrochemical performance, with specific emphasis on energy density, cycling life, rate capacity, and other physical properties. The results demonstrated good-quality LFP powders with crystalline purity of 99.5%, combined impurities (Ni, Cu, Zn, Mn, Ca, Mg, Cd, Na, and K) of about 0.07%–0.2%, carbon content of ~2%–5%, particle-size distribution of 363–474 nm, and first-cycle discharge capacity at a 0.1C cycling rate of ~140–150 mAh/g after 1000 cycles. The discharge capacity remained at 120–130 mAh/g, with first-cycle irreversible capacity loss of about 4%–8%.

Despite the progress made in previous efforts based on wet-processing methodology, there is a continuous desire to improve on utilities consumption, environmental sustainability, and cost, especially considering the new DOE LDES shot goal of 90% reduction in LFP cost by 2030 and to achieve a LCOS of $0.05/kWh for LDES systems with capability of 10+ hr. Thus, recent investigations to further cut costs, improve sustainability, and to achieve a more robust large-scale manufacturing process for LFP cathode materials let to the development of a dry-mixing process (Figure 1) based on RAM principles[1]. Compared to conventional state-of-the-art (SOTA) approaches that are based on wet mixing, a dry-mixing method was applied to mix LFP precursors in dry, solid form to achieve a more homogeneous mixture. RAM mixing involves rapid vibratory movements at about 60 Hz and up to 100× the acceleration due to gravity, which causes random collisions of dry LFP precursor particles, resulting in particle-size

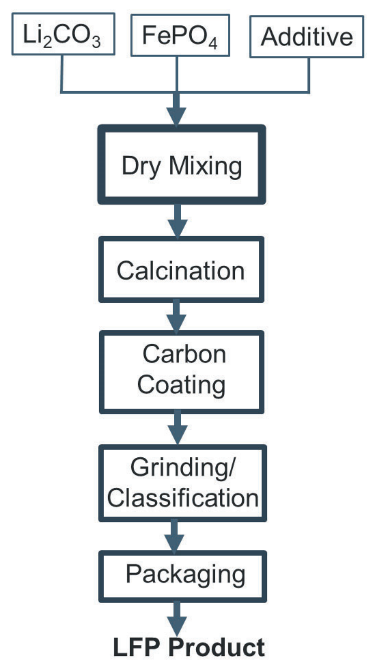

Figure 1. Simplified block flow diagram of the proposed LFP process.

[1] Resodyn Acoustic Mixers. Powders and Solids. https://resodynmixers.com/applications/powders/ (accessed January 30, 2023).

reduction, shaping, mixing, and homogeneous coating in a very short duration, on the order of a few minutes. The relatively short duration of such a scalable mixing process can greatly reduce production times for manufacture of LFP materials at scale.

In the industry, the LFP charge capacity density is often considered to be about 120 mAh/g. Results of samples prepared by the dry-process method have achieved a charge capacity density of 140 mAh/g after 250 cycles in half coin cells with remarkable stability (Figure 2). The results in Figure 2 further demonstrate that there is no loss of quality and performance between materials made by the SOTA wet process and new dry-process technology. However, cost estimates based on the dry-process baseline LFP material (Table 3) show \$115/kWh and 5840 cycles, which equates to about \$0.02/kWh LCOS. Thus, it is anticipated that optimization and plant scale-up of the dry-process technology would potentially reach DOE's storage innovation 2030 target of \$0.05/kWh LCOS for LDES systems capable of 10+ hr, even when costs associated with other battery assembly parameters are accounted for. These preliminary results are the technological basis for this project seeking to scale-up the process. Table 3 shows the technology baseline metrics, SOTA technology, and anticipated reduction/increase in specific parameters between the proposed process and SOTA technology.

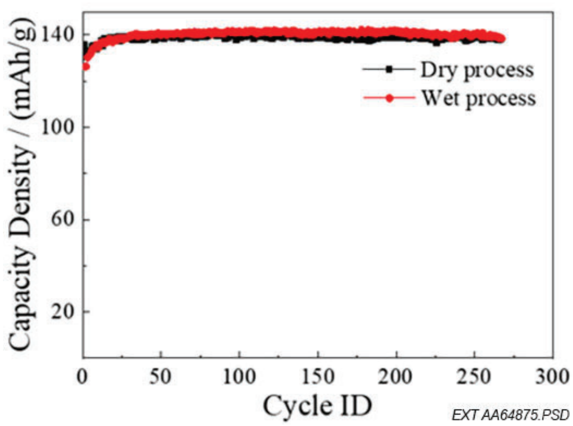

Figure 2. Electrochemical performance of LFP at C/3.

Table 3. Proposed Technology Performance Target Metrics Levels

Property	Proposed Technology	SOTA Technology	Reduction/ Increase
Cost, \$/kWh	115	126	-9%
LFP Product Cost, \$/ton	8460	10,000	-15.4%
LCOS, \$/kWh	0.020	0.035	-43%
Cycle Life, cycles	5840	3650	+60%
Energy Consumption*, MWh/yr	286.2	5,806.5	-51%
CO_2 Emissions*, Mtons/yr	202	4096	-51%
Water Use*, tons/yr	12	1302	-99%
Labor/Operation Time**, hrs	19	36	-47%
Safety (low, medium, high)	High	Medium	N/A

* Calculation is based on 1000 metric tons LFP production per year.

** Calculation is based on one batch LFP cathode material production.

DLM Experience and Qualifications: DLM was founded in 2008 in Grand Forks, North Dakota. DLM (DakotaLithium.com) is the leading consumer lithium battery brand in the United States and Canada, with over 100,000 customers annually. In addition, DLM is a leading manufacturer of lithium batteries for EVs, the maritime industry, and the agricultural industry.

As an expert in lithium battery technology, DLM established a research center at UND in 2012 for the purpose of developing LFP cathode materials. Investments by DLM in R&D activities at UND focused on developing a cost-competitive cathode powder using U.S.-sourced inputs. Graphene was replaced with a low-cost and higher-performance carbon structure, particle coatings were replaced with a low-cost and higher-performance by-product from agricultural food processing, and multiple steps in the production process were consolidated, allowing for a product with superior performance at a lower manufacturing cost.

DLM has deep commercial relationships in the lithium battery cell-manufacturing industry. As a customer, DLM purchases millions of $LiFePO_4$ cells a year that are used to manufacture lithium battery packs (finished batteries). DLM has leveraged its technology and commercial relationships to manufacture a cathode material that is made in America, with manufacturing inputs from U.S. sources, including lithium and carbon coating materials from North Dakota. Cathode powder-manufacturing output has been sold to U.S. cell suppliers that DLM currently sources cells from. The unique relationship where DLM both sells $LiFePO_4$ cathode material to U.S. cell manufacturers and buys $LiFePO_4$ cells from the same cell manufacturers ensures this project's commercial success and stability. DLM's 15 years of combined experience and successes will be utilized to implement the proposed project to achieve success and fulfill CSEA objectives.

EERC Experience and Qualifications: The EERC has worked with more than 1300 clients in all 50 states and 53 countries around the world, with 76% of contracts with private industry. The EERC has a long and successful history of working with NDIC and private industry on large, multimillion-dollar projects and consortia, e.g., CO_2 capture and sequestration projects in western North Dakota, various oil and gas related projects, the Bakken Petroleum Optimization Program (BPOP), among others. The EERC is also a global leader in research, development, demonstration, deployment, and commercialization of technologies from the laboratory scale to full scale and has multiple research portfolios in coal and coal utilization, oil and gas, renewal energy, environmental remediation, etc. These experiences are expected to be of relevance to the proposed project.

Experience and Qualifications of Key Project Personnel: Dr. Yong Hou, DLM Director of Research and Development, will be the principal investigator (PI) for the proposed project. Dr. Hou will oversee the technical development of the LFP cathode materials and testing in the fabricated production line facility. Dr. Hou has 40 years of experience in the lithium battery industry, specifically lithium battery materials research, development, and production. He holds a Ph.D. degree in Systems Engineering from the University of Shanghai for Science & Technology, China. From 2008 to 2022, Dr. Hou worked at UND as a research scientist on cathode material manufacturing. He left UND in the spring of 2022 to join DLM full time as the Director of Research and Development. Prior to his work at UND (before 2007), Dr. Hou was the factory director of a cathode-manufacturing facility in Shenzen, China, where he developed deep relationships with cathode-manufacturing equipment suppliers and deep knowledge of the cathode materials industry.

Dr. Xin Zhang, Senior Engineer at DLM, is a core member of the LFP R&D team. Dr Zhang obtained a B.Sc. degree in Chemical Engineering from Qingdao University of Science and Technology, Qingdao, China; an M.Sc. degree in Chemical Engineering from Guizhou University, Guiyang, China; and a Ph.D. degree in Chemical Engineering from UND. He has been part of the team developing the LFP materials at UND for the past 6 years and has hands-on experience with LIB electrode materials development that includes electrode materials synthesis, characterization, electrochemistry, and battery cell fabrication and testing.

Dr. Alexander Azenkeng, EERC Assistant Director for Critical Materials, will assist the PI (Dr. Hou) in overall project management and reporting (Task 1.0). Dr. Azenkeng has an academic background in physical chemistry and has been project manager for numerous EERC research activities, including several funded by DOE and NDIC. He has 15 years of experience with characterization and assessment of coal materials and recently has been leading EERC efforts to make high-value carbon materials from coal and coal wastes such as graphene and high-quality graphite for the LIB anode manufacture.

Mr. Andrew Jay, CEO of DLM, will be co-advisor for the project. Mr. Jay has 15 years of C-Suite executive-level experience in operations, project management, sales, marketing, and business development. He will leverage this diversity of experience in providing advice to ensure project success.

Mr. Jason Laumb, EERC Director of Advanced Energy Systems Initiatives, will serve also as co-advisor for the project advisor. Mr. Laumb has 22 years of experience in coal science, techno-economic modeling, environmental control systems, supercritical CO_2 power cycles, and advanced gasification technologies.

MANAGEMENT

Overall Project Management: DLM is the lead organization for this project and will work closely with the EERC to oversee all tasks, management, and reporting activities associated with the project. Regular planning meetings will be scheduled with project personnel and advisors to ensure proper project implementation to meet the stated objectives and to adhere to the budget, schedule, deliverables, and milestone requirements. Additionally, regular progress update meetings and/or communications via email, phone calls, or WebEx conference meetings will be conducted with the NDIC/CSEA project manager to discuss any potential challenges and find appropriate remedies in a timely manner. Resumes of key personnel can be found in Appendix D.

The project organizational chart is presented in Figure 3. The lead applicant organization is DLM and Dr. Yong Hou, Director of Research and Development at DLM, is the PI. Dr. Hou will lead Tasks 1.0, 5.0, and 6.0. Dr. Alexander Azenkeng, EERC Assistant Director for Critical Materials, will assist Dr. Hou in leading Task 1.0 in addition to leading Tasks 3.0 and 4.0. Dr. Xin Zhang, Senior Engineer at DLM, will lead Task 2.0 and assist in Tasks 4.0 and 6.0. Mr. Andrew Jay (CEO of DLM) and Mr. Jason Laumb (EERC's Director of Energy Systems Initiatives) will serve as project advisors. Regular communications will be maintained among the key personnel team members by email, phone calls, scheduled meetings, and/or online meetings to ensure smooth implementation of the various tasks on time, schedule, and budget.

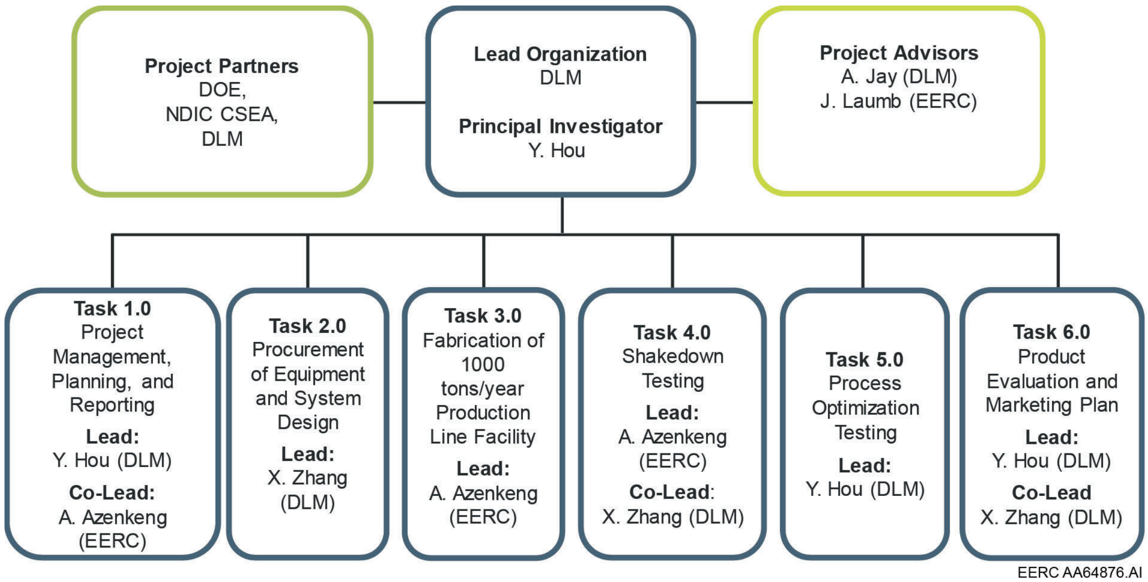

Figure 3. Project organization chart.

Evaluation Points: The project progress will be tracked and measured by completion of identified milestones and/or deliverables as stated in the project timeline in Figure 4 and Table 4. The milestones or deliverables are structured such that project progress will be monitored at various stages during the period of performance to include procurement of equipment and fabrication materials, assembly and fabrication of the production line facility, shakedown testing, process optimization, product evaluation and performance testing, and overall project management and planning.

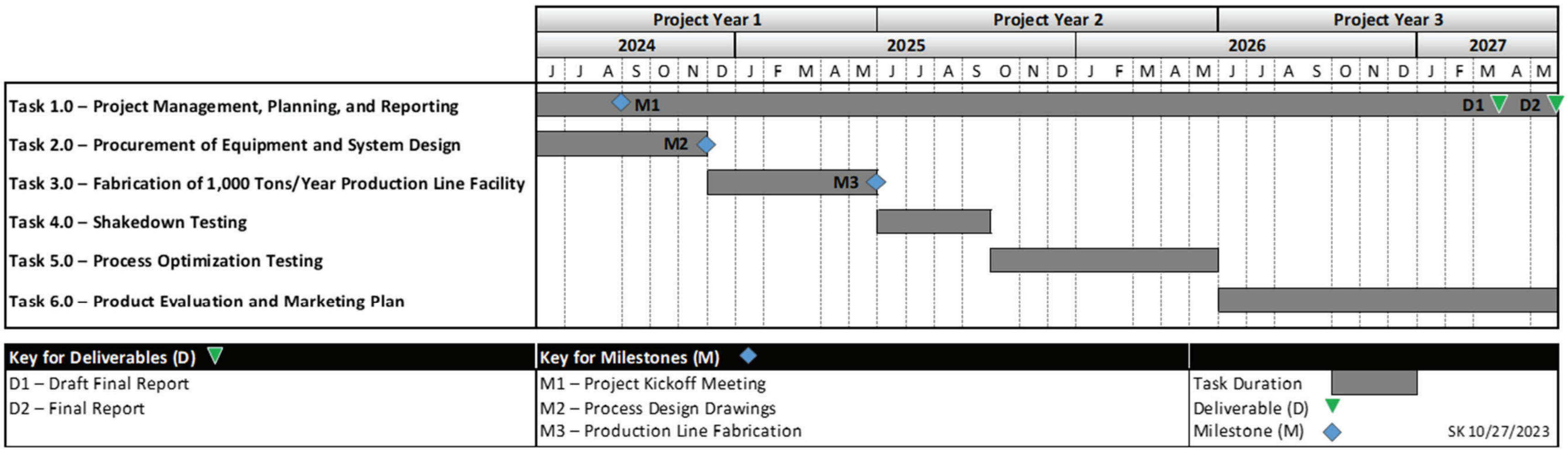

Figure 4. Project timeline.

TIMETABLE

The project timeline is presented in Figure 4 for a total project duration of 3 years, with a projected start date of June 1, 2024. The start date may be adjusted depending on when the award contract is signed or authorized.

BUDGET

The total budget for this proposal is $10,250,000 for a project duration of 3 years beginning from when the contract is signed. The total amount requested from NDIC's CSEA program is $4,000,000. There is a $5,000,000 cash cost-share portion that is anticipated to come from DOE through a proposal in response to Funding Opportunity Announcement (FOA) DE-FE0003020 and another $1,250,000 cash cost share from DLM. The detailed breakdown is presented in Table 4.

Table 4. Itemized List of Project Costs

Project-Associated Expense	NDIC Grant	DOE Share (cash)	DLM Share (Cash)	Total Project
Labor	$1,418,964	$500,000	$1,136c364	$3,055,328
Travel	$0	$6,000	$0	$6,000
Equipment > $5000	$874,718	$2,246,700	$0	$3,121,418
Supplies	$578,722	$1,997,000	$0	$2,575,722
Subcontractor – EERC	$925,327	$0	$0	$925,327
Total Direct Costs	$3,797,731	$4,749,700	$1,136,364	$9,683,795
Facilities and Administration	$202,269	$250,300	$113,636	$566,205
Total Project Costs	**$4,000,000**	**$5,000,000**	**$1,250,000**	**$10,250,000**

TAX LIABILITY

DLM, a small for-profit business, is a taxable entity. The signed Tax Liability form is contained in Appendix I.

CONFIDENTIAL INFORMATION

Appendix A contains a confidential information request. DLM would like to keep all information about its historical financial statements (provided in Appendix G) confidential and only to be used for proposal review as necessary.

PATENTS/RIGHTS TO TECHNICAL DATA

There are no patents or rights that are disclosed in this application that need to be protected.

STATE PROGRAMS AND INCENTIVES

There are no programs or incentives from the State of North Dakota that the applicant has participated in within the last 5 years.

APPENDIX B

SUBCONTRACTOR PROPOSAL

EERC

Energy & Environmental Research Center
15 North 23rd Street, Stop 9018 • Grand Forks, ND 58202-9018 • P. 701.777.5000 • F. 701.777.5181
www.undeerc.org

October 31, 2023

Mr. Andrew Jay
CEO
Dakota Lithium Materials
225 South Lucile Street
Seattle, WA 98108

Dear Mr. Jay:

Subject: EERC Proposal No. 2024-0055 Entitled "Project Support for Demonstration and Scale-Up of a Low-Cost Long-Duration Energy Storage Technology for Lithium-Ion Batteries"

On behalf of the Energy & Environmental Research Center (EERC), I would like to express our commitment to the proposal being sent to the North Dakota Industrial Commission (NDIC) Clean Sustainable Energy Authority (CSEA) program as it paves the way to a clean and secure energy future for North Dakota and the United States. The EERC strongly believes that this is a key step in ensuring clean sustainable energy will remain an important resource to meet the future energy needs of the United States and the world.

Should this project be accepted for award, the EERC stands ready to provide over 60 years of experience in developing, demonstrating, and commercializing clean and efficient energy technologies. The EERC's long history of teaming with industry, state, and government is key to developing the scientific and engineering understanding required to move energy technologies forward into the marketplace. This understanding is critical to building acceptance from both industry, state, and the public for future clean energy efforts.

The EERC looks forward to being a valuable partner in Dakota Lithium Materials demonstration and production line facility. This facility will manufacture lithium-ion battery cathode materials and be located at the UND/EERC premises in Grand Forks, North Dakota. The EERC is committed to working with the team to make a North Dakota-based facility a success should this work be funded.

The EERC scope of work, detailed budget, and project team resumes are included as attachments. If you have any questions regarding the proposed work scope or schedule, please contact me by phone at (701) 777-5051 or by email at aazenkeng@undeerc.org.

Sincerely,

DocuSigned by:
Alex Azenkeng
048DB552AD204BF...
Alexander Azenkeng
Assistant Director for Critical Materials

Approved by:

DocuSigned by:
29499751F2B84D7...
Charles D. Gorecki, CEO
Energy & Environmental Research Center

AA/bjr

Attachments

EERC SCOPE OF WORK
EERC Proposal No. 2024-0055
for
Clean Sustainable Energy Authority

Subrecipient: University of North Dakota Energy & Environmental Research Center (EERC)
Prime Recipient: Dakota Lithium Materials (DLM)
Project Title: Project Support for Demonstration and Scale-Up of a Low-Cost Long-Duration Energy Storage Technology for Lithium-Ion Batteries
Technical Point of Contact: Alexander Azenkeng, EERC, 15 North 23rd Street, Stop 9018, Grand Forks, North Dakota 58202-9018; phone: (701) 777-5051, aazenkeng@undeerc.org

Technical Approach

The proposed scope of work includes support for engineering design, fabrication, facilities, laboratory analyses, and management and reporting. The Energy & Environmental Research Center (EERC) will be responsible for reporting on the progress of these activities. Detailed descriptions of the activities broken into six tasks across two budget periods (BPs) are provided below.

Task 1.0 – Project Management and Planning (all BPs)

The EERC will provide project management support to Dakota Lithium Materials (DLM) for the proposed project. The EERC has well-established business systems in place and extensive experience working with government and state agencies. EERC personnel will work closely with DLM to administer the financial and contractual responsibilities related to the project, offering quick access to decision-makers and quick resolution of issues.

The EERC project team will assist in all aspects of project management, including tracking expenditures and deliverables, including subcontractors. Subcontractors will be reviewed and approved by EERC staff for technical progress at the request of DLM. Support will also be provided to DLM in negotiating and administering sponsored agreements. This may include preparing correspondence and requesting modifications, approvals, and revisions as needed. EERC contracts staff will also prepare and negotiate subcontract/consultant and other purchase agreements as required by the project as well as monitor the agreements and facilitate the receipt and processing of associated invoices. Other activities may include tracking and reporting of equipment.

Other project management activities to be performed will include the development and production of quarterly progress reports, BP reports, a project management plan, and a comprehensive final technical report. EERC activities will include the planning and execution of project status meetings. Technology transfer activities are anticipated to include, at DLM's request, the presentation of results through these meetings and reports as well as presentations at relevant technical conferences and facilitating the involvement of a CSEA designee in project meetings.

Project activities will be accomplished with a team including project management personnel, senior management, budgeting and contracts personnel, and the EERC accounting department. Results of all tasks described above will be provided in project meetings and reports. All additional deliverables will be summarized in project status and final report(s).

Task 2.0 – Procurement of Equipment and System Design (BP1)

The activities of Task 2.0 will include assisting DLM to procure additional equipment items and fabrication materials to support the project. Specific items to purchase will include accessory equipment for process control, data monitoring and acquisition, and fabrication pieces and fittings. EERC design engineers will be involved in an advisory capacity in the engineering design activities to include pipe and identification diagrams (P&ID), process flow diagrams (PFDs), and overall system drawings of the production line. DLM will be responsible for all P&IDs and design drawings that meet all applicable codes for implementation at the EERC or UND facilities. The expected outcomes of this task will include detailed system drawings and completed orders for various equipment, accessory parts, and fittings that are needed for fabrication of the production line facility. The EERC will provide support to track the activities and monitor the status of purchase orders for equipment and accessories as well as the progress of design activities. The progress will be documented and reported to DLM for transmission to CSEA.

Additional technical assistance will include assisting DLM with materials costing for the fabrication work as needed. The EERC will assist DLM in addressing technical issues as necessary and as the issues arise. The EERC will aid in selection of process equipment, redundancy philosophy, selection of materials of construction, effluent identification and disposition, means of process heat recovery, and to make arrangements for adequate facility space and the necessary utilities.

Task 3.0 – Fabrication of 1000 tons/year Production Line Facility (BP1)

The EERC will assist DLM in assembling and building a production line facility to include a preprocessing unit, dry-mixing unit, calcination unit, carbon coating unit, grinding/classification unit, and packaging unit, as well as associated accessories for process control, monitoring, and data acquisition. The individual units will be integrated so that they operate in a semicontinuous mode for a complete production line capable of producing about 1000 tons/year of lithium iron phosphate (LFP) material. The key result of this task will be a completely fabricated production line facility with power turned on and ready for shakedown testing. The EERC will provide limited analytical support for feedstock samples at the initial stages of the project and troubleshooting of issues arising during construction. The EERC's shops and operations group and the capabilities of the machine shop will be available as needed.

Additional technical assistance will be provided by the EERC for project design, hazard and operability (HAZOP) review, and costing efforts for the production facility. The EERC will assist DLM's project team in addressing technical issues that may arise during installation and operation of the system. The EERC will aid in installation and validation of process equipment as needed to ensure successful completion of construction and operation of the system.

Task 4.0 – Shakedown Testing (BP2)

Shakedown testing activities will involve both EERC and DLM personnel. The activities to perform include shakedown testing of the production line system for the ability to produce up to 1000 tons/year LFP cathode materials. Shakedown testing on the integrated system shall be conducted to verify proper operation and functionality of the different units and to demonstrate system ability to operate in a semicontinuous mode. During shakedown testing, the LFP raw material subsamples will be preprocessed by crushing to a suitable size range before feeding to the system. The results from this task will provide data to demonstrate that the production line facility can operate well in a semicontinuous mode. The EERC will provide analytical support for samples produced at various stages during the project for product quality verifications and for troubleshooting of issues arising during shakedown testing.

Task 5.0 – Process Optimization Testing (BP2)
The EERC will assist DLM in carrying out the activities of Task 5.0 to include optimization of process parameters such as temperatures, pressure, flowrates, process gas and environment variables, system stability, etc. During this testing, raw material input streams, product output stream, and product quality will be optimized for steady production of up to 1000 tons/year LFP cathode materials. The production line will be operated for about 7 months to fine-tune process parameters and product quality and optimize the system to maximize the energy savings, CO_2 emission reduction, water use reduction, and overall product cost savings. The raw materials and product will be analyzed on a limited basis with a suitable combination of analytical techniques available at the EERC such as scanning electron microscopy (SEM), x-ray diffraction (XRD), x-ray fluorescence (XRF) spectroscopy, Fourier transform infrared (FTIR) spectroscopy, Raman spectroscopy, and other methods that may be deemed necessary during project implementation. The primary outcome from this task will include process data to demonstrate operability of the facility for manufacturing LFP by the new dry-mixing approach.

Task 6.0 – Product Evaluation and Marketing Plan (BP2)
The EERC will provide assistance as needed and laboratory facilities for evaluation of the LFP materials for its electrochemical performance attributes through testing of various lithium-ion battery (LIB) test articles by DLM personnel. Additionally, the EERC will provide input to DLM as needed for the development of an initial marketing plan to engage potential customers and to establish a market for the produced LFP materials. Specific emphasis will be placed on applications in energy storage such as in electric grid systems and micro-electric grids for rural areas and isolated point consumption to include military bases. Additional markets in heavy-duty transportation vehicles where battery weight and size may be less consequential will be explored, especially given that the proposed batteries are expected to have long-duration energy storage capability of up to 10+ hours at minimal cost of about $0.05/kWh levelized cost of storage (LCOS).

BUDGET
The cost-reimbursable amount for this project is $925,327 for a total project duration of 3 years beginning from the time the contract is signed. A detailed project budget (Table 1) is provided as a table in a format requested by the CSEA program. The proposed work will be initiated upon execution of a contract between our organizations.

Table 1. EERC Project Budget

Project-Associated Expense	NDIC Share (cash)	Total Project
Labor	$420,617	$420,617
Travel	$11,300	$11,300
Supplies	$5,000	$5,000
Communications	$60	$60
Printing and Duplicating	$120	$120
Laboratory Fees and Services		
Natural Materials Analytical Research Lab	$65,187	$65,187
Combustion Test Service	$16,620	$16,620
Document Production Service (Graphics, Editing, and Workflow)	$48,863	$48,863
Shop and Operations	$13,944	$13,944
Technical Software Fee	$8,258	$8,258
Engineering Services Fee	$7,830	$7,830
Outside Lab	$15,000	$15,000
Total Direct Costs	$612,799	$612,799
Facilities and Administration	$312,528	$312,528
Total Project Costs	**$925,327**	**$925,327**

BACKGROUND/QUALIFICATIONS

The project will be managed by Dr. Alexander Azenkeng, who is Assistant Director for Critical Materials at the EERC. Dr. Azenkeng has over 15 years of experience in the management of several large projects at the EERC as well as leading the development of coal-derived high-value carbon products and synthetic graphite for LIB anodes. Additional staff from the EERC's accounting, workflow, and budget analyst groups will be included in the project team as well as technical and senior management personnel to provide oversight during the implementation of the project.

APPENDIX A

BUDGET NOTES

BUDGET NOTES

ENERGY & ENVIRONMENTAL RESEARCH CENTER (EERC)

BACKGROUND

The EERC is an independently organized multidisciplinary research center within the University of North Dakota (UND). The EERC is funded through federal and nonfederal grants, contracts, and other agreements. Although the EERC is not affiliated with any one academic department, university faculty may participate in a project, depending on the scope of work and expertise required to perform the project.

INTELLECTUAL PROPERTY

The applicable federal intellectual property (IP) regulations will govern any resulting research agreement(s). In the event that IP with the potential to generate revenue to which the EERC is entitled is developed under this project, such IP, including rights, title, interest, and obligations, may be transferred to the EERC Foundation, a separate legal entity.

BUDGET INFORMATION

The proposed work will be done on a cost-reimbursable basis. The distribution of costs between budget categories (labor, travel, supplies, equipment, etc.) and among funding sources of the same scope of work is for planning purposes only. The project manager may incur and allocate allowable project costs among the funding sources for this scope of work in accordance with Office of Management and Budget (OMB) Uniform Guidance 2 CFR 200.

Escalation of labor and EERC recharge center rates are incorporated into the budget when a project's duration extends beyond the university's current fiscal year (July 1 – June 30). Escalation is calculated by prorating an average annual increase over the anticipated life of the project.

The cost of this project is based on a specific start date indicated at the top of the EERC budget. Any delay in the start of this project may result in a budget increase. Budget category descriptions presented below are for informational purposes; some categories may not appear in the budget.

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. The labor category rate is the average rate of a personnel group with similar job descriptions. Salary costs incurred are based on direct hourly effort on the project. Faculty who work on this project may be paid an amount over the normal base salary, creating an overload which is subject to limitation in accordance with university policy. As noted in the UND EERC Cost Accounting Standards Board Disclosure Statement, administrative salary and support costs which can be specifically identified to the project are direct-charged and not charged as facilities and administrative (F&A) costs. Costs for general support services such as contracts and IP, accounting, human resources, procurement, and clerical support of these functions are charged as F&A costs.

Fringe Benefits: Fringe benefits consist of two components which are budgeted as a percentage of direct labor. The first component is a fixed percentage approved annually by the UND cognizant audit agency, the Department of Health and Human Services. This portion of the rate covers vacation, holiday, and sick leave (VSL) and is applied to direct labor for permanent staff eligible for VSL benefits. Only the actual approved rate will be charged to the project. The second component is estimated on the basis of historical data and is charged as actual expenses for items such as health, life, and unemployment insurance; social security; worker's compensation; and UND retirement contributions.

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, and UND travel policies, which can be found at https://campus.und.edu/finance/procurement-and-payment-services/travel/travel.html (Policies & Procedures, A–Z Policy Index, Travel). Daily meal rates are based on U.S. General Services Administration (GSA) rates unless further limited by UND travel policies; 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, and reference materials. General purpose office supplies (pencils, pens, paper clips, staples, Post-it notes, etc.) are included in the F&A cost.

Communications: Telephone, cell phone, and fax line charges are included in the F&A 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.

Printing and Duplicating: Page rates are established annually by the university's duplicating center. Printing and duplicating costs are allocated to the appropriate funding source. Estimated costs are based on prior experience with similar projects.

Operating Fees: Operating fees generally include EERC recharge centers, outside laboratories, and freight.

EERC recharge center rates are established annually and approved by the university.

Laboratory and analytical recharge fees are charged on a per-sample, hourly, or daily rate. Additionally, laboratory analyses may be performed outside the university when necessary. The estimated cost is based on the test protocol required for the scope of work.

Document production services recharge fees are based on an hourly rate for production of such items as report figures, posters, and/or images for presentations, maps, schematics, website design, brochures, and photographs. The estimated cost is based on prior experience with similar projects.

Shop and operations recharge fees cover specific expenses related to the pilot plant and the required expertise of individuals who perform related activities. Fees may be incurred in the pilot plant, at remote locations, or in EERC laboratories whenever these particular skills are required. The rate includes such items as specialized safety training, personal safety items, fall protection harnesses and respirators, CPR certification, annual physicals, protective clothing/eyewear, research by-product disposal, equipment repairs, equipment safety inspections, and labor to direct these activities. The estimated cost is based on the number of hours budgeted for this group of individuals.

Engineering services recharge fees cover specific expenses related to retaining qualified and certified design and engineering personnel. The rate includes training to enhance skill sets and maintain certifications using Webinars and workshops. The rate also includes specialized safety training and related physicals. The estimated cost is based on the number of hours budgeted for this group of individuals.

Technical software is a use fee for an advanced project management tool. Costs are associated with software, data entry, maintenance, and enhancement of the system.

Facilities and Administrative Cost: The F&A rate proposed herein is approved by the U.S. Department of Health and Human Services and is applied to modified total direct costs (MTDC). MTDC is defined as total direct costs less individual capital expenditures, such as equipment or software costing $5000 or more with a useful life of greater than 1 year, as well as subawards in excess of the first $25,000 for each award.

APPENDIX B

RESUMES OF KEY PERSONNEL

DR. ALEXANDER AZENKENG
Assistant Director for Critical Materials
Energy & Environmental Research Center (EERC), University of North Dakota (UND)
15 North 23rd Street, Stop 9018, Grand Forks, North Dakota 58202-9018 USA
701.777.5051, aazenkeng@undeerc.org

Education and Training

Ph.D., Theoretical Physical Chemistry, University of North Dakota, 2007.

Dissertation: Theoretical Studies of Low-Lying Electronic States of Lithium, Titanium, and Mercury Compounds; supervised by Prof. Mark R. Hoffmann.

M. Sc., Chemistry, University of Buea, Cameroon, 1998.

Thesis: Preparation of Iron (III) and Nickel (II) Oxide Thin Films from the Corresponding Metal Acetylacetonates via Pyrolysis.

B.Sc., (magna cum laude) Chemistry, University of Buea, Cameroon, 1996; with professional minor in Chemical Processing Technology.

Research and Professional Experience

May 2021–Present: Assistant Director for Critical Materials, EERC, UND.

- Applies chemistry principles to studies involving multiple research portfolios, including computational simulations to elucidate reaction mechanisms of coal combustion and chemical processes at the molecular level; chemical transformations in low-rank coal upgrading; coal–biomass gasification technologies; characterization of materials by spectroscopic and microscopic techniques; CO_2–amine reaction chemistry of CO_2 capture, utilization, and sequestration (CCUS) technologies; reservoir geochemistry of CO_2 sequestration; nuclear magnetic resonance (NMR) spectroscopy study of unconventional oil and gas reservoirs; improved methods for extraction and isolation of critical minerals (rare-earth elements [REEs] and platinum group metals [PGMs]) from coals; and development of approaches for production of high-value carbon materials such as graphene and graphite from coal feedstocks.

Current research interests include development of approaches for making high-value products (graphene and graphite) from coal, critical mineral research for REEs and PGMs, carbon capture technologies for coal combustion and gasification systems, and carbon storage/sequestration in geological sinks.

2008–April 2021: Senior Research Scientist, EERC, UND.

- Applied chemistry principles to studies involving multiple research portfolios, including chemical analysis of materials by scanning electron microscopy (SEM), material corrosion evaluation in oil and gas applications, CO_2 capture using aqueous amine solvents, CO_2 sequestration in geologic formations, and chemical transformations in low-rank coal upgrading.
- Involved in developing analytical approaches to better characterize organic shale and tight rock formations for potential CO_2 storage and improved methods for analyzing REEs in coals, geologic samples, and produced water from oil and gas operations.

2007–2008: Temporary Researcher, EERC, UND.

- Worked on NO_x emission control technologies, CO_2 capture technologies, and gasification technologies.

2005–2007: Graduate Research Assistant, EERC, UND.

- Worked on quantum mechanical modeling of Hg oxidation reactions on activated carbon surfaces.

Professional Activities

Member, Microscopy Society of America, 2010–Present
Member, North Dakota Academy of Sciences, 2004–Present
Member, American Chemical Society, 2002–Present

Publications and Presentations

Books and Book Chapters

Ralston, N.V.C.; Azenkeng, A.; Raymond, L.J. Mercury-Dependent Inhibition of Selenoenzymes and Mercury Toxicity. In *Methylmercury and Neurotoxicity*; Ceccatelli, S., Aschner, M., Eds.; Current Topics in Neurotoxicity 2; Springer: New York, 2012; pp 91–99.

Peer-Reviewed Publications

Azenkeng, A.; Mibeck, B. A.F.; Kurz, B. A.; Gorecki, C. D.; Myshakin, E. M.; Goodman, A. L.; Azzolina, N. A.; Eylands, K.E.; Butler, S.K.; Sanguinito, S. An Image-Based Equation for Estimating the Prospective CO_2 Storage Resource of Organic-Rich Shale Formations. *International Journal of Greenhouse Gas Control* **2020**, *98*, 103038.

Laumb, J.D.; Glazewski, K.A.; Hamling, J.A.; Azenkeng, A.; Watson, T.L. Wellbore Corrosion and Failure Assessment for CO_2 EOR and Storage: Two Case Studies in the Weyburn Field. *International Journal of Greenhouse Gas Control* **2016,** *54*, 479–489.

Olson, E.S.; Azenkeng, A. Laumb, J.D.; Jensen, R.R.; Benson, S.A.; Hoffman, M.R. New Developments in the Theory and Modeling of Mercury Oxidation and Binding on Activated Carbons in Flue Gas. In *Air Quality VI: Mercury, Trace, Elements, SO_3, Particulate Matter, and Greenhouse Gases*, Special Issue of *Fuel Process. Technol.* **2009**, *90* (11), 1360–1363.

Conference and Other Presentations

Azenkeng, A.; Mibeck, B.A.F.; Eylands, K.E.; Butler, S.K.; Kurz, B.A.; Heebink, L.V. Advanced Characterization of Unconventional Oil and Gas Reservoirs to Enhance CO_2 Storage Resource Estimates – Organic Structure and Porosity of Organic-Rich Shales. Presented at Mastering the Subsurface Through Technology Innovation, Partnerships & Collaboration: Carbon Storage & Oil & Natural Gas Technologies Review Meeting, Pittsburgh, PA, Aug 1–3, 2017.

Klenner, R.C.L.; Braunberger, J.R.; Sorensen, J.A.; Eylands, K.E.; Azenkeng, A.; Smith, S.A. A Formation Evaluation of the Middle Bakken Member Using a Multimineral Petrophysical Analysis Approach. Paper presented at the SPE/AAPG/SEG Unconventional Resources Technology Conference, Denver, CO, Aug 25–27, 2014; URTeC Paper No. 1922735.

Laumb, J.D.; Azenkeng, A.; Heebink, L.V.; Jensen, M.D.; Raymond, L.J. CO_2 Utilization Technologies for Lignite-Based Generation. Poster Abstract in *Proceedings of Air Quality IX: An International Conference on Environmental Topics Associated with Energy Production*; Arlington, VA, Oct 21–23, 2013.

Laumb, J.D.; Kay, J.P.; Holmes, M.J.; Cowan, R.M.; Azenkeng, A.; Heebink, L.V.; Hanson, S.K.; Jensen, M.D.; Letvin, P.A.; Raymond, L.J. Economic and Market Analysis of CO_2 Utilization Technologies – Focus on CO_2 Derived from North Dakota Lignite. *Energy Procedia* **2013**, *37*, 6987–6998.

Laumb, J.D.; Kay, J.P.; Holmes, M.J.; Cowan, R.M.; Azenkeng, A.; Heebink, L.V.; Hanson, S.K.; Jensen, M.D.; Letvin, P.A.; Raymond, L.J. Economic and Market Analysis of CO_2 Utilization Technologies –

Focus on CO_2 Derived from North Dakota Lignite. Paper presented at the 11th International Conference on Greenhouse Gas Control Technologies (GHGT-11), Kyoto, Japan, Nov 18–22, 2012.

Azenkeng, A. Development of an Improved CCSEM Technique for Quantitative Coal Mineralogy. Presented at the 28th Annual International Pittsburgh Coal Conference, Pittsburgh, PA, Sept 12–15, 2011.

Technical Reports

Azenkeng, A. *Evaluation of Lime Kiln Ash Ring Samples for Environmental Energy Services, Inc.*; Final Report for Environmental Energy Services, Inc.; EERC Publication 2018-EERC-08-03; Energy & Environmental Research Center: Grand Forks, ND, Aug 2018.

Azenkeng, A.; Kurz, B.A.; Gorecki, C.D. *An NMR-Based Method for Fluid Typing and Proportion Estimation for the Potential for CO_2 Storage or CO_2 EOR in the Middle Bakken Formation*; Final Report included in *Subtask 4.1 – Strategic Studies* Final Report (Aug 10, 2015 – May 31, 2017) for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FE0024233; EERC Publication 2017-EERC-05-13; Energy & Environmental Research Center: Grand Forks, ND, May 2017.

Azenkeng, A.; Pavlish, B.M.; Lentz, N.B.; Galbreath, K.C.; McCollor, D.P. *Feasibility of Hydrothermal Dewatering for the Potential to Reduce CO_2 Emissions and upgrade Low Rank Coals*; Final Report (June 25, 2008 – Dec 31, 2009) for the University of Wyoming; EERC Publication 2010-EERC-02-02; Energy & Environmental Research Center: Grand Forks, ND, Feb 2010.

Hanson, S.K.; Azenkeng, A.; Laumb, J.D.; McCollor, D.P.; Pavlish, B.M.; Buckley, T.D.; Botnen, L.S. *Subtask 3.7 – Beneficiated Lignite Market Study*; Final Report (Aug 1, 2009 – June 30, 2010) for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-08NT43291; EERC Publication 2010-EERC-06-09; Energy & Environmental Research Center: Grand Forks, ND, June 2010.

JASON D. LAUMB
Director of Advanced Energy Systems Initiatives
Energy & Environmental Research Center (EERC), University of North Dakota (UND)
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Education and Training
M.S., Chemical Engineering, University of North Dakota, 2000.
B.S., Chemistry, University of North Dakota, 1998.

Research and Professional Experience
May 2021–Present: Director of Advanced Energy Systems Initiatives, EERC, UND. Laumb provides leadership on projects related to advanced energy systems and leads a multidisciplinary team of scientists and engineers working on advanced energy technologies from pollution control to new energy platforms. Principal areas of interest and expertise include renewable energy, CO_2 capture, techno-economic modeling, extraction of critical materials, environmental control systems, supercritical CO_2 power cycles, and advanced gasification technologies. Experience includes biomass and fossil fuel conversion for energy production, with an emphasis on ash effects on system performance; trace element emissions and control for fossil fuel combustion systems, with a particular emphasis on air pollution issues related to mercury and fine particulates; and design and fabrication of bench- and pilot-scale combustion and gasification equipment.

September 2019–April 2021: Assistant Director of Advanced Energy Systems, EERC, UND. Laumb assisted the EERC executive team by providing leadership on projects related to advanced energy systems. Laumb led a multidisciplinary team of scientists and engineers working on advanced energy technologies from pollution control to new energy platforms. Specific areas of interest included CO_2 capture, techno-economic modeling, environmental control systems, supercritical CO_2 power cycles, and advanced gasification technologies. Research activities focused on low-carbon-intensity power cycles for fossil fuel-fired systems.

2008–August 2019: Principal Engineer, Advanced Energy Systems Group Lead, EERC, UND. Laumb led a multidisciplinary team of 30 scientists and engineers to develop and conduct projects and programs on power plant performance, environmental control systems, the fate of pollutants, computer modeling, and health issues for clients worldwide. Efforts focused on development of multiclient jointly sponsored centers or consortia funded by government and industry sources. Research activities included computer modeling of combustion/gasification and environmental control systems, performance of SCR technologies for NO_x control, mercury control technologies, hydrogen production from coal, CO_2 capture technologies, particulate matter analysis and source apportionment, the fate of mercury in the environment, toxicology of particulate matter, and in vivo studies of mercury–selenium interactions.

2001–2008: Research Manager, EERC, UND. Laumb led projects involving bench-scale combustion testing of various fuels and wastes as well as a laboratory that performs bench-scale combustion and gasification testing. Laumb served as principal investigator and managed projects related to the inorganic composition of coal, coal ash formation, deposition of ash in conventional and advanced power systems, and mechanisms of trace metal transformations during coal or waste conversion and wrote proposals and reports focused on energy and environmental research.

2000–2001: Research Engineer, EERC, UND. Laumb assisted in the design of pilot-scale combustion equipment and wrote computer programs to aid in the reduction of data, combustion calculations, and prediction of boiler performance. Laumb was also involved in the analysis of combustion control technologies' ability to remove mercury and the suitability of biomass as boiler fuel.

1998–2000: SEM Applications Specialist, Microbeam Technologies, Inc., Grand Forks, North Dakota. Laumb gained experience in power system performance including conventional combustion and gasification systems; knowledge of environmental control systems and energy conversion technologies; interpreting data to predict ash behavior and fuel performance; assisting in proposal writing to clients and government agencies such as the National Science Foundation and the U.S. Department of Energy; preparing and analyzing coal, coal ash, corrosion products, and soil samples using scanning electron microscopy (SEM)/energy-dispersive spectroscopy (EDS); and modifying and writing FORTRAN, C+, and Excel computer programs.

Professional Activities
Member, American Chemical Society

Publications
Has coauthored numerous professional publications.

APPENDIX C

LETTERS OF SUPPORT

October 12, 2023

To Whom it May Concern,

It is the intent of Shenzhen FBTech Electronics Ltd to source lithium iron phosphate (LiFePO4) battery cathode powder from Dakota Lithium to be used for manufacturing LiFePO4 cells, the building blocks of lithium batteries.

Shenzhen FBTech Electronics Ltd has the capacity to manufacture 2GWH of LiFePO4 cells and plans to expand capacity to manufacture 5GWH by 2026. To manufacture these cells Shenzhen FBTech Electronics Ltd will require 2000 metric tons of LiFePO4 battery cathode powder supplied by Dakota Lithium by 2026.

Shenzhen FBTech Electronics Ltd manufacture cells that qualify as grade A, of the highest quality, and are cost competitive. Shenzhen FBTech Electronics Ltd intends to source LiFePO4 battery cathode powder from Dakota Lithium with the goal to further our company's innovation and growth as a world leader in lithium iron phosphate battery manufacturing.

LiFePO4 battery cathode powder supplied by Dakota Lithium shall meet the supplier and engineering requirements of Shenzhen FBTech Electronics Ltd.

Please note this letter is the intent of Shenzhen FBTech Electronics Ltd and is not a purchase order. It reflects a forecast of future sales based on the best available data and is non-binding.

Together Shenzhen FBTech Electronics Ltd and Dakota Lithium will help to build a lithium battery supply chain in the US. We look forward to this partnership.

Sincerely,

Tommy Zeng
Chief Executive Officer
Shenzhen FBTech Electronics Ltd

SHENZHEN FBTECH ELECTRONICS LTD.

independent boat builders, inc

WWW.IBBI.COM

To Whom It May Concern,

Independent Boat Builders, Inc. supports the efforts of Dakota Lithium to build a lithium battery materials factory in North Dakota and believes that a high-quality, cost-competitive lithium-ion battery manufacturing supply chain in the USA is imperative for national defense, electric vehicle production, solar & wind energy storage, and the many industries and products that are powered by lithium battery technology.

IBBI currently manufactures almost **25% of all boats** sold in the United States. We would like to start installing lithium batteries in our boats. We think it is very important for those batteries to be manufactured in the United States.

Lithium cathode battery materials production is the missing link the US lithium battery supply chain. Recognizing this, our office supports the Department of Energy's efforts to partner with local industry to build lithium cathode materials factories here in the United States. It is our hope that this grant process identifies and supports industry leaders in each US geographical region, including the great plains. It is our belief that Dakota Lithium is uniquely prepared to build a factory in the Great Plains region, and we support their efforts and encourage your consideration of their application.

Building a lithium cathode materials factory in North Dakota will support not just one community, but help to create a lithium battery technology cluster in the Great Plains region. The great plains leads the nation in energy production and innovation. For the last decade Dakota Lithium has partnered with the University of North Dakota to support research into lithium battery technology. Dakota Lithium is now commercializing that research and aims to build a 300,000 SF factory, creating 280 highly technical and well-paid jobs in North Dakota. This factory will be manufacturing lithium iron phosphate cathode materials – Dakota Lithium will be sourcing iron from Minnesota, carbon from North Dakota, and phosphate from the Great Plains region, creating thousands of jobs in the region. In addition, it is our hope that by building the first lithium cathode battery materials factory in the US in the Great Plains region that lithium cell manufacturers and lithium battery pack assembly companies will follow, creating thousands more highly paid jobs.

Sincerely,

Tom Broy

Tom Broy
President

17703 Hunting Bow Circle, Suite 102 | Lutz, FL 33558 | p 813-527-3132

October 7, 2022

To Whom it May Concern,

It is the intent of American Battery Factory to source lithium iron phosphate {LiFePO4) battery cathode powder from Dakota Lithium to be used for manufacturing LiFePO4 cells, the building blocks of lithium batteries.

American Battery Factory will have the capacity to manufacture 3 gigawatts of LiFePO4 cells by 2024, with aggressive plans to expand that capacity in the following years. To manufacture these cells American Battery Factory will require 5,300 metric tons of LiFePO4 battery cathode powder in 2024, which requirement will increase in the years following as American Battery Factory's manufacturing capacity increases.

American Battery Factory intends to manufacture cells that qualify as Made in America for use in Dakota Lithium battery packs and intends to source LiFePO4 battery cathode powder from Dakota Lithium that is Made in America.

Dakota Lithium is sourcing Made in America cells from American Battery Factory for the intent of building Made in America battery packs to power Made in America tractors that will be sold in the US and global agricultural markets.

Please note this letter is the intent of American Battery Factory and is not a purchase order. It reflects a forecast of future sales based on the best available data and is non-binding. As the LiFePO4 battery cathode powder supplied by Dakota Lithium meets the supplier and engineering requirements of American Battery Factory, American Battery Factory and Dakota Lithium will engage in further discussions with the intent to enter into a definitive agreement for the purchase and supply of LiFePO4 battery cathode powder.

Together American Battery Factory and Dakota Lithium will help to build a domestic lithium battery supply chain and transform the United States economy. We look forward to this partnership.

Sincerely,

Paul Charles
Chief Executive Officer
American Battery Factory

Mike Davidson
Chief Operations Officer
American Battery Factory

APPENDIX D

QUALIFICATIONS OF KEY PERSONNEL

DR. YONG HOU
Director of Research and Development
218.791.3746 (phone), hou@dakotalithium.com

Education and Training
Ph.D., Systems Engineering, University of Shanghai for Science & Technology, China, 2007.
M.S., Systems Engineering, University of Shanghai for Science & Technology, China, 1992.
B.S. Electronics Engineering, Hunan University of Art & Science, China 1983.

Research and Professional Experience
Oct 2008–Present: Cofounder and VP of Research, Dakota Lithium Materials, Grand Forks, ND. Research includes nano-sized LiFePO4 powder as ideal cathode materials for lithium-ion batteries, battery packs for electric vehicles, and energy storage.

Apr 2017–Apr 2022: Research Engineer, IES, University of North Dakota, half-time. Research focused on battery materials and energy storage including "A Low-Cost and Reproducible Synthetic Procedure for Mass Production of Lithium Iron Phosphate (LFP) Cathode Materials for Lithium-Ion Batteries," "Preparation of Graphene-Modified $LiFePO_4$ Cathode for Li-Ion Battery," "Advanced Integrated Solar–LFP Battery-Powered Pump System for Remote Farm Fields," " The Preparation of a High-Capacity Graphene Modified Graphite/SiOx Anode Electrode," "Porous Silicon/Lignite-Derived Graphene Composite Anodes for Lithium-Ion Battery," "Improve Electrical Conductivity of Substrate Materials for Bipolar Plate Lead-Acid Battery," and "Lignite-Derived Graphene/Si Nanocomposite Anode for Lithium-Ion Battery" projects. Expertise includes electrochemical enhancement of battery electrode; energy storage and conversion; advanced BMS; battery packs; distributed microgrid systems; and modeling of renewable energy systems.

Aug 2008–Jul 2012: Adjunct Professor, Department of Technology, University of North Dakota, part-time. Taught Renewable Energy Economics, Energy Systems and Sustainability, Product Research and Development, Technology and Innovation Management, and Operations Management; managed and negotiated to order for lab equipment; assisted in lab maintenance and organization; and mentored graduate and undergraduate in research design and problem-solving toward their energy-related research.

2007–2008: VP of Product Development, Neosonic Li-Polymer Energy (Zhuhai) Corporation, China. Worked on "The Design and Development of New Lithium Polymer Battery Use for Light Electric Vehicles"; directed enterprise resource planning (ERP) system and testing laboratory of the company.

1995–2002: Founder/General Manager, Shanghai Zhongdian International, China. Managed wholesale of Compaq computer and service business and led product design and maintenance of management information system (MIS) software project.

1992–1995: Engineering Manager, Shanghai Branch Company of Chinese Electronics Group, China. Worked on hardware and software service and distribution of AST and Tatun computers.

Awards and Honors
Recipient, *Innovate ND Award*, North Dakota Commerce, 2010.
Recipient, *National Torch Plan Award*, project of MIS of Commerce Bank's Loan Management, China, 2000.

First Place, *Mathematics Competition*, Hunan University of Art and Science, China 1981.

Relevant Publications

Xu, S.; Hou, X.; Wang, D.; Zuin, L.; Zhou, J.; Hou, Y.; Mann, M. Insights into the Effect of Heat Treatment and Carbon Coating on the Electrochemical Behaviors of SiO Anodes for Li-Ion Batteries. *Advanced Energy Materials* Feb **2022**.

Zhu, H.; Gao, Y.; Hou, Y., Wang, Z.; Feng, X. Real-Time Pricing Considering Different Type of Smart Home Appliances Based on Markov Decision Process. *International J of Electrical Power and Energy Systems,* May **2019**.

Zhu, H.; Gao, Y.; Hou, Y.; Tao, L. Multi-Time Slots Real-Time Pricing Strategy with Power Fluctuation Caused by Operating Continuity of Smart Home Appliances. *Engineering Applications of Artificial Intelligence,* May **2018**, *71*, 166–174.

Zhu, H.; Gao, Y.; Hou, Y. Real-Time Pricing for Demand Response in Smart Grid Based on Alternating Direction Method of Multipliers. *Mathematical Problems in Engineering.* **2018**, doi:10.1155/2018/8760575.

Wu, W.; Peng, L.; Hou, Y.; Su, L.; Zhang, H. An Experimental Investigation on the Solubility Characteristics of CO_2-Ionic Liquids as New Working Pairs Used for Absorption Refrigeration Systems. *The Journal of Chemical Thermodynamics*, Jan **2018**.

Wu, W.; Hou, Y.; Wu, J.; Su, L. Predicting Phase Behavior of CO_2 and Imidazole Ionic Liquids as New Working Pairs in Absorption Refrigeration System Using GC-EOS Method. *International Journal of Thermal Sciences,* June **2016**.

Hou, Y.; Peng, Y.; Johnson, A.L.; Shi, J. Empirical Analysis of Wind Power Potential at Multiple Heights for North Dakota Wind Observation Sites. *Energy Science and Technology,* Aug **2012**, *4*(1), ISSN 1923-8460.

Hanson, S.M.; Johnson, A.L.; Hou, Y.; Hellwig. Recharging Centers for Disease Control Light Trap Batteries with Solar Panel. *International Journal of Applied Science and Technology*, Sep **2012,** *2*(7).

Hou, Y.; Xu, F.; Chen, W. A Sustainable Growth Model Based on the Substitution of Renewable Energy. *Systems Engineering – Theory & Practice*, Sep **2008,** *28*(9), 67–72.

Hou, Y.; Xu, F.; Chen, W. A Sustainable Growth Model with the Utilization of Renewable Energy. *IEEE International Conference on Communications, Services, Knowledge and Engineering*, Sep **2007,** 5012–5015, ISBN: 1-4244-1311-7.

Synergistic Activities

Reviewer: *Sustainable Energy, Grids and Network; Technological Forecasting and Social Change; Sustainable Cities and Society; Waste and Biomass Valorization; Colloids and Surfaces A: Physicochemical and Engineering Aspects; ACS Omega, ACS Sustainable Chemical & Engineering.*

XIN ZHANG
Senior Engineer
701.739.4090, xin@cleanrepublic.com

Education and Training
Ph.D. in Chemical Engineering, University of North Dakota, Grand Forks, ND, (May 2023)
M.S. in Chemical Engineering, Guizhou University, Guiyang, China, (June 2017)
B.S. in Chemical Engineering, Qingdao University of Science and Technology, Qingdao, China, (June 2013)

Research and Professional Experience
September 2023–Present: Senior Engineer, Clean Republic doing business as Dakota Lithium Materials, Seattle, Washington.

- Leading the development of advanced lithium-ion battery materials, focusing on optimizing both cathode and anode components for enhanced performance and efficiency.
- Collaborated with cross-functional teams, including research and development, production, and quality assurance, to ensure the successful integration of new materials into product lines.
- Conducted comprehensive testing and analysis of new material formulations, utilizing state-of-the-art laboratory equipment and techniques.

May 2023–August 2023: Research Associate, CEM Energy Studies, University of North Dakota, ND.

- LFP cathode, silicon anode development for advanced lithium-ion batteries.
- Proposal drafting.

September 2018–May 2023: Graduate Research Associate, CEM Energy Studies, University of North Dakota, ND.

- Silicon-based anode, LFP cathode development for advanced lithium-ion batteries.
- Proposal drafting and manuscript preparation.

September 2018–December 2018: Internship, Pack Lithium-Ion Batteries Production, Clean Republic LLC, Grand Forks, ND.

- Lithium-ion battery pack design and fabrication.

July 2018–September 2018: Internship, Button Lithium-Ion Batteries Production, Mic-Power LLC, China.

- Button lithium-ion battery cell electrode design and fabrication.
- Button cell electrolyte injection.

March 2013–April 2013: Internship, Petrochemical Plant, Qilu Petrochemical Co., Ltd, China.

- Catalyst design and regeneration.

January 2010–February 2010: Internship, Polyvinyl Alcohol Chemical Plant, Anhui Wanwei Group CO. Ltd, China.

- Process design and distributed control system operation.

Research Projects

- A Low-Cost and Reproducible Synthetic Procedure for Mass Production of LFP Cathode Materials for LIBs. 2022–2023.

- Preparation of Graphene-Modified $LiFePO_4$ Cathode for LIBs. 2018–2022 (Phase I, II).
- Preparation of Graphene-Modified $LiFePO_4$ Cathode for LIBs (ND-REC). 2019–2020.
- Production of Battery-Grade Iron Phosphate (Plant Design). 2023.
- The Preparation of Nano-silicon Enveloped Graphite Composite for High-Performance Lithium-Ion Batteries. 2021–2023.
- Electrochemical Performance Improvement for Carbon Coated SiO_x and Graphite Composite LIB Anode by Chemical Pre-Lithiation Process (DOE DE-FE0031984). 2021–2022.
- The Preparation of a High-Capacity Graphene Modified Graphite/SiO_x Anode Electrode for Commercial Button Batteries. 2020–2022.
- Porous Silicon/Lignite-Derived Graphene Composite Anodes for LIBs (UCFER). 2019–2020.
- Freestanding Lignite-Derived Graphene-Based Foam Anode for LIBs (ND EPSCoP). 2019–2020.

Patents

Lu, Y., Zhang, X., Wang, P., Zhao, G., Liu, Y., and He, M. “Catalyst for Oxidative Coupling of Methane, Preparation Method thereof and Application thereof.” U.S. Patent No. 11,298,684. 12 Apr. 2022.

Publications

Chen, Z., Pan, H., Lin, Q., Zhang, X., Xiao, S., and He, S. 2017, The Modification of Pd Core–Silica Shell Catalysts by Functional Molecules (KBr, CTAB, SC) and their Application to the Direct Synthesis of Hydrogen Peroxide from Hydrogen and Oxygen. *Catalysis Science and Technology*, 7, p. 1415–1422.

Li, F., Zhang, X., and Ji, Y. 2023, Decision Tree Model to Classify Wastewater Evaporation. *Industrial and Engineering Chemistry Research*.

Li, F., Zhang, X., and Ji, Y. 2023, Influence of Air Velocity and Solid Concentration on Water Evaporation during Sewage Sludge Air-Drying. Under Review.

Pan, H., Zhao, J., Zhang, X., Yi, Y., Liu, F., and Lin, Q. 2018, Catalytic Combustion of Styrene over the Binary Mixture of Manganese and Copper-Based Catalyst in the Absence and Presence of Water. *Kinetics and Catalysis*, p. 296–303.

Pushparaj, R.I., Cakir, D., Zhang, X., Xu, S., Mann, M., and Hou, X. 2021, Coal-Derived Graphene/MoS_2 Heterostructure Electrodes for Li-ion Batteries: Experiment and Simulation Study. *ACS Applied Materials and Interfaces*, 59950.

Pushparaj, R.I., Hou, X., Zhang, X., and Abdelmalek, B. 2023, Coal-Derived Porous Carbon Anodes for Na-Ion Batteries. Under review.

Saha, S., Kiran, K., Zhang, X., Hou, X., and Roy, S. 2023, Investigating the Tribological and Corrosion Behavior of Co–Cr Alloy as an Implant Material for Orthodontic Applications. *Wear*, 204755.

Saha, S., Kiran, K., Zhang, X., Hou, X., and Roya, S. 2023, Investigating the Tribological and Corrosion Behavior of Co-Cr Alloy as an Implant Material for Orthodontic Applications. 24th International Conference on Wear of Materials. Banff, Canada.

Wan, J., Pan, H., Lin, Q., Zhao, J., Zhang, X., Hu, P. 2017, Activated Carbon Preparation from Different Raw Materials and Its Separation and Enrichment of CH_4 from Coalbed Methane. *Natural Gas Chemical Industry*, 42(2) p. 34–39.

Wang, P., Zhang, X., Zhao, G., Liu, Y., and Y. Lu. 2018, Oxidative Coupling of Methane: MO_X-modified (M=Ti, Mg, Ga, Zr) Mn_2O_3-Na_2WO_4/SiO_2 Catalysts and Effect of MO_X Modification. *Chinese Journal of Catalysis*, 39(8) p. 1395–1402.

Xu, S., Zhou, J., Wang, J., Pathiranage, S., Oncel, N., Pushparaj, R.I., Zhang, X., Mann, M., and Hou, X. 2021, In-Situ Synthesis of Graphene-Coated Silicon Monoxide Anodes from Coal-Derived Humic Acid for High-Performance Lithium-Ion Battery. *Advanced Functional Materials*, 2101645.

Ye, B., Zhang, X., Gao, H. Salehfar, Y., Wu, N., and Hou, Y. 2023, Deep Neuro-Dynamic Programming for Real-Time Control Strategy Optimization of an Integrated Power System. Under review.

Zhang, R., Hou, X., Zhang, X., and Ji, Y. 2022, Chemical Pre-Lithiation of Lignin-Derived Hard Carbon Aimed for Lithium-Ion Battery Anode with High Rate Performance. Presentation, AIChE Annual Conference, AZ, USA.

Zhang, X., Hou, X., and Mann, M. 2021, Coal-Derived Graphene as a 3D Free-Standing Lithium-Ion Battery Anode. Poster and Podium Presentation, ND EPSCoR State Conference, ND, USA.

Zhang, X., Hou, X., and Mann, M. 2021, Coal-Derived Graphene-Based Freestanding Si@G Foam Anode for Lithium-Ion Battery. Podium Presentation, 3rd AIChE Battery and Energy Storage Conference. Podium Presentation, USA.

Zhang, X., Hou, X., Hou, Y., and Mann, M. 2019, Improving Electrical Conductivity of Carbon Fiber for Flexible Battery by Metal Electrodeposition Method. Poster Presentation. AIChE Annual Conference, FL, USA.

Zhang, X., Hou, X., Hou, Y., and Mann, M. 2022, Electrochemical Performance Improvement for Carbon Coated SiO_x and Graphite Composite Lithium-Ion Battery Anode by Chemical Pre-Lithiation Process. Poster Presentation, 4th AIChE Battery and Energy Storage Conference, NY, USA.

Zhang, X., Hou, X., Hou, Y., Zhang, R., Xu, S., and Mann, M. 2023, Insights into Chemical Pre-Lithiation of SiO_x/Graphite Composite Anodes through Scanning Electron Microscope Imaging. *ACS Applied Energy MaterialX.s*, 6, p. 7996–8005.

Zhang, X., Hou, Y., Mann, M., and Hou, X. 2023, Electrode Optimization of SiO_x/Graphite Anode for Lithium-Ion Batteries Using a Taguchi Design Method. Under review.

Zhang, X., Mann, M., Hou, Y., and Hou, X. 2023, Non-Woven Carbon Fiber Substrate for Bipolar High-Energy Density Lithium-Ion Batteries. Under review.

Zhang, X., Pan, H., Lin, Q., Chen, Z, Wang, J. 2017, Effect of Pd-Based Catalysts Prepared by Different Methods on Performance of Direct Synthesis of H_2O_2. *Inorganic Chemicals Industry*, 49(6) p. 85–89.

Zhang, X., Wang, H., Pushparaj, R.I., Mann, M., and Hou, X. 2022, Coal-Derived Graphene Foam and Micron-Sized Silicon Composite Anodes for Lithium-Ion Batteries. *Electrochimica Acta*, 141329.

ANDREW AUGUSTINE JAY
Chief Executive Officer
206.200.7469, andrew@andrewjay.org

Education and Training
Master of Nonprofit Leadership, Albers School of Business, Seattle University, 2009.
Bachelor of Arts, Political Science and Cultural Anthropology, New College of Florida, 2003.

Research and Professional Experience
2018–Present: Chief Executive Officer, Dakota Lithium. Dakota Lithium (Dakotalithium.com) creates practical, clean tech energy products to help people across the planet with long-lasting energy storage.

- Increased battery sales and revenue by 2180% between 2018 and 2022 to create the number one consumer lithium battery brand in United States and Canada.
- Established Dakota Lithium as a premium brand by scaling exceptional customer service, high-quality product development, digital marketing excellence, and extensive social media partnerships.
- Invested in research and development (R&D) partnership with a leading research university to develop a patented lithium cathode battery materials production process. Built pilot-scale chemical-manufacturing assembly line to turn this R&D into new line of business: Dakota Lithium Materials.
- Negotiated and finalized contracts valued at US$500+ million with leading electric vehicle manufactures to purchase lithium batteries manufactured by Dakota Lithium, including lithium battery cells manufactured using Dakota Lithium's cathode material.

2018–Present: Chief Executive Officer, Hilltopper Electric Bike Company. Hilltopper is an original e-bike company, with a decade of high-voltage adventures in the Seattle area (Hilltopperbikes.com). Owned by a parent company of Dakota Lithium, Clean Republic.

2014–2018: Chief Executive Officer, Tiny Trees Preschool. As founding CEO, built Tiny Trees into the largest outdoor preschool in United States. Tiny Trees uses outdoor classrooms to make quality education in reading, math, and science affordable for families and give kids glorious childhoods—one full of play, exploration, and wonder of the natural world.

- Opened ten schools in Washington State, with 270 children attending daily.
- Developed brand, website, social media, and marketing collateral that fueled exponential customer growth and long wait lists. For example, in 2018, Tiny Trees received over 5000 applications for only 300 spaces.
- Passed legislation in Washington State that created a friendlier regulatory environment. New legislation created health and safety standards for outdoor preschool that allowed for full-day classes.
- Partnered with 30+ nature-based and outdoor preschools to create Washington Nature Preschool Association (WaNPA.org) to advocate for and successfully pass legislation.
- Built a high-performing team of 40+ teachers and staff and raised $1.1. million in start-up capital.

2013–2014: Director of Seward Park Audubon Center, National Audubon Society. Directed environmental learning center serving 4000 youth and 10,000 adults a year, including marketing, fundraising, staff leadership, finance, and operations.

2007–2013: National Director of BOLD & GOLD, YMCA of Greater Seattle. Built BOLD & GOLD – Boys/Girls Outdoor Leadership Development from a small program serving 30 youth a year to a national brand with over 1500 youth attending 72 different wilderness expeditions across the United States and Canada.

- Managed and led team of 60 staff.
- Raised $1.6 million in major gifts and institutional investors.
- Directed BOLD & GOLD national expansion to YMCAs across country.
- Developed partnerships with historically black colleges and University of Washington affinity groups to create a diverse and equitable workforce that resulted in 40% of 60 staff identifying as people of color.
- Directed a successful multistate advocacy campaign that pushed for changes to federal regulations, allowing nonprofits like YMCA to access federal lands for youth outdoor trips.
- Developed brand, website, social media, and marketing collateral that fueled exponential customer growth (>80% annually) and long wait lists.

2003–2007: Course Director, Instructor, and Trainer, Outward Bound USA and South Africa. Used outdoor adventure as tool to help people build the leadership and life skills needed to thrive in business, school, and life. Deployments included helping incoming MBA students with Stanford School of Business build team leadership and communication skills through student-led wilderness expeditions (WA), helping at-risk youth learn anger management and decision-making skills (FL, CO, WA, AK), and training staff in South Africa how to deliver quality youth development programs.

2005–2007: Course Leader, National Outdoor Leadership School. Taught undergraduate students leadership, management, and communication skills on 30- to 90-day wilderness expeditions in North America. Students received college credit from the University of Utah.

1999–2003: Executive Director, New College Bike Shop. Operated on-campus bike shop. Recruited, trained, and supervised all-volunteer staff of student mechanics and managed bike share program with fleet of 50+ community bicycles.

Awards and Honors

- Winner of Social Venture Partners Fast Pitch Award for Best Nonprofit Start-Up
- Winner of Sustainable Seattle Leadership Award
- Winner of Washington Women's Foundation Award

RYAN ELLISON
Director of Business Development and Investor Relations
+46 767136312, ryan@dakotalithium.com

Education and Training
B.S. (Cum Laude), Commercial Aviation, University of North Dakota.
- Commercial/Instrument SEL and MEL (July 2003)
- Flight Instructor, SEL
- Flight Instructor, Instrument (March 2004)

Research and Professional Experience
January 2009–Present: Director of Business Development and Investor Relations – Founder and Chairman, Clean Republic doing business as Dakota Lithium Materials, Seattle, Washington. Helped establish Clean Republic, a clean energy company focused on providing green solutions to everyday people. For the past 5 years been focused on the development of new business lines and raising capital to support the ever-growing business. In addition to main duties, provide an interface between investors and the company to ensure proper information flow and ideas.

May 2016–Present: Principal, Ellison Group AB, Stockholm, Sweden. Provides consultancy services to a number of clients in the aviation domain with a focus on NextGen/SESAR concepts, time- and performance-based operations and next-generation navigation/surveillance systems. Additional clients outside the aviation domain include those focused on bringing new technology to market, including electric vehicles, lithium batteries, and others.

May 2014–May 2016: Senior Vice President – Aventus Business Development, AVTECH Sweden AB, Stockholm, Sweden. Developed a comprehensive sales strategy for the Aventus product group. Worked directly with the CEO, CFO, and Board of Directors in communicating needs of the clients, overall strategy, and detailed sales plans for customers. Coordinated with the technical team in developing a forward-looking business development strategy to meet the future needs of customers. Developed technical material to disseminate key aspects of the Aventus product.

June 2013–May 2014: Vice President, Global Consultancy, AVTECH Sweden AB, Stockholm, Sweden. Worked directly for the CEO during a period of company reconstruction while developing and implementing strategies and business lines for AVTECH’s Consultancy Group. Provided technical consultation to AVTECH’s partners and customers in the area of time- and performance-based operations and weather uplinks.

February 2010–June 2013: Key Account Manager, PBN Technical Expert, AVTECH Sweden AB, Stockholm, Sweden. Provided consultancy expertise within performance-based operations, trajectory- and time-based operations, and flow management both internally and externally to AVTECH. Participated in a number of European and U.S.-based airspace modernization programs (SESAR, NextGen) while maintaining close relationships with customers throughout the projects' life cycles.

February 2009–February 2010: System Engineer, CSSI Inc., Washington, D.C. Developed concepts for NextGen with the FAA/ATO-P. Fostered client relationships and provided timely services, development of concept papers, and support.

August 2007–November 2008: Business Development/Technical Pilot, Naverus, Inc., Kent, Washington. Developed concepts and techniques to identify benefits of Performance-Based Navigation (PBN) Program. Cultivated strong client relationships, identified client needs, and resolved all client issues. Key PNB consultant on design and procedures.

DR. ALEXANDER AZENKENG
Assistant Director for Critical Materials
Energy & Environmental Research Center (EERC), University of North Dakota (UND)
15 North 23rd Street, Stop 9018, Grand Forks, North Dakota 58202-9018 USA
701.777.5051, aazenkeng@undeerc.org

Education and Training

Ph.D., Theoretical Physical Chemistry, University of North Dakota, 2007.
Dissertation: Theoretical Studies of Low-Lying Electronic States of Lithium, Titanium, and Mercury Compounds; supervised by Prof. Mark R. Hoffmann.
M. Sc., Chemistry, University of Buea, Cameroon, 1998.
Thesis: Preparation of Iron (III) and Nickel (II) Oxide Thin Films from the Corresponding Metal Acetylacetonates via Pyrolysis.
B.Sc., (magna cum laude) Chemistry, University of Buea, Cameroon, 1996; with professional minor in Chemical Processing Technology.

Research and Professional Experience

May 2021–Present: Assistant Director for Critical Materials, EERC, UND.

- Applies chemistry principles to studies involving multiple research portfolios, including computational simulations to elucidate reaction mechanisms of coal combustion and chemical processes at the molecular level; chemical transformations in low-rank coal upgrading; coal–biomass gasification technologies; characterization of materials by spectroscopic and microscopic techniques; CO_2–amine reaction chemistry of CO_2 capture, utilization, and sequestration (CCUS) technologies; reservoir geochemistry of CO_2 sequestration; nuclear magnetic resonance (NMR) spectroscopy study of unconventional oil and gas reservoirs; improved methods for extraction and isolation of critical minerals (rare-earth elements [REEs] and platinum group metals [PGMs]) from coals; and development of approaches for production of high-value carbon materials such as graphene and graphite from coal feedstocks.

Current research interests include development of approaches for making high-value products (graphene and graphite) from coal, critical mineral research for REEs and PGMs, carbon capture technologies for coal combustion and gasification systems, and carbon storage/sequestration in geological sinks.

2008–April 2021: Senior Research Scientist, EERC, UND.

- Applied chemistry principles to studies involving multiple research portfolios, including chemical analysis of materials by scanning electron microscopy (SEM), material corrosion evaluation in oil and gas applications, CO_2 capture using aqueous amine solvents, CO_2 sequestration in geologic formations, and chemical transformations in low-rank coal upgrading.
- Involved in developing analytical approaches to better characterize organic shale and tight rock formations for potential CO_2 storage and improved methods for analyzing REEs in coals, geologic samples, and produced water from oil and gas operations.

2007–2008: Temporary Researcher, EERC, UND.

- Worked on NO_x emission control technologies, CO_2 capture technologies, and gasification technologies.

2005–2007: Graduate Research Assistant, EERC, UND.

- Worked on quantum mechanical modeling of Hg oxidation reactions on activated carbon surfaces.

Professional Activities

Member, Microscopy Society of America, 2010–Present
Member, North Dakota Academy of Sciences, 2004–Present
Member, American Chemical Society, 2002–Present

Publications and Presentations

Books and Book Chapters

Ralston, N.V.C.; Azenkeng, A.; Raymond, L.J. Mercury-Dependent Inhibition of Selenoenzymes and Mercury Toxicity. In *Methylmercury and Neurotoxicity*; Ceccatelli, S., Aschner, M., Eds.; Current Topics in Neurotoxicity 2; Springer: New York, 2012; pp 91–99.

Peer-Reviewed Publications

Azenkeng, A.; Mibeck, B. A.F.; Kurz, B. A.; Gorecki, C. D.; Myshakin, E. M.; Goodman, A. L.; Azzolina, N. A.; Eylands, K.E.; Butler, S.K.; Sanguinito, S. An Image-Based Equation for Estimating the Prospective CO_2 Storage Resource of Organic-Rich Shale Formations. *International Journal of Greenhouse Gas Control* **2020**, *98*, 103038.

Laumb, J.D.; Glazewski, K.A.; Hamling, J.A.; Azenkeng, A.; Watson, T.L. Wellbore Corrosion and Failure Assessment for CO_2 EOR and Storage: Two Case Studies in the Weyburn Field. *International Journal of Greenhouse Gas Control* **2016,** *54*, 479–489.

Olson, E.S.; Azenkeng, A. Laumb, J.D.; Jensen, R.R.; Benson, S.A.; Hoffman, M.R. New Developments in the Theory and Modeling of Mercury Oxidation and Binding on Activated Carbons in Flue Gas. In *Air Quality VI: Mercury, Trace, Elements, SO_3, Particulate Matter, and Greenhouse Gases*, Special Issue of *Fuel Process. Technol.* **2009**, *90* (11), 1360–1363.

Conference and Other Presentations

Azenkeng, A.; Mibeck, B.A.F.; Eylands, K.E.; Butler, S.K.; Kurz, B.A.; Heebink, L.V. Advanced Characterization of Unconventional Oil and Gas Reservoirs to Enhance CO_2 Storage Resource Estimates – Organic Structure and Porosity of Organic-Rich Shales. Presented at Mastering the Subsurface Through Technology Innovation, Partnerships & Collaboration: Carbon Storage & Oil & Natural Gas Technologies Review Meeting, Pittsburgh, PA, Aug 1–3, 2017.

Klenner, R.C.L.; Braunberger, J.R.; Sorensen, J.A.; Eylands, K.E.; Azenkeng, A.; Smith, S.A. A Formation Evaluation of the Middle Bakken Member Using a Multimineral Petrophysical Analysis Approach. Paper presented at the SPE/AAPG/SEG Unconventional Resources Technology Conference, Denver, CO, Aug 25–27, 2014; URTeC Paper No. 1922735.

Laumb, J.D.; Azenkeng, A.; Heebink, L.V.; Jensen, M.D.; Raymond, L.J. CO_2 Utilization Technologies for Lignite-Based Generation. Poster Abstract in *Proceedings of Air Quality IX: An International Conference on Environmental Topics Associated with Energy Production*; Arlington, VA, Oct 21–23, 2013.

Laumb, J.D.; Kay, J.P.; Holmes, M.J.; Cowan, R.M.; Azenkeng, A.; Heebink, L.V.; Hanson, S.K.; Jensen, M.D.; Letvin, P.A.; Raymond, L.J. Economic and Market Analysis of CO_2 Utilization Technologies – Focus on CO_2 Derived from North Dakota Lignite. *Energy Procedia* **2013**, *37*, 6987–6998.

Laumb, J.D.; Kay, J.P.; Holmes, M.J.; Cowan, R.M.; Azenkeng, A.; Heebink, L.V.; Hanson, S.K.; Jensen, M.D.; Letvin, P.A.; Raymond, L.J. Economic and Market Analysis of CO_2 Utilization Technologies –

Focus on CO_2 Derived from North Dakota Lignite. Paper presented at the 11th International Conference on Greenhouse Gas Control Technologies (GHGT-11), Kyoto, Japan, Nov 18–22, 2012.

Azenkeng, A. Development of an Improved CCSEM Technique for Quantitative Coal Mineralogy. Presented at the 28th Annual International Pittsburgh Coal Conference, Pittsburgh, PA, Sept 12–15, 2011.

Technical Reports

Azenkeng, A. *Evaluation of Lime Kiln Ash Ring Samples for Environmental Energy Services, Inc.*; Final Report for Environmental Energy Services, Inc.; EERC Publication 2018-EERC-08-03; Energy & Environmental Research Center: Grand Forks, ND, Aug 2018.

Azenkeng, A.; Kurz, B.A.; Gorecki, C.D. *An NMR-Based Method for Fluid Typing and Proportion Estimation for the Potential for CO_2 Storage or CO_2 EOR in the Middle Bakken Formation*; Final Report included in *Subtask 4.1 – Strategic Studies* Final Report (Aug 10, 2015 – May 31, 2017) for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FE0024233; EERC Publication 2017-EERC-05-13; Energy & Environmental Research Center: Grand Forks, ND, May 2017.

Azenkeng, A.; Pavlish, B.M.; Lentz, N.B.; Galbreath, K.C.; McCollor, D.P. *Feasibility of Hydrothermal Dewatering for the Potential to Reduce CO_2 Emissions and upgrade Low Rank Coals*; Final Report (June 25, 2008 – Dec 31, 2009) for the University of Wyoming; EERC Publication 2010-EERC-02-02; Energy & Environmental Research Center: Grand Forks, ND, Feb 2010.

Hanson, S.K.; Azenkeng, A.; Laumb, J.D.; McCollor, D.P.; Pavlish, B.M.; Buckley, T.D.; Botnen, L.S. *Subtask 3.7 – Beneficiated Lignite Market Study*; Final Report (Aug 1, 2009 – June 30, 2010) for U.S. Department of Energy National Energy Technology Laboratory Cooperative Agreement No. DE-FC26-08NT43291; EERC Publication 2010-EERC-06-09; Energy & Environmental Research Center: Grand Forks, ND, June 2010.

JASON D. LAUMB
Director of Advanced Energy Systems Initiatives
Energy & Environmental Research Center (EERC), University of North Dakota (UND)
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Education and Training

M.S., Chemical Engineering, University of North Dakota, 2000.
B.S., Chemistry, University of North Dakota, 1998.

Research and Professional Experience

May 2021–Present: Director of Advanced Energy Systems Initiatives, EERC, UND. Laumb provides leadership on projects related to advanced energy systems and leads a multidisciplinary team of scientists and engineers working on advanced energy technologies from pollution control to new energy platforms. Principal areas of interest and expertise include renewable energy, CO_2 capture, techno-economic modeling, extraction of critical materials, environmental control systems, supercritical CO_2 power cycles, and advanced gasification technologies. Experience includes biomass and fossil fuel conversion for energy production, with an emphasis on ash effects on system performance; trace element emissions and control for fossil fuel combustion systems, with a particular emphasis on air pollution issues related to mercury and fine particulates; and design and fabrication of bench- and pilot-scale combustion and gasification equipment.

September 2019–April 2021: Assistant Director of Advanced Energy Systems, EERC, UND. Laumb assisted the EERC executive team by providing leadership on projects related to advanced energy systems. Laumb led a multidisciplinary team of scientists and engineers working on advanced energy technologies from pollution control to new energy platforms. Specific areas of interest included CO_2 capture, techno-economic modeling, environmental control systems, supercritical CO_2 power cycles, and advanced gasification technologies. Research activities focused on low-carbon-intensity power cycles for fossil fuel-fired systems.

2008–August 2019: Principal Engineer, Advanced Energy Systems Group Lead, EERC, UND. Laumb led a multidisciplinary team of 30 scientists and engineers to develop and conduct projects and programs on power plant performance, environmental control systems, the fate of pollutants, computer modeling, and health issues for clients worldwide. Efforts focused on development of multiclient jointly sponsored centers or consortia funded by government and industry sources. Research activities included computer modeling of combustion/gasification and environmental control systems, performance of SCR technologies for NO_x control, mercury control technologies, hydrogen production from coal, CO_2 capture technologies, particulate matter analysis and source apportionment, the fate of mercury in the environment, toxicology of particulate matter, and in vivo studies of mercury–selenium interactions.

2001–2008: Research Manager, EERC, UND. Laumb led projects involving bench-scale combustion testing of various fuels and wastes as well as a laboratory that performs bench-scale combustion and gasification testing. Laumb served as principal investigator and managed projects related to the inorganic composition of coal, coal ash formation, deposition of ash in conventional and advanced power systems, and mechanisms of trace metal transformations during coal or waste conversion and wrote proposals and reports focused on energy and environmental research.

2000–2001: Research Engineer, EERC, UND. Laumb assisted in the design of pilot-scale combustion equipment and wrote computer programs to aid in the reduction of data, combustion calculations, and prediction of boiler performance. Laumb was also involved in the analysis of combustion control technologies' ability to remove mercury and the suitability of biomass as boiler fuel.

1998–2000: SEM Applications Specialist, Microbeam Technologies, Inc., Grand Forks, North Dakota. Laumb gained experience in power system performance including conventional combustion and gasification systems; knowledge of environmental control systems and energy conversion technologies; interpreting data to predict ash behavior and fuel performance; assisting in proposal writing to clients and government agencies such as the National Science Foundation and the U.S. Department of Energy; preparing and analyzing coal, coal ash, corrosion products, and soil samples using scanning electron microscopy (SEM)/energy-dispersive spectroscopy (EDS); and modifying and writing FORTRAN, C+, and Excel computer programs.

Professional Activities
Member, American Chemical Society

Publications
Has coauthored numerous professional publications.

APPENDIX E

BUDGET NOTES

BUDGET NOTES

DAKOTA LITHIUM MATERIALS (DLM)

BUDGET INFORMATION

The proposed work will be done on a cost-reimbursable basis. The distribution of costs between budget categories (labor, travel, supplies, equipment, etc.) and among funding sources of the same scope of work is for planning purposes only.

The cost of this project is based on a specific start date indicated at the top of the Dakota Lithium Materials (DLM) budget. Any delay in the start of this project may result in a budget increase. Budget category descriptions presented below are for informational purposes; some categories may not appear in the budget.

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. The labor category rate is the average rate of a personnel group with similar job descriptions. Salary costs incurred are based on direct hourly effort on the project. Costs for general support services such as contracts and intellectual property (IP), accounting, human resources, procurement, and clerical support of these functions are charged as facilities and administrative (F&A) costs.

Fringe Benefits: Fringe benefits are budgeted as a percentage of direct labor. The rate of 25% is estimated on the basis of historical data and is charged as actual expenses for items such as health and unemployment insurance, social security, and worker's compensation.

Travel: Travel may include site visits, meetings, and conferences. Travel costs are estimated on a U.S. Department of Energy (DOE) example per trip with three trips planned:

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
Budget Period 1									
		2	2	$250	$500	$100	$150	$2,000	Current GSA rates

Equipment: If equipment (value of $5000 or more) is budgeted, it is discussed in the text of the proposal and/or identified more specifically in the accompanying budget detail.

Item	Unit	Cost/unit	Cost	Justification
Resodyn Mixer, RAM 5	1	$1,300,000	$1,300,000	Dry mixing raw materials
2 in 1 Synthesis and Carbon Coating Furnace	1	$1,214,000	$1,214,000	sinter LFP cathode and CVD carbon coating
Jet Mill, LNJ-36A	2	$ 118,000	$ 236,000	Materials milling and classification
Glove box, 16-200-412	1	$ 49,000	$ 49,000	Inject electrolyte, cell vacuum and case sealing
01-9191-149 Scale	1	$ 10,520	$ 10,520	Material synthesis
Feeding System	1	$ 25,000	$ 25,000	Handling of material throughout the process
51-014-540 Vacuum Oven	1	$ 16,650	$ 16,650	Material synthesis
01-184-214 Vacuum Pump	1	$ 6,350	$ 6,350	Material synthesis
MSKAFAIIH B110 Coaster (MTI)	1	$ 12,000	$ 12,000	Full-cell fabrication
MSK180 Die Cutter (MTI)	1	$ 9,989	$ 9,989	Full-cell fabrication
MSK111A-E Stacking machine	1	$ 36,000	$ 36,000	Full-cell fabrication
MSK120 Pouch cell case/cup forming machine	1	$ 12,986	$ 12,986	Full-cell fabrication
MSK115III11 Hot Sealer	1	$ 10,998	$ 10,998	Full-cell fabrication
MSK E2300A Calendaring (MTI)	1	$ 30,975	$ 30,975	Full-cell fabrication
MSK540 Slitting Machine	1	$ 38,750	$ 38,750	Full-cell fabrication
MSK30000w welder	1	$ 22,000	$ 22,000	Full-cell fabrication
Interface 1010E Potentiostat	1	$ 21,700	$ 21,700	Electrochemical performance testing
Full cell tester	5	$ 4,700	$ 23,500	Electrochemical performance testing
Forklift	1	$ 30,000	$ 30,000	Material handling
Warehouse Racking Equipment	2	$ 5,000	$ 10,000	Material Storage
Pallet Jack	1	$ 5,000	$ 5,000	Material Handling
Total			**$3,121,418**	

Supplies: Supplies include items and materials that are necessary for the project and can be directly identified to the project. Supply and material estimates are based on market plot prices and prior experience. Examples of supply items are chemicals raw materials, gases, nuts, bolts, piping, containers, minor equipment (value less than $5000), signage, safety items.

Subcontractor: The EERC will be a subrecipient of this proposal. The EERC budget justification is attached as Appendix B.

Facilities and Administrative Cost: The F&A rate proposed herein is the de minimis rate prescribed by DOE and is applied to modified total direct costs (MTDC). MTDC is defined as total direct costs less individual capital expenditures, such as equipment or software costing $5000 or more with a useful life of greater than 1 year as well as subawards in excess of the first $25,000 for each award.

APPENDIX F

BUSINESS PLAN

BUSINESS PLAN

COMMERCIAL OPPORTUNITY

The transition to clean energy is happening worldwide and it's unstoppable. It is not a question of "if," it is just a matter of how soon. The annual Institute for Energy Studies (IES) report estimates that in 2030 there will be 10 times as many electric vehicles on the road worldwide and 50% of the cars sold in the Unites States will be electric. The agency says solar panels installed across the globe will generate more electricity at the end of the decade than the United States power system produces now. Renewable energy, such as wind and solar, will supply 50% of the world's electricity needs, up from 30% now (World Energy Outlook, International Energy Agency, 2023). The war in Ukraine has increased demand for wind, solar, and other renewables as an alternative to Russian oil and gas. This has led to a scramble to build the lithium batteries needed to store electricity from wind and sunlight for variable use at any time.

Lithium iron phosphate (LFP) cathode materials were invented in the United States and the inventors received a Nobel prize for their work. But according to the U.S. Department of Energy (DOE), 0% of the world's LFP battery material manufacturing now takes place in North America. Greater than 90% of lithium cathode material manufacturing is in Asia, mostly in China. With 0% of the world's LFP cathode production in the United States, battery cell factories must import the materials at a higher cost than a Chinese cell factory. The result is United States cell factories cannot manufacture a cost-competitive product and remain small, with limited production. This impacts industries down the supply chain, with utilities, electric car makers, consumer energy storages, and even the United States defense industry dependent on China to supply their lithium batteries.

Dakota Lithium Materials (DLM) is the leading consumer battery brand in North America, with over 50,000 individual customers each year, over $33 million in revenue in 2022, and an estimated $55 million revenue in 2023. In addition, DLM is a leading original equipment manufacturer (OEM) for the agricultural industry, maritime boat builders, electric cars and trucks, and grid energy storages. The company's business case for LFP cathode material has the company producing profits once the full 10,000-tons/yr facility gets online after 3 years of the project. The majority of the losses will be related to setup time, factory optimization, and quality control. This project will allow for a stabilized start-up period to ensure the LFP cathode meets industry and customer specifications.

DLM leverages the need for millions of lithium battery cells annually to secure sales contracts and supplier agreements with United States cell manufacturers. For example, DLM will commit to ordering cells if the cell manufacturer commits to ordering lithium battery materials from DLM. The result is made-in-America cells built from DLM's battery material technology that can be assembled into made-in-America batteries. This provides a competitive edge for government contracts and for the hearts and minds of American consumers. A number of letters of intent from potential customers have been included within this application package, both from United States and Asian companies.

INNOVATION AND VALUE POSITION

Innovation

DLM began joint research with the University of North Dakota (UND) in 2012. Led by Dr. Yong Hou, DLM has been providing funding for a team of researchers to develop a manufacturing process for LFP cathode material production. The work has been in partnership with UND and received grant funding from the state of North Dakota. The result of this 10 years of research was a successful pilot line for cathode material that this grant will be bring to a mass production scale.

Innovation in lithium-ion batteries (LIBs) is driven by innovation in lithium battery materials. In lab testing, the LFP powder made from the newly developed dry-process technology exceeded the highest industry standard for LFP cathode material, and after laboratory testing has been approved for use by both cylindrical and prismatic cell customers. Product performance characteristics include:

- Exceptionally long lifespan: 3600–6000 recharge cycles, which allows for batteries that last 15–20 years. When combined with innovations in electrolyte, this lifespan can be increased an extra 20%–40%.
- Significantly more than 15.4% cost reduction. DLM has developed a novel dry-process production technology for United States-made LiFePO4 material. Compared with the conventional wet-processing method, the proposed produce process reduces 51% of energy consumption and CO_2 emissions, 99% of water consumption, along with 47% of operating time, which results in 60% less costs in operation and at least 15.4% of total cost reduction for LFP powder product.

Supply Chain Advantages

The United States accounts for 0% of the world's LFP cathode material production. Thus, as a United States company with market-leading technology, DLM has unique advantages that allow for scaling production at low cost. Other approaches to maintain a steady supply of raw materials of good quality for a sustained large-capacity manufacture of LFP cathode materials include use of North Dakota-sourced food-grade glucose products made from corn, with North Dakota being one of the largest producers of glucose products in the United States. Supply chain advantages include the following:

- The United States has 0% of the world's cathode material production. As a United States company with market-leading technology, and a first-to-market opportunity, DLM has unique supply chain advantages that allow for scaling production at low cost.
- The novel dry-process technology is based on unique resonant acoustic mixing RAM equipment made by Resodyn Mixer, a designated manufacturer in Montana.
- DLM has replaced the particle coating, one of the more expensive inputs for cathode materials, with a glucose structure from North Dakota agricultural corn products. North Dakota is one of the major producers of corn in the United States, providing a low-cost and widely available alternative.

Market and Value Position

The global LFP battery market size in 2020 was valued at $8.37 billion. Demand is expected to reach $49.6 billion by 2028, which is a relatively short period for that amount of growth. Furthermore, as advancements continue in LFP cathode materials, the selection of LFP for use in long lifespan energy storage will increase as advancement in lowering costs continues. Currently, there is no LFP cathode production in the United States. Many more sectors will require energy storage in the renewable energy industry, so there is a need for more LFP cathode material supply and not a lack of market. This puts DLM in a unique position to generate material for a wider market.

ESTIMATION OF NEAR-TERM MARKET PROJECTIONS

Internal Demand

DLM has been experiencing rapid growth since it started in 2008. The LFP cathode production can meet DLM's internal demands for LIB cells and battery pack manufacture. For example, in 2022, the company had a demand for more than 700 tons of LFP powder for its LFP battery products. Following the company's growth of 30%-40% annually since it started, it is estimated that the internal demands for LFP cathode materials will continuously grow by 30%–40% annually in the near-term future. Driven by the rapidly growing demand for DLM products and electric grid energy storage applications, there will be a sharp increase by folds in the coming years.

Broader Market Need

There are huge demands for LIB cathode materials for electric vehicle (EVs) and grid energy storage applications in the United States besides DLM's own need.

Production and Sales Projection

To meet the internal and broader market demands in the United States, the objective of this proposed project is to set up a demonstration plant for making LFP material in Grand Forks, North Dakota. Table F-1 provides current projections for 2028. It is anticipated that commercialization of this technology will make DLM even more profitable in the near-to-long-term.

Table F-1. Near-Term Estimates and Sales Projections

Annual Sales and Production Goals			
	2026	**2027**	**2028**
Revenue (USD)	$1,035,000	$11,499,540	$16,560,000
Tons Produced	90	1000	1440
Average Selling Price per Ton (ASP)	$11,500	$11,500	$11,500
Monthly Tons Produced		83	120
New Jobs Generated by DLM	10	27	38

Key Risks to Market

- Regulatory Issues: Currently, there are no major regulatory issues that would affect the production of this material.

- Intellectual Property (IP): DLM owns the IP required for this project. This includes patents, trade secrets, and industry knowledge. In the development of LFP materials-manufacturing technology, DLM chose to operate silently and grow the development privately. Funded with grants from the state of North Dakota and cash contributions made by DLM's profitable battery business, the research performed remained secret. The result is an information advantage, no staff turnover, and a team of researchers who are rooted in the community and the Great Plains. Thus, the IP of the proposed work is wholly American-owned. UND provides additional R&D support for this project. Future IP developed at UND may be licensed to DLM if applicable to this project.

- Market Prices' Uncertainty: The global demand for LFP is rapidly increasing. Therefore, not only are new ventures likely going to enter this LFP market in the United States, but the existing big suppliers are extending their production capability. That will increase the risk of a falling market price of LFP material if the supply is much greater than the demand in the United States. Alternately, one of the main raw material prices, such as lithium carbonate, could increase suddenly.

The ultimate objective of this proposed project is to set up a demonstration plant for making LFP material in Grand Forks, North Dakota. With support from the North Dakota Industrial Commission and DOE, this project will establish a production capacity of 1000 tons upon completion of this project in 2026. By extension, DLM will produce and sell 1440 tons of LFP material by 2028. With government funds invested of approximately $9 million, the DLM project anticipates a result in 1440 tons annual production, $16.56 million revenue, and 38 new jobs generated in business in 5 years.

REFERENCE

International Energy Agency, 2023, World Energy Outlook 2023: https://www.iea.org/reports/world-energy-outlook-2023 (accessed October 2023).

APPENDIX H

BUDGET PROJECTIONS

Dakota Lithium Materials Financial Projections

All numbers in USD		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
LiFePO4 Powder		0	140,300	1,035,000	11,499,540	16,560,000	16,560,000	47,520,000	47,520,000	47,520,000	47,520,000
Others											
Total Revenue		**0**	**140,300**	**1,035,000**	**11,499,540**	**16,560,000**	**16,560,000**	**47,520,000**	**47,520,000**	**47,520,000**	**47,520,000**
Lithium Carbonate (mTon)		52,200	208,800	914,400	3,744,000	5,391,360	5,391,360	16,174,080	16,174,080	16,174,080	16,174,080
Iron Phosphate (mTon)		40,000	160,000	800,000	3,272,000	4,711,680	4,711,680	14,135,040	14,135,040	14,135,040	14,135,040
Glucose (mTon)		2,000	8,000	40,000	163,000	234,720	234,720	704,160	704,160	704,160	704,160
Dispersal (mTon)		1,200	4,800	24,000	98,000	141,120	141,120	423,360	423,360	423,360	423,360
Total Material Cost		**95,400**	**381,600**	**1,778,400**	**7,277,000**	**10,478,880**	**10,478,880**	**31,436,640**	**31,436,640**	**31,436,640**	**31,436,640**
Gross Profit		**-95,400**	**-241,300**	**-743,400**	**4,222,540**	**6,081,120**	**6,081,120**	**16,083,360**	**16,083,360**	**16,083,360**	**16,083,360**
Payroll		-735,000	-867,500	-1,414,765	-1,664,765	-1,964,765	-2,063,003	-3,006,153	-3,156,461	-3,314,284	-3,479,998
Advertising and Promotion			-9,000	-18,000	-18,000	-36,000	-36,000	-54,000	-54,000	-54,000	-54,000
Travel		-6,000	-6,000	-6,000	-12,000	-12,000	-12,000	-12,000	-12,000	-12,000	-12,000
Shop and Office Rents		-60,000	-60,000	-60,000	-60,000	-60,000	-60,000	-180,000	-180,000	-180,000	-180,000
Liability Insurance		-12,000	-12,000	-24,000	-24,000	-24,000	-24,000	-72,000	-72,000	-72,000	-72,000
Nitrogen		-5,600	-16,128	-32,256	-112,000	-161,280	-161,280	-483,840	-483,840	-483,840	-483,840
Electricity & Other Utilities		-9,750	-19,500	-39,000	-195,000	-280,800	-280,800	-842,400	-842,400	-842,400	-842,400
Equipment Depreciation			-216,667	-216,667	-216,667	-216,667	-216,667	-400,000	-400,000	-400,000	-400,000
Shipment		-5,000	-5,000	-7,000	-12,000	-15,000	-15,000	-50,000	-50,000	-50,000	-50,000
Legal Services		-6,000	-6,000	-6,000	-12,000	-12,000	-12,000	-12,000	-12,000	-12,000	-12,000
Product R&D			-100,000	-100,000	-100,000	-300,000	-300,000	-500,000	-500,000	-500,000	-500,000
Others			0	0	0	0	0	0	0	0	0
Total Operating Cost		**-839,350**	**-1,317,795**	**-1,923,688**	**-2,426,432**	**-3,082,512**	**-3,180,750**	**-5,612,393**	**-5,762,701**	**-5,920,524**	**-6,086,238**
Interest costs					-400,000	-240,000	-240,000	-640,000	0		
Finance net											
Net Profit		**-934,750**	**-1,559,095**	**-2,667,088**	**1,796,108**	**2,998,608**	**2,900,370**	**10,470,967**	**10,320,659**	**10,162,836**	**9,997,122**

Cash holdings EOP	**250,000**	**250,000**	**2,270,695**	**19,408**	**-199,162**	**706,986**	**2,075,356**	**842,323**	**17,418,982**	**41,837,818**	**66,090,939**
Net cash flow from operations			-1,559,095	-2,667,088	1,796,108	2,998,608	2,900,370	10,470,967	10,320,659	10,162,836	9,997,122
Changes in working capital 1 (build up)			-98,210	-724,500	-8,049,678	-11,592,000	-11,592,000	-33,264,000	-33,264,000	-33,264,000	-33,264,000
Changes in working capital 2 (received)			0	140,300	1,035,000	11,499,540	16,560,000	16,560,000	47,520,000	47,520,000	47,520,000
Subcotract -EERC		-400,000	-597,000		0	0	0				
Down payment of loans											
Investment - equipment		-3,000,000	-225,000				-6,500,000	0			
CSEA Grant		2,000,000	2,000,000								
DOE Grant		2,500,000	2,500,000								
Adding capital or Financing				1,000,000	5,000,000	-2,000,000		5,000,000	-8,000,000		
Cash flow		**1,350,000**	**2,020,695**	**-2,251,288**	**-218,570**	**906,148**	**1,368,370**	**-1,233,033**	**16,576,659**	**24,418,836**	**24,253,122**

APPENDIX I

TAX LIABILITY

Industrial Commission

Tax Liability Statement

Applicant:

Dakota Lithium Materials

Application Title:

Demonstration and Scale-Up of a Low-Cost Long-Duration Energy Storage Technology for Lithium-Ion Batteries

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.

DocuSigned by:
Andrew Jay
1DB8F066FE6145C...
____
Signature

CEO
____
Title

11/1/2023
____
Date

DocuSign

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Notary Events	Signature	Timestamp

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Certified Delivered	Security Checked	11/1/2023 10:01:02 AM
Signing Complete	Security Checked	11/1/2023 10:01:48 AM
Completed	Security Checked	11/1/2023 12:42:16 PM

Payment Events	Status	Timestamps

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How to contact EERC:

You may contact us to let us know of your changes as to how we may contact you electronically, to request paper copies of certain information from us, and to withdraw your prior consent to receive notices and disclosures electronically as follows:
To contact us by email send messages to: larry.strayhorn@und.edu

To advise EERC of your new email address

To let us know of a change in your email address where we should send notices and disclosures electronically to you, you must send an email message to us at larry.strayhorn@und.edu and in the body of such request you must state: your previous email address, your new email address. We do not require any other information from you to change your email address.

If you created a DocuSign account, you may update it with your new email address through your account preferences.

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To request delivery from us of paper copies of the notices and disclosures previously provided by us to you electronically, you must send us an email to larry.strayhorn@und.edu and in the body of such request you must state your email address, full name, mailing address, and telephone number. We will bill you for any fees at that time, if any.

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To inform us that you no longer wish to receive future notices and disclosures in electronic format you may:

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The minimum system requirements for using the DocuSign system may change over time. The current system requirements are found here: https://support.docusign.com/guides/signer-guide-signing-system-requirements.

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To confirm to us that you can access this information electronically, which will be similar to other electronic notices and disclosures that we will provide to you, please confirm that you have read this ERSD, and (i) that you are able to print on paper or electronically save this ERSD for your future reference and access; or (ii) that you are able to email this ERSD to an email address where you will be able to print on paper or save it for your future reference and access. Further, if you consent to receiving notices and disclosures exclusively in electronic format as described herein, then select the check-box next to 'I agree to use electronic records and signatures' before clicking 'CONTINUE' within the DocuSign system.

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- You can access and read this Electronic Record and Signature Disclosure; and
- You can print on paper this Electronic Record and Signature Disclosure, or save or send this Electronic Record and Disclosure to a location where you can print it, for future reference and access; and
- Until or unless you notify EERC as described above, you consent to receive exclusively through electronic means all notices, disclosures, authorizations, acknowledgements, and other documents that are required to be provided or made available to you by EERC during the course of your relationship with EERC.

TECHNICAL REVIEWERS' RATING SUMMARY

C-05-I

Grand Power- North Dakota Battery Manufacturing Plant
Submitted By: Packet Digital, LLC
Date of Application: October 2023
Request for $10,000,000 Grant / $17,355,992 Loan
Total Project Costs $56,558,592

		Technical Reviewer			
		I1	**I2**	**I3**	
Rating Category	**Weighting Factor**	**Rating**	**Rating**	**Rating**	**Average Weighted Score**
1. Objectives	3	3	5	3	11
2. Impact	9	2	5	4	33
3. Methodology	9	3	3	2	24
4. Facilities	3	3	3	3	9
5. Budget	9	4	4	2	30
6. Partnerships	9	5	5	4	42
7. Awareness	3	3	3	4	10
8. Contribution	6	3	4	4	22
9. Project Management	6	4	4	2	20
10. Background	6	3	4	4	22
	315	203	258	198	223

OVERALL TECHNICALLY SOUND	I1	I2	I3
GOOD (IF > 214)	☐	☒	☐
FAIR (200-213)	☒	☐	☐
QUESTIONABLE (IF< 200)	☐	☐	☒

Mandatory Requirements	I1		I2		I3	
Diversification Delivery:	Yes	No	Yes	No	Yes	No
Project enhances the production of clean sustainable energy, to make the State a world leader in the production of clean sustainable energy, and/or to diversify and grow the State's economy.		✓	✓		✓	
Commercialization or Development/Expansion:	Yes	No	Yes	No	Yes	No
Concept will lead to the **large-scale development and commercialization** of projects, processes, activities, and technologies that reduce environmental impacts and/or increase sustainability of energy production and delivery.		✓	✓		✓	

In State Requirement:	Yes	No	Yes	No	Yes	No
The funds distributed from the financial assistance are to be applied to support in-state activities and must have other sources of financial support.	✓		✓		✓	

1. **The objectives or goals of the proposed project with respect to clarity and consistency with Clean Sustainable Clean Energy Authority goals of projects, processes, activities, and technologies that reduce environmental impacts and increase sustainability of energy production and delivery are: 1 – very unclear; 2 – unclear; 3 – clear; 4 – very clear; or 5 – exceptionally clear.**

Reviewer I1 (Rating 3)
The application seems to be requesting support for implementing manufacturing Li batteries using existing processes and materials. While the desire is to utilize raw materials from North Dakota, those sources are still in the experimental stages and not available commercially, so it seems that materials will need to be sourced from other locations, including overseas in order to start production according to the schedule in the application. According to public sources, there are around $100 B battery manufacturing plants announced in the US. While this project is intended to go for a market niche that is different from most announced manufacturing plans, the competition in the niche space can easily be impacted if the overall Li battery space is oversupplied.
The application does not present any clear beneficial impact to the environment in North Dakota nor any direct impact on sustainability of energy production in North Dakota.

Reviewer I2 (Rating 5)
Proposed project seeks to utilize North Dakota rare earth elements to produce lithium-ion batteries in North Dakota. If successful, the project would provide value-added opportunity for the state's coal resources as well as expand in-state manufacturing in the clean energy sector.

Reviewer I3 (Rating 3)
The proposal was clear in conveying intent to design and build a new Li-ion battery cell manufacturing plant, but more detail could have been included to convince the reviewers of a sound plan for equipment and facility needs. As written, the proposal declares that Packet Digital will design a facility and will engage in a process of equipment selection, but no detail is offered. The detail provided did not sufficiently describe how the objectives would be accomplished.

2. **The objectives will make a difference in the near term to the state's economy: 1 – no impact; 2 – small impact; 3 – likely impact; 4 – most likely impact; or 5 – significant impact.**

Reviewer I1 (Rating 2)
The project will have a beneficial impact on the state from jobs for construction and production similar to other manufacturing processes of a similar magnitude.

Reviewer I2 (Rating 5)
Three-year project timeframe would provide several thousand labor hours and construction activity starting in 2024, with associated economic impact.

Reviewer I3 (Rating 4)
Design and construction of a battery cell manufacturing plant will undoubtedly create jobs and revenue in the state of North Dakota.

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

Reviewer I1 (Rating 3)
The process to be used are clear and of good quality.

Reviewer I2 (Rating 3)
Concept is well-explained, could use more detail on technology, equipment needs, commercial availability.

Reviewer I3 (Rating 2)
As stated previously, more detail was needed to convince this reviewer of a sound plan for utilizing state funding to achieve the stated goals. The proposal declares that Packet Digital will design a facility and will engage in a process of equipment selection, but no detail is offered. The detail provided did not sufficiently describe how the objectives would be accomplished. Furthermore, in three places in the proposal text, brief statements were included to indicate involvement of the universities to contribute to the advancement of the state of the art, but no detail was offered. If university involvement is intended, more detail was required to understand this.

4. **The facilities and equipment available and to be purchased for the proposed pilot or commercialization strategy is: 1 – very inadequate; 2 – inadequate; 3 – adequate; 4 – notably good; or 5 – exceptionally good.**

Reviewer I1 (Rating 3)
Facilities for the project can be constructed as proposed and equipment proposed is available.

Reviewer I2 (Rating 3)
Proposed production facility is well-defined. Specific equipment needs to be determined.

Reviewer I3 (Rating 3)
The commercialization strategy seems clear, but little detail is offered to relate the commercialization strategy to the request for funding to build the manufacturing facility. Therefore, the reviewer cannot assess the adequacy of the equipment and/or facilities.

5. **The proposed budget is comprehensive and sufficient relative to the outlined work and the timetable: 1 – not sufficient; 2 – possibly sufficient; 3 – likely sufficient; 4 – most likely sufficient; or 5 – certainly sufficient.**

Reviewer I1 (Rating 4)
The budget proposed seems adequate for the project.

Reviewer I2 (Rating 4)

Timetable is clear and well-defined. Budget and timetable information provided do not include contingency.

Reviewer I3 (Rating 2)
With insufficient detail on equipment and facility design, the reviewer cannot assess whether the proposed budget is sufficient.

6. The appropriate strategic partnerships are in place for short and long term plans to be successful: 1 – very limited; 2 – limited; 3 – adequate; 4 – better than average; or 5 – exceptional.

Reviewer I1 (Rating 5)
A good list of strategic partnership are listed and this space in the Li battery manufacturing space is not getting equal attention due to the much publicized need for EV batteries.

Reviewer I2 (Rating 5)
Project applicant is well-established in the sector and utilizing key technical and industrial partners with considerable breadth of experience.

Reviewer I3 (Rating 4)
Much of the proposal narrative addresses the extensive strategic partnerships in place. It is clear that a commercial pathway exists.

7. The likelihood that the project approach (time & budget) will achieve its technical and market goals is: 1 – not achievable; 2 – possibly achievable; 3 – likely achievable; 4 – most likely achievable; or 5 – certainly achievable.

Reviewer I1 (Rating 3)
The project is most likely achievable under the current timeline and budget.

Reviewer I2 (Rating 3)
Project timeline is aggressive given inflationary and supply-chain impacted environment, though applicant indicates existing partnerships with suppliers and existing business structure to reduce risk exposure.

Reviewer I3 (Rating 4)
With the information presented, the reviewer accepts that 36 months and $56M is sufficient to accomplish the goal of building a Li-Ion battery cell manufacturing plant.

8. The scientific and/or technical contribution of the proposed work to specifically address Clean Sustainable Energy Authority goals of impacting technology used in North Dakota's energy industries will likely be: 1 – extremely small; 2 – small; 3 – significant; 4 – very significant; or 5 – extremely significant.

Reviewer I1 (Rating 3)
The processes as outlined are processes the would be utilized independent of location of the process and are difficult to rate as achieving Clean Sustainable Authority goals.

Reviewer I2 (Rating 4)

As described, proposed facility has potential to provide additional opportunity to develop rare earth elements from North Dakota's geologic resources and further expand state leadership in battery manufacturing and energy storage.

Reviewer I3 (Rating 4)
A battery cell manufacturing plant has potential to create an epicenter of battery research and electromotive machinery development and manufacturing. This would contribute to CSEA's goals. This is a secondary effect because little research is proposed in detail.

9. The project management plan, including budgeting projections, partner connections and well-defined milestone chart is: 1 – very inadequate; 2 – inadequate; 3 – adequate; 4 – notably good; or 5 – exceptionally good.

Reviewer I1 (Rating 4)
The project management plan is well defined and achievable.

Reviewer I2 (Rating 4)
Budget, deliverables, and partnerships are clearly explained.

Reviewer I3 (Rating 2)
Partner connections are well-defined in the proposal narrative. Clearly, the project could lead to commercial success, but insufficient detail was provided to assess budgeting projections or adequacy of the project management plan. When a Gantt chart was provided, it was provided for only the first year of the three-year project.

10. The background and experience of the project principals with regards to technical qualifications and competence is: 1 – very limited; 2 – limited; 3 – adequate; 4 – better than average; or 5 – exceptional.

Reviewer I1 (Rating 3)
The background and experience of the team is well suited for this project.

Reviewer I2 (Rating 4)
Project applicant team consists of several decades of experience with development, production, and marketing of lithium ion batteries, materials, and systems.

Reviewer I3 (Rating 4)
Packet Digital has clearly demonstrated technical qualifications, competence, and experience in developing battery systems for military systems.

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 the project is technically sound.

Reviewer I1
The project is very interesting and would be good to see it go forward in North Dakota. It is difficult to make the link to Clean Sustainable Energy Authority goals as currently defined. If

the project included obtaining the raw materials from North Dakota and the processing necessary to utilize them in the manufacturing process, the linkage would be much stronger. At present it is hard to see the processes for the raw material keeping pace with this project and therefore the link to CSEA becomes weak. Because of that, other sources of financial support from the State of North Dakota may be more fitting.

Reviewer I2

Would recommend that the project is technically sound. The economic feasibility of onshoring supply and production of batteries and battery materials remains challenged. However, the applicant has significant experience with the proposed battery technology, with strong support from the federal government and other sectors. The project also provides additional support for the development of North Dakota rare earth element extraction.

Reviewer I3

The prospect of building a Li-Ion Battery Cell Manufacturing Plant in Fargo is exciting. It has the potential to not only create a new industry center in North Dakota, but also one that is critical to national security interests. The proposed project is worthy of consideration. Unfortunately, insufficient detail was included in the proposal to truly justify the level of funding requested.

October 31, 2023

North Dakota Industrial Commission
ATTN: Clean Sustainable Energy Program
State Capitol – 14th Floor
600 East Boulevard
Bismarck, ND 58505-0840

Dear Clean Sustainable Energy Program,

Packet Digital is submitting the enclosed grant/loan application to request funding in support of the Clean Sustainable Energy Project, "Grand Power – United States Flexible Lithium-Ion Battery Cell Manufacturing Plant" in the amount of $27,355,992 ($10,000,000 Grant, $17,355,992 Loan). This funding will be used as a match for the 36-month project which will run from January 1, 2024, to December 31, 2026, and has a total budget of $56,558,592 million. Other partners in this project include the US Navy, Rainbow Energy, UND, NDSU, US Airforce Research Laboratory, Lockheed Martin, Anduril, and Toyota.

The development of high-performance US made Li-Ion battery cells for autonomous systems satisfies a Presidential Executive Order and the requirements of the US Military. End to end ownership of critical components of our national defense technology chain is essential for our National Defense and the safety of the American people. Reliable Unmanned Aircraft Systems (UAS) powered by clean sustainable energy will have a very significant impact on North Dakota and the world over. The applications for this technology include various applications including air, space, ground, and underwater autonomous systems.

If you have questions, I can be reached at 701-365-4421 or terri.zimmerman@packetdigital.com.

This letter sets forth a binding commitment on behalf of Packet Digital to complete the project as described in the application. Thank you for your consideration.

Sincerely,

Terri Gunn Zimmerman
CEO
Packet Digital, LLC
3241 University Dr. S
Fargo, ND 58104
enc

Clean Sustainable Energy Authority

North Dakota Industrial Commission

Application

Project Title:

Grand Power – North Dakota Battery Manufacturing Plant

Applicant:

Packet Digital, LLC

Date of Application:

October 31, 2023

Amount of Request

Grant: **$10,000,000**
Loan: **$17,355,992**

Total Amount of Proposed Project:

$56,558,592

Duration of Project:

36 months - Jan 1, 2023, to Dec 31, 2026

Point of Contact (POC):

Terri Zimmerman

POC Telephone:

701-365-4421

POC Email:

terri.zimmerman@packetdigital.com

POC Address:

3241 University Dr., Fargo ND 58104

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ABSTRACT

Objective: Packet Digital proposes to build an end-to-end Li-ion battery manufacturing facility in North Dakota to produce the most performant batteries with the longest cycle life batteries for autonomous systems. This plant will be a flexible manufacturing facility to produce high energy density batteries and will include raw material receiving & storage, inspection testing, production, quality control, final inspection, compliance, packaging, storage, and shipping. Our goal is to build upon our currently industry leading solutions, and through development and the licensing of intellectual property with our strategic partners enable the manufacturing of innovative batteries built solely in North Dakota, United States.

Li-Ion batteries are widely used in military and commercial applications, such as portable electronics, vehicles, drones, weapons, and energy storage systems. High Energy Density Li-Ion battery production is limited and is currently dependent on adversarial sources. Furthermore, drones in complex operations such as ship-to-ship, ship-to-shore, or long range ISR require data storage, processing, and communications built-in to provide real time state of battery information to the operator; therefore, military customers and drone manufacturers are highly concerned about cyber security for batteries obtained from adversarial sources.

Our collaboration with the Navy to define the standard for on-ship Li-Ion batteries, chargers, stowage and transport aboard the Navy's fleet provides us with a unique perspective and experience to create this solution at scale. Packet Digital's partnerships with many commercial customers, including Lockheed Martin, Toyota, Anduril, Easy Aerial, Pterodynamics, L3 Harris, Shield AI, and Skyways, also bring valuable resources and input to the requirements process and battery cell sales volumes at the completion of the plant.

Expected Results: To establish a US based Li-Ion battery cell plant to meet the unfulfilled need for domestic production and reduce the heavy dependence on foreign sources of raw materials and components. To meet these expectations, we will: Establish production line capacity design requirements. Establish production input requirements for flexible production line and related laws and regulations including safety procedures and protocols. Obtain Approvals, Acquire Land, Design and Build Facilities, Select and Procure Equipment, Install and Commission Equipment, Train Personnel, Execute Pilot Production, Start Mass Production, Operation, and Maintenance, Transition to 3 Shift operation, 7 days per week. This work will result in creating clean sustainable energy jobs, wealth, and tax revenues for North Dakota.

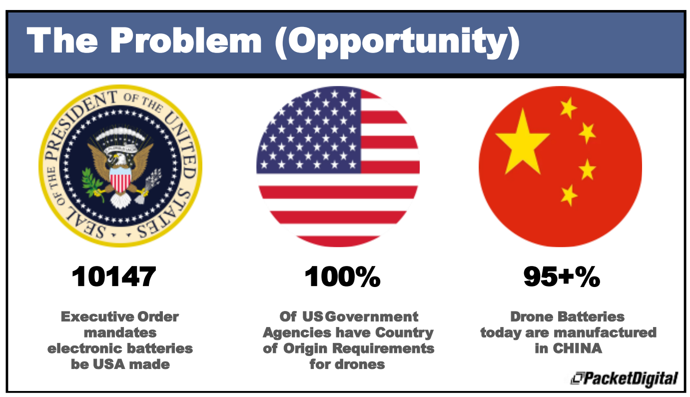
Duration: The battery cell plant factory will be commissioned in 2 years and fully operational in less than 3 years. **Total Project Cost:** Development of this capability will require approximately $56,558,592: $21,846,608 for Engineering, Technology, and Capital and $34,711,984 for Land, Facilities, Equipment, Inventory, Interest, and Fees: <u>Grant Totals</u>: $10,000,000 CSEA with grant matching of $2,826,868 – Navy and $9,019,740 - Packet Digital: <u>Loan Totals</u>: $17,355,992 CSEA BND with matching of $12,282,860 - Participating Bank and $5,073,133 - Packet Digital
Participants: Packet Digital, US Navy, Rainbow Energy, UND, NDSU, US Airforce Research Laboratory, Lockheed Martin, Anduril, and Toyota.

PROJECT DESCRIPTION

Objectives: To support the United States desire to onshore critical supply chain components for battery technology and products identified in Executive Order 14017, Packet Digital, a proven smart battery, smart charger, battery management system, and battery fleet management system manufacturer based in Fargo, North Dakota, will create a Lithium-Ion battery cell production facility in or near Fargo, ND. This is the final step in completely transitioning the Packet Digital battery solutions now being built for the Navy fleet and multiple additional military and commercial customers to become fully US made products.

This work is critical for the National Defense of the United States and critical to the efficient and self-sustaining operation of the US economy. Li-Ion batteries are found in nearly every weapon system used by the US Department of Defense, particularly for portable equipment. They provide more energy for less weight, which is essential for a soldier carrying between 15-25 pounds of batteries alone, in addition to their use in autonomous systems where performance and weight are of utmost concern.

Development of this capability will require approximately $56 million in public and private financing to optimize the facility, buy the equipment, develop the manufacturing processes, and train the manufacturing and engineering talent. It will be profitable and cash flow positive in four years.



Li-ion batteries are essential for powering electric vehicles (EVs), Autonomous Systems like drones, dismounted soldier communications, missiles, munitions, and reconnaissance. However, the US currently relies heavily on foreign sources of lithium and other critical materials for its battery supply chain. This poses economic, environmental, and national security risks for the country.

The US Government has established country of origin requirements for unmanned systems. Drones in complex operations such as ship-to-ship, ship-to-shore, or long range ISR require real time information regarding power, such as communications through a CAN interface reporting real time state of the battery. It is a risk to national security to have such batteries produced by adversarial parties. In addition, military and commercial customers are concerned that adversarial parties could limit the available supply of cells. Therefore, it is essential that all electronics on the drone, including the battery, are produced from trusted suppliers.

According to a report by the US Department of Energy, the global demand for Li-Ion batteries is expected to grow by more than 500% by 2030, driven by the transition to clean energy and transportation. However, the US only produces about 1% of global lithium supply and less than 10% of global battery cell manufacturing capacity.

Methodology: Our approach is to build a Li-Ion battery cell manufacturing plant in North Dakota optimized for military and commercial battery cell production. The effort will focus on high power pouch cells and the facility will be optimized with multiple production lines to support various formats and cell models needed in the market. These types of batteries are only produced by foreign sources today. This effort will accelerate the onshoring of battery manufacturing processes and support the US-designed / US-made imperative. To support the demand from customers and provide return on investment the production lines will run multiple shifts. This plant will be a flexible manufacturing facility to produce high energy density batteries and will include raw material receiving **and** storage, inspection testing, production, quality control, final inspection, compliance, packaging, storage, and shipping. Our project process and timeline include:

Establish Production Line Capacity Design Requirements –

Initial target production model: 6.8Ah LCO 4.45V Pouch Cell lithium-ion battery. Modular design expanding to 6.6/Ah,15.4AH, and 2.19Ah, and more.

Production volume: 2,000 pieces per day. Certain processes can operate 24 hours a day.

Production Line Compatibility: Compatible size and capacity parameters, Thickness: 3 to 12 millimeters, Width: 43 to 100 millimeters, Length: 80 to 200 millimeters, Capacity range: up to 30Ah. The line will be a segmented automated production line to allow for flexible production capacity.
Electrochemical System Compatibility: The production line environmental control can accommodate the production of electrochemical systems such as LFP, NCM, and others with higher environmental requirements.

Establish Project Requirements for Flexible Production Line and Related Laws and Regulations

Requirements: document the structure and layout of the plant, the load-bearing capacity of the workshop, define detailed static electricity requirements, power configuration capacity, gas power specifications and any other relevant information, the quantity of orders per batch and the frequency of model changes.

Local Laws and Regulations: document the necessary requirements and provisions concerning local labor laws, safety regulations and guidelines, include environmental protection requirements, detailed energy consumption regulations, sanitation (occupational health) guidelines, include fire prevention and lightning protection requirements, define guidelines for special equipment, include regulations for handling radioactive sources, detailed requirements for hazardous waste disposal. Include any other relevant requirements pertaining to the design specifications of the lithium-ion battery plant and production, as well as storage-related requirements.

Design – Technical data has been created to establish the target cell models with performance indicators reaching the levels for energy and power density requirements for unmanned aircraft, including cell formula, materials standards, material supplier lists, manufacturing instructions, standard operating procedures, quality control plan, and failure modes and effects analysis (a step-by-step approach for identifying all possible failures in design, manufacturing process, and the manufactured product). The design will optimize the layout of the production line(s) and the process flow of battery production, considering the capacity, volume, power, HVAC and airflow requirements of each piece of equipment, and expected output, functional module distribution, and overall plant layout.

Equipment Selection and Procurement – Equipment includes environmental, propulsion and logistics equipment, test instrumentation, chemical material test instrumentation, performance test equipment, and production equipment. This process will include comparison and selection of vendors, optimization of production lines in terms of performance, precision, efficiency, automation and data, confirmation and signing of equipment technical agreements and business contracts, and inspection of equipment before shipment from vendors.

Facility Installation and Commissioning - Typically, the equipment vendors send technicians onsite to lead installation and commissioning. Packet Digital engineers will also assist in the completion and debugging. The methods, procedures and standards for installation and commissioning of each equipment will be established separately according to the requirements of each piece of equipment and the equipment manufacturer's recommendations.

Personnel Training – Personnel (including cell design engineers, production management, production engineering, quality control, and others) will be trained through the equipment installation process, engineering, production of samples, during the Pilot Run process and throughout mass production.

Pilot Production I & II – Verification **-** This effort includes two pilot run phases with two verification periods.

Mass Production, Operation and Maintenance **-** Quality control, training and process implementation will continue.

Anticipated Results: Anticipated result is an end-to-end Li-Ion battery manufacturing facility in North Dakota to produce the highest energy density and longest cycle life batteries for autonomous systems. Upon award Packet Digital will conclude the requirements capture and commence the design process, equipment selection, equipment procurement, installation, staffing and training of personnel, pilot production runs, and verification and ultimately mass production, operation, and ongoing maintenance**.** Packet Digital expects to begin operations of the proposed cell factory within 30 months of funding approval. Pilot production runs will be completed and ultimately lead to three shift operations within 42 months. The anticipated result will be lightweight, high energy density battery cells with industry leading cycle life and competitive pricing.

Facilities: The new cell manufacturing plant will be built in or near Fargo, ND to be relatively close to Packet Digital's engineering and prototyping location on University Drive South, and to their 25,000 sq ft. manufacturing and assembly plant on 7th Ave North. The facility will be purpose built to support the manufacturing process required for cell assembly and will support expansion through a modular expansion model. Facility recommendations and design advice will be procured from strategic partners with prior and successful experience in this type of manufacturing process. The initial battery cell plant building is planned at 31,528 sq feet. The building will include engineering/administrative, warehouse, production, material test, facility test areas. There is an additional 10,000 sq feet reserved for expansion in this initial building.

Resources: Packet Digital will call upon its experienced resources, developed partnership resources, and their geographic location.

Expertise – Packet Digital has been working on power solutions since its inception 20 years ago and with decades of experience building high performing power solutions for military and consumer solutions and acutely aware of current and future requirements. Currently Packet Digital is developing the power safety standards for the US Navy Fleet for batteries, charging, stowage, and transport, as well as developing power solutions with the US Airforce to be deployed in space, in addition to multiple commercial and battery customers. Packet Digital has a broad range of customers to draw upon for requirements capture. Packet Digital has battery and engineering expertise and is adding additional battery chemistry capabilities.

Developed Partnerships – Packet Digital has developed many strategic partnerships over the years, and they have signed letters of support with some of these partners to support the requirements, design, training, testing, and bringing up of the new battery facility. Please see letter of support from US Navy, US Air Force Research Lab, Rainbow Energy, Toyota, Lockheed Martin, University of North Dakota, and North Dakota State University.

Collaboration with the US Navy enables Packet Digital to accelerate requirements capture and provide collaboration of battery experts within the Navy.

Collaboration with Rainbow Energy has the potential to provide critical rare earth metals that Packet Digital will need for our high-performance battery chemistries. Rainbow Energy, a North Dakota company focused on turning energy produced using Coal plants into clean energy through Carbon Capture, while at the same time extracting critical rare earth metals needed to produce batteries.

Collaboration with local universities, including University of North Dakota (UND). UND is a world leader in energy-related research and education. UND offers a graduate certificate program in Energy Storage Systems that provides knowledge about lithium-ion battery technologies and how they can be effectively and sustainably integrated with various energy systems, this work will support the work that Packet Digital is doing on this project. UND has a focus on Energy Storage systems and Lithium-Ion Batteries technologies such as energy storage technologies, renewable energy sustainability, and the value of energy storage and e-mobility technology. UND also specializes in developing energy technologies that are economically competitive, reliable, sustainable, and politically and environmentally acceptable. UND’s experience and success developing high performance lithium-ion batteries from the byproducts of North Dakota lignite coal will be particularly valuable to this collaboration. During this project we will collaborate with UND to secure as many local raw materials as possible and seek raw materials from non-adversarial partners. Local raw materials will be put into use in products of significant need for our US Military.

North Dakota State University (NDSU) has amassed well over 110,000 square feet of state-of-the-art research facilities at the NDSU Research and Technology Park. The facilities support cleanrooms, laboratory space, microfabrication, device packaging, device testing, reliability/failure analysis, material synthesis, processing, and characterization. This project will utilize NDSU testing facilities.

The Energy & Environmental Research Center (EERC) is researching the extraction of rare earth elements (REEs) from lignite coal, which is abundant in North Dakota. EERC has demonstrated the ability to extract a synthetic form of Graphene, which is used to make Li-Ion batteries. Packet Digital will pursue opportunities to collaborate with EERC to test by-products produced through the EERCs efforts in our battery chemistries.

Packet Digital’s partnerships with many commercial customers, including Lockheed Martin, Toyota, Anduril, Easy Aerial, Pterodynamics, Shield AI, L3 Harris and Skyways, also bring valuable resources and input to the requirements process and battery sales volumes at the completion of the plant.

Geographic Locations - The state of North Dakota is ideal for this factory. It has available land, a cooler climate which is highly desired for battery manufacturing and has made an ambitious and synergistic investment in UAS technology. North Dakota was selected for one of the seven national FAA UAS test sites and as one of 10 participants in the U.S. Department of Transportation's UAS Integration Pilot Program. It is one of the first states to offer a comprehensive Beyond Visual Line of Sight network for UAS. The state has also leveraged its natural resources, geographic advantages, regulatory flexibility, and innovation culture to become a leader in this field. North Dakota is a leading energy state. North Dakota is also providing funding to bring raw material processing into North Dakota that Packet Digital will leverage for this project. North Dakota State University and the University of North Dakota are home to two of the premier battery science departments in the country and will create a pipeline of talent to help staff the factory and drive future innovations.

Techniques to Be Used, Their Availability and Capability: While the process of manufacturing Li-Ion battery cells is complex and challenging, it is a process that is well known and there are multiple companies who have developed the skills around the world. Each type of battery is different and creates a different set of challenges for the design and manufacturing process. UAS batteries require very high-power density to support the high-power requirements for take-off and landing, while at the same time supporting the requirement for extremely low weight. As mentioned in the resources section, Packet Digital has developed multiple partnerships with battery cell producers across various scenarios, and they have partnership documents in place to gain the needed support and counsel to jump start the factory creation process.

Specialized chemistry formulas for the cathode and anode formulas will be used for production of the high-rate lithium-ion battery. Electrolyte is a critical component for the high discharge rate required and a specialized electrolyte formula will be utilized. The cell bill of materials includes specifications and material models and quantities. Product design standards include ratio design, electrode dimension design, electrolyte injection quantity design, capacity design, tab design, separator design, packing film length design, width design, cutting die dimension and layout design. Standard Operating Procedures and requirements in each production process (includes over 200 SOPs), such as coating work guide document for cathode, work methods and requirements for checking preparation, first inspection for trial production, coating, loading level inspection, cell performance test items (rate discharge, cycle life, discharge at high and low temperature, capacity retention, short circuit, over charge, forced discharge, thermal shock, free drop, impact) and in process quality control, process failure mode and effects analysis and raw material IQC inspection items and inspection standards and processes.

Packet Digital is a highly experienced producer of very high energy density batteries and has attained up to 10X the cycle life of most drone batteries available today with smart power management capabilities and patented unique algorithms with proof points including:

- A 30 – 40% increased performance/efficiency for **Lockheed Martin** with 10X cycle life
- Software that automatically manages battery health of fleet of batteries for **Bell Helicopter** for commercial 100-pound payload UAS
- High efficiency batteries for **Anduril,** a DoD contractor for border protection
- Extended endurance from 90 minutes to 15-18 hours on **US Marine Corps** program
- Achieved multi day flight for **OSD** Operational Energy Office.
- Enhanced reliability and doubled endurance on Talon (UAS platform) for **NAVAIR**

- Designing battery for space power beaming for **Northrop Grumman SSPIDR** and designing next generation power solution for **AFRL** and their suppliers for small spacecraft.
- Designing battery for a sea glider drone that flies and submerges for 6 months for **NRL.**
- Developing drone batteries and chargers for the **Navy fleet.**

In addition, Packet Digital will be staffing additional experienced battery cell chemistry experts to supplement their current team's expertise.

Environmental and Economic Impacts while Project is Underway: There will be very little environmental impact during the project other than the environmental impact which can be attributed to the development and creation of the new facility, which will follow all applicable state and federal regulations.

From an economic point of view, we will be requiring multiple trades and construction workers to develop the new facility resulting in 10's of thousands of labor hours. In the first three years, not counting construction workers, this project will require over 250,000 hours of labor from current and future hires, with a go forward rate of approximately 120,000 hours per year.

Ultimate Technological and Economic Impacts: This project will create the foundation for a battery technology innovation center in North Dakota, Grand Power. The need for lighter, safer and more powerful battery technology is a never-ending journey. By providing leading technology from a US source with end-to-end supply chain ownership it is our goal to push the boundaries of battery technology and research, development, and delivery faster than anyone in the market. Grand Power will accelerate North Dakota's leadership across all things power in the United States. Grand Power will create clean sustainable energy jobs, wealth, and tax revenues for North Dakota. Grand Power will attract and retain talent to North Dakota. Grand Power will promote the efficient, economic, and environmentally sound development and use of North Dakota's energy resources, materials and products. Finally, Grand Power will maximize the market potential for clean sustainable energy resources, materials and products and associated byproducts.

Why the Project is Needed: This effort is essential to support a critical national security issue and enable us to produce critical components of battery production for the US military in the United States. In addition, this project has a solid business case: the $4 billion drone battery market is growing at 19% CAGR and is expected to grow to $9.6 Billion in 2026. With a large growing market, the strong push for US made solutions, the demand from our military and commercial customers for US made cells, and Packet Digital's battery expertise, this plant will achieve profitability and be cash flow positive in four years.

Packet Digital has over a decade of experience in the power solutions space and has been deeply involved with the progress over the past 9 years, with a long and illustrious slate of both military and commercial customers. Packet Digital has the relationships and the leadership team in place to ensure the success of the project.

This funding, when combined with private funding, will enable Packet Digital to execute on this critical project for our national security and the safety and independence of the American people.

STANDARDS OF SUCCESS

The measure of success will be in achieving the project and stated goals and bringing value to North Dakota through new jobs and expanding North Dakota energy research, resources, materials and products and utilization of North Dakota energy byproducts.

The project goal is to provide the capability of a US based Li-Ion battery cell plant to counteract the current lack of domestic production to meet the unfulfilled need and reduce the heavy dependence on foreign sources of raw materials and components. To meet these expectations, we will:

- Document requirements for production line capacity
- Document requirements for flexible production line, related laws, and regulations
- Obtain approvals, acquire land
- Design and build facilities
- Select and procure equipment
- Install and commission equipment
- Train personnel
- Execute pilot production
- Start mass production, operation and maintenance
- Transition to 3 shift operation, 7 days per week

The value to North Dakota: This work will create clean sustainable energy jobs, wealth, and tax revenues for North Dakota and will promote the use of North Dakota resources through collaboration with Rainbow Energy, Coal Creek Station and utilize Coal Creek by-products.

Commercialization processes are underway as Packet Digital is already in discussion with several military customers including US Navy, NAVAIR, Naval Warfare, Air Force Research Laboratory, and with multiple commercial companies including Anduril, Lockheed Martin, Easy Aerial, Pterodynamics, L3 Harris, Shield AI, Skyways, Toyota, and Bell Helicopter regarding the product requirements and volume needs. Packet Digital's management team brings over 40 years of experience in developing, incubating, and commercializing new technologies. Packet Digital's CEO has extensive experience launching new products and services in global markets. This research and development effort will bring the manufacture of the highest energy density lithium-ion battery cells to North Dakota and address a significant need for military and commercial autonomous systems.

The University of North Dakota and North Dakota State Universities will assist in raw material research, and testing and analysis of the raw and processed materials. The high energy density lithium battery plant will create a new industry in the state and create more visibility for North Dakota with this cutting-edge battery technology. This effort will preserve jobs and create new jobs in the research and development with twenty-five persons being employed during this project at the plant and with more added as the battery plant revenue grows, research positions for testing and analysis at the universities and the Energy & Environmental Research Center.

This North Dakota project will enhance research and education in the area of battery cell development utilizing new techniques to manufacture high energy density cells. During the project, Packet Digital will work with both NDSU and UND.

BACKGROUND/QUALIFICATIONS

Packet Digital is an engineering firm with over a decade of experience in designing and building power management solutions for autonomous systems and has market leading military and commercial customers. Packet Digital has developed patented innovative algorithms that bring advanced power system performance to many applications. Packet Digital has integrated these algorithms into smart batteries and secured a patent for our Smart Batteries that have extended life. We have also developed innovative algorithms for our Maximum Power Point Tracking power system for unmanned aerial systems (UAS). One of the key differentiators of our technology is that it offers active power savings, meaning the circuitry does not have to be put into a sleep mode to save power. This is critical in UAS applications because of the importance of maintaining full functionality while in flight. With our technology, we have extended battery life 400% in wireless sensors, 40% in a portable radio for the military, and reduced power consumption by 20% in data center servers. We are bringing expertise to building power efficient systems and intelligent power management algorithms for autonomous systems in the air, space, ground and underwater.

After Packet Digital's success with military radios, the US Marine Corp called on Packet Digital in 2014 to extend endurance in an existing unmanned aircraft system (UAS) platform. Packet Digital built high performance battery systems and a Maximum Power Point Tracking System and successfully extended the flight times of the UAS from 90 minutes to 15-18 hours. Following this program, the Office of the Secretary of Defense called on Packet Digital for further innovations to extend flight times through the night and Packet Digital's power systems successfully enabled multiple days of flight time on this military UAS program. The visibility from these programs enabled Packet Digital to begin securing commercial customers. In collaboration with Lockheed Martin, Packet Digital improved power efficiency by 40% and cycle times to 10X of any battery Lockheed had ever worked with. Today, Packet Digital has contracts to set the battery and charging and safety standards for UAS power solutions for the US Navy Fleet (adding 5 new drone manufacturers as customers), to create power solutions for the Airforce Research Laboratory's space efforts, and with multiple commercial companies including Anduril, Lockheed Martin, Easy Aerial, Pterodynamics, L3 Harris, Shield AI, Skyways, and Bell

Helicopters. All of Packet Digital's customers are seeking a US made end-to-end battery solution including battery cells from Packet Digital.

Packet Digital has a very experienced team including key personnel:

Terri Zimmerman: Experienced CEO | Board Member | Leader with a demonstrated history of success with 30 years of working in the power, batteries, application-specific integrated circuits, software, unmanned systems industries. Strategic financial leader experienced at assessing, planning, and implementing large-scale projects with key alliances raising more than $600 Million in capital. Strong business development skills, adept at establishing high-growth operations of substantial impact. Industry Chairperson of Research Institute of Autonomous Systems. Appointed by three governors to state economic development boards. Previous experience at Deloitte & Touche and C-Level executive at Great Plains Software.

Andrew Paulsen, CTO. Mr. Paulsen has led the development of new products and technologies since 2005. Extensive research, testing, and product development expertise in the batteries, power algorithms and power electronics, including air and ground based solar powered vehicles, batteries & electronics, and other technologies enabling electrification and autonomy.

Thanh Nguyen: Industry expert and consultant with over 30 years of business development experience in the battery industry covering all aspects of the manufacturing, sales, partnership, purchasing, delivery, and technology research processes.

Matt Steele, Director of Operations. Mr. Steele leads the project teams and manufacturing operations to develop and build batteries and chargers for UAS, space, and battery electronics and power applications. Bachelor of Science Electrical Engineering and MBA from NDSU.

Jason Stange, Senior Space Systems Engineer. Mr. Stange has 10+ years of experience designing power & instrument payloads for satellite-based science missions from concept through delivery to customers, including innovative designs for front-end amplifiers, digital high voltage power supplies, and analog-to-digital discriminators.

Joe Weinberg, Lead Engineer. Mr. Weinberg has an extensive background in circuit design, power electronics, batteries, instrumentation, and critical PCB layout. He has broad experience in hardware design, including aspects of high efficiency and high reliability power conversion.

Other participants in the project include:

The US Navy is a key participant in the project providing both expertise and requirements as well as funding. The US Navy is funding a separate project for a standardized battery to be utilized in the Navy Fleet for all UASs. For this project the Navy will provide matching dollars of $2,826,868 for engineering labor to design and launch the cell plant and inventory costs.

The University of North Dakota will assist in rare earth mineral identification and extraction strategies. North Dakota State University will provide testing facilities prior to the plant completion.

MANAGEMENT

Management Plan: Packet Digital will lead the effort with significant collaboration with the Navy and support from University of North Dakota and North Dakota State University. Teams will work in parallel and interact directly as needed. Daily communication will take place via email. Weekly status meetings will be held via video conference, however, face--to--face meetings will be scheduled quarterly at a minimum to ensure team cohesiveness. Meeting minutes will be maintained. Both parties have developed a clear work breakdown structure that defines the content, responsibilities, and budgeted time for each sub-project. All parties will have a project team and work will be conducted in accordance with this structure. The development schedule and financial reports will be updated on a monthly basis. Major schedule items will include systems requirements definition, design and development activities, prototype development, integration and test, and final delivery.

Quality Assurance & Systems Engineering: Existing validated software and hardware will be leveraged as much as possible. A tailored systems engineering approach will be utilized for this development effort to efficiently execute the development while ensuring proper due diligence is maintained. A risk management approach will be utilized including a matrix to track requirements that are deemed to have high risk.

TIMETABLE

The schedule of phases is provided quarterly; however, we have scheduled the work on a weekly time frame. Our plan is to provide interim quarterly updates on progress. The left most blue bar indicates the quarter when a step in the project will start and the right most blue bar for a step indicates the quarter in which we expect the work to complete.

We have provided four years' worth of scheduled activities; however, we are requesting funding for the first three years. We expect the project to begin in January of 2024 and requesting funding through 2026.

Expected Project Timelines

procedure	Estimated time required (weeks)	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16
		1	14	27	40	53	66	79	92	105	118	131	144	157	170	183	196
1. Document Requirements for Production Line Capacity																	
1.1 Finalize Production Line Requirements	2																
1.2 Finalize Production Capacity Requirements	3																
2. Document requirements for flexible production line, related laws, and regulations																	
2.1 Finalize flexible production line requirements	2																
2.2 Research and document local applicable laws	3																
2.3 Research and document applicable local and federal regulations.	3																
3. Obtain Approvals, Acquire Land																	
3.1 Identify optimal areas with help from City of Fargo	2																
3.2 Search for potential Locations	2																
3.3 Review and Select Site	2																
3.4 Close on Land Purchase	8																
4. Design and Build Facilities																	
4.1 Finalize the technical process details	2																
4.2 Plant layout design	8																
4.3 Technical and after-sales requirements for production, testing and other equipment and instruments	8																
4.4 ITB (Invitation to Bid) released, Vendors Proposal Evaluation	6																
4.6 Obtain Building Permit	6																
4.7 Construction	52																
4.8 Receive Certificate of Occupancy	1																
5. Select and Procure Equipment																	
5.1 Summary List of Equipment & Asset Purchased.	1																
5.2 Equipment selection	8																
5.3 Equipment and instrument manufacturing supervision and certification	20																
5.4 (FAT) Factory acceptance test (FAT) for equipment and instrument	3																
5.5 Equipment transportation	6																
6. Install and Commission Equipment																	
6.1 Equipment Machinery Installation	8																
6.2 Equipment commissioning	8																
7. Train Personnel																	
7.1 Personnel training	8																
7.2 Various tests and analysis	8																
8. Execute Pilot Production																	
8.1 Preparation before pilot production	4																
8.2 Minor and pilot tests	12																
8.3 Project Final Acceptance	1																
9. Start Mass Production																	
9.1 Start 1 Shift Operation	36																
10. Transition to 3 shift operation																	
10.1 Start Two Shift Operation	36																
10.2 Start 3 Shift Operation	1																

BUDGET

We have provided two tables below to describe the budget breakdown of our $56,558,592 project. The first table describes those expenses that qualify for grant funding. The second table describes those expenses that qualify for loan funding.

Project Associated Expense	NDIC Grant	Packet Digital Grant (Cash)	Navy Grant Share	Bank Sponsor Grant Share	Other Grant Share	Total Grant
Working Capital	$ -	$ -	$ -	$ -	$ -	$ -
Tech Transfer	$ 7,173,133	$ 7,173,133	$ -	$ -	$ -	$14,346,265
1st Yr Eng & Exp	$ 509,684	$ -	$ 509,684	$ -	$ -	$ 1,019,368
2nd Yr Eng & Exp	$ 1,293,878	$ -	$ 1,293,878	$ -	$ -	$ 2,587,755
3rd Yr Eng & Exp	$ 1,023,306	$ 1,846,608	$ 1,023,306	$ -	$ -	$ 3,893,220
Total	**$ 10,000,000**	**$ 9,019,740**	**$ 2,826,868**	**$ -**	**$ -**	**$21,846,608**

Project Associated Expense	NDIC Loan	Packet Digital Loan (Cash)	Navy Loan Share	Bank Sponsor Loan Share	Other Loan Share	Total Loan
Land	$ 1,250,000	$ 250,000	$ -	$ 1,000,000	$ -	$ 2,500,000
Improvements	$ 7,167,250	$ 1,433,450	$ -	$ 5,733,800	$ -	$14,334,500
Interest	$ 399,819	$ 399,819	$ -	$ -	$ -	$ 799,639
Fees	$ 126,259	$ 126,259	$ -	$ -	$ -	$ 252,518
Equipment	$ 6,936,325	$ 1,387,265	$ -	$ 5,549,060	$ -	$13,872,649
Inventory	$ 1,476,340	$ 1,476,340	$ -	$ -	$ -	$ 2,952,679
Total	**$ 17,355,992**	**$ 5,073,133**	**$ -**	**$ 12,282,860**	**$ -**	**$34,711,984**

Facility costs: The safety, air handling, and clean room requirements for a facility doing this type of manufacturing are critical to support this type of manufacturing process, therefore the budgeted price per square foot has been adjusted up accordingly to meet these requirements.

Equipment costs: The equipment needed for this project is highly specialized and we have coordinated with experienced partners in the industry to identify what is needed and how much it is expected to cost.

Labor Costs: Early training and requirements work is required. Staffing begins with a subset of staff early in the process, the rest of labor is budgeted to be added as needed over the first three years.

Technology Transfer: We are leaning heavily on the expertise of partners to ensure the factory, equipment, and processes.

Detailed project budgets have been created providing further backing for the expenses we have documented and can be made available if needed.

The cost and complexity of this project is high and without funding near the requested levels it would be difficult for us to proceed with this much-needed capability.

CONFIDENTIAL INFORMATION

We are requesting that some of the information in our submittal package be kept confidential. Please see attached confidentiality request template.

PATENTS/RIGHTS TO TECHNICAL DATA

Packet Digital reserves the right to file patents related to the intellectual property generated from this proposal and will work with legal counsel to determine if additional patents could be filed. Our power management algorithms and methodology are protected by our patent portfolio. We also have copyrights and our registered trademarks include On-Demand Power®, PowerSage®, and Packet Digital ®.

STATE PROGRAMS AND INCENTIVES

Below are the State Programs that we have participated in within the last five years:

North Dakota Development Fund – Revolving Working Capital Available Line of Credit of $500,000 from 2006 to 2021– Paid off Feb 2, 2021.

North Dakota Development Fund and Bank of North Dakota (New Venture Fund) – Preferred Equity invested of $999,999 Oct 19, 2009. On May 25, 2022, an agreement was made to commence repayment. Accrued dividend payment of $300,000 have been paid and payments to return equity to the state on term schedule have commenced – Current balance $957,925.

Bank of ND Interest Rate Buydown– PACE Program – 3241 University Dr S, Fargo ND $200,000 – May 4, 2021, running for 81 months.

Bank of ND Interest Rate Buydown – PACE Program – 704 38th St N, Fargo ND – In process expected commencement January of 2024

North Dakota Renewable Energy Council – Solar Soaring Phase I, II, III - $1,225,000 - Feb 2017 – Aug 2017 – Naval Research Lab and US Marine Corp provided matching dollars for UAS power systems. The first extended endurance UAS power system built by Packet Digital.

North Dakota Renewable Energy Council – Portable Solar Array Modules Phase I & II – $1,000,000 - May 2018 – Sep 2020 – DoD contractor and Naval Research Lab through Office of Secretary of Defense provided matching funds – System revision requests continue from military customer. Last revision occurred Sept 2023. Systems shipping to customer.

Industrial Commission

Tax Liability Statement

Applicant:

Scranton Holding Company/North American Iron, Inc.

Application Title:

"Green" iron production facility

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

James Bougalis, CEO

Title

October 30, 2023

Date

Jeff Jonson

October 30, 2023

Grand Power – North Dakota Battery Manufacturing Plant
Packet Digital
terri.zimmerman@packetdigital.com

By Electronic Mail

Re: Letter of Support for Packet Digital

This Letter of Support indicates Rainbow Energy Center's (REC) support for the proposed development of a North Dakota Battery Manufacturing Plant by Packet Digital.

As a North Dakota company focused on the execution of our vision to maximize the operation of Coal Creek Station and Nexus Line and reduce our overall footprint and carbon emissions while finding new ways to further utilize the incredible resources right here in North Dakota, we support the efforts of Packet Digital to revolutionize battery manufacturing and development here in our state.

Our ongoing efforts to support the extraction of critical minerals and rare earth elements from our lignite coal go hand in hand with the efforts of Packet Digital to process those products into high-performance batteries.

As a board member of Packet Digital for over ten years, I am very familiar with the company's capabilities, products and strategies. It is very rewarding to have our interests completely aligned to create additional value for North Dakota and to produce a solution that also meets the needs of the United States Military to help protect American lives.

This Letter of Support is not binding and does not agree to any terms or conditions for a future arrangement.

Please feel free to contact me if you have any questions.

Regards,

Jeff Jonson
Executive Vice President

RAINBOW ENERGY CENTER
NEXUS LINE
918 E Divide Ave 4th Floor
Bismarck, ND 58501
Office: 701 222 2290
Mobile: 701 226 2299
Email: j.jonson@rainbowenergy.com

26 October 2023

Program Manager – Advanced Battery Technology
Naval Air Warfare Center Aircraft Division – Webster Outlying Field (NAWCAD WOLF)
17800 Molls Cove Road B8125
St Inigoes, MD 20684

Re: Clean Sustainable Energy Authority Funding

The purpose of this letter is to provide the full support for and commitment to Packet Digital's proposed Clean Sustainable Energy Authority Project: Grand Power – North Dakota Battery Manufacturing Plant from the Advanced Battery Technology Program NAWCAD WOLF.

The Navy is rapidly expanding its use of autonomous systems throughout the Fleet to include functional areas such as weapons, transportation, intelligence, surveillance, and reconnaissance applications. Due to the increasing reliance on these autonomous technologies, it is critical that we ensure that our national security needs are backed by our national production industry. Unfortunately, current US production of lithium batteries and other energy storage systems are not fulfilling the demand of our national defense manufacturing infrastructure. The Packet Digital proposal closes the largest gap in those capabilities.

Packet Digital has a stellar record of accomplishment among leading US-based defense contractors who rely on their expertise to build high-efficiency batteries, chargers and power systems, expertise that enables increased operational capabilities across air, space, and undersea platforms.

Additionally, the constant increases in electric autonomous system deployment require higher battery manufacturing capacity than what is currently supported nationally. While much investment has gone toward the EV battery market, specifically autos, critical markets such as battery systems for unmanned systems have largely been left behind. This lack of US investment has led battery supply chains to continue to depend on China for fulfillment, which coupled with the ever-increasing operational dependence of unmanned systems operations, is creating a large risk to national security.

We currently have an active contract with Packet Digital in the amount of $7,437,931.19 to commission equipment for a battery plant and build prototype solutions for batteries utilized within the Navy Fleet. Packet Digital has continuously demonstrated a strong reputation for delivering quality and innovation with their unmanned systems battery development. In addition, for fiscal year 2024, we are expecting follow on program funding to continue the unmanned systems battery development, prototype batteries, and production facility efforts. As such, this NAWCAD Program strongly supports government investment in unmanned system battery development and manufacturing in the US and strongly advocates for the continued relationship with Packet Digital.

Sincerely,

William A. Macchione
PM Advanced Battery Technology
NAWCAD WOLF

28 October 20223

Senior Project Manager
Toyota Tsusho America
700 Triport Road
Georgetown, KY 40324

Re: Packet Digital US Battery Factory Proposal

I'm writing this letter to document my full support for Packet Digital's US Battery Factory Proposal.

I worked closely with Packet Digital in my role as senior project manager at Toyota Tsusho America. We are collaborating on a battery recycling initiative with Packet Digital, where we are taking batteries from our hybrid vehicle lines of automobiles and working to reuse the cells for other purposes to satisfy other critical power solutions.

I have been very impressed with the technical capabilities of Packet Digital, their professionalism, and their ability to innovate on challenging technical problems.

I chose to work with Packet Digital after months of investigation. I learned that they have consistently demonstrated the ability to produce highly efficient and resilient batteries for both defense and commercial customers. Based on Packet Digital's success and the working relationship we have built, we have been in discussion regarding an investment in the Company.

I support government investment in US based development and manufacturing, and I strongly advocate for Packet Digital to be a recipient of those funds. There is no other unmanned systems battery development and assembly company in the U.S. with a stronger reputation for delivering quality and innovation than Packet Digital.

Sincerely,

Travis Malston
Project Manager

UND UNIVERSITY OF NORTH DAKOTA

UND.edu

Vice President for Research & Economic Development
Tech Accelerator, Suite 2050
4201 James Ray Drive Stop 8367
Grand Forks, ND 58202-8367
Phone: 701.777.6736
Fax: 701.777.2193
Email: vpr@UND.edu
Website: UND.edu/research

October 27, 2023

Re: Clean Sustainable Energy Authority Funding

The University of North Dakota has a history of collaboration with Packet Digital that goes back many years. Terri Zimmerman, Packet Digital CEO and a UND graduate, has been active in supporting the University in various roles over the years. The collaborations we've had with her teams and companies have been fruitful and successful. UND is very interested to support Packet Digital on the Grand Power – North Dakota Battery Manufacturing Plant Clean Sustainable Energy Authority Project.

For UND the importance of this work could not hit closer to home. As a university we are very active in both primary research and in creating technology advancements for autonomous flight. Our other collaborators, across the US Military and commercial companies, have made it crystal clear to us how important the work we are doing to advance autonomous systems is to the security of our country. The work that Packet Digital has been doing on Autonomous Power Solutions is groundbreaking and our faculty and students are excited to collaborate with them as they continue to advance the industry for the betterment of our National Defense and Safety.

UND is a world leader in energy-related research and education. UND offers a graduate certificate program in Energy Storage Systems that provides knowledge about lithium-ion battery technologies and how they can be effectively and sustainably integrated with various energy systems. This work will support the work that Packet Digital is doing on this project. We focus on Energy Storage systems and Lithium-Ion Batteries technologies such as energy storage technologies, renewable energy sustainability, and the value of energy storage and e-mobility technology. We specialize in developing energy technologies that are economically competitive, reliable, sustainable, and politically and environmentally acceptable. Our experience and success developing high performance lithium-ion batteries from the byproducts of North Dakota lignite coal will be particularly valuable to this collaboration.

In closing, UND is very impressed with the work that Packet Digital is doing in this critical area. We fully support their application for this grant, and we look forward to collaborating with them on creating the best possible battery solutions in the world, built in North Dakota.

Mark Askelson, PhD
Mark Askelson
Associate Vice President for Research-National Security
University of North Dakota

Brian Tande, PhD.
Dean, College of Engineering & Mines
University of North Dakota

October 24th, 2023
Advanced Space Power Program
Air Force Research Laboratory
Kirtland AFB

Re: Clean Sustainable Energy Authority Funding

I'm writing this letter, on behalf of the Air Force Research Lab's (AFRL), to document our full support for Packet Digital's **Grand Power – North Dakota Battery Manufacturing Plant** Clean Sustainable Energy Authority Project proposal.

Across all branches of the defense department, including the Air Force and Space Force, the use of Autonomous systems is growing rapidly. The Pentagon's recently announced 'Replicator' program is just the latest program supporting the growing momentum behind transitioning to autonomous systems. One of the baseline and fundamental requirements of all these efforts is the need to power these devices efficiently and effectively.

Power is exactly where Packet Digitals expertise shines and becomes critical to the effort. Packet Digital has demonstrated the ability to produce highly efficient and resilient battery packs for both defense and commercial customers for terrestrial, airborne, and upcoming space applications. Together with AFRL, Packet Digital has been working on turning their learning and expertise into essential solutions for our national space projects where high performance, reliability, and extended operating conditions are critical. Moving further up the supply chain to create the battery cells is essential to reducing our dependence on adversaries, like China, for items that are critical to our national defense.

Unfortunately, current U.S. production does not meet the demands of our national defense branches. The Packet Digital proposal helps to close one of the largest gaps in those capabilities.

Through the SSPIDER program, AFRL is seeking to harvest solar power from space, convert it to RF signals that can be beamed to forward operating positions for our war fighters and eliminate the need to move power along traditional supply chains. Once the power is received, in many cases it must be stored for use in light, safe, and resilient battery systems. Packet Digitals' expertise will be instrumental in developing advances in this critical area of need.

AFRL has worked with Packet Digital on multiple projects, and they have consistently demonstrated very strong performance and capabilities. Without hesitation we support their proposal.

Sincerely,
Robert Walters, Ph.D.
ARFL/RVSV Senior Mentor,
Advanced Apace Power

NDSU NORTH DAKOTA STATE UNIVERSITY

October 25, 2023

Re: Clean Sustainable Energy Authority Funding

To Whom It May Concern:

North Dakota State University's Office of Research and Creative Activity is very interested in supporting Packet Digital with collaboration for the Grand Power – North Dakota Battery Manufacturing Plant Clean Sustainable Energy Authority Project.

With many NDSU graduates employed at Packet Digital, and a track record of multiple prior successful collaborations between Packet Digital and the University, we look forward to the opportunity to making a positive impact on driving high performance battery chemistry technologies that meet the performance and safety requirements of Packet Digital's national defense and commercial customers. Packet Digital is developing innovative battery technology in North Dakota that brings higher performance for autonomous vehicles in space, air, ground and underwater. Enabling power technologies across these applications impacts many American lives. We look forward to collaborating with Packet Digital on the innovation and testing of this important grant.

At NDSU we have amassed well over 110,000 square feet of state-of-the-art research facilities at the NDSU Research and Technology Park. The facilities support cleanrooms, laboratory space, microfabrication, device packaging, device testing, reliability/failure analysis, material synthesis, processing, and characterization.

We look forward to collaborating on the work that Packet Digital, the Navy, the Air Force, and others are doing on this critical area of importance for our country and for the safety of our communities.

Sincerely,

Colleen M. Fitzgerald, PH.D.
Vice President, Office of Research and Creative Activity
North Dakota State University

Lockheed Martin Procerus Technologies
500 S Geneva Rd, Vineyard, UT 84058

LOCKHEED MARTIN

31 October 2023

Lockheed Martin Procerus Technologies
500 S Geneva Rd
Vineyard, UT 84058

Re: Packet Digital US Battery Plant Funding Support

I am writing this letter to provide Lockheed Martin's support for Packet Digital's proposed US Battery Plant Project in North Dakota.

Packet Digital is our supplier for batteries and charging systems. In addition, we are collaborating with Packet Digital on power systems including charging, batteries, and extended endurance batteries for our Indago 4 Drone. Packet Digital's batteries have not only provided increased performance but have also provided significant improvement in cycle life.

Lockheed Martin's Indago 4 is a small unmanned aerial vehicle (UAV) designed for expeditionary intelligence, surveillance, and reconnaissance (ISR) applications. It is a vertical takeoff and landing (VTOL) system that weighs less than 10 lbs. and can be deployed in approximately 2 minutes. It has an endurance of 50-70 minutes with payload and a range of 10-12 km. The Indago 4 is equipped with high-resolution camera systems that provide users with incredible zoom capability used to accurately identify people, objects, vehicles, and weapons. The EO or daytime cameras include low light settings for twilight, nighttime, and cloudy days. The IR cameras provide thermal infrared capabilities for covert nighttime operations providing heat signatures in white hot, black hot, and heat map color displays for detailed analysis and situational awareness in the darkness.

The Indago 4 is being sold to both military and commercial customers. To meet the requirements of our military customers it is imperative that we have a US-made solution for our Power Systems. For Lockheed, the best possible solution is that we can continue our productive relationship with Packet Digital and purchase our future batteries from their US factory in North Dakota.

Therefore, Lockheed Martin strongly supports continued investment in unmanned system battery development and manufacturing in the US and strongly advocates for Packet Digital to be a recipient of those funds. Throughout Lockheed Martin's experience with Packet Digital, they have demonstrated they are well positioned to continue delivering quality and innovation as a battery development and assembly company.

Sincerely,

Paul Kendrick
Contracts Manager
Lockheed Martin Procerus Technologies

State of North Dakota

SECRETARY OF STATE

CERTIFICATE OF ORGANIZATION
OF

PACKET DIGITAL LLC
Secretary of State ID#: 19,604,400

The undersigned, as Secretary of State of the State of North Dakota, hereby certifies that Articles of Organization for

PACKET DIGITAL LLC

duly signed and executed pursuant to the provisions governing a North Dakota Limited Liability Company, have been received in this office and are found to conform to law.

ACCORDINGLY the undersigned, as such Secretary of State, and by virtue of the authority vested in him by law, hereby issues this Certificate of Organization to

PACKET DIGITAL LLC

Effective date of organization: August 29, 2003

Issued: August 29, 2003

Alvin A. Jaeger
Secretary of State

ID# 19,604,400

72823

RECEIVED
AUG 29 2003
SEC. OF STATE

ARTICLES OF ORGANIZATION
OF
PACKET DIGITAL LLC

The undersigned organizer, who is a natural person and who is eighteen (18) years of age or older, in order to form a limited liability company under the provisions of the North Dakota Limited Liability Company Act (N.D. Cent. Code Chapter 10-32), does hereby adopt the following Articles of Organization:

ARTICLE I
NAME

The name of this company shall be Packet Digital LLC.

ARTICLE II
PURPOSES AND POWERS

The purposes of the company are:

a. Develop and market low power electronics and information based solutions; and

b. all other general business purposes.

ARTICLE III
PERIOD OF DURATION

Unless dissolved earlier according to law, the period of this company's duration shall be perpetual.

ARTICLE IV
REGISTERED OFFICE – REGISTERED AGENT

The registered office of this company is located at 3130 36th Avenue S.W., Fargo, ND 58104, and its registered agent at that address is Joel Jorgenson.

ARTICLE V
ORGANIZER

The name and address of the organizer, who is an adult natural person, is:

Name	**Address**
Joel Jorgenson	3130 36th Avenue S.W. Fargo, ND 58104

NORTH DAKOTA

ARTICLE VI
BOARD OF GOVERNORS

The affairs of this company shall be managed by a Board of Governors. The Operating and Member Control Agreement shall provide for managers of this company which shall include, but not be limited to, a President, Secretary and Treasurer. The number, qualifications, term of office, method of election, powers, authority, and duties of the governors of this company, the time and place of their meetings, and such other provisions with respect to them as are not inconsistent with the express provisions of these Articles of Organization shall be as specified in the Operating and Member Control Agreement of this company.

ARTICLE VII
INDEMNIFICATION AND PERSONAL LIABILITY

No governor of the company shall be personally liable to the company nor to its members for any monetary damages or breach of fiduciary duty as a governor. However, this provision shall not eliminate or limit the liability of a governor:

a. For any breach of the governor's duty of loyalty to the limited liability company or to its members;

b. For acts or omissions not in good faith or that involve intentional misconduct or a knowing violation of law;

c. For any distributions from the company which are determined to be illegal under N.D. Cent. Code Section 10-32-66;

d. For any transaction from which the governor derived an improper personal benefit; or

e. For any act or omission occurring before the date when the provision in the Articles of Organization eliminating or limiting liability becomes effective.

Each manager and governor, past or present of the company, and each person who serves or may have served at the request of the company as director, officer, governor, manager, employee or agent of another corporation, limited liability company, partnership, joint venture, trust or other enterprise, and their respective heirs and legal representatives, shall be indemnified by the company in accordance with, and to the fullest extent permissible under, the provisions of N.D. Cent. Code Chapter 10-32, as it may be from time to time amended. Whenever the applicable provisions of N.D. Cent. Code Chapter 10-32 make indemnification permissible upon the finding that certain standards are met, such indemnification shall be mandatory by the company.

ARTICLE VIII
MEMBERSHIP INTERESTS

With respect to membership units:

a. The membership interests of the company shall be represented by (and shall be known as) membership units which shall be issued by the Board upon the receipt of the agreed upon contribution.

b. All membership units shall be ordinary membership units or such other classes of membership units with rights and preferences as shall be determined by the Board of Governors from time to time.

c. Upon the acceptance of a new contribution:

   (1) The method for the restatement of value of previous contributions as set forth in N.D. Cent. Code Section 10-32-57 shall not be used.

   (2) Instead, the Board shall, by resolution, establish the value to be accorded to the new contribution and the number of membership units to be issued upon receipt of the contribution.

   (3) The members shall then, as of the effective date of the acceptance of the contribution, execute and place in the member control agreement and statement of contributions accepted and in the other required records of the company, a statement of contributions as provided in N.D. Cent. Code Section 10-32-51.

ARTICLE IX
PREEMPTIVE RIGHTS

Except to the extent required by section 9 of article XII of the Constitution of North Dakota, there shall be no preemptive rights in any person to acquire unissued membership units of the company.

I, the above named organizer, have read the foregoing Articles of Organization, know the contents and believe the statements made therein to be true.

Dated this 28th day of August, 2003.

Joel Jorgenson

Joel Jorgenson, Organizer

72823

19,604,400

STATEMENT OF CONSENT TO SERVE AS REGISTERED AGENT
FOR
PACKET DIGITAL LLC

RECEI
AUG 29
SEC. OF

I, Joel Jorgenson, an individual North Dakota resident, hereby consents to serve as registered agent for Packet Digital LLC, until I am removed or resign according to law.

Dated this 28th day of August, 2003.

Joel Jorgenson, Registered Agent

NORTH DAKOTA
Filed 8-29 2003
Secretary of State

NS

POWER TO THE (DRONES)

Our Customers: Smart/Demanding

UNITED STATES ARMY
UNITED STATES NAVY
UNITED STATES MARINE CORPS
AIR FORCE RESEARCH LABORATORY
UNITED STATES NAVY NAVAL RESEARCH LABORATORY
NASA
UNITED STATES SPACE FORCE DEPARTMENT OF THE AIR FORCE MMXIX

LOCKHEED MARTIN
BELL
ANDURIL
KRAUS AEROSPACE
Platform AEROSPACE

CISCO
JOHN DEERE
intel
Uber
amazon

PacketDigital

Our Superpower

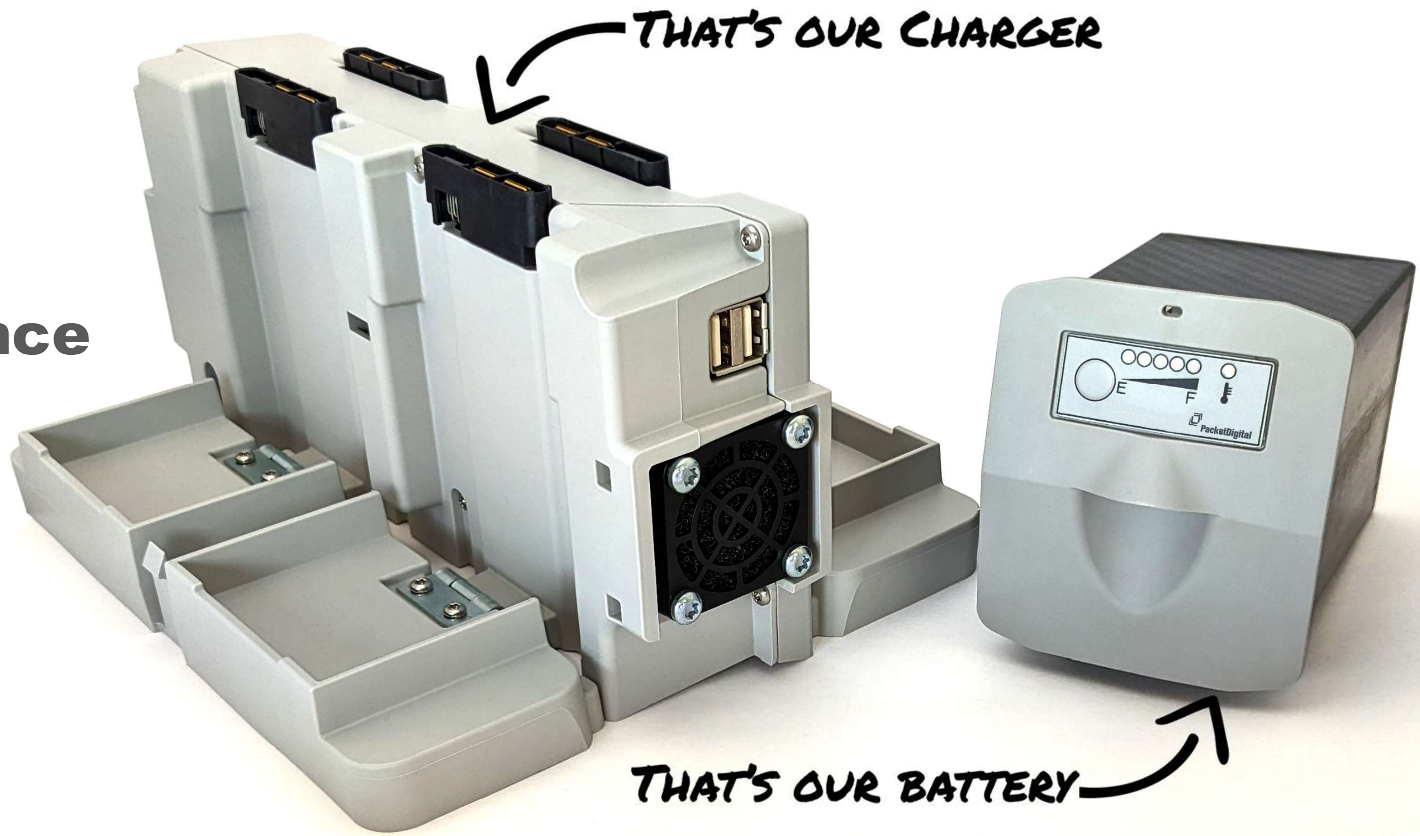
We Build Great Batteries

Highest Performance

Longest Lasting

Safest

Made in the USA



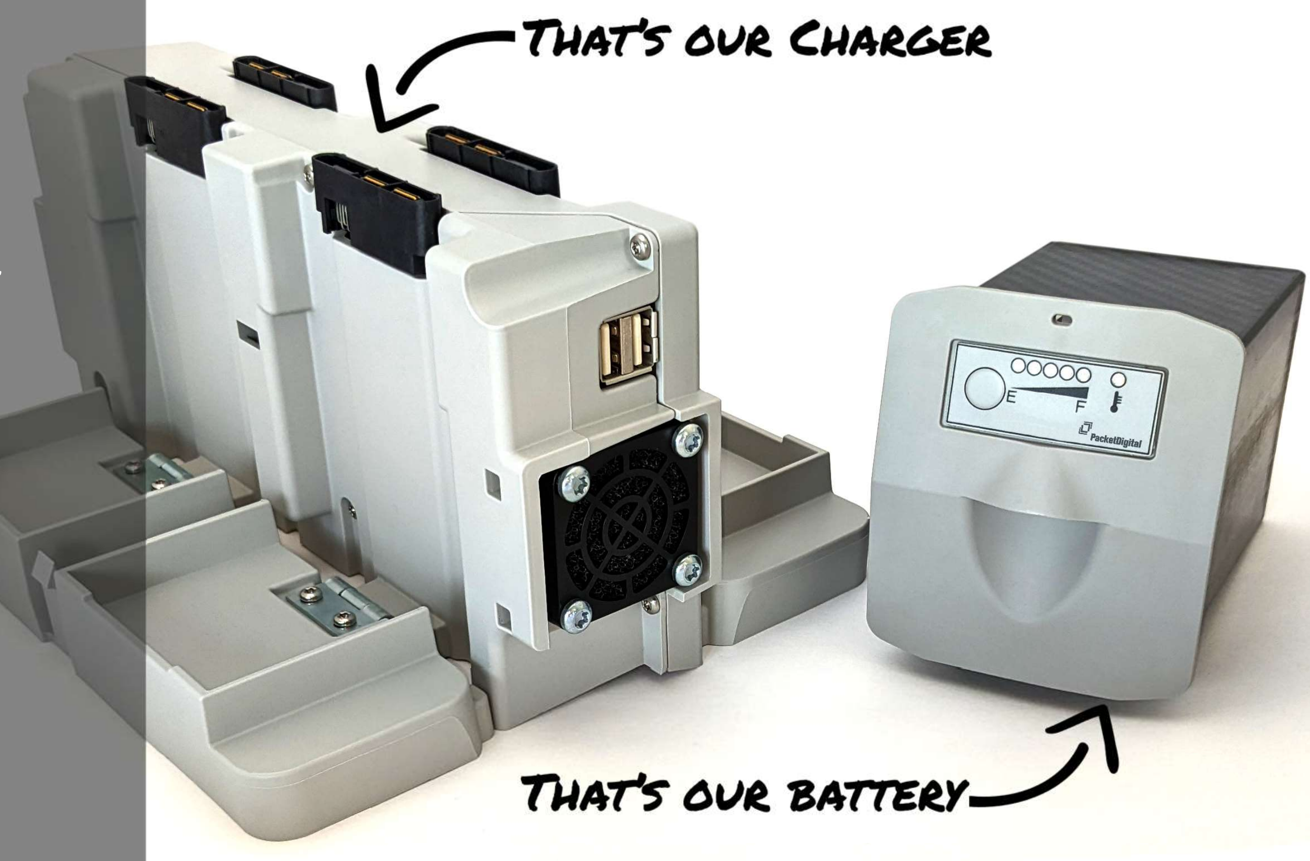
PacketDigital

Our Superpower

"We have been cycling Packet Digital's battery for 6 months. It is now at 1000 cycles that's 10X better than anything we have ever seen, and it only shows 11% degradation"

- **Lockheed Martin, Chief Engineer**

LOCKHEED MARTIN



PacketDigital

The Problem (Opportunity)

10147

Executive Order mandates electronic batteries be USA made

100%

Of US Government Agencies have Country of Origin Requirements for drones

95+%

Drone Batteries today are manufactured in CHINA

PacketDigital

Opportunity

A Battery Cell Factory in North Dakota

PacketDigital

Flight Duration from 1.5 to 18 Hours

Achieved Multi-Day Flight

Flight Duration from 1.5 to 18 Hours

40%+ Performance | 10X Lifetime

Flight Duration from 1.5 to 18 Hours

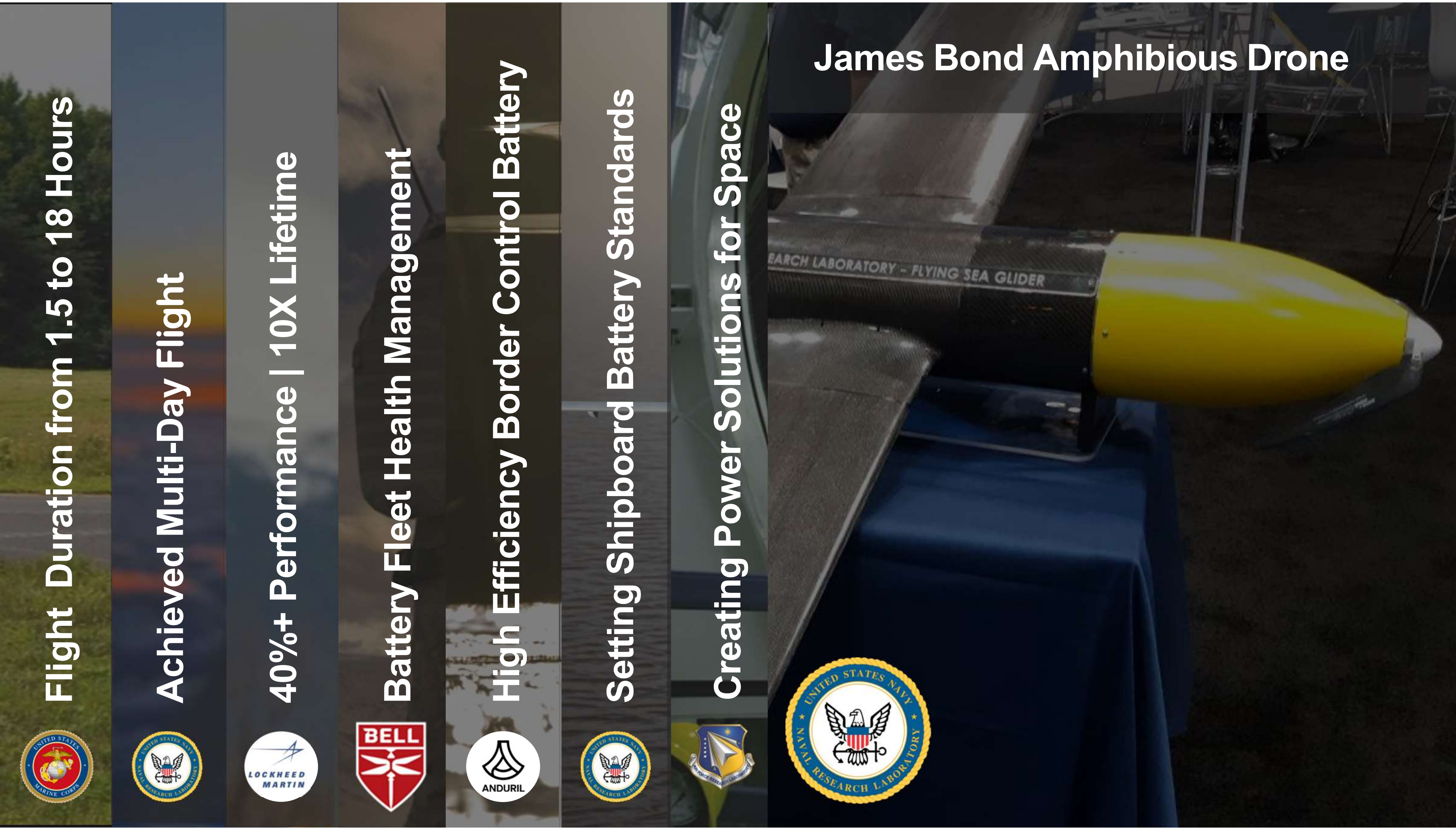
Achieved Multi-Day Flight


Battery Fleet Health Management
Flight Duration from 1.5 to 18 Hours
Achieved Multi-Day Flight
40%+ Performance | 10X Lifetime
BELL
LOCKHEED MARTIN


High Efficiency Border Control Battery
Flight Duration from 1.5 to 18 Hours
Achieved Multi-Day Flight
40%+ Performance | 10X Lifetime
Battery Fleet Health Management
LOCKHEED MARTIN
BELL
ANDURIL


Setting Shipboard Battery Standards
Flight Duration from 1.5 to 18 Hours
Achieved Multi-Day Flight
40%+ Performance | 10X Lifetime
Battery Fleet Health Management
High Efficiency Border Control Battery
LOCKHEED MARTIN
BELL
ANDURIL
L3HARRIS™
SHIELD AI
PTERO DYNAMICS
SURVICE ENGINEERING COMPANY
SKYWAYS


Creating Power Solutions for Space
Flight Duration from 1.5 to 18 Hours
Achieved Multi-Day Flight
40%+ Performance | 10X Lifetime
Battery Fleet Health Management
High Efficiency Border Control Battery
Setting Shipboard Battery Standards
LOCKHEED MARTIN
BELL
ANDURIL
AIR FORCE RESEARCH LABORATORY
NORTHROP GRUMMAN
GENERAL ATOMICS
MAXAR



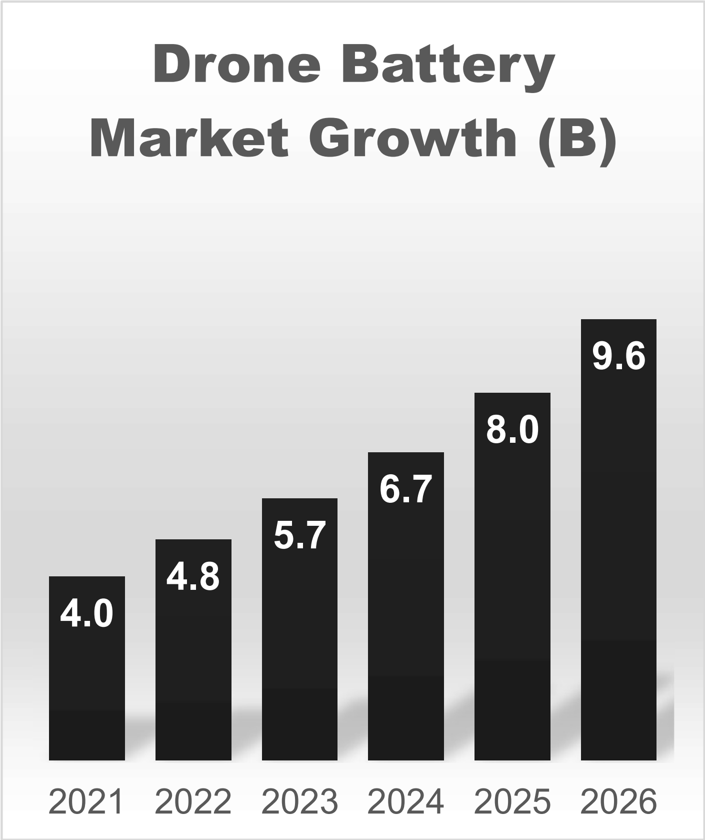
Flight Duration from 1.5 to 18 Hours
Achieved Multi-Day Flight
40%+ Performance | 10X Lifetime
Battery Fleet Health Management
High Efficiency Border Control Battery
Setting Shipboard Battery Standards
Creating Power Solutions for Space
James Bond Amphibious Drone
EARCH LABORATORY - FLYING SEA GLIDER
LOCKHEED MARTIN
BELL
ANDURIL
UNITED STATES NAVY
NAVAL RESEARCH LABORATORY

Our Focus: LARGE Niche Market

North America projected to lead the battery market for drones owing to increased demand for commercial and military drones

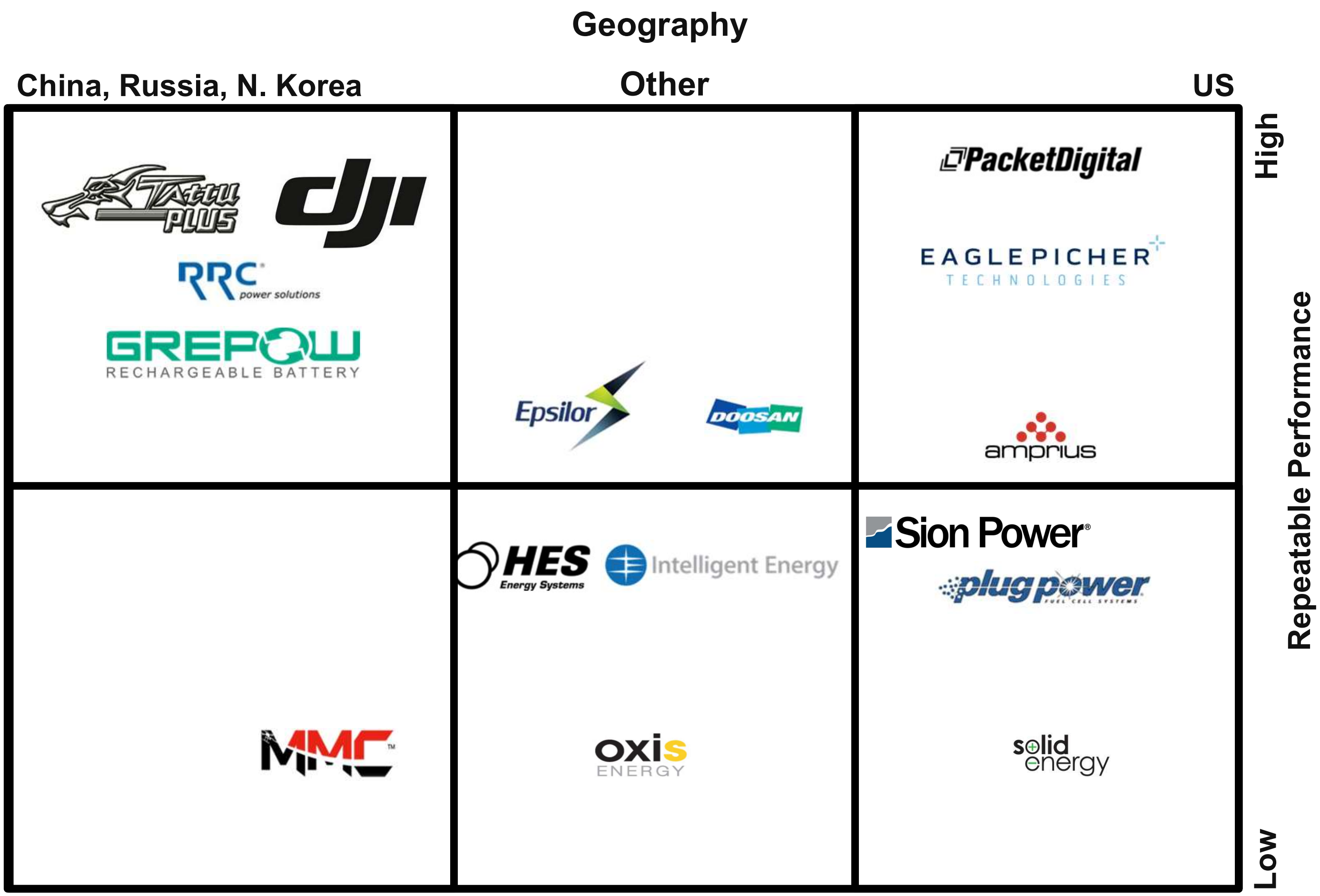
Market Drivers

- **Drone Service providers require multiple batteries per drone in order to maintain required turnaround times**
- **Policy changes and technology improvements are enabling viability of increased Drone application breadth**
- **Increasing complexity of UAS operations requires smarter and more innovative battery solutions**



19% CAGR from 2021 to 2026

Our Competitive Position



Competitive Differentiation

Geography

Repeatable Performance
- Quality
- Availability at scale
- Performance
- Cycle Life

Packet Digital, a US company, gets highest marks in both metrics due to our end-to-end solution, very high performance and unparalleled cycle life.

Our Leaders: Experienced/Visionary

Operations

Matt Steele

15 years designing and manufacturing advanced electronics with an education in engineering and business

CTO

Andrew Paulsen

Key Technical Leader the company since the inception. Well versed in all areas of the product responsible for technical strategy

CEO

Terri Zimmerman

Over 30 Years of C-Suite Experience, Finance, Business Development, Sales, and Government Relations

Marketing

Matt Sather

10+ years of sales, marketing, and vendor management in the UAS and E-Commerce market

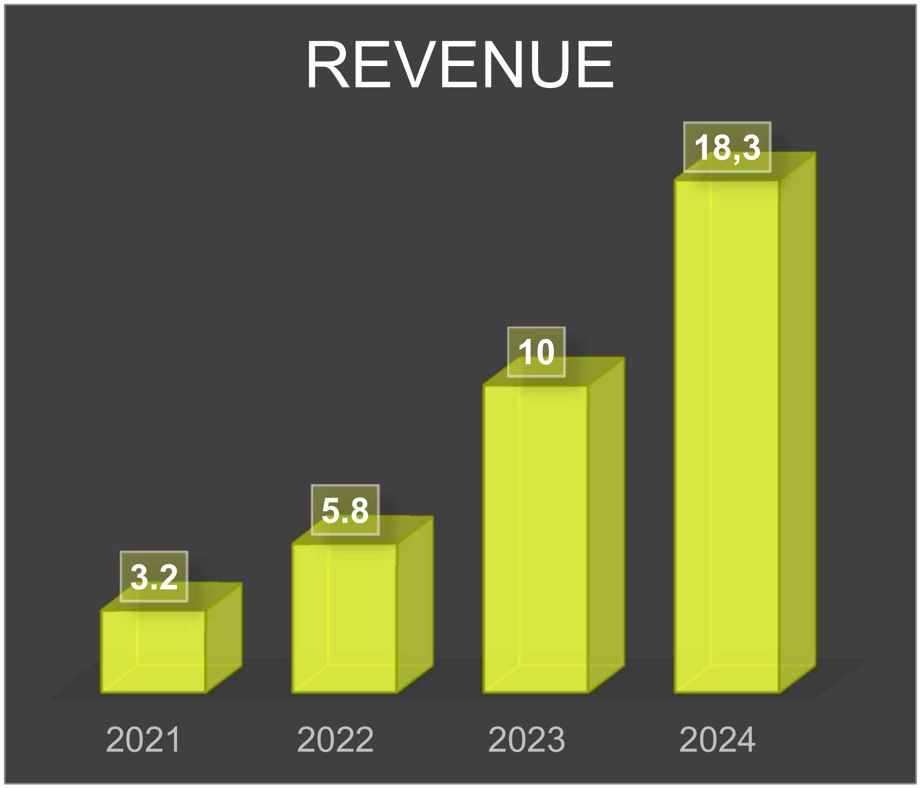
ADVISOR

Darren Laybourn

22 Year Microsoft CVP with diverse product ownership and 30+ years of Business and Engineering Leadership

DL0

Our Financials: Growth & Profit



2023 COMMITMENTS

- Defining **Navy Fleet** standards for Drone Batteries and Charging systems
- Creating power solution for amphibious drone/sub for **Navy**
- Creating next generation power solutions for space with the **Airforce Research Lab**
- Designing battery for space power beaming for **Northrup Grumman SPIDER**
- Delivering Batteries to **Lockheed**
- Delivering Batteries to **Anduril**
- …

Current Financing Goals

Raise $60 Million

Federal Funds

State Funding

Customer Investments

Private Financing

Expected Results

Battery Cell Manufacturing Plant

Technology Transfer Funding

Staffing and Training

Production Ramp Up

End to End U.S. Supply Chain

PacketDigital


POWER TO THE (DRONES)
THAT'S OUR BATTERY
PacketDigital

TECHNICAL REVIEWERS' RATING SUMMARY

C-05-J

Carbon Convert Prototype

Submitted By: Carbon Convert, LLC

Date of Application: October 2023

Request for $500,000 Grant

Total Project Costs $4,500,000

		Technical Reviewer			
		J1	**J2**	**J3**	
Rating Category	**Weighting Factor**	**Rating**	**Rating**	**Rating**	**Average Weighted Score**
1. Objectives	3	2	3	4	9
2. Impact	9	2	1	4	21
3. Methodology	9	2	2	3	21
4. Facilities	3	2	3	3	8
5. Budget	9	1	3	2	18
6. Partnerships	9	2	3	2	21
7. Awareness	3	1	3	2	6
8. Contribution	6	2	2	2	12
9. Project Management	6	2	3	3	16
10. Background	6	2	2	1	10
	315	114	150	162	142

OVERALL TECHNICALLY SOUND			
GOOD (IF > 214)	☐	☐	☐
FAIR (200-213)	☐	☐	☐
QUESTIONABLE (IF< 200)	☒	☒	☒

Mandatory Requirements	J1		J2		J3	
Diversification Delivery:	Yes	No	Yes	No	Yes	No
Project enhances the production of clean sustainable energy, to make the State a world leader in the production of clean sustainable energy, and/or to diversify and grow the State's economy.		✓	✓		✓	
Commercialization or Development/Expansion:	Yes	No	Yes	No	Yes	No
Concept will lead to the **large-scale development and commercialization** of projects, processes, activities, and technologies that reduce environmental impacts and/or increase sustainability of energy production and delivery.		✓		✓	✓	

In State Requirement:	Yes	No	Yes	No	Yes	No
The funds distributed from the financial assistance are to be applied to support in-state activities and must have other sources of financial support.		✓	✓		✓	

1. **The objectives or goals of the proposed project with respect to clarity and consistency with Clean Sustainable Clean Energy Authority goals of projects, processes, activities, and technologies that reduce environmental impacts and increase sustainability of energy production and delivery are: 1 – very unclear; 2 – unclear; 3 – clear; 4 – very clear; or 5 – exceptionally clear.**

Reviewer J1 (Rating 2)
"Aims to develop a revolution technology" employing Artificial Photosynthesis. In current literature the highest reported efficiency for Artificial Photosynthesis is 22.4%.

Reviewer J2 (Rating 3)
Proposed project seeks to achieve goals of CSEA but is at a developmental stage that does not align with the objective of deploying large-scale commercial technology.

Reviewer J3 (Rating 4)
If the proposed project were to achieve success (working prototype, demonstration of production of valuable byproducts, and productive early application in a commercial environment), the project would yield significant advances in clean energy in the state of North Dakota. The objectives set forth in the proposal are clear and would be very consistent with CSEA goals.

2. **The objectives will make a difference in the near term to the state's economy: 1 – no impact; 2 – small impact; 3 – likely impact; 4 – most likely impact; or 5 – significant impact.**

Reviewer J1 (Rating 2)
The project timetable is only one year in length and is to only develop a prototype (small scale model). Then commercialization will take place with equipment being shipped across the country and eventually around the world.

Reviewer J2 (Rating 1)
No defined impacts from project development and deployment.

Reviewer J3 (Rating 4)
Assuming the objectives led to a successful demonstration of technology, the state of North Dakota would likely realize an economic impact. This project, if successful, would likely create jobs, positive media coverage leading to additional economic opportunities, and tax revenue.

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

Reviewer J1 (Rating 2)
In the methodology section of this proposal it is stated that "a comprehensive project plan will be drawn up, detailing timeline, resources required, risk mitigation measures and contingency plans.

Reviewer J2 (Rating 2)
Application lacks description of technology, TRL, or sufficient information to ascertain how the technology achieves stated goals.

Reviewer J3 (Rating 3)
A cogent methodology was put forth. Additional detail would have benefitted the proposal and impacted the reviewer's estimation of odds of success. Examples: discussion of critical design questions, description of sourcing pathways for very unique items such as quantum dots and nanowire catalysts, more detail on assembly challenges expected, and key tests anticipated.

4. The facilities and equipment available and to be purchased for the proposed pilot or commercialization strategy is: 1 – very inadequate; 2 – inadequate; 3 – adequate; 4 – notably good; or 5 – exceptionally good.

Reviewer J1 (Rating 2)
There is limited information provided regarding facilities or equipment to be purchased. There is also a letter of support from Bismarck State College indicating support and looking forward toward a potential partnership that could serve our constituents.

Reviewer J2 (Rating 3)
Application provides detailed list of commercially-available equipment needs.

Reviewer J3 (Rating 3)
It is clear that the proposal team has an understanding of the major components that will need to be purchased, but it is less clear how these components will be sourced. A discussion about anticipated challenges would have added value to the proposal in convincing reviewers that the sourcing goals are achievable within budget and schedule. Little discussion of the development facilities required (instrumentation, gas supply, safety equipment) was provided.

5. The proposed budget is comprehensive and sufficient relative to the outlined work and the timetable: 1 – not sufficient; 2 – possibly sufficient; 3 – likely sufficient; 4 – most likely sufficient; or 5 – certainly sufficient.

Reviewer J1 (Rating 1)
There is limited information provided relative to timetable other than a comment about the construction of the storage container with electrical, HVAC, and plumbing.

Reviewer J2 (Rating 3)
Timing and budget seem sufficient for this stage of project development.

Reviewer J3 (Rating 2)
Insufficient detail was presented in the proposal to ascertain the sufficiency of the proposed budget.

- Implied in the budget discussion is the availability of qualified scientists and engineers capable of executing the scientific aspect of the work. If staffing is delayed, this will significantly impact the suitability of the proposed budget.

- If the sourcing of materials reveals financial surprises, this will impact the suitability of the proposed budget.

6. The appropriate strategic partnerships are in place for short and long term plans to be successful: 1 – very limited; 2 – limited; 3 – adequate; 4 – better than average; or 5 – exceptional.

Reviewer J1 (Rating 2)
There are only two *potential* partnerships identified. Harvestone has agreed to CONSIDER working with Carbon Convert, LLC. Bismarck State College has committed to developing a relationship with Carbon Convert, LLC. There was little information on long term plans.

Reviewer J2 (Rating 3)
Application includes one commercial and institutional partner.

Reviewer J3 (Rating 2)
The proposal did not communicate a plan to expand partnerships beyond a blanket statement from BSC and a "we'll consider it" letter of tepid interest from Harvestone to provide the CO2 slipstream. The reviewer is left questioning what commercial pathways have been explored for sale of the byproducts produced and what capabilities are made available by BSC opening its doors to Carbon Convert. Construction, assembly, and thorough science-based testing of the prototype may require significant facilities, instrumentation, and safety equipment. A discussion of all these parameters of concern would have enhanced this proposal.

7. The likelihood that the project approach (time & budget) will achieve its technical and market goals is: 1 – not achievable; 2 – possibly achievable; 3 – likely achievable; 4 – most likely achievable; or 5 – certainly achievable.

Reviewer J1 (Rating 1)
Only one year to go from research development to fabrication and then operation is very aggressive and seems unlikely.

Reviewer J2 (Rating 3)
Timeframe and budget appear appropriately scaled for level of technology development.

Reviewer J3 (Rating 2)
It is possible for the proposed project to achieve success, but the odds of success are heavily weighted on finding qualified scientific and engineering staff to transform a lab-tested nascent technology into a working prototype. Success also depends heavily on securing adequate development and testing facilities at BSC. The reviewer is hopeful, but cautious about the estimation of probability of success, given the lack of science background of the project principals. They are all accomplished in management and administration, but the success of this project will depend equally on application of science.

8. The scientific and/or technical contribution of the proposed work to specifically address Clean Sustainable Energy Authority goals of impacting technology used in North Dakota's energy industries will likely be: 1 – extremely small; 2 – small; 3 – significant; 4 – very significant; or 5 – extremely significant.

Reviewer J1 (Rating 2)
There would need to be large scale production of unit with and efficiency higher than 22.4% as reported in the literature to have a noticeable impact on the capture of CO_2 and on the environment. There is not planned location for construction after the first year.

Reviewer J2 (Rating 2)
Project application is for pre-commercialization/prototype development.

Reviewer J3 (Rating 2)
This review question, as written, asks the reviewer for an assessment of LIKELY contribution to science and technology. With little science evaluation of the NASA technology presented in the proposal, the reviewer has concerns regarding whether this nascent technology can be transformed into a commercially viable, operational system, especially with little science and engineering focus applied to the development of plans to mature the technology. Early establishment of science and engineering staff will be critical to the success of this project.

9. The project management plan, including budgeting projections, partner connections and well-defined milestone chart is: 1 – very inadequate; 2 – inadequate; 3 – adequate; 4 – notably good; or 5 – exceptionally good.

Reviewer J1 (Rating 2)
There are no scientific partners listed in this proposal with the exception of some of the partners having *some* experience in the oil industry. Budget projections do not address container costs and availability after they have completed the research and development.

Reviewer J2 (Rating 3)
Budget, partnerships, and milestones are adequate for the proposed level of technology development.

Reviewer J3 (Rating 3)
Budgeting projections, partner connections, and a summary list of milestones were presented in the proposal. Again, more detail would have strengthened the proposal, but material presented was adequate to address CSEA demands.

10. The background and experience of the project principals with regards to technical qualifications and competence is: 1 – very limited; 2 – limited; 3 – adequate; 4 – better than average; or 5 – exceptional.

Reviewer J1 (Rating 2)
There seems to be a lack of technical and science/chemistry background with the individual principals, however, there appears to be leadership skills. The only scientific/chemistry involvement could be at Bismarck State College.

Reviewer J2 (Rating 2)
Personnel/participant information provided in the application cites little engineering or other technical background experience.

Reviewer J3 (Rating 1)
The proposal presented no relevant technical qualifications of the project principals.

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 the project is technically sound.

Reviewer J1
This proposed project lacks scientific/chemistry expertise and does not fully describe the proposed process. There seems to be leadership skills but little scientific background. Current research indicates a 22.4% success rate with this concept.
This proposal is not technically sound.

Reviewer J2
The proposed project is a novel concept for CO2 reduction and clean energy production, it currently falls outside the scope of CSEA due its early-stage development status. Though the technology could ultimately advance the goals of CSEA upon further proof of concept. Would not recommend that the project is technically sound at this time, and needs additional pre-commercialization study, economic and engineering analysis.

Reviewer J3
Transforming a nascent technology tested by NASA in its labs into a viable commercial prototype is often a monumental task. Although the potential is exciting and possibly beneficial to North Dakota, the bridge to cross involves substantial science and engineering skillsets to ascertain the correct development pathway, then to execute the required development work, which will likely be substantial. Inclusion of one principal with demonstrated technical knowledge would have benefitted this proposal.

October 27, 2023

Clean Sustainable Energy Authority
North Dakota Industrial Commission

Dear Commission Members,

Carbon Convert, LLC respectfully requests your consideration for our Carbon Convert Prototype project. You will find our application materials included and we look forward to discussing this phenomenal project with you and its potential for North Dakota and the rest of the world.

Our project at Carbon Convert, LLC aims to develop a revolutionary technology that employs artificial photosynthesis to reduce carbon dioxide (CO2) into two commercially viable elements - oxygen and carbon monoxide. Initiated from an idea proposed by Marlo Anderson, the project leverages a unique thin-film technology developed by NASA. Moreover, by combining the produced carbon monoxide with hydrogen extracted from water, we can generate diverse combustion fuels, further enhancing our technology's commercial appeal.

Upon successful proof of concept with the prototype, our plan is to scale up production, designing units that fit within standard shipping containers for easy transportation and global distribution.

Sincerely,

Jim Silrum

Jim Silrum
Carbon Convert, LLC
215 Airport RD
Bismarck ND 58504
(701) 220-8227
Carbonconvert.tech

APPLICATION CHECKLIST

Use this checklist as a tool to ensure that you have all of the components of the application package. Please note, this checklist is for your use only and does not need to be included in the package.

☐	Application
☐	Transmittal Letter
☐	Tax Liability Statement
☐	Letters of Support (If Applicable)
☐	Confidentiality Request
☐	Business Plan (Appendix)
☐	Historical Financial Statements (3 years) (Appendix)
☐	Budgeted Projections (Appendix)
☐	Loan/Loan Guarantee Application (if Applicable, Appendix)
☐	Other Appendices (If Applicable)

When the package is completed, send an electronic version to sustainableenergy@nd.gov

For more information on the application process please visit:
https://www.ndic.nd.gov/grant-programs/csea/clean-sustainable-energy-authority-applicant-information

Questions can be addressed to the Industrial Commission at 701-328-3722.

Clean Sustainable Energy Authority

North Dakota Industrial Commission

Application

Project Title: Carbon Convert Prototype

Applicant: Carbon Convert, LLC

Date of Application: October 31, 2023

Amount of Request
    Grant: $500,000
    Loan:

Total Amount of Proposed Project: $4,500,000

Duration of Project: 1 Year

Point of Contact (POC): Jim Silrum

POC Telephone: (701) 220-8227

POC Email: Jim@carbonconvert.tech

POC Address:215 Airport RD, Bismarck ND 58504

TABLE OF CONTENTS

Please use this table to fill in the correct corresponding page number.

ABSTRACT

Objective:

Our project at Carbon Convert, LLC aims to develop a revolutionary technology that employs artificial photosynthesis to reduce carbon dioxide (CO_2) into two commercially viable elements - oxygen and carbon monoxide. Initiated from an idea proposed by Marlo Anderson, the project leverages a unique thin-film technology developed by NASA. Moreover, by combining the produced carbon monoxide with hydrogen extracted from water, we can generate diverse combustion fuels, further enhancing our technology's commercial appeal.

Upon successful proof of concept with the prototype, our plan is to scale up production, designing units that fit within standard shipping containers for easy transportation and global distribution.

Expected Results:

Our project at Carbon Convert, LLC not only looks to mitigate the environmental impact of CO_2 emissions but also envisions turning this global challenge into a commercially viable opportunity. With the success of the prototype in showing how much CO_2 can be converted and the amount of fuels that can be made from the conversion, the production of the conversion shipping containers will commence at a location preferably in western ND so that the completed units can be shipped to wherever they are needed around the world.

Duration:

The development of the full-scale prototype will be completed within one year.

Total Project Cost:

$4,500,000

Participants:

Marlo Anderson – Founder

Latoya Johnson – Processes & Efficiencies

Dr. Douglas Jensen – Prototype Laboratory

Steve Bakken – Project Lead

Dave Blair – Business Development

Jeff Bruce – Research & Development Project Manager

Seth Rusek – Solar Expert

Jim Silrum – Strategic Initiatives

PROJECT DESCRIPTION

Objectives:

Our project at Carbon Convert, LLC aims to develop a revolutionary technology that employs artificial photosynthesis to reduce carbon dioxide (CO_2) into two commercially viable elements - oxygen and carbon monoxide. Initiated from an idea proposed by Marlo Anderson, the project leverages a unique thin-film technology developed by NASA.

The journey from conception to realization started with the validation of Anderson's idea via successful lab experiments conducted by NASA. Following this validation, an exclusive license for the commercialization of this technology was granted to Carbon Convert, LLC.

Currently, we are in the process of constructing a small-scale prototype that will demonstrate our ability to harness light energy to break down CO_2 into oxygen and carbon monoxide. These by-products hold immense potential for various industries, including healthcare, water treatment, pharmaceutical, metal fabrication, and food and beverage sectors. Moreover, by combining the produced carbon monoxide with hydrogen extracted from water, we can generate diverse combustion fuels, further enhancing our technology's commercial appeal.

Upon successful proof of concept with the prototype, our plan is to scale up production, designing units that fit within standard shipping containers for easy transportation and global distribution.

In collaboration Bismarck State College (BSC) and with a CO_2 producing company (so far Dakota Spirit ethanol plant in Spiritwood, ND), we anticipate that the prototype development phase will see substantial progress by June 2024, adhering to the terms of our license agreement with NASA.

By October 2024, we aim to have our first batch of commercial units ready for sale. These units will provide a mutually beneficial solution to facilities with CO_2 emissions, converting waste into valuable commodities while contributing significantly to carbon neutrality.

In essence, our project at Carbon Convert, LLC not only looks to mitigate the environmental impact of CO_2 emissions but also envisions turning this global challenge into a commercially viable opportunity.

Methodology:

The prototype development phase will commence with an initial **Design and Planning** stage. At the onset, it is crucial to understand thoroughly the iPVEC technology patented by NASA, as well as any other required or related technologies. The design will be based on the details provided in the patent and will be supplemented with additional research into CO_2 conversion technologies, container-based manufacturing setups, and other relevant areas. The team will also need to factor in operational scenarios, safety issues, ease of use, maintenance requirements, and cost factors during the design stage. A comprehensive project plan will be drawn up, detailing the timeline, resources required, risk mitigation measures, and contingency plans.

Following the Design and Planning phase, the team will move to the **Material Sourcing and Preparation** stage. This will involve procuring the necessary materials and components as per our "shopping list", such as PV Electrodes, CdS Quantum Dots, TiO_2 Nanowire Photocatalyst, Cu/ZnO Electrocatalyst, among others. These materials will be prepared and assembled in compliance with the design specifications and safety regulations.

Next, the **Assembly and Construction** of the prototype takes place. The team will work on implementing the design in a controlled environment, ensuring that the components fit together as planned. This phase will likely require a lot of adjustments and refinements as real-world issues manifest. Regular testing will be conducted during this process to ensure that each part functions as expected.

Upon successful assembly of the prototype, we will shift focus to the **Testing and Analysis** phase. The assembled prototype will be subjected to rigorous testing under a variety of conditions to evaluate its performance, efficiency, reliability, and safety. These tests will help us discover any design flaws or areas for improvement. The data gathered from the tests will be analyzed thoroughly for valuable insights and to inform adjustments.

Finally, the **Iteration and Refinement** stage will involve making necessary modifications and improvements to the prototype based on the findings from the testing phase. This process of iteration is critical to refining the product and ensuring it is ready for production.

Prototyping is often a cyclical process, and we may need to repeat certain stages based on findings during testing and refinement. By maintaining flexibility and a commitment to continuous improvement in our methodology, we aim to develop a robust, reliable product that meets the needs of our customers and the specifications of the iPVEC technology.

Anticipated Results:

1. **Successful Construction of Prototype:** Construction of a working prototype of the CO2 conversion unit. This device, housed within a shipping container, will contain all the necessary components as described in the patent granted to NASA and subsequent design phases.

2. **CO2 Conversion Capability:** The prototype will be capable of converting CO2 into hydrocarbon fuels using both photovoltaic and electrochemical processes. This is the core functionality expected from the iPVEC technology.

3. **Energy Efficiency:** Given the use of photovoltaic cells, the prototype will exhibit energy efficiency. How efficient the unit ends up being could vary and determining this will be one of the outcomes of the testing phase, but initial projections are that the unit will achieve 92% energy efficiency, which is close to those from a coal-fired power plant.

4. **Scalability Insights:** The prototype will provide valuable insights into the scalability of the unit. It will afford an understanding of the complexities involved in producing the conversion units at scale and clues about how production could be made more efficient.

5. **Potential Challenges Uncovered:** The prototype phase will likely reveal challenges or obstacles in the design, production, or operation of the units. These could relate to the reliability of the unit, its efficiency, or other issues that could arise from its real-world operation.

6. **Iterative Improvements:** After testing and refinement stages, the prototype will be improved upon, readying it for mass production. The design will be robust and capable of being manufactured at scale.

The prototype phase is a critical part of development and key in identifying potential future challenges and paths to their resolution. This phase will provide valuable insights that will help align the project with its objective – turning CO2 into a valuable resource.

Facilities:

The Chemistry Department at Bismarck State College has agreed to provide laboratory and development space along with assistance in the research necessary to develop both the initial and full-scale prototype units. Upon completion of the full-scale prototype, Harvestone Low Carbon Partners has agreed to consider working with Carbon Convert, LLC by providing access to the CO2 slip stream from the Dakota Spirit ethanol facility in Spiritwood, ND.

Resources:

1. Financial Resources:

- Project Budget: $4,500,000
- Research and Development Budget: $700,000
- Design and Engineering: $1,100,000
- Fabrication and Assembly: $900,000
- Testing and Validation: $950,000
- Deployment and Maintenance: $850,000

2. Physical Resources:

- Building & Infrastructure: Provided by Bismarck State College and perhaps the Dakota Spirit ethanol plant.
- Equipment & Tools: This includes laboratory equipment for testing and analysis, tools and machinery for prototype construction, and safety equipment for the staff.
- Materials: PV Electrodes, CdS Quantum Dots, TiO_2 Nanowire Photocatalyst, and Cu/ZnO Electrocatalyst.

3. Human Resources:

- Research Scientists/Engineers: Skilled personnel who understand the patent, conduct research, and design the prototype. These will include a chemical engineer, a mechanical engineer, an electrical engineer, a materials scientist, an analytical chemist, and a safety engineer.
- Technicians: Skilled staff who can construct the prototype and conduct tests.
- Product Manager: This person would oversee the project, ensuring that it stays on schedule and within budget.
- Administrative Staff: Individuals who can manage procurement, HR, finances, and other back-end tasks.

4. Intellectual Resources:

- Patent Information: A detailed understanding of the iPVEC technology patented by NASA.
- Research Data: This includes any preliminary studies, as well as research from relevant fields.
- Prototype Design: Detailed design documents for the prototype, including technical specifications and assembly instructions.

5. Time:

- Project Duration: One year.

Techniques to Be Used, Their Availability and Capability:

1. NASA's Solar Powered Carbon Dioxide (CO2) Conversion: Marlo Anderson has been granted the license to use this patented technology from NASA. The license to utilize this technology in shipping containers is exclusive to Carbon Convert, LLC.
2. Water Electrolysis: This is a widely used process to separate water molecules into oxygen and hydrogen gas molecules.
3. Fischer-Tropsch Synthesis: This was first developed in the 1920s and is used for the creation of syngas.

Environmental and Economic Impacts while Project is Underway:

This project is to prove through prototypes in live scenarios what has already been proven in NASA laboratories. When the prototypes have proven how much CO2 can be converted into oxygen and syngas, the full-scale production of units will begin for sale to our prospective customers all over the world. The prototypes will have limited beneficial impacts to the environment or the economy, however the sale and use of the technology beyond the project will have tremendous environmental and economic impacts, all of which will be beneficial.

Ultimate Technological and Economic Impacts:

Depending on the scalability of Carbon Convert's technology, the economic impacts will be considerable with the creation of jobs, unit sales eventually in the hundreds of millions of dollars, along with the sale of the oxygen and syngas created as end products. With North Dakota as an energy leader and in the process of working toward the receipt of CO2 from many other states, Carbon Convert's technology will provide a significant positive impact to the economy of the state and its people.

North Dakota has the necessary geological formations for the sequestration of CO2, but how much better will it be to create valuable products from this CO2 rather than the creation of CO2 landfills.

Why the Project is Needed:

Carbon Convert's technology will transform CO2 from a waste product to an extremely valuable and useful commodity.

STANDARDS OF SUCCESS

The standards by which the success of the project is to be measured. This may include:

- *Emissions reduction.* With the capture, conversion, and utilization of CO2 by those customers deploying Carbon Convert's technology, all or at least the vast majority of the CO2 produced through their processes will be eliminated.
- *Reduced environmental impacts.* The capture, conversion, and utilization of CO2 with the use of Carbon Convert's technology will eliminate the environmental impacts of that same CO2 being released into the air.
- *Increased energy sustainability.* Through the use of Carbon Convert's technology, a whole new source of usable energy will be provided.
- *Value to North Dakota.* With North Dakota as an energy leader and in the process of working toward the receipt of CO2 from many other states, Carbon Convert's technology will provide a significant positive impact to the economy of the state and its people.
- *Explanation of how the public and private sector will make use of the project's results, and when and in what way.* Carbon Convert's intention is to deploy its technology first to those large CO2 producers of the state, e.g., power plants, ethanoyl facilities, cement manufacturing, etc. However, depending on the scalability of the technology, there may be no limit to how this technology will be utilized.
- *The potential commercialization of the project's results.* Carbon Convert is planning to install its technology in 40-foot shipping containers so that they can be easily shipped to any location in the world. These units can be connected to accommodate the CO2 output of the facility utilizing them.
- *How the project will enhance the research, development and technologies that reduce environmental impacts and increase sustainability of energy production and delivery of North Dakota's energy resources.* Being that Carbon Convert will be the first to develop and deploy artificial photosynthesis, we believe our concept will be the first of many related technologies that will spin off from what is discovered. With the understanding that CO2 is a valuable resource for energy and oxygen production and with the abundance of CO2 available, it cannot help but to be seen as the most sustainable source of North Dakota's energy resources.
- *How it will preserve existing jobs and create new ones.* No existing jobs will be eliminated through the deployment of Carbon Convert's technology. Rather, high-paying jobs will be created in North

Dakota for the Carbon Convert units produced, sold, deployed, and maintained. Additional jobs will be created as a result of the oxygen and syngas that will be produced as end products.

- *How it will otherwise satisfy the purposes established in the mission of the Program.* Carbon Convert's technology will be created in a modular fashion so that our customers may deploy those modules that best suit their needs. The first module simply separates CO2 molecules into oxygen and carbon monoxide molecules that can then be collected and sold for any number of uses. Oxygen and carbon monoxide hold immense potential for various industries, including healthcare, water treatment, pharmaceutical, metal fabrication, and food and beverage sectors. The second module when utilized combines hydrogen with the carbon dioxide to generate diverse combustion fuels that are cleaner burning that coal and oil.

BACKGROUND/QUALIFICIATIONS

Please provide a summary of prior work related to the project conducted by the applicant and other participants as well as by other organizations. ***This should also include summary of the experience and qualifications pertinent to the project of the applicant, key personnel, and other participants in the project.***

Marlo Anderson, founder of National Day Calendar and a well-known Radio and TV personality, brings a wealth of experience and a versatile approach to innovation to Carbon Convert. His show, The Tech Ranch, serves as a hub for technology insights and trends, fostering a wide-reaching dialogue about the evolving digital landscape. Marlo's commitment to sustainability and community engagement, along with his diverse entrepreneurial ventures, uniquely position him to guide Carbon Convert in its mission to utilize NASA's thin-film technology to transform carbon dioxide into sustainable fuels, aiming for significant environmental impact.

Latoya Johnson is a distinguished executive with a track record of successfully managing multi-million-dollar construction projects, leading large subcontractor teams, and optimizing budget usage. Armed with a bachelor's degree in Organizational and Business Management, she has built robust relationships with vendors, stakeholders, and clients. As an experienced Business Development Manager, she has negotiated contracts exceeding $10.5M and achieved a 35% surge in company sales. Latoya embodies her belief that actions speak louder than words through her dedication, diligence, and commitment to customer satisfaction. Her versatile career path involves roles in customer service, sales, office management, marketing, client relations, business development, client retention, accounting, and project management. Latoya masterfully balances client satisfaction and business profitability, emphasizing integrity and respect in all business transactions.

Steve Bakken brings a broad skillset in both the public and private sectors to Carbon Convert from his thirty plus years as a business owner and politician. He has developed and championed a broad perspective towards our resources, business, and education in the energy sector in North Dakota as well as regional, national, and global relationships that has afforded him access to all levels of government, business, associations, and executives on state, federal and international platforms. He has an extensive skill set in Communications, Public Relations, Government Relations, Policy, Strategy, Workforce Development, Marketing and Business Development and has affiliations with numerous local, state, federal, and international organizations.

Dave Blair brings over 20 years of experience in economic and business development, including roles with KLJ Engineering and his company, Network Solutions and Services. He significantly contributed to the TransCanada Keystone XL pipeline project as a tribal liaison, ensuring effective collaboration between 10 tribes and TransCanada. Dave was instrumental in training tribal monitors, preparing legislative and regulatory documents, and engaging with diverse stakeholders including Native American tribes, farmers, ranchers, and legislative groups. In addition, he conducted a feasibility study for introducing natural gas to Rugby and Beulah, ND, and executed a preliminary marketing study for the Northern Pulse Growers Association. As the Regional Business Development manager for SinoStruct, he introduced innovative manufacturing ideas and product concepts in the oil and gas industry. Moreover, Blair led business development in ND for Ultra 3X, a water treatment company, where he introduced a pioneering technology for wastewater management. His robust business relations span the renewable energy, fossil fuel, manufacturing, and construction sectors.

Jeff Bruce brings a wealth of experience from diverse roles he held in leading energy companies, including Fuimus Companies / Consulting Terra-Gen LLC, E&I Global Energy Services Inc., E&I Tech Services, Black & Veatch, Tri-Technic, and Kiewit Energy. His expertise spans multiple sectors like Solar, BESS, Wind Farm, Substation, Transmission line, and Industrial Construction. Notably, from 2021-2023, he supervised all Electrical and High Voltage Contractors for significant projects as a High Voltage & Electrical SR PM/CM at Fuimus Companies. Prior to that, Bruce was the president of E&I Global Energy Services Inc., overseeing daily operations and project estimates. Complementing his impressive career is his dedication to continuous learning, demonstrated by his completion of a USAR Electronics Course, an OJT Electrical Apprentice, and various other industry-related training.

Seth Rusek is an innovator at the forefront of the energy industry and owner of Pryzmatiq Energy Storage Systems (PESS). PESS brings solutions-based products and capabilities for custom built modular electrical systems, solar generation, and battery technology. Solar projects currently span multiple nations and include cutting edge PV Solar Panels or Parabolic Solar systems, with atmospheric solar systems currently under development.

Jim Silrum transitioned into the entrepreneurial sphere of Marlo Anderson in the summer of 2023, assuming the pivotal role of Strategic Initiatives. Prior to this, he amassed nearly two decades of experience serving as the North Dakota Deputy Secretary of State, during which he established invaluable relationships with public officials, gained a profound understanding of governmental operations, and honed his skills in policy formation. This was further enriched by 20 years spent in nonprofit administration, where he made a significant impact through the cultivation of authentic relationships. Harnessing these experiences, Jim now contributes his expertise to Carbon Convert, LLC, helping transform the waste product of carbon dioxide into valuable elements, thereby benefiting our world.

MANAGEMENT

*A description of **how** the applicant will manage and oversee the project to ensure it is being carried out on schedule and in a manner that best ensures its objectives will be met, **and a description of the evaluation points to be used** during the course of the project.*

Carbon Convert, LLC's Project Manager will be responsible for overseeing the work of the highly skilled individuals who will be working to bring the project to completion. Please see the project timetable below for project milestones. Our greatest motivation for success is that NASA has already proven the viability of this technology in their laboratories, and they have given us one year to make significant progress in moving our project to commercialization.

Initial Prototype – 25 Points: The first prototype being built is the small-scale model proving that CO2 moving across the nano film and catalysts activated by sunlight will be reduced to oxygen and carbon monoxide molecules. This will be completed in November of 2023 and will be used for demonstration purposes to prove the viability of the technology and encourage investment dollars.

Catalyst Evaluation – 25 Points: It is understood that the use of different catalyst metals will result in greater efficiencies for CO2 conversion. Testing will be conducted to determine the best catalyst to be used for cost and conversion rate purposes. This will be done by June of 2024.

Nano Film and CO2 Storage Configuration – 25 Points: It is also understood that piping and storage container configuration can significantly improve the available surface area for the conversion of the CO2. Testing will be conducted to determine the best configuration. This will be done by June of 2024.

Full-Scale Prototype – 25 Points: The full-scale prototype will be constructed on the Bismarck State College campus and deployed at a facility, hopefully Dakota Spirit in Spiritwood, ND, by the fall of 2024. This will then be the launching point for Carbon Convert, LLC to move into commercialization.

TIMETABLE

Please provide a project schedule setting forth the starting and completion dates, dates for completing major project tasks/activities, and proposed dates upon which the interim reports will be submitted.
Research and Development by January 1, 2024 – Hire research team, conduct initial research to determine feasibility and potential for the technology, and develop initial concept design

Design and Engineering by March 1, 2024 – Hire design and engineering team, refine concept design, create detailed engineering plans, and design safety features.

Fabrication and Assembly by July 1, 2024 – Hire fabrication and assembly team, build and modify storage container to accommodate technology, install electrical, plumbing, and HVAC systems, and integrate components and safety features.

Testing and Validation by September 1, 2024 – Conduct initial testing to ensure proper function, address any issues or areas for improvement, and validate safety features.

Deployment and Maintenance by November 1, 2024 – Connect container to CO2 capture system, implement maintenance plan to ensure system continues to function properly, and monitor and optimize system for efficiency and effectiveness.

BUDGET

*Please use the table below to provide an **itemized list** of the project's capital costs; direct operating costs, including salaries; and indirect costs; and an explanation of which of these costs will be supported by the financial assistance and in what amount. The budget should identify all other committed and prospective funding sources and the amount of funding from each source. **Please feel free to add columns and rows as needed.** Higher priority will be given to projects with a high degree of matching private industry investment.*

Project Associated Expense	NDIC Grant	NDIC Loan	Applicant's Share (Cash)	Other Project Sponsor's Share	Total
Salaries			$250,000	$750,000	$1,000,000
Supplies	$500,000			$1,200,000	$1,700,000
Marketing				$50,000	$50,000
Office Supplies, Rent, & Utilities				$500,000	$500,000
Contract Labor				$1,250,000	$1,250,000
Total					

Please use the space below to justify project expenses and discuss whether the project's objectives will be unattainable or delayed if less funding is available than requested.

Carbon Convert, LLC
Project Budget Detail

- Salaries/Fringe Benefits – $1,000,000

  These funds will be used to hire a project manager, chemical engineer, mechanical engineer, electrical engineer, materials scientist, analytical chemist, and a safety engineer for the project.

- Supplies – $1,700,000

  These funds will be used for the supplies necessary for research and development, design and engineering, fabrication and assembly, and testing and validation. The supplies necessary include:

  1. Transparent and Conductive Photovoltaic (PV) Electrodes
  2. Cadmium Sulfide (CdS) Quantum Dots
  3. Titanium Dioxide (TiO2) Nanowire Photocatalyst
  4. Copper/Zinc Oxide (Cu/ZnO) Electrocatalyst
  5. Flow Chamber with CO2
  6. Electrolyte

7. Gas Diffusion Layer (GDL)
8. Indium Tin Oxide (ITO) at Anode
9. Electrocatalysts and Photocatalysts
10. 40 foot Long Shipping Containers
11. Other, e.g., wiring and electrical components, gas and liquid handling hardware, and safety equipment

- Marketing & Advertising Costs – $50,000

  These funds will be used for the continued development of our website carbonconvert.tech and to develop and distribute our promotional materials.

- Other Direct Costs – $1,750,000

  The costs associated with this category are:

  1. Office expenses such as rent and utilities - $500,000
  2. Contract labor for research and development experts – $1,250,000

As with most projects of this scale, funding delays will result in higher costs due to inflation. Our founder, Marlo Anderson, has been granted a one-year license from NASA for the artificial photosynthesis technology they have proven in the lab. That license will go through June of 2024, but will be extended if it can be shown that significant progress is being made in bringing the technology to commercialization.

CONFIDENTIAL INFORMATION

A person or entity may file a request with the Commission to have material(s) designated as confidential. By law, the request is confidential. The request for confidentiality should be strictly limited to information that meets the criteria to be identified as trade secrets or commercial, financial, or proprietary information. The Commission shall examine the request and determine whether the information meets the criteria. Until such time as the Commission meets and reviews the request for confidentiality, the portions of the application for which confidentiality is being requested shall be held, on a provisional basis, as confidential.

If the confidentiality request is denied, the Commission shall notify the requester and the requester may ask for the return of the information and the request within 10 days of the notice. If no return is sought, the information and request are public record.

Note: Information wished to be considered as confidential should be placed in separate appendices along with the confidentiality request. The appendices must be clearly labeled as confidential. If you plan to request confidentiality for **reports** if the proposal is successful, a request must still be provided.

To request confidentiality, please use the template available at http://www.nd.gov/ndic/CSEA-app-doc-infopage.htm.

PATENTS/RIGHTS TO TECHNICAL DATA

Any patents or rights that the applicant wishes to reserve must be identified in the application. If this does not apply to your proposal, please note that below.

NASA's Solar Powered CO2 Conversion – Patent No. US 9,528,192 B1 – Date of Patent: December 27, 2016

Carbon Convert, LLC will likely be developing other technologies and processes that will be patented during the project. These will be protected as well.

STATE PROGRAMS AND INCENTIVES

Any programs or incentives from the State that the applicant has participated in within the last five years should be listed below, along with the timeframe and value.

Carbon Convert, LLC also applied for a grant from the North Dakota Agricultural Products Utilization Commission on October 1, 2023. Determination has not yet been made as to whether the application for $250,000 will be funded.

**Revised 5/10/2023*

Industrial Commission

Tax Liability Statement

Applicant:

Scranton Holding Company/North American Iron, Inc.

Application Title:

"Green" iron production facility

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.

Jim Silrum

Signature

James Bougalis, CEO

Title

October 30, 2023

Date

Clean Sustainable Energy Grant Application
Carbon Convert, LLC
Three-Year Projected Financial Plan

Year 1: Research & Development

- No Revenue
- Expenses:
    - Advertising (Marketing for initial recruitment, project announcement): $50,000
    - Contract labor (Hiring experts for R&D): $1,550,000
    - Supplies (Procuring R&D materials): $1,400,000
    - Office expenses (Rent, utilities): $500,000
    - Salaries and wages (Staff salaries): $1,000,000

Total Expenses: **$4,500,000**

Net Loss: **$4,500,000**

Year 2: Production of 12 Units

- Revenue:
    - Gross receipts or sales (12 units at $500,000 each): **$6,000,000**
- Expenses:
    - Advertising (Marketing for product launch): $100,000
    - Contract labor (Temporary workers for production): $1,080,000
    - Materials & supplies (Materials for unit manufacturing): $3,600,000
    - Office expenses (Rent, utilities): $560,000
    - Salaries and wages (Staff salaries): $1,080,000

Total Expenses: **$6,420,000**

Net Loss: **$420,000**

Year 3: Production of 52 units

- Revenue:
    - Gross receipts or sales (52 units at $500,000 each): **$26,000,000**
- Expenses:
    - Advertising (Marketing for sales expansion): $150,000
    - Contract labor (Temporary workers for larger scale production): $1,296,000
    - Materials & supplies (Materials for unit manufacturing): $15,600,000
    - Office expenses (Rent, utilities for larger operation): $784,000
    - Salaries and wages (Staff salaries): $1,296,000

Total Expenses: $19,126,000

Profit: **$6,874,000**

Carbon Convert, LLC
Clean Sustainable Energy Grant Application

Expenditures

Please provide a breakdown of expenditures. Include all sources of match. Provide supporting documentation as a separate attachment.

EXPENDITURES FOR THIS REPORTING PERIOD ONLY				
Project Expense	**NDIC**	**CSEA Recipient**	**Other Sponsor**	**Total**
Salaries		$250,000	$750,000	$1,000,000
Supplies	$500,000		$1,200,000	$1,700,000
Marketing			$50,000	$50,000
Office Supplies, Rent, & Utilities			$500,000	$500,000
Contract Labor			$1,250,000	$1,250,000
Total	$500,000	$250,000	$3,750,000	$4,500,000

CUMULATIVE EXPENDITURES				
Project Expense	**NDIC**	**CSEA Recipient**	**Other Sponsor**	**Total**
Salaries		$250,000	$750,000	$1,000,000
Supplies	$500,000		$1,200,000	$1,700,000
Marketing			$50,000	$50,000
Office Supplies, Rent, & Utilities			$500,000	$500,000
Contract Labor			$1,250,000	$1,250,000
Total	$500,000	$250,000	$3,750,000	$4,500,000

Please note that no expenditures have currently been made for this project.

The expenditure details are as follows:

- Salaries/Fringe Benefits – $1,000,000
  These funds will be used to hire a project manager, chemical engineer, mechanical engineer, electrical engineer, materials scientist, analytical chemist, and a safety engineer for the project.

- Supplies – $1,700,000
  These funds will be used for the supplies necessary for research and development, design and engineering, fabrication and assembly, and testing and validation. The supplies necessary include:

  1. Transparent and Conductive Photovoltaic (PV) Electrodes
  2. Cadmium Sulfide (CdS) Quantum Dots
  3. Titanium Dioxide (TiO2) Nanowire Photocatalyst
  4. Copper/Zinc Oxide (Cu/ZnO) Electrocatalyst
  5. Flow Chamber with CO2
  6. Electrolyte
  7. Gas Diffusion Layer (GDL)
  8. Indium Tin Oxide (ITO) at Anode
  9. Electrocatalysts and Photocatalysts
  10. 40 foot Long Shipping Containers
  11. Other, e.g., wiring and electrical components, gas and liquid handling hardware, and safety equipment

- Marketing & Advertising Costs – $50,000
  These funds will be used for the continued development of our website carbonconvert.tech and to develop and distribute our promotional materials.

- Other Direct Costs – $1,750,000
  The costs associated with this category are:

  1. Office expenses such as rent and utilities - $500,000
  2. Contract labor for research and development experts – $1,250,000

HARVESTONE
LOW CARBON PARTNERS

2841 3rd ST SW
Underwood, ND 58576
(701) 442-7513

September 29, 2023

Jim Silrum
Carbon Convert, LLC
215 Airport RD
Bismarck ND 58504

Dear Jim,

With this letter, Harvestone Low Carbon Partners agrees to consider working with Carbon Convert, LLC to facilitate a CO2 slip stream from the Dakota Spirit ethanol facility in Spiritwood, ND. This access may be granted when Carbon Convert's full-scale prototype is ready for deployment and the two parties agree to all other terms for such consideration. At such time when the prototype is complete, scheduling with Harvestone Low Carbon Partners will be necessary to facilitate the placement and connection and will be contingent on the then current plans or commitments for the CO2 from the Dakota Spirit ethanol facility and the parties reaching agreement on all terms. Nothing in this letter conveys any rights to Carbon Convert and Harvestone Low Carbon Partners and Dakota Spirit maintain all rights to the CO2 from the facility.

Harvestone looks forward to exploring further use of Carbon Convert's technology after the prototype's deployment and use.

Sincerely,

Jeff Zueger
CEO

Jeff Zueger

BISMARCK STATE COLLEGE | North Dakota's Polytechnic Institution

1500 Edwards Avenue
PO Box 5587
Bismarck, ND 58506-5587
701.224.5400

October 30, 2023

Jim Silrum
Carbon Convert, LLC
215 Airport Road
Bismarck, ND 58504

Dear Mr. Silrum,

Bismarck State College (BSC) is committed to developing public-private partnerships that drive workforce and economic development. Carbon Convert, LLC's project developing revolutionary technology that employs artificial photosynthesis to reduce carbon dioxide (CO2) into two commercially viable elements - oxygen and carbon monoxide aligns with BSC's polytechnic mission.

As we discussed at our initial meeting, BSC can offer a variety of resources to facilitate research and development, prototyping, and commercialization. We are supportive of the project and look forward to determining how a potential partnership can serve our constituents.

Please accept this letter of support for your project and in support of your grant application to the North Dakota Industrial Commission for the Clean Sustainable Energy Authority.

Sincerely,

Douglas J. Jensen, Ed.D.
President

TECHNICAL REVIEWERS' RATING SUMMARY

C-05-K

Cerilon GTL

Submitted By: Cerilon GTL ND Inc. (Cerilon)

Date of Application: October 2023

Request for $20,000,000 Grant / $80,000,000 Loan

Total Project Costs $3,600,000,000

		Technical Reviewer			
		K1	**K2**	**K3**	
Rating Category	**Weighting Factor**	**Rating**	**Rating**	**Rating**	**Average Weighted Score**
1. Objectives	3	5	4	5	14
2. Impact	9	4	3	5	36
3. Methodology	9	5	4	5	42
4. Facilities	3	4	5	4	13
5. Budget	9	4	3	5	36
6. Partnerships	9	4	4	5	39
7. Awareness	3	3	3	5	11
8. Contribution	6	5	4	3	24
9. Project Management	6	4	3	5	24
10. Background	6	5	4	5	28
	315	273	228	306	267

OVERALL TECHNICALLY SOUND			
GOOD (IF > 214)	☒	☒	☒
FAIR (200-213)	☐	☐	☐
QUESTIONABLE (IF< 200)	☐	☐	☐

Mandatory Requirements	K1		K2		K3	
Diversification Delivery:	Yes	No	Yes	No	Yes	No
Project enhances the production of clean sustainable energy, to make the State a world leader in the production of clean sustainable energy, and/or to diversify and grow the State's economy.	✓		✓		✓	
Commercialization or Development/Expansion:	Yes	No	Yes	No	Yes	No
Concept will lead to the **large-scale development and commercialization** of projects, processes, activities, and technologies that reduce environmental impacts and/or increase sustainability of energy production and delivery.	✓		✓		✓	

In State Requirement:	Yes	No	Yes	No	Yes	No
The funds distributed from the financial assistance are to be applied to support in-state activities and must have other sources of financial support.	✓		✓		✓	

1. The objectives or goals of the proposed project with respect to clarity and consistency with Clean Sustainable Clean Energy Authority goals of projects, processes, activities, and technologies that reduce environmental impacts and increase sustainability of energy production and delivery are: 1 – very unclear; 2 – unclear; 3 – clear; 4 – very clear; or 5 – exceptionally clear.

Reviewer K1 (Rating 5)
The objective of this application is to establish a state-of-the-art facility in Trenton, ND by 2028 for the conversion of natural gas into diesel fuel, lubricant base oil, other products, and excess energy under conditions of carbon neutrality using catalytic Fisher-Tropsch (F-T) synthesis-based technology. The goal of this proposal is to complete a Front-End Loading Phase 3 (FEL 3) detailed engineering design, as needed to prepare for construction.

Reviewer K2 (Rating 4)
This proposal for gran support is the second stage of an on-going large project. Its ultimate goal is to utilize the locally available but unutilized flare gases from petroleum drilling and processing industry in in the State of North Dakota to produce various fuels and other products through a gas-to-liquid (GTL) technology. The overall project includes a component of carbon capture and underground sequestration (CCUS). The proposal documented in fair detail the business plan, the technologies, and project management and execution plans for this stage and beyond. Particularly, the proposal provides information on feasibility study of carbon capture and sequestration, aiming at reducing the carbon footprint. Thus, the goal of this project aligns well with the CSEA's funding mission of reducing environmental impacts and increasing sustainability of energy production and delivery in the State of North Dakota.

Reviewer K3 (Rating 5)
The applicant has provided significant metrics regarding its production, emissions, and other outputs.

2. The objectives will make a difference in the near term to the state's economy: 1 – no impact; 2 – small impact; 3 – likely impact; 4 – most likely impact; or 5 – significant impact.

Reviewer K1 (Rating 4)
The project, after its completion in 2028, will provide a market for excess natural gas and natural gas being flared that needs to be produced from petroleum from the Williston, ND industrial complex and Bakken Formation. The project will therefore serve as a viable option for natural gas utilization in times of low market demand. The proposal projects the economic impact to North Dakota to be > $6 million per year during its first 5 years of production. Over 2300 jobs (~140 jobs directly in the facility) will be generated when the facility commences, according to the proposal. In the short term, several construction-related jobs will be supported.

Reviewer K2 (Rating 3)

The proposed work (to be completed by the end of 2025) is still in its engineering design stage. Additional R&D activities on environment assessment and carbon capture and sequestration are on-going. Thus, the impact on making a difference to the North Dakota's economy is small in the near term. However, successful achievement of the ultimate project objectives would make a great impact on North Dakota's economy in the long run.

Reviewer K3 (Rating 5)
The $3.6 billion project offers to increase the state's GDP by nearly one percent, reduce takeaway pressure on Northern Border, and to employ hundreds of people. In addition, the applicant offers the stability of a downstream operator.

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

Reviewer K1 (Rating 5)
The FEL 3 design will leverage the personnel and expertise gained via successful completion of FEL 2. Software to be employed for the engineering design (e.g., Hyses, Aspen) is state-of-the-art (per Sect 1.6). The technological methodology focuses upon F-T synthesis utilizing syngas prepared from natural gas via hydro formation, with the F-T product undergoing hydrotreatment and hydrocracking, followed by fractionation and CO2 recovery.

Reviewer K2 (Rating 4)
The proposal provides fairly good information on the methodologies to be used in the project. Cerilon GTL has self-owned GTL technologies which are proven and being used in other similar operations around the world. Although details of the technologies are not fully provided (which would provide more adequate info for better assessment), this technical reviewer believes that the quality of the methodology as discussed in the proposal is sound.

Reviewer K3 (Rating 5)
This proposal is very thorough and has included more than 100 subject matter experts.

4. **The facilities and equipment available and to be purchased for the proposed pilot or commercialization strategy is: 1 – very inadequate; 2 – inadequate; 3 – adequate; 4 – notably good; or 5 – exceptionally good.**

Reviewer K1 (Rating 4)
The applicants have the necessary facilities to complete the FEL 3 design. For the preparation of the facilities, the construction site has been obtained and surveyed, with a site plan prepared, arrangements for utilities made, and initiation of the necessary paperwork for permits.

Reviewer K2 (Rating 5)
The proposed work is in the engineering design stage. Hardware facilities and equipment are not needed or to be purchased for the proposed work. Other facilities to conduct the scope of work as outlined in the proposal, such as contracted services by engineering design firms and business teams, are in place.

Reviewer K3 (Rating 4)

The project faces critical risks related to the availability and lead-time of the materials and equipment needed. The applicant has a clear understanding of these risks and earns high marks, but the risk still exists.

5. The proposed budget is comprehensive and sufficient relative to the outlined work and the timetable: 1 – not sufficient; 2 – possibly sufficient; 3 – likely sufficient; 4 – most likely sufficient; or 5 – certainly sufficient.

Reviewer K1 (Rating 4)
$100 million is requested ($80 million for a loan; $20 million for a grant), with this amount matched through equity raise and vendor financing, to reach $200 million to complete the FEL 3 study.

Reviewer K2 (Rating 3)
First of all, this reviewer has no experience in accessing budgets of this scale. The proposed budget for the work in this stage totals $200M, among which $20M (this proposal) is requested from CSEA as a grant and $80M as a loan from CSEA. The combined grant and loan from CSEA are approx. 50% of the proposed budget for the work in this stage (as the share from other project sponsors is termed as "up to" $100.7M; page 23 of the proposal). Therefore, it is this reviewer's best judgment that the proposed budget is likely sufficient for the work and time.

Reviewer K3 (Rating 5)
The applicant has utilized previous funding to develop a comprehensive budget and timetable with input from more than 100 subject matter experts.

6. The appropriate strategic partnerships are in place for short and long term plans to be successful: 1 – very limited; 2 – limited; 3 – adequate; 4 – better than average; or 5 – exceptional.

Reviewer K1 (Rating 4)
Natural gas feedstock will be provided through the Northern Border Pipeline, with a short pipeline to the proposed gas-to-liquid (GTL) facility being planned. Additionally, arrangements are being made to tap into the WBI pipeline to access residual natural gas (e.g., intended for flaring). Licensing agreements have been made between the applicants and the developers of natural gas hydro formation, F-T and hydrotreating / hydrocracking. Potential customers for the products have also been identified, according to Appendix A and partnerships for carbon capture and sequestration are under development.

Reviewer K2 (Rating 4)
The proposal documents well its partnerships with technology providers, engineering design firms, and other related business and government organizations.

Reviewer K3 (Rating 5)
The applicant has sufficiently developed relationships with suppliers; energy producers, processors, and transporters; and supporting suppliers in the community, to complete and operate the project.

7. The likelihood that the project approach (time & budget) will achieve its technical and market goals is: 1 – not achievable; 2 – possibly achievable; 3 – likely achievable; 4 – most likely achievable; or 5 – certainly achievable.

Reviewer K1 (Rating 3)
The application has a detailed Gantt Chart for completing the construction of the proposed facility in 2028. But, as the application notes, the timeline is highly dependent upon this proposal being funded, a Title 17 loan from the DOE being approved, and additional capital being raised.

Reviewer K2 (Rating 3)
As commented in Item 5 above, this reviewer has no experience in accessing budgets of this scale. With the expertise and management plans provided in the proposal, its technical and market goals are likely achievable within the time and budgets.

Reviewer K3 (Rating 3)
The applicant has a well developed plan. However, supply chain issues, significant equity needs, market changes, and other external factors still threaten its ability to be successful.

8. The scientific and/or technical contribution of the proposed work to specifically address Clean Sustainable Energy Authority goals of impacting technology used in North Dakota's energy industries will likely be: 1 – extremely small; 2 – small; 3 – significant; 4 – very significant; or 5 – extremely significant.

Reviewer K1 (Rating 5)
As stated in the proposal, the proposed GTL facility would be the only GTL facility of its kind in the USA, utilizing state-of-the-art F-T catalytic and adsorption-based carbon capture and sequestration (CCS) technology, the latter to be applied throughout the processing stages. The resultant processing will be nearly carbon-neutral (to the greatest extent among the world's GTL facilities) due to CCS. Importantly, the GTL facility would uniquely utilize natural gas that would otherwise undergo venting via a flare, thereby addressing recent NDIC mandates to reduce flaring.

Reviewer K2 (Rating 4)
Once the overall GTL project is completed as proposed in 2028 (page 22 of the proposal), it would make a significant impact to the energy industries in North Dakota. It not only complements the existing oil industry but also adds value to the underutilized resources while significantly reducing the carbon footprint in North Dakota.

Reviewer K3 (Rating 5)
The applicant is pursuing a world-leading GTL facility and the technologies utilized by the facility could encourage further development in downstream development and will make the sale of products produced with North Dakota energy more competitive in markets sensitive to emission and environmental concerns.

9. The project management plan, including budgeting projections, partner connections and well-defined milestone chart is: 1 – very inadequate; 2 – inadequate; 3 – adequate; 4 – notably good; or 5 – exceptionally good.

Reviewer K1 (Rating 4)
A robust Gantt chart has been prepared, listing milestones. The applicants have good experience in managing this project through their successful FEL 2 work.

Reviewer K2 (Rating 3)
The project management plan is adequately discussed, especially with the supplementary information provided in appendices.

Reviewer K3 (Rating 5)
The management team is exceptionally experienced in the subject matter and has engaged more than 100 other subject matter experts. The overall team has produced a clear and trustworthy budget and milestone chart.

10. **The background and experience of the project principals with regards to technical qualifications and competence is: 1 – very limited; 2 – limited; 3 – adequate; 4 – better than average; or 5 – exceptional.**

Reviewer K1 (Rating 5)
The CEOs of Cerilon, Inc and Cerlion GTL, Inc, are deeply experienced in the GTL space. The remainder of the team appears to be well suited to complete the proposed project.

Reviewer K2 (Rating 4)
The proposal showed that the project team has a great array of technical/ industrial expertise and business experiences. The background and technical qualifications appear better than average.

Reviewer K3 (Rating 5)
The management team is exceptionally experienced in the subject matter and holds experience building and operating similar businesses globally. In addition, the applicant has engaged more than 100 other subject matter experts.

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 the project is technically sound.

Reviewer K1
This project fulfills several key niches in the energy infrastructure established in northwestern North Dakota that leverages the Bakken Formation: 1) It addresses the NDIC-mandated limit on flaring of natural gas, to improve the environment; 2) It diversifies the market portfolio for natural gas by providing additional avenues for excess natural gas: diesel, lubricant base, and others; 3) it enriches North Dakota's leadership position in sustainable energy through new areas: LTG processes and downstream product development; 4) it integrates synergistically with local feedstock (natural gas) and utility supplies, and may be an exporter of energy to nearby refineries; and 5) would be the only domestic supplier of Groups III+ lubricant base oils. The applicants are qualified to lead this project and are focusing their efforts on the project's success. The applicants have leveraged \$25 million of equity raised plus ~\$70 million funding from local, regional, and state levels of the North Dakota government to launch the project successfully. The requested funds of \$100 million, although an additional major commitment from North

Dakotans, I believe will be a good investment that will ultimately benefit to the State and will be key to Cerilon raising the remainder of the funds for the ~$3.6 billion project (via a $2.0 billion DOE Title 17 loan and ~$1.5 million of projected equity from investors and vendors).

The proposal's strengths are its overall rationale (as given above), the leadership team, and the technological approach, which appears to be sound and fulfills the sustainability mission of the NDIC. The weakness is the high extent of the project's reliance on local or state funding currently.

Reviewer K2
This proposal has demonstrated good progress from its initial project planning stage and plans for the next engineering design and implementation stage. It also showed dedicated efforts in accessing the technologies of carbon sequestration to be included in this overall project for reducing the carbon footprint. Thus, the overall project fully aligns with the CSEA funding mission and as it will establish a new and environmentally sustainable industry in the State of North Dakota.
It is recommended that the proposal be funded by CSEA.

Reviewer K3
This project is not a guaranteed success. External forces are the greatest threat against its success. However, it is a great pursuit for the State of North Dakota as it attempts to mitigate risks regarding North Border, stabilize the energy industry across commodity cycles, and complete in a world concerned about emissions and environmental impacts.
The applicant has shown its expertise in the subject and has been a forthright participant in the state since it began the pursuit its project. It has received substantial public support; however, this support is a bet by the state and local political subdivisions to build the project for their own benefits in addition to the applicant's economic gains.

Cerilon GTL ND Inc.
First Canadian Centre
350 7th Avenue SW, Suite 2900
Calgary, Alberta, Canada T2P 3N9

October 31, 2023

North Dakota Clean Sustainable Energy Authority
North Dakota Industrial Commission
State Capitol 14th Floor
600 E. Boulevard Ave. Dept. 405
Bismarck, ND 58505-0840

Subject: Transmittal Letter for the Clean Sustainable Energy Authority Grant Round 4

Dear Commissioners,

I am writing this letter to formally submit our application for funding consideration by the North Dakota Clean Sustainable Energy Authority (CSEA) for advancing the next stage (FEL-3) of our Gas to Liquids project in North Dakota. This letter serves as a binding commitment on behalf of Cerilon GTL ND Inc. ("Cerilon") to complete the project as described in our submitted application, contingent upon the award from the CSEA.

Cerilon has carefully reviewed the project scope, timelines, and financial projections. We are confident in our capabilities to carry out this project efficiently and effectively, thereby contributing to the sustainable energy landscape in North Dakota.

By signing this letter, I am affirming that Cerilon GTL ND Inc. commits to fulfill all the project's requirements as presented in our application. This includes, but is not limited to, project planning, execution, management, and delivering the project within the stipulated budget and timeframe.

Please consider this letter as an official representation of our intent and commitment. We look forward to your positive response and are open to providing any further information that you may require for evaluation.

Yours sincerely,

Duursema

Nico Duursema

CEO, Cerilon Inc.

Clean Sustainable Energy Authority **North Dakota Industrial Commission**	**Application** **Project Title:** Cerilon GTL **Applicant:** Cerilon GTL ND Inc. (Cerilon) **Date of Application:** October 31, 2023 **Amount of Request:** **Grant:** $20 million **Loan:** $80 million **Total Amount of Proposed Project:** $ 3.6 billion **Duration of Project:** 5 years **Point of Contact (POC):** Nico Duursema **POC Telephone:** +1 (587) 227-8441 **POC Email:** nico.duursema@cerilon.com **POC Address:** Cerilon Inc. First Canadian Centre 350 - 7 Avenue SW, Suite 2900 Calgary, Alberta, Canada, T2P 3N9

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Abstract

Objective:

Cerilon's GTL facility in North Dakota will convert abundant associated natural gas into high-value, environmentally sustainable products. The facility will reduce the need for flaring of excess gas in the state, supporting a critical state objective to be net zero by 2030 while continuing support the growth and viability of its energy industry. The CCUS component will serve as a model for environmental responsibility in the oil and gas sector by capturing and sequestering initially 450,000 Ton Per Annum (TPA) and with extension to post combustion capture, up to 2 million tons per annum (MTPA) of CO_2.

This project was previously approved for funding under the CSEA program for initial engineering work (FEL 2: Feasibility Study and Conceptual Engineering) which has now been materially completed.

Cerilon aims to further advance this project and is seeking financial assistance for the FEL 3 (Front-End Engineering and Design) stage of the project, along with advancing the implementation of Carbon Capture and Underground Sequestration (CCUS) and securing long-lead items such as compressors and separators crucial to the operational success and timelines of the facility.

The Cerilon GTL facility aims to enable continued growth in local oil production by converting associated natural gas into value-added products, thereby reducing the need to curtail oil production and further support a critical state objective to be net zero by 2030 by minimize gas flaring.

Together, these objectives strategically align with North Dakota's economic and environmental goals, fostering a more resilient and sustainable energy ecosystem.

Expected Results:

The following are the expected results from final completion of construction of the facility, being a direct result of the development funding sought in this application:

1. Consume 240-280 mmcf/d of natural gas from state pipelines, reducing the risk of production curtailments and minimizing flaring, supporting the State's endeavor to be net zero by 2030.
2. Energy security enhancement. Produce 24,000 bpd of high quality, strategically important transition energy products. This will be the only North American supply of Group III+ base oils, the main feedstock for synthetic lubricants, in North America.
3. Establish the initial infrastructure and enable the development of a CCUS hub.
4. Support the energy transition by providing the world's lowest carbon footprint GTL products in the world.
5. Enable and initiate the large-scale development of a ND downstream industry that set up ND for a more robust energy industry. This will assist to North Dakota's downstream energy industry, countering the impacts of the oil and gas boom and bust cycles.
6. Establish new technology jobs in a rural area supporting community development and stability.
7. Support local community in developing services and provide support for fiber optic cable, services, emergency and health services, water supply, and road transport infrastructure development.

The specific funding sought (together with the expected matching non-State funds) will enable Cerilon GTL to complete the remaining development work to reach an affirmative final investment decision ("FID") and to raise the necessary capital to thereafter complete the construction and startup of the GTL project facility.

Duration:

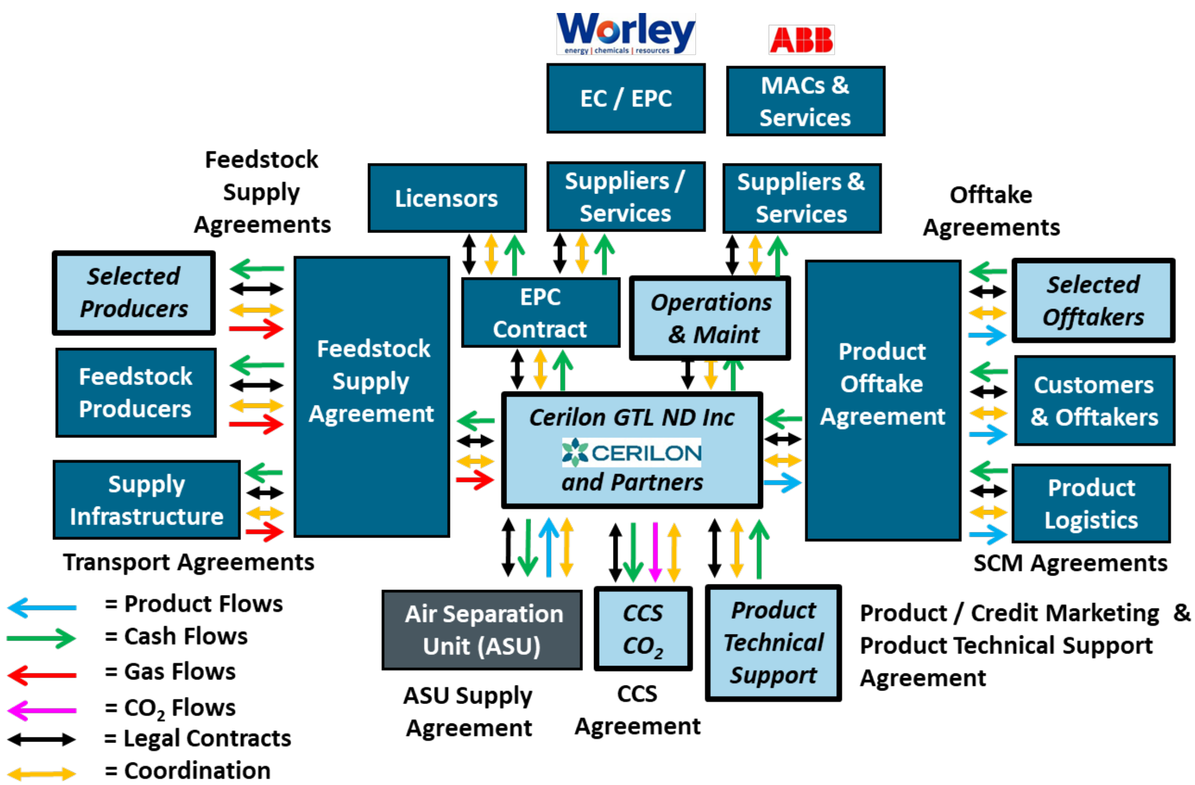
The development of this project is expected to span 5 years. Upon completion, the Cerilon GTL project is expected to remain operational for at least 30 years, contributing long-term environmental and economic benefits.

Total Project Cost:

The estimated cost of the project is estimated at this stage of development is $3.6 billion.

Participants:

Cerilon is the primary participant, engaging various industry leading partners for commercial and engineering contracting support and technical licenses. Please refer to **Appendix A** for more details on the project partners. The key commercial structure partners outlined below. Each participant has clearly defined roles and responsibilities tailored to their expertise, which collectively contribute to the project's robustness and viability.



During the development stage the project is utilizing local ND companies, like BARR Engineering, Crowley Fleck, and Diamond Resources. Various other local companies will be utilized.

1 Project Description

1.1 Objectives

The project primary objectives are:

- **Regional Leadership and Energy Security:** Establish the first 24,000 bpd sustainable products business providing a distributed and standalone energy facility in North Dakota and the USA.
- **Energy Transition and CCUS Integration:** To establish a platform in transition energy to lower North Dakota's carbon footprint using gas that would otherwise be flared, and by adding a dedicated CCUS facility that complements the environmental benefits of the GTL facility.
- **HSSE Compliance:** To not only meet but exceed all health, safety, security, and environmental (HSSE) targets throughout the development and operational phases.
- **Stakeholder Engagement and Community Support:** To proactively involve key stakeholders, ensuring their active participation and buy-in throughout the project lifecycle. The project will also make the local economy more robust to boom and bust cycles while providing access to infrastructure and services like roads, fiber optic internet, medical, emergency response and business opportunities.
- **Environmental Sustainability:** To apply best practices in sustainability, aiming for appropriate minimized emissions, and effective CO_2 sequestration to produce the lowest carbon footprint GTL products in the world.
- **Job Creation and Knowledge Transfer:** To leverage data and insights from previous global large-scale GTL projects to mitigate risks in development and improve business performance.

The project secondary objectives are:

- **Scalability:** To create an operational model that can serve as a platform for future projects.
- **Project Templates:** To continuously update our set of best practice guidelines, process workflows, and project templates for rapid implementation in future projects.

The Project Health, Safety, Security, Environmental (HSSE), and ESG objectives are:

- **Safety Culture:** To establish protocols that ensure the health, safety, and security of all employees and contractors involved in the project and business.
- **Environmental Stewardship:** To commit to practices that protect the environment and align with the latest applicable HSSE regulations.
- **Lower Carbon Future:** To design and implement processes that contribute to reducing the carbon footprint.
- **Social Responsibility:** To create a social and community environment around the project that fosters care, respect, and active contribution to society.
- **Good Governance:** To govern all project activities with an emphasis on responsible stewardship, compliance, and ethical conduct.

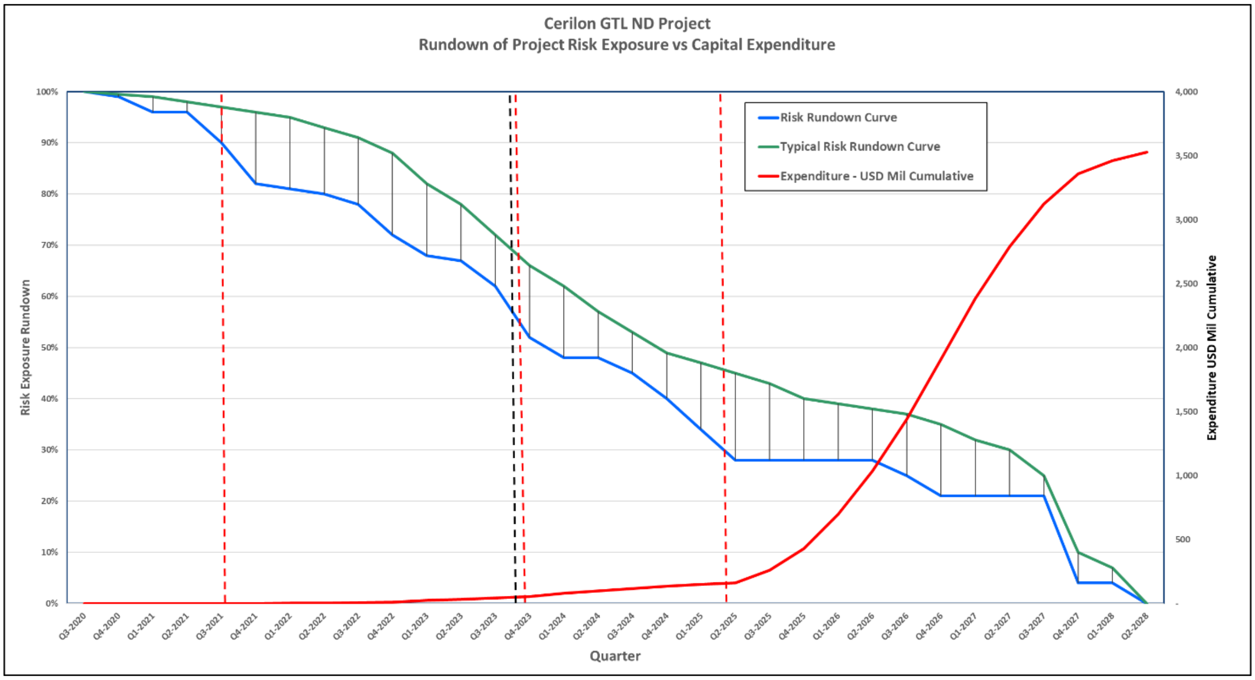
1.1.1 Achievements to Date to Fulfill Objectives

It is pertinent to highlight that the team successfully accomplished numerous objectives as outlined in the successful 2021 CSEA application.

- The FEL 2 report has reached its draft phase.
- The site has been acquired, appropriately zoned, and the environmental baseline has been established.

- FEL 2 engineering has been finalized, preparations for the subsequent phase are in place, and simulation studies concerning the facility tanks have been executed.
- Reliability modeling is complete, and the commercial division has finalized several agreements encompassing feedstock, product offtake, licensing, and utilities.
- The operations division has devised an operational framework, supplemented by the necessary policies and procedures to bolster the project's evolution.

Collectively, these advancements contribute to the project's risk mitigation.



1.2 Methodology

1.2.1 Technology and Process Methodology

The Project is based on converting lower-value natural gas into hydrogen and higher value synthetic fuels and lubricant feedstock. The first step in the GTL process is the production of syngas which is the building blocks for the Fischer-Tropsch (F-T) process. Syngas is comprised mainly of hydrogen (H_2) and carbon monoxide (CO), which is produced by the partial oxidation of methane (CH_4) over a catalyst. The syngas is then converted into the higher value chain by the synthetic production of hydrocarbon liquids, wax, and light hydrocarbon condensate (LHC) over a catalyst in what is known as the F-T reactors. These hydrocarbons end up as the feed to the product work-up unit (PWU) in the hydro processing upgrading section. The products from the hydro processing section result in high-value saleable products. The block flow diagram for the GTL process can be found in the attached Technology and Process Plan.

With respect to the production of the syngas, the selected technology for the GTL process is known as secondary or autothermal reforming. The syngas is then presented to the F-T reactors where wax and LHC is produced. Further processing is required to transfer the F-T products into usable synthetic hydrocarbons, which is accomplished by using standard refinery type hydro processing. The production of fuels and base oils can be separated into four major steps (Figure 1).

- Feedstock acquisition. Obtaining the correct feedstock to be used in the production of fuels and oils, in this case natural gas (detailed information is provided in the Feedstock Plan).

- Feed gas preparation and Syngas generation.
- F-T where wax and LHC is produced.
- Upgrading or conversion of the F-T products into synthetic base oils and fuels.

The GTL process produces multitude of catalytic reactions which are exothermic resulting in the production of waste heat. Waste heat is recovered and used to produce power for internal use and export the excess power. This process will produce carbon dioxide (CO_2), which will be partially recovered and sequestered to reduce the carbon footprint of the process.

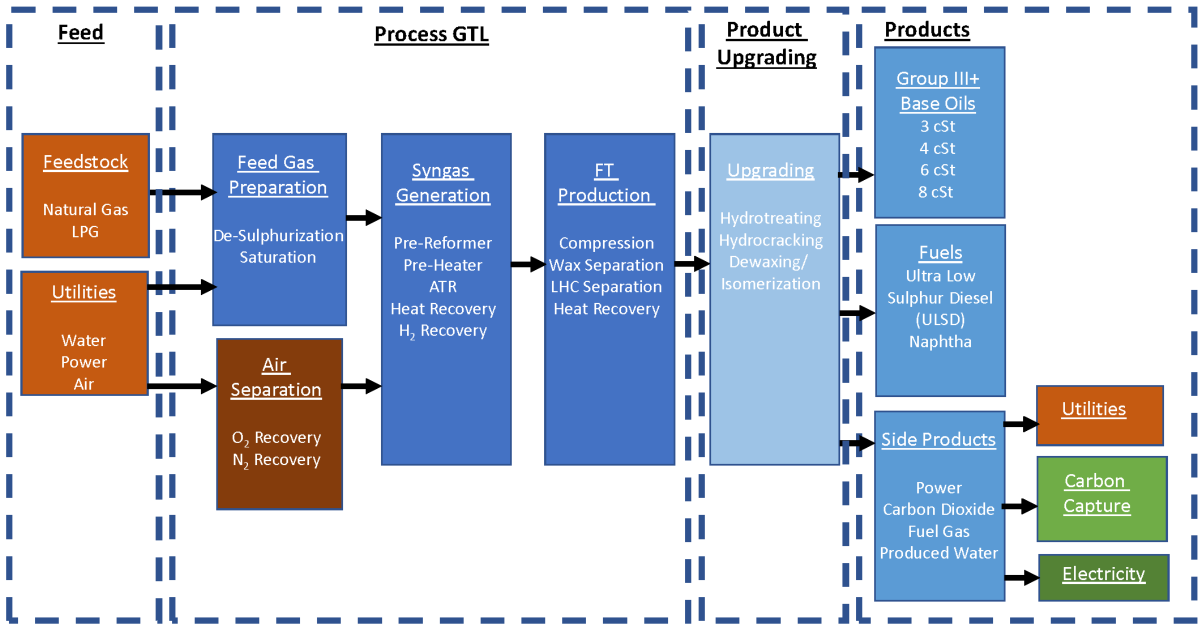


Figure 1 GTL Process

The current GTL design basis is to produce a minimum of 24,000 barrels per day of total product out of the F-T reactors, wax + LHC, which is fed to the PWU or upgrading unit. The PWU is a series of hydroprocessing operations that requires H_2 to produce the synthetic products: group III+ base oils, ultra-low sulphur diesel and naphtha. During the hydroprocessing operations the H_2 addition causes volumetric swell resulting in yields greater than 100%.

The process units making up the Project are composed of licensers syngas, F-T and refinery designs. The syngas and F-T portion was split into two trains, keeping the sizing of the equipment of these units within the experience band of the licensor, while at the same time maximizing as much common equipment as possible to minimize capital expenditures. This philosophy also increases the reliability of the overall facility by allowing the different sections to be taken offline for catalyst changes. Catalyst life will vary between 2 and 4 years depending on the operation and the system, the inability to take individual sections down for catalyst change would have resulted in site-wide unit outages.

1.2.2 Carbon Capture

Carbon dioxide generated during the various stages of the GTL process is captured using state-of-the-art absorption technologies. This enables sequestration of CO_2 emissions captured, aligning with our commitment to environmental responsibility. The captured CO_2 will then be compressed and transferred via a dedicated pipeline to a nearby third-party Carbon Capture and Underground Sequestration (CCUS) operator. This partnership facilitates efficient utilization and long-term storage of the CO_2, further enhancing the eco-friendliness of our entire operation.

In addition to our pre-combustion capture strategy, we are also incorporated post-combustion carbon capture technology into our plot plan, fortifying our commitment to environmental excellence. Utilizing advanced solvent-based systems, the post-combustion unit is designed to capture the residual CO_2 emitted during the GTL combustion stages. This anticipated expanded capture option will increase our total capture rate to over 90% of produced CO_2. Detailed scope work for this unit is underway, considering multiple suppliers with cutting-edge capture technologies. The integration of both pre-combustion and post-combustion capture mechanisms allows us to optimize CO_2 sequestration and furthers our collaborative relationship with the nearby third-party CCUS operator in establishing the CCS hub, thereby elevating the environmental sustainability of the entire operation.

1.2.3 Project Execution Methodology

The project will employ a stage-gate model, ensuring rigorous review of deliverables and criteria at each gate. The Cerilon GTL board will oversee the transition to subsequent stages, contingent on meeting prior gate criteria.

1.2.4 The Business and Operations Methodology

The business and operations methodology being applied is:

1. Business: Learning organization design to adapt rapidly to the markets. Integrate the processes, facility and markets with Machine Learning (ML) and Artificial Intelligence (AI). People centered with collaborative approach methodologies.
2. Operations: Smart Manufacturing Design and Methodologies being applied. This enables the use of IoT, sensors, ML and AI via state-based control and Ethernet APL methodologies.

Cerilon GTL has partnered with ABB, a global automation, energy efficiency, and equipment supplier, to work with us to design and optimize our design for optimum efficiency and availability.

1.3 Anticipated Results

With the initial funding from the previous CSEA grant and other funders, the Cerilon team procured and zoned the land, established an environmental baseline, advanced permitting, and FEL 2 engineering. With the funding sought from this application, the incremental results are anticipated to be:

1. Process Methodology Results:
    a. Seamlessly transition from FEL2 to FEL3/FEED, ensuring technical continuity. Bridging activities are already being executed to set up the design basis for the FEL 3 / FEED stage of the project.
    b. Confirm the pathway to determine our carbon footprint.
    c. Adoption of cutting-edge CCUS, water treatment, and gas conversion technology.
    d. Determine the reliability through detailed RAM model.
    e. Achieve the HAZOP of the design.
    f. Conclude all the applicable specifications and standards for the design.
    g. Confirm the site plot plan.
    h. Produce the Process and Instrumentation Diagrams (P&ID)s.
    i. Confirm the Heat and Energy Balance as well as the utility balance for the design.
    j. Confirm all of the long lead items.
    k. Establish a product base that can be expanded into downstream petrochemical operations.

   l. Update the Main Automation Contractor (MAC) design and strategy.
2. Execution Methodology Results:
   a. Deliver the project to the FID stage, including capital raise, on time and within budget.
   b. Ensure the quality of design and construction meets or exceeds industry standards.
   c. Obtain all permits required for the construction of the facility.
   d. Add to and enhance the network of world-class partners and suppliers.
   e. Implement risk mitigation strategies tailored to the FEL 3 phase and beyond.
   f. Confirm the approval for the route to transport the FT reactors via Duluth.
3. Business and Operations Methodology Results:
   a. Cultivate the right culture and team setup to achieve optimal results.
   b. Aim for increased plant operational availability.
   c. Conclude the major agreements for feedstock and product offtake based on current interim agreements.
   d. Confirm all major utility agreements for the facility.
   e. Develop a more detailed plan for the recruitment and training of the people for the facility in conjunction with the State of ND and the development and training entities.

1.4 Facilities

The Project features the construction and operation of a Gas to Liquids Facility near Trenton in North Dakota, USA. The GTL facility will convert 240 to 280 million standard cubic feet per day (MMscf/day) of natural gas to 24,000 barrels per day (bpd) of liquid hydrocarbon products. It is being developed to produce transition energy, explicitly embracing a low-carbon strategy. The design produces approximately 13,560 bpd of ultra-low sulfur diesel (56.5% of production), 4,920 bpd of naphtha (20.5%) and 5,520 bpd of Group III+ lubricant base oils (23%).

The Project will contain the following key components:

- Process equipment to facilitate the conversion of natural gas firstly into hydrogen and then to liquid hydrocarbon products:
- Group III+ Base Oils: these base oils are the primary component of many premium lubricants (e.g., synthetic motor oil). Their primary market is lubricant manufacturers who combine them with their proprietary additives to produce saleable products.
- Ultra ultra-low sulfur diesel (ULSD): the ULSD to be produced by the Project is a unique, premium quality, synthetic, middle distillate. The ULSD produced by the Project is a fully fungible, drop-in alternative for petroleum-based diesel.
- Naphtha: the naphtha to be produced by the project is a mixture of hydrocarbons that may be either sold to petroleum refineries or chemical plants for further processing or used as a diluent to reduce the viscosity of bitumen. Bitumen from the Canadian oil sands is too viscous to be efficiently transported via a pipeline. Diluents are added to the bitumen to reduce its viscosity for pipeline transport.
- Electric energy generation using excess heat generated by the conversion of natural gas to liquid hydrocarbon products. This will produce between 30 to 50 MW of excess power than can be provided back into the grid for other users.
- Carbon capture for off-site, third-party sequestration of carbon dioxide (CO_2).

- Utilities and other support services.
- Temporary facilities to support construction.

Figure 2 Cerilon's GTL Location

Cerilon owns a large portion, and is under contract to acquire some additional parcels, all for a contiguous land block of approximately 370 acres in Sections 25 and 36, Township 153 North, Range 103 West in Williams County on which the Project will be constructed (the Project Site). The Project Site is approximately 1.5 miles southwest of Lake Trenton and the unincorporated community of Trenton, 2.75 miles northwest of the Missouri River, 5 miles northeast of the unincorporated community of Buford, and 7.5 miles southwest of the city limits of Williston. The Project Site is bordered to the west by Savage Services' Bakken Petroleum Servicers Hub (Savage), to the north by the Great Northern Railroad, and to all other sides by agricultural land, homesteads, and farmsteads.

Project Site Layout, Suitability and Acquisition

The Bakken Formation in western North Dakota contains both crude oil and natural gas deposits. The production of crude oil therefore also results in the production of associated natural gas. This gas can be recovered and processed into natural gas, turning a byproduct of oil production into a saleable product. However, if the gas cannot be recovered, it must be vented to a flare per NDAC 43-02-03-45. The flare combusts the methane in the gas to form carbon dioxide, which significantly reduces the greenhouse gas emissions from the venting of the gas.

The North Dakota Industrial Commission (NDIC) issued order no. 24665 with the goal to reduce the volume of flared gas in the state [reference (2)]. The NDIC issued its current policy and guidance document pertaining to this order on September 22, 2022 [reference (3)]. Among other policies identified in the document, it sets a goal of 91% recovery of this gas and restricts oil production for operators that cannot meet this goal. Individual operators have also established their own goals to reduce flaring as part of their environmental, social, and governance (ESG) goals.

However, capacity constraints within the infrastructure to collect, process, and transport coproduced gas to market have limited the ability of oil and gas wells in western North Dakota to maximize oil production while meeting the requirements to reduce the volume of flared gas. The Project would consume 240 to 280 MMscf/day of natural gas in western North Dakota, where the infrastructure constraints are the tightest. This consumption would greatly facilitate NDIC's targets for reducing the volume of flared gas.

Cerilon considered locations in several North American jurisdictions including Alberta, Oklahoma, and Louisiana as well as potential locations in the Middle East before concluding that the first facility would be in North Dakota. Once this decision was made, Cerilon undertook a site selection study to identify an optimal location for the Project within the state. Critical site location criteria that were included in the study are:

1. Proximity to the following infrastructure:
    a. Existing natural gas pipelines for feedstock supply.
    b. Suitable for geology for CO_2 sequestration or an existing CO_2 pipeline to geology that is suitable for sequestration.
    c. Rail line and product pipelines for economical product shipping.
    d. Electric transmission lines for access to both sufficient electric power for the site when not generating electricity, and for interconnection to the grid to supply excess electricity.
2. Sufficient distance from airports and air force bases that would be impacted by tall structures to be constructed.
3. Reasonably flat and level land suitable for the construction of large industrial structures and equipment.
4. Zoned for industrial development or eligible for rezoning.
5. Sufficient acreage available for purchase.

Western North Dakota was identified as a promising jurisdiction for the Project due to the abundant natural gas supply, suitable geology for carbon sequestration, and available transportation to markets. The North Dakota Department of Commerce identified nine potential sites and provided information that Cerilon incorporated into the site selection study. Cerilon then met with local development authorities and municipal officials to evaluate their interest in industrial development of the type proposed. The Project Site was identified as the ideal candidate as it met all the criteria noted above.

Cerilon subsequently acquired some of the parcels and has agreements in place to acquire the remaining parcels, making up the Project Site. Cerilon has also received conditional approval from Williams County to zone the Project Site for heavy industrial, contingent upon receiving a Conditional Use Permit from Williams County.

The next diagram indicates the preliminary plot plan design that was reviewed and approved by the insurance providers for safety and suitability. The construction, operability and safety reviews ensure that the site is optimized.

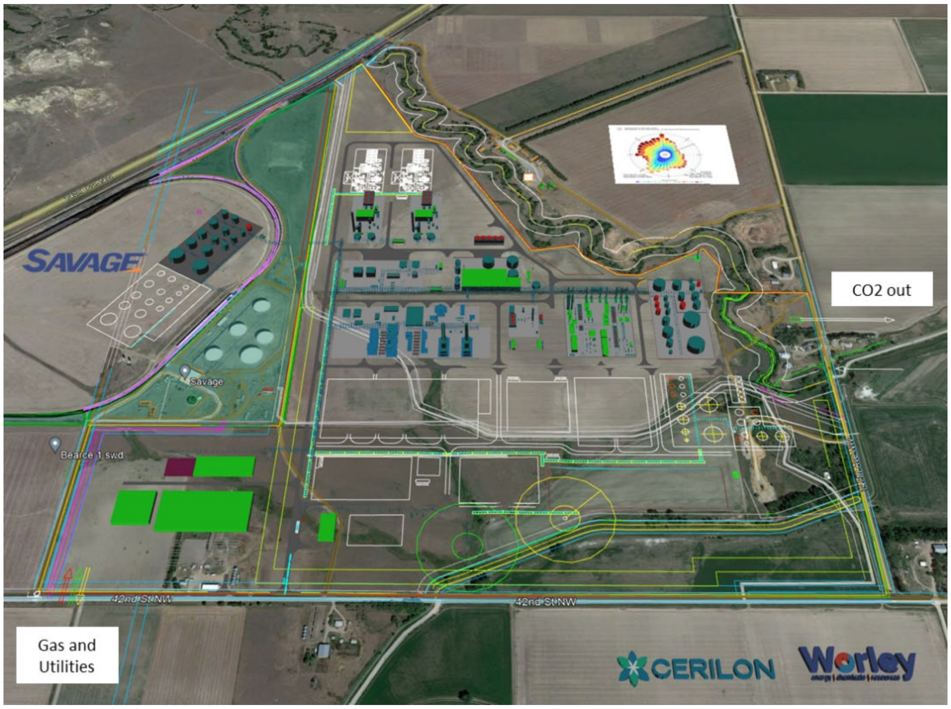


Figure 3 Preliminary Site Layout (Cerilon GTL FEL 2 Report)

The site potentially requires the re-routing of some pipelines and will utilize existing infrastructure.

Plans are coordinated with Willaims County on the supply of potable water, upgrading of the Marley Crossing, and services that will support the facility but also benefits the local community.

The feedstock pipeline is planned to be a short pipeline from the Northern Border Pipeline.

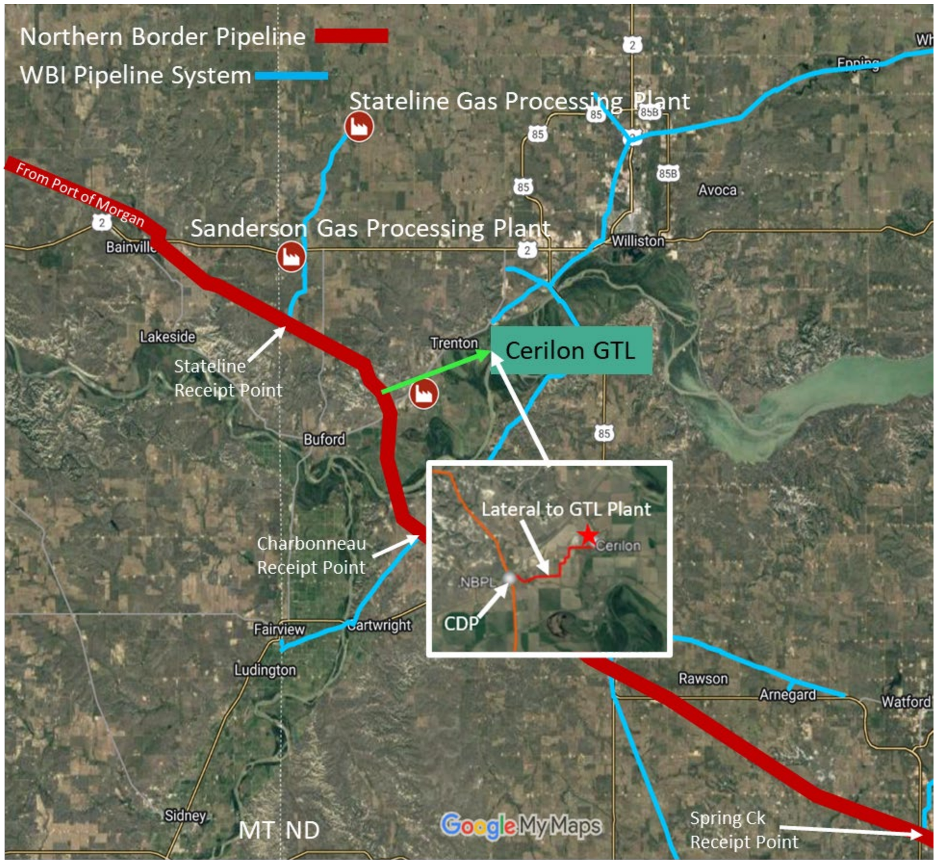
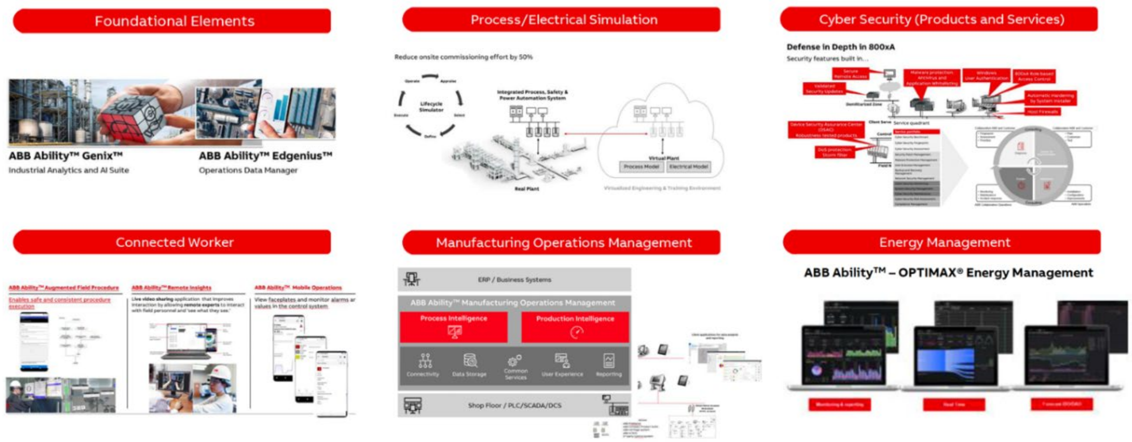


Figure 4 Northen Border Gas Supply and Lateral Pipeline to Site

1.5 Resources

Facility operational resources:

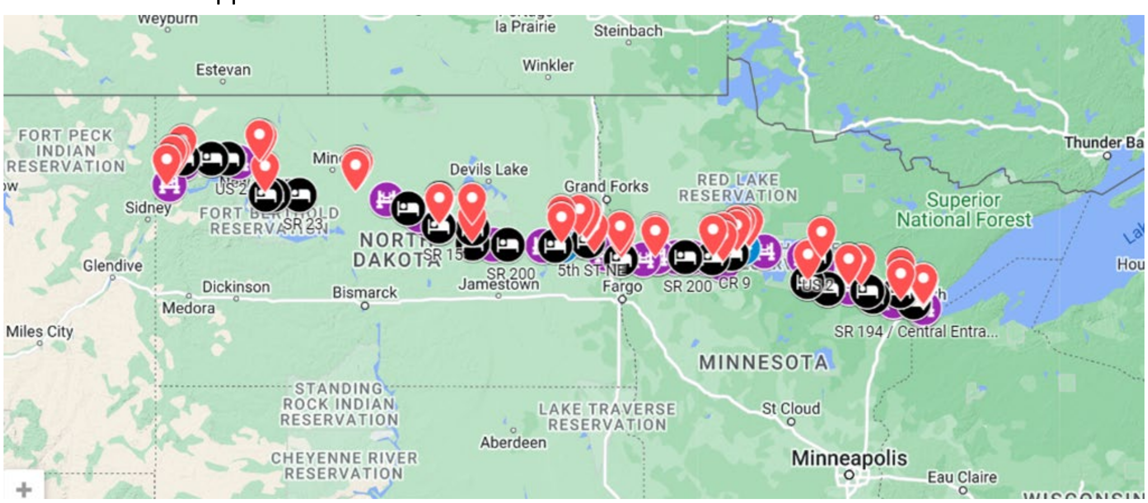
- The facility will require 6 MW of power to start up but will be self-sustaining to supply its own power. The facility will potentially supply between 30-50 MW of additional power to the grid.
- The facility will require water during the startup for pressure testing and commissioning but will be self-sustaining during normal operations. The GTL will also have water treatment facilities to treat process water.
- The facility effluents will be normal facility effluents that can be treated by the city sewage treatment and the catalyst can be treated by the ND precious metal recovery facility.
- Access to the fiber optic communications will be required and discussion continues with Nemont.
- The Cerilon GTL facility will provide the platform to establish other services to the local community that will be resources that can be optimized.
- The Cerilon GTL ND facility will be supported by a team of global resources from various contractors. This includes various simulation models and energy optimization tools to ensure the support of this state-of-the-art facility.



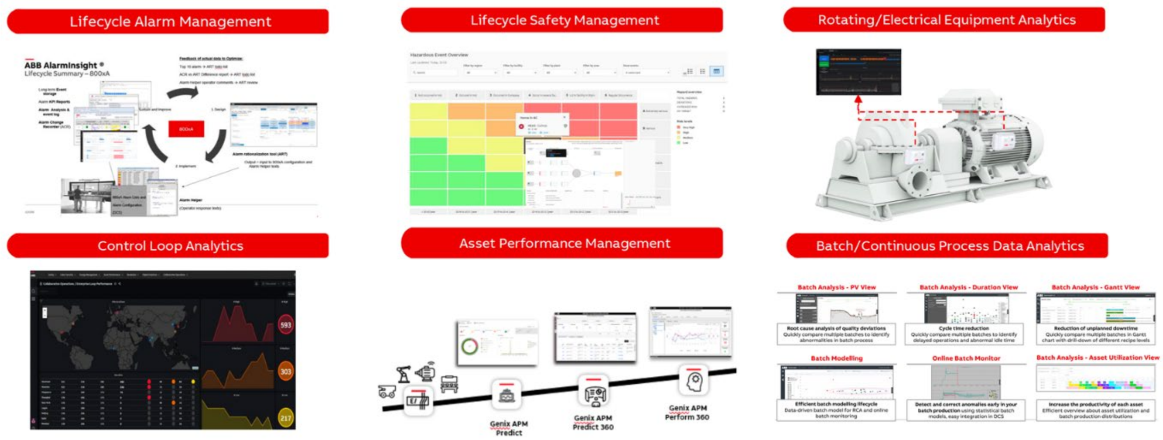
- The facility will require 141 facility people during operations. Cerilon GTL ND plans to do training of the necessary people and utilize state of the art monitoring to mitigate people requirements over time.

During construction:

- The facility will be constructed with a modular approach to design and build modules, skids, and units that can be manufactured in ND and North America fabrication shops and shipped to site. This will reduce the number of people required on site. The shortage of ND labor can be partially mitigated. High level studies were concluded to determine the level of modularization and the number of modules to be shipped to site.



- The design of the controls of the facility will enable the testing of modules and other units in the cloud prior to shipment and assembly on site. The facility will be monitored to enable global support of the facility.



- Local support services in restaurants, hotels, general, IT, and other resources will be required to support the construction of the GTL facility.

The support of our world class licensors will be required to support the detail design, construction, and startup of the GTL facility.

Various global support services will be contracted to support the project startup and later operations. The team will bring global expertise and we will train local ND people to be the future support companies.

1.6 Techniques to Be Used, Their Availability, and Capability

The availability of all of the different techniques with state-of-the-art capability are being utilized. The team has embraced new learning and techniques and utilized for instance Large Language Models (LLMs) to assist with the generation of the policies and procedures for reviews.

Design Phase:

- Process Design: Latest techniques in process design, Value Improving Practices (VIPs), and plant optimization will be employed.
- Tools: Utilization of state-of-the-art simulation modeling tools such as Hyses for process, Arena for SCM design, Corys for Controls, and Aspen for Optimization.
- Contractors: Our anticipated contractors for these tasks include Worley, Wood, ABB, BARR Engineering, and EERC.
- Decision-making: The team will apply Kepner Tregoe (KT) analyses, risk models, Value optimization models, and various value and effectiveness techniques to ensure that correct options and decisions are made.
- The Intellectual Property (IP) team scrutinized over 3,600 patents to ensure that the Cerilon GTL ND facility will have the Freedom to Operate (FTO). These reviews were concluded with a combination of database searches in IP databases and this FTO plan will be updated during FEL 3.

Project Execution:

- Team Management: Collaborative approaches like action logs, DOAG matrices, and RASCI matrices will be utilized.
- Risk and Change Management: Management of Change (MOC) and Risk Registers will be regularly updated. Risk Management is central to the successful completion of a project and receives extensive focus by the project management team.

- Reporting: Monthly reviews, trending, and monthly reconciliation will be conducted.
- Monthly interface meetings are taking place to ensure different perspectives are aligned in the execution of the project.
- Cost and Scope: Cost management and estimating will adhere to AACE principles, while stakeholder and scope management techniques will be rigorously applied.

Business Operations:

- Organizational Learning: Learning organization systems thinking techniques will be incorporated in design and operations.
- Integration: Business Process Mapping (BPM) will be used to ensure aligned integration across different facets of the project.

Standards and Principles:

- All utilized techniques and principles are known to us or available to us, and we are capable of deploying them effectively to support the project's design, development, and operations.
- The team created over 200 specifications and standards to ensure that the procurement of equipment will align with the requirements. This will continue.

1.7 Environmental and Economic Impacts while Project is Underway

Environmental Impact:

- The site and ground will be resurfaced and graded to be level for the construction.
- EPC firm will contain any spillage, effluents, or any material being used such as water for the pressure testing.
- All waste material, excess will be collected and properly treated or removed.
- No air or water pollution during construction. Dust to be suppressed and water sprayed on the ground to minimize dust movement.
- Noise to be controlled during construction as much as possible.

Economic Impact – Construction Phase:

- The State of ND compiled a REMI model and the summary below is an extract from the report in **Appendix B**. A newer edition has been drafted by North Dakota and is under review.
- This indicates significant job creation, state sales/value added taxes payable, and revenue to the state.
- The model results are attached for reference.

Economic Impacts[1] from the Operation Phase of the GTL Facility and ASU Facility								
Employment (Job Creation)								
Category	Units	2026	2027	2028	2029	2030	Annual Average	5-years Impact
Total Employment	Individuals (Jobs)	1,697	2,207	2,338	2,786	2,289	The employment concept is the same as used by the U.S. Bureau of Economic Analysis, so it captures full-time, part-time and sole proprietors as one. Because employment is a stock concept, the results cannot be aggregated over multiple years. They should be only interpreted as the impact in the single year relative to base year.	
Direct Employment	Individuals (Jobs)	99	101	101	101	101		
Indirect Employment	Individuals (Jobs)	656	741	736	757	679		
Induced Employment	Individuals (Jobs)	388	463	490	589	503		
Other Employment	Individuals (Jobs)	554	902	1,011	1,339	1,006		
Wages and Salaries								
Category	Units	2026	2027	2028	2029	2030	Annual Average	5-years Impact
Wages and Salaries	Millions of Fixed (2020) Dollars	$105.25	$129.57	$138.56	$164.53	$140.05	$135.59	$677.96
State Gross Domestic Product (GDP) & Output								
Category	Units	2026	2027	2028	2029	2030	Annual Average	5-years Impact
State GDP	Millions of Fixed (2020) Dollars	$491.45	$577.53	$590.88	$634.14	$576.68	$574.14	$2,870.69
State Output	Millions of Fixed (2020) Dollars	$1,167.74	$1,339.20	$1,351.80	$1,412.80	$1,306.65	$1,315.63	$6,578.17
Total Impacts on the State Tax Revenue[10]								
Category	Units	2026	2027	2028	2029	2030	Annual Average	5-years Impact
Tax Revenue from Sales & Use Tax[11]	Millions of Fixed (2020) Dollars	$58.50	$67.09	$67.73	$70.78	$65.46	$65.91	$329.57
Tax Revenue from Individual Income Tax[12]	Millions of Fixed (2020) Dollars	$5.11	$6.30	$6.73	$8.00	$6.81	$6.59	$32.95
Total Tax Revenue[13]	Millions of Fixed (2020) Dollars	$63.62	$73.39	$74.46	$78.78	$72.27	$72.50	$362.52

Figure 5 Economic Impacts

1.8 Ultimate Technological and Economic Impacts

Technology Impacts:

- Combinations in process technologies and the application of CCUS will create the lowest carbon footprint GTL facility in the world in North Dakota.
- The business systems thinking, and systems integration will create advantages in business operations.
- The operational optimizations and application of Machine Learning (ML) and Artificial Intelligence (AI) will improve the availability of the operations for the next 30 years.
- The process technology platform will create a base from which many other downstream technologies can be implemented, and new businesses created.
- The technologies will enhance the ability to recruit and retain people in ND as the leading technologies will create sought after jobs.

Economic Impacts – Operations Phase:

- The economic impact was modelled by the State of ND in their REMI model, and the results are provided in **Appendix B** - REMI Model - Operations.
- The financial impact to the state is above $6 billion in the first 5 years of operations.
- The return for the state and economic impacts cannot be measured only in the financial impact but should also consider the impact in times of downturns when oil prices are low, the robustness of a more stable economy with a strong downstream sector. This will not be achieved with one GTL project, but it ignites the pathway to many more developments.
- The multiplier effect on adding value, opportunities, and secondary business to ND will be more than just one project impact.
- The measure of people with hope open to challenge the status quo and wanting to do more for the state of ND is of huge value.

1.9 Why the Project is Needed

The project will deliver the following benefits for North Dakota:

1. Environmental Impact:

a. Carbon Footprint Reduction: Significantly lowers the carbon footprint of energy products compared to conventional methanol facilities.
b. Carbon Capture and Sequestration: Establishes and supports the infrastructure for capturing and sequestering CO_2 emissions.
c. Flaring Reduction: Mitigates the need for and the occurrence of flaring natural gas in North Dakota.
d. The ULSD being produced has lower NOx and SOX emissions with a high cetane value making it a beautiful product for use as a transport energy source with a lower carbon footprint than conventional products.

2. Economic Benefits:
   a. Resource to Value Transition: Shifts the energy industry from focusing solely on resource extraction ('resource play') to adding value to local gas ('value play').
   b. Industry Diversification: Promotes a more robust, integrated oil and gas industry capable of weathering economic cycles.
   c. Economic Stimulation: Fuels economic growth through high-value products and new technology jobs.
   d. This facility anticipates a revenue stream above $ 1billion per annum which will also provide extensive tax benefits to the State of ND.
   e. The Cerilon GTL ND facility will also have very little impact on the water resources as it is mostly water self sufficient once the plant is in operation. The size of the impact in comparison with the size of the facility is minute.
3. Social Impact:
   a. Community Benefits: Generates local economic benefits including high-caliber new technology jobs.
   b. Stakeholder Engagement: Creates momentum for further investment in North Dakota from other major organizations.
   c. Access to services: The Cerilon GTL will create the need for services like emergency response, firefighting, and ambulance services. Further services to the community includes catering, suppliers, office support services, cleaning, and others.
4. Infrastructure and Industry Support:
   a. Natural Gas Utilization: Enhances the environmental performance of a project that will use 240 to 280 million scf/day of natural gas within North Dakota, supporting continued oil production.
   b. Reduce Flaring: The state is committed to reduce flaring and the utilizing of natural gas that otherwise would have been flared, is utilized in the facility as feedstock.
   c. Pipeline Infrastructure: Addresses limitations in existing pipeline infrastructure by creating local demand for natural gas, alleviating the need to transport it to distant customers.
   d. The facility enables a strategic decision by the State of ND to develop and more robust energy industry and establishes a platform for downstream developments. This reduces the impact of the boom-and-bust cycles of the oil and gas industry as low oil prices benefit the petrochemical industry in downturns.
   e. The Cerilon GTL ND facility enables the development of the CCUS hub with a critical base load of CO_2 required for the feasibility of these facilities and infrastructure.

f. The Cerilon GTL ND facility also produces ULSD winter diesel that can be utilized in cold climates. The product has a very high cetane value and low emissions making it a beautiful product to use.
g. The benefit of energy security is only valued in times of hurricanes and shortage. The Cerilon GTL ND facility is way from the hurricane corridor and provides a strategic energy security source in ND.
h. The excess power generated by the Cerilon GTL ND facility will support the oil and gas and other new energy demanding industries that can utilize the excess power.

2 Standards of Success

1. Carbon Intensity and Emissions Reduction:
    a. Aim to reduce the Carbon Intensity (CI) score relative to a typical or GTL facility. This will be the lowest carbon footprint GTL facility in the world. The synthetic lubricant Group II+ feedstock will be the best carbon footprint products in the world and the energy efficiency generated by it is world class.
    b. Capture up to ~2 MTPA of CO_2 with both pre- and post-combustion technologies.
    c. Implement state-of-the-art adsorption and solvent-based CO_2 capture.
2. Environmental Impact and Sustainability:
    a. GTL products biodegradable within 3 weeks and non-toxic to aquatic life.
    b. Provide an energy transition path by capturing and storing CO_2.
    c. Improve the energy sustainability of North Dakota's Oil and Gas sector by adding a large consumer of natural gas and reducing gas flaring in the State.
3. Economic and Value Impact:
    a. Shift from resource play to value play, thereby enhancing state revenue.
    b. Contribute to job creation in tech sectors like computing centers supported with machine learning and artificial intelligence Cerilon GTL will utilize.
    c. Impact financial contributions from a growing downstream industry in North Dakota.
    d. Develop a community in Trenton ND that will receive economic benefits and stable income for the community. It will further support the development of necessary infrastructure that forms the base of future development.
4. Commercialization and Industry Leadership:
    a. Establish North Dakota as a leader in both GTL and CCUS technologies.
    b. Attract additional investments and projects through public and private sector utilization.
5. Innovation and R&D:
    a. Collaborate with leading experts in GTL and CCUS for local R&D.
    b. Further improvements in CO_2 capturing technologies will be utilized in the facility to improve the CO_2 capture efficiency.
    c. Explore technological improvements for environmental benefits.
    d. Provides state of the art smart manufacturing facility by utilizing ethernet APL and state base control.
    e. Engage in active research to keep enhancing existing technologies.

6. Job Preservation and Creation:
    a. Create new job opportunities requiring a variety of skill sets in both GTL, ML, AI, Automation and Control, and CCUS.
    b. Safeguard existing upstream Oil and Gas jobs by ensuring a long-term offtake of gas.
7. Alignment with Program Mission:
    a. Offer cleaner, green transition energy solutions.
    b. Facilitate CO_2 sequestration through the development of new CCUS infrastructure.
    c. Enable the utilization of new Automation and Control technologies in a ND facility.
8. Sector Utilization and Community Impact:
    a. Make CCUS technologies and infrastructure accessible to the public and private sectors.
    b. Enhance community sustainability through job creation and environmental initiatives.

3 Background/Qualifications

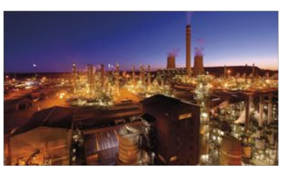
Cerilon's team brings together a wealth of expertise specifically in GTL (Gas to Liquids) and associated technologies. With hands-on experience in some of the world's largest GTL facilities, the team is adept in a range of functions, from process engineering to operations management. Additionally, members have prior involvement in large-scale technical projects, including those with relevancy to CCUS (Carbon Capture, Utilization, and Storage) facilities. This depth of experience is complemented by specialists in key functional areas, enhancing the team's capabilities across the board.

Sasol 1 (1955) Sasolburg *
20,000 bpd

PetroSA Mossgas (1992)
Mosselbay *
15,000 bpd

Escravos GTL (1997)
Nigeria *
34,000 bpd

Shell Pearl GTL (2012)
Qatar *
144,000 bpd



Sasol 2 (1980) and
Sasol 3 (1984) Secunda *
160,000 – 168,000 bpd

Shell Bintulu (1993) Malaysia *
12,000 – 15,000 bpd
upgraded

Sasol Oryx (2007) Qatar *
34,000 bpd

OLTIN YO'L GTL (2021)
Uzbekistan *
34,000 bpd

The team has reviewed lessons learned from previous GTL facilities and applied the knowledge and know how to benefit the design of the Cerilon GTL ND facility.

The team has been expanded and during the FEL 2 stage we had at the peak about 160 people from a variety of disciplines working on the project to deliver the results required. This includes functions like tax, ERP systems, FOREX, marketing, sales, logistics, operations, maintenance, engineering, reliability modelling, transport logistics, construction, commissioning and startup, financing, economic modeling, sustainability, people skills and training, simulation modeling and many others to ensure success.

See **Appendix F** for the Cerilon Team Resumes.

4 Management

After analyzing a wide array of projects, our team has distilled the critical success factors necessary for optimal execution. These insights inform our strategic approach, a blend of global best practices and lessons learned from past projects.

4.1 Execution Fundamentals

Collaborative Culture: Our approach fosters collaboration among all project stakeholders, ranging from operations and engineering to suppliers and EPC contractors, to collectively contribute to project success.

End Goals: Before commencing any project, we define the desired outcomes across various aspects: business operations, environmental impact, stakeholder relationships, and construction methodologies.

Proven Methodologies: We adhere to globally accepted execution practices, ensuring alignment with project goals throughout each stage. This includes steadfastly managing scope, schedule, quality, and costs, without sacrificing the project's core objectives.

Communication and Governance: Transparent, accountable communication is a cornerstone of our process. We clearly delineate roles and responsibilities for all team members and partners.

Standardization: Templates for engineering, business, and operations are standardized to not only serve the current project but also to ensure easy replication in future projects.

4.2 Risk and Contract Management

Our risk assessment involves third-party validation, including consultations with fabricators, EPC, and insurance firms. This ensures that all involved parties are carrying appropriate risks. Similarly, our contracting structure is designed with the interests of the owner as a priority.

4.3 Ongoing Review and Control

Gate reviews and control points are integrated at crucial stages to ensure project compliance and alignment with initial goals, post the FEL 2 gate and at the end of the FEL 3/FEED.

5 Timetable

Interim progress reports will be provided each quarter and a Stage report after the remaining FEL 3, and Execution stages. The schedule will be monitored closely by the team to ensure the delivery to schedule.

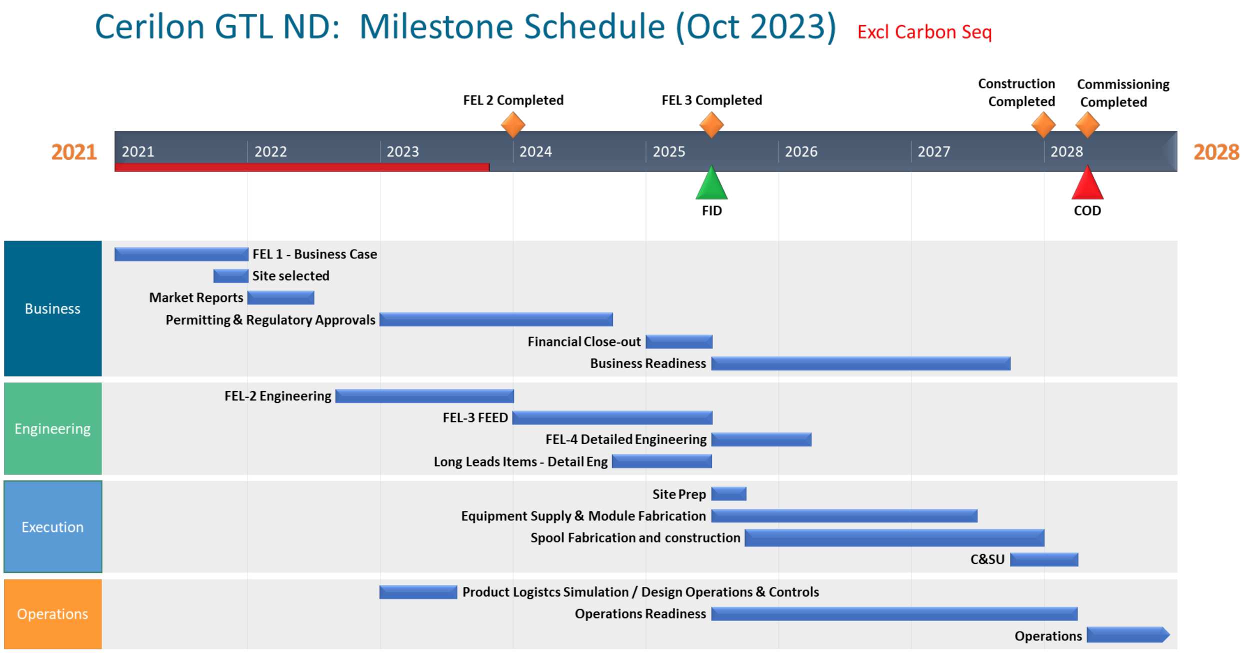


Figure 6 Cerilon GTL ND: Milestone Schedule (Oct 2023)

Appendix C is a summary of cumulative costs by quarter for this stage of the project, along with a summary of major milestones. These will be funded with the CSEA grant and CSEA loans, along with matching equity and vendor financing funds as required. It is assumed that the CSEA grant and CSEA loan will be requested in tranches.

6 Budget

Project Stage	Status	NDIC Grant	NDIC Loan	Applicant's Share (Cash)	Other Project Sponsor's Share	Total
FEL 1 & 2	Substantially complete	$7.0M	$13.7M	$1.0M	NDDF Loan: $3M Williams County Loan 1: $6M Williams County Loan 2 (Land Bridge): $10M McKenzie County Loan: $5M	**$45.7 M**
FEL 3 and Long Lead Items	To commence in 2024	-	$26.3M CSEA Approved Loan ($1.3M released, $25M to be released upon equity raise)	-	$25M of current $80M Equity Raise	**$51.3M**
		$20M (this application)	$80M (this application)	-	Up to $55M of current $80M Equity Raise Up to $45.7M of Vendor Financing	**$200.7M**
Total Pre-FID		**$27M**	**$120M**	**$1.0M**	**$149.7M**	**$297.7M**
FID / Execution	2025	-	-		$2.0B DOE Title 17 Loan $1.3B Investor Equity	**$3.3B**
Project Total		**$27 M**	**$120 M**	**$1.0M**	**$3.4B**	**$3.6B**

To align with the project development execution timeline, timely access to financial resources is crucial. To facilitate Cerilon's overall funding strategy, Société Générale has been appointed as a financial advisor, spearheading a $80 to 100M equity raise with institutional investors. This allows for flexibility to protect the schedule and order long lead items like compressors and transformers. This equity raise will be instrumental in unlocking a portion of the previously approved CSEA grants, in addition to the new FEL 3 Stage grants and loans sought in this application. The importance of these grants cannot be overstated; they not only solidify the State of North Dakota as a key co-sponsor but also set the stage for future tranches of funding.

Cerilon is also actively engaged with the U.S. Department of Energy to secure low-cost debt financing under the Title 17 Loan program, with a Part I application currently in progress. This move further diversifies funding options, aligning with a strong institutional partner, and enhancing project credibility.

In the absence of timely funding, the effects would be detrimental to the project's progression, necessitating alternative financing solutions that could detract from our core development activities. While a delay in funding would not halt the project, it would certainly impede our timeline, affecting our role as a gas consumer and delaying the development of a downstream industry, thereby impacting North Dakota's strategy for addressing rising trapped gas production.

Given the ongoing advancements in our financial strategy, we are keen to ensure that the CSEA grant and other funding mechanisms are in place to fulfill our financial requirements as per the stipulated timeline, thereby securing the project's success.

7 Patents/Rights to Technical Data

The Cerilon team will establish patents and rights that will be owned by Cerilon GTL ND Inc.'s affiliate ND Ventures Ltd. for all the intellectual property added to the wide range of intellectual property and templates to be licensed by ND Ventures to Cerilon GTL. In addition, the Cerilon team will be completing its own development of the Manufacturing Execution System (MES) platform, and the ML and AI platforms that will be incorporated into the project.

Cerilon GTL will also be using licensed technology from the previously mentioned internationally recognized licensors, whose technology will need to be kept confidential.

8 State Programs and Incentives

Cerilon GTL ND Inc. has received the following State and County financing to date:

- $3 million NDDF loan
- $6 million Williams County loan
- $10 million Williams County Land Bridge Loan
- $7 million CSEA grant
- $5 million McKenzie County Loan
- $40 million CSEA loan (of which $15 million has been released under matching requirements)

Cerilon is in the process of raising up to $80 million of additional investor capital. In the event the full amount of $100 million in this application is provided by the CSEA, additional matching capital will be sourced from equipment vendors or other long lead suppliers.

Industrial Commission

Tax Liability Statement

Applicant:

Scranton Holding Company/North American Iron, Inc.

Application Title:

"Green" iron production facility

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

James Bougalis, CEO
____
Title

October 30, 2023
____
Date

Appendix F Cerilon GTL Team

Nico Duursema

Chief Executive Officer, Cerilon Inc.

Executive Leadership Team

Nico Duursema has been a leader in the global energy business for over 25 years, with roles in North and South America, Africa, and the Middle and Far East within the petrochemical, transportation, mining, and oil and gas industries. As CEO of Cerilon Inc., Nico's core areas of specialty are low carbon, gas-to-liquid (GTL), renewables, bio-to-liquids (BTL), and downstream petrochemicals.

Nico Duursema is an energy business executive with experience in North and South America, Africa, and the Middle and Far East within the technology, petrochemical, transportation, mining, and oil and gas industries.

He is the CEO of the Cerilon Group of companies. Core specialty areas are low carbon energy, gas-to-liquids (GTL), renewables, bio-to-liquids (BTL), Ammonia, other downstream petrochemicals, and new technology integration. Cerilon supports global energy security with a strategic green transition energy commitment to changes toward a new energy future.

He has a BSc (Industrial Eng) from the University of Pretoria, South Africa, and Honors in Business. He has an MBA from Stellenbosch University, South Africa, and concluded an Executive Leadership Development Program at Daniels College of Business, Denver, Colorado, USA.

Nico serves on Cerilon's corporate boards and as Chairman of the Cerilon Kingdom Fund. He is a member of the Canadian Energy Executive Association (CEEA) and has served for three years as CEEA board governor. Nico is the founder of the Global XTL Summit, enabling the growth of anything to liquids (XTL).

Believes in Ownership, Leadership, Stewardship, and Excellence.

Ron Opperman

Chief Executive Officer, Cerilon GTL Inc.

Executive Leadership Team

Ron has more than 35 years of industry experience in managing and leading complex businesses at the executive level. Ron is skilled in managing a wide range of business functions, including sales and marketing, supply chain, health, safety, environment, research and development and project management.

Ron has managed international businesses in real Volatile, Uncertain, Complex, and Ambiguous (VUCA) environments. He was based in the Middle East for 11 years, leading diverse, multicultural teams. As CEO, Ron managed a petrochemical business with annual revenues of USD $800 million.

Ron has broad experience in various chemical industries, including gas, petrochemicals, metallurgy, and water treatment. He was also responsible for developing business strategies, supply chain design and enterprise resource planning business systems for a multi-billion project based in the US. Ron has also served as the COO of ND Ventures, Cerilon's project management and execution arm.

He holds an MBA from North-West University in South Africa.

Peter Farkas

Chief Financial Officer

Executive Leadership Team

Peter is a Calgary native and a University of British Columbia commerce and law graduate and has spent more than 35 years in senior executive financial, operations and legal roles throughout western Canada.

Mr. Farkas is a strategic executive with practical executive leadership and business development work experience in various industries: oil and gas, mining, energy services, manufacturing, investment, real estate, pipelines, petrochemicals, transportation, and food production. Often advising businesses through critical growth stages, including through corporate mergers and acquisitions, his knowledge from CFO, operational and legal perspectives guide the organization's significant decisions.

Peter is an active member of the Alberta Bar and is an entrepreneur. Peter brings a synthesis of analysis and effective execution for truly unique solutions. He is the quintessential corporate problem solver who controls legal risk while ushering complex projects, business development, and growth scenarios to successful completion.

Renelle Bryden

Vice President, Financial Planning & Analysis

Senior Leadership Team

Renelle has over 20 years of expertise in upstream/midstream oil and gas accounting and finance. Areas of expertise include internal and external reporting, performance management, governance & regulatory reporting, treasury and project management. She was responsible for preparing consolidated financial statements for Nexen, a Canadian company with worldwide operations.

She is adept at providing high-level analysis to enhance decision-making, strengthen internal controls and facilitate process improvements while incorporating and suitably weighing operational, corporate, administrative and accounting goals. She was responsible for cash management activities that included cash flow forecasting, a foreign exchange program of over one billion annually, investments averaging three hundred million, and short-term borrowing. Renelle is a Chartered Professional Accountant of Canada.

Jacques Botha

Vice President, Project Services

Senior Leadership Team

Jacques has more than 30 years of experience in all phases of project development and implementation, with a specific focus on project services. This includes estimating, project controls, document management, human resources, and information technology both from the corporate office and field locations working within various cultures.

Jacques has executed projects in South Africa, Kuwait, United Arab Emirates, the Netherlands, and Canada with values up to USD $14 billion. He has experience in oil refining, mining and ore processing, in-situ heavy oil facilities, LNG, and oil pipelines. Jacques has extensive coal- and gas-to-liquids and oilsands experience working in both owner and engineering firms.

Jacques has a Bachelor's in Mechanical Engineering, a Master's in Industrial Engineering, and an Honours in Business Administration.

Kellie Donohue

Director, Human Resources, Cerilon Inc.

Senior Leadership Team

Kellie is a highly accomplished HR professional with two decades of experience spanning various industries, including oil and gas services, professional services, Indigenous organizations, construction, veterinary clinics, and low-income housing boards. Armed with a Master's degree in Leadership, a Certified Human Resources Leader designation, and a Psychosocial Health and Safety Advisor standing, she possesses deep expertise in the strategic development and implementation of human resource departments.

Kellie's career has been marked by a keen ability to build and nurture relationships, effectively communicate with diverse audiences, and leverage historical insights to forge a healthier future. Her core strengths lie in HR team development, civility program implementation, organizational reviews, coaching, and the design and delivery of training programs aimed at risk mitigation, fostering respect, and enhancing the bottom line.

With her comprehensive skill set and extensive industry experience, Kellie is an invaluable asset for organizations seeking to optimize their HR functions and foster a culture of productivity and respect.

Rochelle Harding

Director, Sustainability and Engagement

Senior Leadership Team

Rochelle has over 20 years of experience as a regulatory affairs and environmental assessment specialist. Her work includes permitting in multiple jurisdictions and industries, developing and implementing strategies to manage regulatory, stakeholder, and environmental issues, stakeholder engagement, and Indigenous consultation. Rochelle has experience in major energy projects from concept development through to operations.

Rochelle has experience working on projects that require extensive environmental and socio-economic issues management due to their location in sensitive environments, potential risks or specific stakeholder concerns, including work on multiple in-situ oil sands developments, large pipeline projects, LNG facilities, flood mitigation structures, and carbon capture and sequestration projects. Rochelle also has experience as an air quality assessment specialist.

Rochelle has a B.Sc. in Chemical Engineering and an M.Sc. in Biochemical Engineering from the University of Saskatchewan

Niel Erasmus

Project Director, CGTL ND Engineering

Senior Leadership Team

Mr. Niel Erasmus is a results-oriented senior manager known for his strategic acumen and solution-focused approach. With a track record of successfully leading high-profile resource projects from concept to commissioning and operation, he consistently delivers on time and within budget while ensuring safety and securing commitment from diverse stakeholders. His exceptional communication skills, grounded in a customer and safety-focused mindset, have earned him trust and rapport across cultural communities. He excels at lateral thinking, using innovative methods to optimize processes and expand operations while maintaining strict fiscal control.

He has also led and coordinated innovative engineering projects for oil sands mature fine tailings treatment, successfully attracting interest from Tier 1 operators. Niel has extensive project management experience, including delivering a complex tailings treatment facility, managing small projects portfolios, and leading EP and EPCM proposals.

Niel holds a Bachelor of Engineering (Metallurgical) from the University of Pretoria and a Master of Engineering Management. He is a Professional Engineer registered with the Association of Professional Engineers and Geoscientists of Alberta and a member of the Canadian Institute of Mining, Metallurgy, and Petroleum.

Jeff Pendrel

General Counsel

Senior Leadership Team

Mr. Jeff Pendrel is a highly engaged, results-oriented professional with over 20 years of energy experience internationally (U.K. and Middle East) and in Canada. He has held executive-level positions with overall responsibility for multiple functions, including Legal, Marketing, Supply Chain, JV, Land Corporate Communications and Government Relations.

Jeff is a passionate, commercially oriented and impactful leader with superior communication and leadership skills and a proven ability to lead high-performing teams. Jeff has advised on carbon sequestration, net-zero (blue hydrogen) energy projects and other ESG-friendly infrastructure projects throughout his career. He has successfully led negotiations to enable multiple First Nation Communities' participation in carbon capture projects.

He has implemented a significant change in strategy for the Marketing Business unit, including acquiring midstream assets, optimizing legacy assets, implementing a gas and crude hedging program, and developing numerous new customer relationships in Canada, the US and Europe. The Marketing Business Unit generates sustainable annual cash flows of over $125 Million.

Jeff is a member of the Law Society of Alberta and British Columbia. He completed his MBA at the University of Cambridge and his Bachelor of Laws at the University of Saskatchewan. In addition, he has a Bachelor of Management. He is a life-long learner and active volunteer with youth sports.

Peter Barry

Engineering Manager, Cerilon Inc.

Senior Leadership Team

Peter has over 30 years of experience in project management, project engineering, and civil/structural design for commercial and institutional buildings, industrial oil and gas, LNG, offshore, port facilities, oilsands mining, and bridge projects. His fields of expertise include leadership and coordination of multi-discipline teams, organization, and management of design work for small and large projects as well as the design of onshore and offshore structures in structural steel and reinforced concrete, module and skid design for structures.

He is experienced in the coordination of design teams for project definition, FEED and detailed design, progress monitoring, quality assurance, certifying authority approvals, modularization, coordination of brownfield maintenance, modifications, package engineering and subcontractor management.

Peter's building experience includes projects ranging from residential houses to large commercial and institutional buildings. His LNG experience includes being the lead structural engineer in the Project Management Team assisting the Owner of the Woodfibre LNG Project in British Columbia, Canada. His offshore experience includes projects on the east coast of Canada, in the Gulf of Mexico, and in Africa. His oil sands experience includes Teck Resources' Frontier Mine Prefeasibility Study, Shell's Albian Oilsands Debottlenecking, Syncrude's Tailings Systems, Imperial Oil's Kearl project and Petro-Canada's Fort Hills study.

Rudi Heydenrich

Technology Management & GTL Venture Development

Senior Leadership Team

Rudi is an experienced Chemical Engineer with extensive experience in providing technical and research support to one of the largest industrial complexes in the world – initially by doing it himself but also by leading multi-disciplinary teams. An individual with demonstrated experience in the art of technology decision-making and governance, the art of in-and out-licensing of proprietary technologies and direct involvement in the commercialization of three major technologies during a career at Sasol.

Over a period of circa 25 years, Rudi has established himself as a leader in the fields of New Business Development, Research and Development and technology transfer in the field of Energy and Chemicals technologies. He spearheaded the development and, ultimately, the commercialization of the Sasol Slurry Phase Distillate™ technology (Sasol's GTL Technology) in Qatar, Nigeria and currently Uzbekistan. During this period, he served on several Divisional Boards, Advisory Boards and JV constructs. A recipient of many awards for his contributions to the field, most notably the World CTL Award in 2011.

Rudi's extensive experience and knowledge in most aspects of Gas-to-Liquids technologies, the unique products from it and the efforts to implement complex GTL ventures acquired over the last 20+ years makes him extremely suitable to advise prospective owners, project and technology developers in this field. His preference is to work in the strategic domain, but he has also demonstrated the ability to translate strategy into tactical plans and then provide oversight on the delivery against the plan. He is an adaptable individual with a preferred collaborative leadership style and strongly believes in setting direction but then creating the space and removing obstacles in the way of the professionals who are best suited to execute the plans.

During his career, he has demonstrated a track record in the ability to successfully engage and collaborate with people across the globe. This covers people in industry, private and public sectors. He has a passion for technology and the skill of bridging the gap between the R&D and commercial worlds.

Additional Team Members

Name	Title	Description
Jeanne Mather	Corporate Investment Advisor	Project Financing of power, renewable and LNG projects and Reserve Based Finance (upstream oil & gas).
Ryan Galloway	Director, Corporate Investment	Finance, accounting, capital markets, and equity research and institutional sales expertise
Richard Mather	Corporate Investment Advisor	Investment, Advisory and Corporate Strategy expert with a focus on Oil & Gas and Renewable Energy.
Ed Cameron	International GTL Business Development	Led major GTL businesses and international GTL projects to develop complex joint ventures. Expert in GTL commercial negotiations, securing and expanding natural gas supply, licensing, utilities, and offtake agreements.

Name	Title	Description
Greg Farkas	Senior Business Analysis	Specializing in economic evaluations, modelling, data analysis and strategic planning.
Barry MacNamara	Corporate Development & Marketing	M&A and natural gas marketing lead negotiator striking deals with E&P companies, Utilities, and LNG stakeholders. Experience in CSS.
Heinrich Holt	O&M Specialist, Central Support Services, XTL Facilities	Experience in developing GTL commercial and safety frameworks, improving underperforming operational units, and elevating well-performing organizations.
Holger Maul	Global Operational Expert	Lead large-scale performance improvement efforts in complex petrochemical plants, including running operations and ensuring continuous improvement in XTL facilities.
Michiel Coetzee	Process Engineering and Licensing	GTL process specialist with 30 years of GTL licensing experience. Technology development and optimization for small to medium-sized enterprises and process engineering activities expertise
Andrew Nagy	Snr Manager, Process Engineering	Led the engineering, including initial scoping, FEED, DBM, HAZOP, project implementation, and start-up
Sujit Sarkar	Mechanical Engineering Advisor	Specialist in design, engineering, and applications for combustion systems applicable to all industries. Specifically in power generation design and engineering start-ups.
Rigard du Plessis	Marketing & Business Development	GTL International marketing and business development, particularly within the specialty chemicals, GTL products, and energy environments.
Nick Meijer	Automation & OT Integrator	Design, manufacturing operations, process control, and asset maintenance optimization. Experience in MES and XTL facility optimization and availability improvement.
David Wedlock	Principal Scientist, Base Oils	Recognized as a prominent figure in the global lubricants and base oils industry and particle science and engineering.
David Whitby	Business Development & Marketing	Business development consultancy owner of international downstream oil, gas and energy industries with a focus on Base Oils and lubricants.
Joe Rousmaniere	International Sales & Marketing	Authority in the international trade and marketing of lubricant base oils and waxes.
Joe Boom	Senior Advisor	GTL commercial and previous GTL financing experience. Proficiency in transportation, labor consultancy, technology licensing, capital project contracting and procurement, supply chain management, commercial deal-making, and mega project contracting and procurement
Madelein Kleyn	Patent & IP Commercial Specialist	Technical expertise includes petrochemicals, chemistry, process engineering, explosives, agriculture and software. Focus on IP and GTL IP expertise includes deal negotiations, Due Diligence, IP Portfolio Management, IP policy and strategy development and implementation, data privacy and data monetization.

Name	Title	Description
Megan Keith	Senior Manager, Accounting	US and Canadian tax project, which consists of managing multiple disciplines and organization of information to achieve various tax incentives and credits, liaising with external auditors, writing accounting policies and setting up the financial reporting process. Managing IRA impacts.
Tristan Hahn	Carbon Management Advisor	Pivotal role in the global GTL and coal-to-liquids (CTL) projects, employing in-house FT synthesis and coal gasification technologies to convert hydrocarbons into premium diesel and chemical feedstock
Anbu Shanmugam	Engineering Systems Expert	Development and implementation of the SmartPlant suite of products, including Smart3D, Schematics, SmartPlant Foundation, and SmartPlant Operations, contributing to enhanced project efficiency.
Graham Lea	Process Engineer, Water Specialist	Strength in the GTL process engineering design of water and wastewater treatment plants.
Francois Van Huyssteen	RAM&SCM Specialist	Pivotal in driving the adoption of simulation, production scheduling, and Industry 4.0 transformation.
PJ Vlok	Reliability Expert	Systems design and analysis, data mining, stochastic process modelling, multivariate regression modelling, numerical methods, predictive statistics, statistical analysis of failure data, and mathematical programming.
Maggi Long	Business Systems Manager	Quality management projects in accordance with ISO 2009:2015 requirements demonstrated through internal audits.
André Steynberg	GTL Process Specialist / Technologist	Specialist in GTL and Fischer-Tropsch (FT) technologies. Along with developing programs for commercial readiness
Jan Boshoff	Commissioning & Start-up Technologist	GTL research and development of gas conversion, chemicals, synthetic fuels, filtration, as well as fundamental molecular dynamics simulations of polymer systems

TECHNICAL REVIEWERS' RATING SUMMARY

C-05-L

NDeV Flare Gas Mitigation Project
Submitted By: NDeV- Extiel, LLC
Date of Application: November 2023

Request for $3,000,000 Grant / $10,000,000 Loan
Total Project Costs $30,000,000

		Technical Reviewer			
		L1	**L2**	**L3**	
Rating Category	**Weighting Factor**	**Rating**	**Rating**	**Rating**	**Average Weighted Score**
1. Objectives	3	3	3	3	9
2. Impact	9	3	2	2	21
3. Methodology	9	4	2	2	24
4. Facilities	3	2	2	2	6
5. Budget	9	2	2	3	21
6. Partnerships	9	3	2	3	24
7. Awareness	3	2	2	2	6
8. Contribution	6	2	1	2	10
9. Project Management	6	3	2	3	16
10. Background	6	3	3	4	20
	315	177	129	165	157

OVERALL TECHNICALLY SOUND	L1	L2	L3
GOOD (IF > 214)	☐	☐	☐
FAIR (200-213)	☐	☐	☐
QUESTIONABLE (IF< 200)	☒	☒	☒

Mandatory Requirements	L1		L2		L3	
Diversification Delivery:	Yes	No	Yes	No	Yes	No
Project enhances the production of clean sustainable energy, to make the State a world leader in the production of clean sustainable energy, and/or to diversify and grow the State's economy.	✓		✓		✓	
Commercialization or Development/Expansion:	Yes	No	Yes	No	Yes	No
Concept will lead to the **large-scale development and commercialization** of projects, processes, activities, and technologies that reduce environmental impacts and/or increase sustainability of energy production and delivery.		✓		✓	✓	

In State Requirement:	Yes	No	Yes	No	Yes	No
The funds distributed from the financial assistance are to be applied to support in-state activities and must have other sources of financial support.		✓	✓			✓

1. **The objectives or goals of the proposed project with respect to clarity and consistency with Clean Sustainable Clean Energy Authority goals of projects, processes, activities, and technologies that reduce environmental impacts and increase sustainability of energy production and delivery are: 1 – very unclear; 2 – unclear; 3 – clear; 4 – very clear; or 5 – exceptionally clear.**

Reviewer L1 (Rating 3)
Goals are stated, but it appears that there would be minimal impact on the environment because more than 90% of the flare gas is already collected by rule from the North Dakota Department of Mineral Resources.

Reviewer L2 (Rating 3)
The project is focused on attempting to use a pyrolysis chamber with associated petroleum gas to produce carbon black and hydrogen.

Reviewer L3 (Rating 3)
No comments

2. **The objectives will make a difference in the near term to the state's economy: 1 – no impact; 2 – small impact; 3 – likely impact; 4 – most likely impact; or 5 – significant impact.**

Reviewer L1 (Rating 3)
The impact of this proposal could be positive but most of the flare gas is already captured and processed to meet the flaring limits imposed by the ND Oil and Gas Division of the Industrial Commission. Therefore, the applicant might have limited access to flare gas because of the lack of locations for this proposal unless they were to locate at or near a point of access to the flare gas gathering lines.

Reviewer L2 (Rating 2)
I am rating the impact as small as I don't believe that they currently have data that shows the reactor noted will be successful in producing the products they are suggesting without significant additional materials that maybe problematic.

Reviewer L3 (Rating 2)
No comments

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

Reviewer L1 (Rating 4)
The clarity of the methodology is acceptable with the block diagram. There needs to be more information of the potential markets for the products and byproducts of this process. The

facilities and equipment available and to be purchased for the proposed pilot or commercialization strategy is significant and could have an impact on the environment. Currently H2-Industries is planning to deliver the technology in self-contained ISO containers that are pre-assembled and shipped for installation on site.

Reviewer L2 (Rating 2)
The proposal makes a leap in stating that a reactor that they claim can produce carbon black and hydrogen from wood chips could be used to transform associated petroleum gas to the same products. I see NO data that demonstrates that outcome from processing associated petroleum gas (APG). In addition, no source for the APG has been identified.

Reviewer L3 (Rating 2)
No comments

4. **The facilities and equipment available and to be purchased for the proposed pilot or commercialization strategy is: 1 – very inadequate; 2 – inadequate; 3 – adequate; 4 – notably good; or 5 – exceptionally good.**

Reviewer L1 (Rating 2)
The amount of funds used during the first 13 months of the project appear to account for the entire 30 million. It appears that 25 million will be used within 10 months from the start of construction. There needs to be more description .of the timeline using those funds.

Reviewer L2 (Rating 2)
Since I see no data that the devise will process APG to hydrogen and carbon black I must rate the facility as inadequate.

Reviewer L3 (Rating 2)
No comments

5. **The proposed budget is comprehensive and sufficient relative to the outlined work and the timetable: 1 – not sufficient; 2 – possibly sufficient; 3 – likely sufficient; 4 – most likely sufficient; or 5 – certainly sufficient.**

Reviewer L1 (Rating 2)
The budget is not comprehensive and primarily lists administrative costs and only a lump sum of 25 million for construction.

Reviewer L2 (Rating 2)
The same comment holds here as in item 4, since I see no data that the devise will be successful in producing the results noted I have to question the sufficiency of the budget.

Reviewer L3 (Rating 3)
No comments

6. **The appropriate strategic partnerships are in place for short and long term plans to be successful: 1 – very limited; 2 – limited; 3 – adequate; 4 – better than average; or 5 – exceptional.**

Reviewer L1 (Rating 3)
There appears to be only one partnership with Extiel Technologies, LLC who holds the patented process to convert associated petroleum gas into carbon black and zero-carbon hydrogen. There is also discussion or working with EERC at the University of North Dakota as well as Triple Curl Resources and Gap Midstream, LLC, E-Force Services, LLC, and Moore control systems International, Inc.

Reviewer L2 (Rating 2)
I see no letters of commitment from potential partners, no letters of support from sources of APG and no letters of interest from potential off take partners.

Reviewer L3 (Rating 3)
No comments

7. **The likelihood that the project approach (time & budget) will achieve its technical and market goals is: 1 – not achievable; 2 – possibly achievable; 3 – likely achievable; 4 – most likely achievable; or 5 – certainly achievable.**

Reviewer L1 (Rating 2)
The project shows a very aggressive timetable for completion. To acquire equipment and construction is unlikely in the 1 O months identified in the as identified in the budget section of the proposal.

Reviewer L2 (Rating 2)
This reviewer is not convinced that the proposed technology solution will be successful as presented in achieving the stated goals. More data would need to be presented

Reviewer L3 (Rating 2)
No comments

8. **The scientific and/or technical contribution of the proposed work to specifically address Clean Sustainable Energy Authority goals of impacting technology used in North Dakota's energy industries will likely be: 1 – extremely small; 2 – small; 3 – significant; 4 – very significant; or 5 – extremely significant.**

Reviewer L1 (Rating 2)
Because most of the flare gas is already captured and processed, the contribution of this proposal will be small. On a small scale where a gathering system is not available, a project of this scale could be beneficial.

Reviewer L2 (Rating 1)
Since I'm not convinced they will be successful following the activities as proposed I must rate the impact of the project very low.

Reviewer L3 (Rating 2)
No comments

9. The project management plan, including budgeting projections, partner connections and well-defined milestone chart is: 1 – very inadequate; 2 – inadequate; 3 – adequate; 4 – notably good; or 5 – exceptionally good.

Reviewer L1 (Rating 3)
The milestone chart is quite aggressive, and the management plan is brief only listing Steering Team meetings, Weekly Project meetings, and weekly reporting from the Project Manager. Budget projections are listed, but as stated earlier are very aggressive in completion.

Reviewer L2 (Rating 2)
There are a number of deficiencies in the information submitted. First of all, there are no commitments from groups that have been identified as critical to the success. As stated earlier, I would have expected to see data on the ability of the reactor to affect the conversion to carbon black and hydrogen included. They also note the technologies ability to convert CH4 and CO2 but don't discuss the implications of the other components found APG namely, ethane, propane, normal butane, isobutene. The company that would be managing the activity has not been formed as of this submission. Finally, they have not identified a source of the APG which would be required for this activity. I would have expected to see that partnership as part of the submission.

Reviewer L3 (Rating 3)
No comments

10. The background and experience of the project principals with regards to technical qualifications and competence is: 1 – very limited; 2 – limited; 3 – adequate; 4 – better than average; or 5 – exceptional.

Reviewer L1 (Rating 3)
It appears that at least one of the principals listed has some experience with this type of work. The others are primarily administrators and there is one engineer listed. It does appear that there may be others with experience involved in some of the other entities listed such as EERC at the University of North Dakota.

Reviewer L2 (Rating 3)
The principals called out appear to be qualified but it's not clearly stated if they will be the technical staff of the new joint venture that they anticipate forming.

Reviewer L3 (Rating 4)
No comments

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 the project is technically sound.

Reviewer L1

There is virtually no discussion regarding sources of financial support, and it does not appear that this proposal would increase sustainable energy production and delivery in North Dakota. This proposal does, however, elicit interest in flare gas conversion processes.

Reviewer L2

The proposed activity is one that has potential to be of benefit to the State of North Dakota. The problem is that the submitted information leaves this reviewer with a number of critical questions that have not been answered. To recommend that the State make the investment requested I would need to see significant additional information made available. At this time I would NOT recommend funding for this activity.

Reviewer L3

- Eliminate associated gas which is flared
- From the presentation, it appears that the Extiel process requires a fair amount of gas. Below is a breakdown of the flared gas in ND. The examiner would have questions how the company is planning to get an adequate supply of gas.
- 2023_Jan, Feb Mar
  - Average of 144,000 MCF/Day Flared
    - Limited to wells more than 1 year old
    - Approx. 5% of Gas produced in ND is flared
  - 12,575 Wells had greater than 1% of produced gas flared, but the average gas flared per well is 11.34MCFPD
  - 187 wells flare MORE than 100MCFPD
  - 37 wells flare MORE than 300MCFPD
- Summary: Approximately 5% of the gas in ND is flared, which is a large number. Limiting wells older than one year (stripping out flush production) decreases the amount of flared gas. The remaining flared gas is spread across 12,575 wells, making it difficult to process large volumes of gas. Although it is not mentioned in the proposal, the examiner estimates that it will take a relatively large volume of gas for its device. There are only 187 wells that flare more than 100MCFPD, most of which will likely be connected to gas gathering at some point.

North Dakota Energy Ventures
4207 Boulder Ridge Road, Suite 220
Bismarck, North Dakota 58503

November 1, 2023

North Dakota Industrial Commission
State Capital – Fourth Floor
600 East Boulevard Avenue
Bismarck, ND 58505

Re: Project titled "NDeV Flare Gas Mitigation Demonstration Project"

To NDIC & Clean Sustainable Energy Authority Program:

North Dakota Energy Ventures (NDeV) is submitting this application for grant funding under the North Dakota Industrial Commission Clean Sustainable Energy Authority Program. This project will demonstrate a scalable solution for eliminating associated gas flares to reduce greenhouse gas and hazardous air pollution emissions while providing a pathway that monetizes the gas and ultimately pays for the mitigation equipment.

The project cost is budgeted at $30,000,000 and with this application, NDeV requests a $3,000,000 Grant for preliminary engineering and project development and a Loan in the amount of $10,000,000 to advance the project. We are confident that with this initial capital infusion, we will attract the remaining loan, grant, and investor capital to complete the project. Once the demonstration project is complete, the process will have been sufficiently de-risked to attract capital resources to scale gas processing to a level that makes a significant contribution to a cleaner environment and improves health outcomes for the public.

If you have any questions or require additional information, please do not hesitate to call our technology partner at Extiel Technologies Mr. Steve Wolf at 512 970-7506 or by email at Steve.Wolf@extiel.com.

Sincerely,

Dr. Parag Kumar
Director, North Dakota Energy Ventures, LLC

Application

Project Title: NDeV Flare Gas Mitigation Project

Applicant: NDeV-Extiel, LLC

Date of Application: November 1, 2023

Amount of Request
Grant: $3 Million
Loan: $10 Million

Total Amount of Proposed Project:$30 Million

Duration of Project: 18 Months

Point of Contact (POC): Steve Wolf or
Michael O'Brien

POC Telephone: (512) 970-7506

POC Email: Steve.Wolf@extiel.com or
Michael.OBrien@extiel.com

POC Address: Extiel Technologies, Inc.
1020 East Levee St., Ste 180
Dallas, Texas 75207

Clean Sustainable Energy Authority

North Dakota Industrial Commission

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ABSTRACT

Objective:
North Dakota Energy Ventures, LLC (NDeV) is a North Dakota company founded by two prominent Bismarck medical doctors with the mission of developing technological solutions to address environmental challenges that effect the climate and the health of the citizens of ND. The robust energy sector in ND faces many challenges as it strives to reduce its impact on the environment. One such challenge is the routine flaring of Associated Petroleum Gas (APG), primarily in the Bakken.

This project demonstrates a scalable technology that will mitigate existing flare gas impacts from the release of GHG's such as CO_2, SO_2, NO_x, and CH_4 and the emission of hazardous combustion products formed inside the flare itself. These combustion products include Polycyclic Aromatic Hydrocarbons or PAHs, a class of chemicals that have a known detrimental impact on human health. It has been reported that individuals within a 60-mile radius of flaring operations have a higher degree of respiratory issues and cancer clusters have been identified downwind of flares. Eliminating these flares and diverting the APG to beneficial use will have a dramatic impact on both health outcomes and health care costs.

NDeV has partnered with Extiel Technologies, LLC, developer of a patented process that converts APG into carbon black and zero-carbon hydrogen. The process called Absolute Pyrolysis Technology (APT) consumes 100% of the flare gas with no need for CO_2 sequestration and no emissions. GHG emissions and criteria air pollutants could be reduced to nearly zero and the coproduced hydrogen could create zero-carbon electricity to run the process and for export into the local grid. The produced carbon black monetizes the currently wasted APG and provides a revenue stream that will incentivize capital providers to fund the construction of future APT plants.

Each day, oil and gas operators in The State of North Dakota flare over 500 mmscf of APG (4 million MTPY) (Metric Tons Per Year) with an annual Henry Hub value of $550 million, according to a Synapse Energy Economics study. Burning this amount of gas releases nearly 10 million MTPY of CO_2 into the atmosphere (equivalent to 2.2 million passenger vehicles) and an unknown quantity of PAHs and other criteria pollutants. Distributed and scalable APT units can convert this gas, at or near the wellhead, into 2.6 million MTPY of easily transported carbon black creating a revenue stream of $2.6 billion annually ***without the need for underground CO2 sequestration.*** This technology affords the State of North Dakota the opportunity to greatly reduce greenhouse gas emissions and hazardous air pollutants while monetizing a lost resource bringing more revenue to the state, resource owners, and operators while simultaneously improving human health outcomes and the environment.

NDeV-Extiel, LLC, a North Dakota Limited Liability Company, proposes to develop a $30 million flare gas mitigation project that will ultimately convert Associated Petroleum Gas (APG) into hydrogen, carbon black, and zero-carbon electricity. The same unit, operated under alternate conditions, will produce chemical grade synthesis gas (syngas), a mix of carbon monoxide and hydrogen. Syngas is the building block for a variety of industrial chemicals and transportation fuels including methanol, ammonia, urea, gasoline, Jet/Diesel, and synthetic base oils. To achieve this goal, the company will deploy Absolute Pyrolysis Technology (APT) a process developed and patented by Extiel Technologies, LLC that has

previously completed proof of concept trials on wood pellets at a near commercial scale. Applying the APT approach, coupled with other known technologies, will both reduce GHG's from flaring operations and create high value commodities that will make the project financially viable. As an outgrowth of this Pilot project, NDeV-Extiel will develop larger scale facilities that will allow the State of North Dakota to meet its goals of reducing or **eliminating** APG flaring in the state. This Pilot Project mitigates GHG emissions and criteria pollutants resulting in improved health outcomes for ND citizens **while creating new revenue streams** for resource owners, operators, and the State of North Dakota.

Expected Results:
Extiel's APT technology can process any carbonaceous feedstock in solid, liquid, or gaseous form and convert that feedstock into hydrogen and other marketable commodities. With APG as the feedstock for the APT Pilot unit, the process will create ultrapure carbon black along with zero-carbon hydrogen without the need for carbon sequestration. The carbon black will be sold into the $18 billion per year market with off takers signing contracts in advance while the produced hydrogen is used to make zero-carbon electricity meeting the power needs of the facility with some available for export to the local grid. By creating power to run the process from the produced hydrogen, the entire operation is carbon neutral. Additionally, this small Pilot project will reduce GHG emission by 5,700 MTPY. The inherent scalability of the process offers the potential to avoid millions of tons of CO2 currently discharged by APG flaring operations in the state.

Duration:
The design/development phase of the project is roughly 90 days. Construction is expected to take 15 – 18 months and, once operating, the facility may be relocated to other flare gas well sites. The Pilot Project will be the application of a single Extiel APT-500k, the development and operating side of which is detailed further in this grant application.

Total Project Cost:
Project costs are benchmarked at $30 million with $3 million for Front End Engineering & Design (FEED) and project development and $27 million earmarked for detailed design, fabrication, construction, management, land leases, operations, and related costs associated with the project. Project costs are detailed further in this application.

Participants:
NDeV-Extiel (a to be formed LLC) is a joint venture between Extiel Technologies, LLC (Extiel) and North Dakota Energy Ventures, LLC (NDeV). Extiel is a technology and project developer vertically integrated in the manufacture of high-performance specialty chemical intermediates, fuels, solvents, oils, and paraffinic waxes. Extiel has developed and patented the APT Technology to further their goals.

NDeV's is owned by Dr. Parag Kumar, a pediatric hospitalist at Sanford who has lived Bismarck for over twenty years. He has been working on pediatric health related issues for the past 15 years and most recently focused on the health of children exposed to emissions from APG flaring. Dr. Kumar is also a clinical professor of pediatrics at UND Medical School.

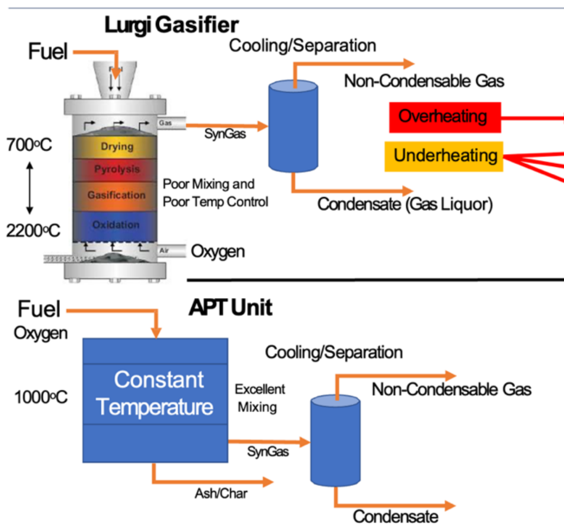
PROJECT DESCRIPTION

Objectives:
The objective of the NDeV-Extiel JV is to build and operate a scalable flare gas mitigation project that, when expanded, can address the flare gas issues that exist across western North Dakota. To achieve this objective, the venture will apply Extiel's patented APT technology on a small but commercial-scale APT-500k, which will process 7 to 30 MTPD (320 to 1,440 mscfd) of APG, depending on operating mode. The Pilot Project will produce sufficient hydrogen to meet the plant's operational electrical load and produce excess energy for remittance into the Grid. Ultra-pure carbon black is the main revenue generating output. Carbon black is currently used in tires, belts, hoses, inks, paint, printer toner, and numerous other applications.

Using the same technology, appropriately scaled, Extiel has developed a preliminary design for an integrated specialty chemicals plant that consumes 960 MTPD (46,000 mscfd) of APG while avoiding 814,000 MTPY CO2 emissions. Ten such units could consume essentially all APG currently flared in ND. Details and a Block Flow Diagram are provided in presentation format attached to this document.

Methodology:
Extiel's APT reactor differs from conventional pyrolysis/gasification processes (Lurgi, Plasma, or Auger) in that all feed material enters the top of the reactor and all end products exit the bottom. This ensures that all feed material is subjected to the design temperature with no underheating and no overheating. Because of this design feature, the produced gases are of higher quality with fewer impurities and downstream processing cost is greatly reduced. Below is a comparison between the Lurgi and APT process emphasizing the superior gas quality produced by the APT Unit.

APT Fluidized Moving Bed Reactor (FMBR) vs Lurgi Type Gasifier



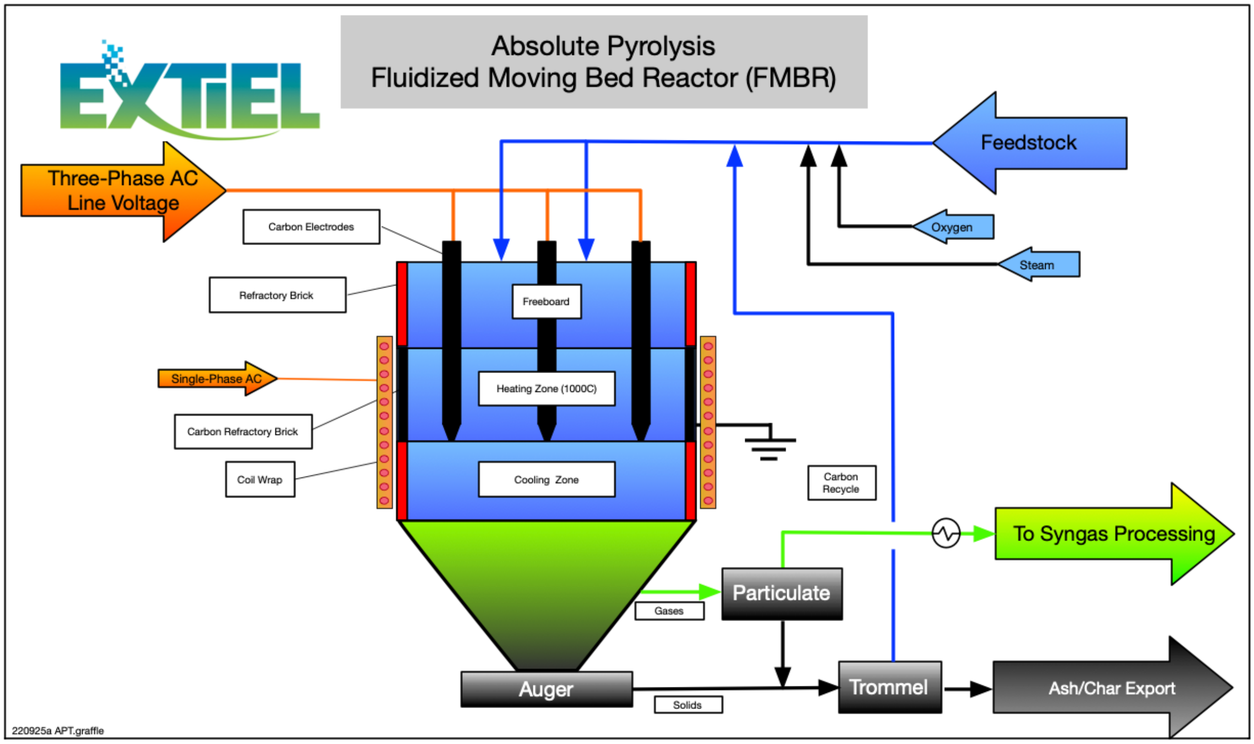
Lurgi Gasifier - Lignite Non-Condensable Fraction	
Component	Volume %
Hydrogen	38.6%
Carbon Dioxide	32.3%
Carbon Monoxide	15.4%
Methane	11.9%
C2 & C3 Hydrocarbons	0.8%
Hydrogen Sulfide*	0.7%
Other	0.2%
Total	100%
* *Many sulfur compounds*	

Lurgi Gasifier - Lignite Condensable Fraction (Gas Liquor)	
Component	Percent
Water	??%
Tars	??%
Oil	??%
Phenolics	??%
Ammonia	??%
Sulfur Dioxide	??%
Other	??%
Total	100%

APT Unit - Wood Non-Condensable Fraction	
Component	Volume %
Hydrogen	52.4%
Carbon Dioxide	0.2%
Carbon Monoxide	45.5%
Methane	1.2%
C2 & C3 Hydrocarbons	0.5%
Sulfur Compounds	0.0%
Other	0.3%
Total	100%

APT Unit - Wood Condensable Fraction	
Component	Percent
Water	??%
Carbon Disulfide	??%
Other	??%
Total	100%

Reactor temperature is precisely maintained at 1000℃ using internal electrodes and fluidization of the bed is achieved by the interacting magnetic fields produced within the reactor vessel. Finally, the bed material is constantly moving vertically through the reactor body. The result is what Extiel calls the Fluidized Moving Bed Reactor (FMBR).

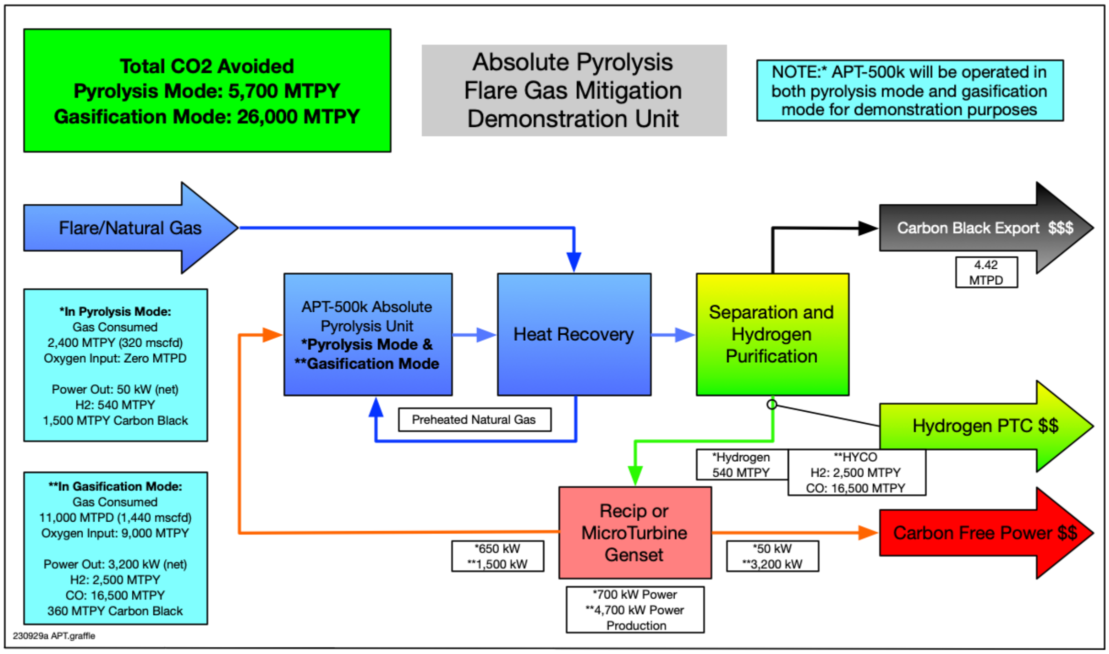


When operated on the pyrolysis mode, no oxygen is introduced, and the end products are pure carbon black and clean hydrogen. To meet commercial grade specifications (99.99% pure), the hydrogen goes through the same purification processes found in commercial hydrogen plants. If used in a combustion device such as an engine, boiler, or turbine, no further processing is needed.

The same reactor can be operated in gasification mode where pure oxygen is introduced along with the APG. In this case, carbon black is not produced, rather, methane reacts with the oxygen to produce carbon monoxide (CO) and hydrogen (H2). A subsequent commercially proven catalytic process step called Water Gas Shift (WGS), reacts CO with H2O to form additional hydrogen and sequestration-ready CO2. The Pilot Project will test the APT-500k in both pyrolysis and gasification modes.

Anticipated Results:

The Pilot Project, if operated year-round in pyrolysis mode, anticipates reducing CO2 emissions from flaring by 5,700 MTPY, ***without the need for sequestration***, while producing 1,500 MTPY of low carbon intensity (CI) carbon black and 540 MTPY of zero-carbon hydrogen. If the same APT-500k were operated in gasification mode year-round, the anticipated amount of avoided CO2 would be 26,000 MTPY. This assumes that a sequestration sink is available or that the carbon is otherwise sequestered in a commercial product such as methanol. Meanwhile, 19,000 MTPY of syngas would be produced, sufficient to feed a 200 BPD Fischer-Tropsch plant producing clean fuels, solvents, base oils, and wax. The Pilot Project will not produce these end products but will demonstrate the ability to produce a reliable and clean syngas stream that is suitable for such a use. This is a necessary step to attract the required capital for larger projects that use any of the several commercially available downstream processes for turning syngas into ammonia, urea, methanol, fuels, etc.



From a commercial perspective, it is expected the Pilot Project will generate more than sufficient cash flow from carbon black and power sales to both repay a $6 Million loan and provide a return on an equity investment of up to $10 Million. This project is forecasted to produce sufficient cash flow to repay a $6 Million loan in 5 years.

Economics: APT-500k Flare / Natural Gas to Hydrogen, Syngas, and Carbon Black

Process	Feedstock	Production	Conversion	Offtake
APT-500k Pyrolysis Mode Zero CO2 Emissions Avoided CO2 vs Flaring: 5,700 MTPY	Power Input: 650 kW Flare Gas: 2,400 MTPY (320 mscfd)	Clean Hydrogen: H2: 540 MTPY Low CI Carbon Black: 1,500 MTPY	Hydrogen to Power: 700kW	Power (net): 50kW Carbon Black: 1,500 MTPY
APT-500k Gasification Mode Zero CO2 Emissions Avoided CO2 vs Flaring: 26,000 MTPY	Power Input: 1,500 kW Flare Gas: 11,000 MTPY (1,400 mscfd)	Clean Synthesis Gas: H2: 2,500 MTPY CO: 16,500 MTPY Low CI Carbon Black: 360 MTPY	Hydrogen to Power: 4,700 kW Syngas to Hydrogen: H2: 3,700 MTPY	Power Out: 3,200 kW (Net) Low CI Carbon Black: 360 MTPY

Source: 230928b APT Production Calculator

Key: MTPY = Metric Tons Per Year
LPM = Liters Per Minute
MW = Megawatts
mmscfd = million standard cubic ft/day

Facilities:

The heart of the Pilot Project is Extiel's patented APT-500k reactor. Many of the component parts are sourced from arc furnace designs with some important differences. APT operates at lower temperatures than an arc furnace and requires much lower voltage so that arcing does not occur. Rather, electricity passes between electrodes through a conductive bed substrate. The heat needed for dissociation of the feedstock is generated by the electrical resistance of the bed which is both fluidized and moving. In pyrolysis mode, nearly all the heat input comes from the electrical load. When operating in gasification mode, most of the required heat is provided by partial oxidation of the feed and the resulting exothermic (heat producing) reactions. This exotherm explains the much higher throughput capacity of the APT reactor in gasification mode vs pyrolysis mode.

An on-site genset consuming produced hydrogen, syngas, and/or APG will provide electrical power to operate the plant. The hydrogen/syngas conditioning train will include compressors, heat exchangers, adsorbent vessels, reactor vessels, particulate control devices, and a full suite of controls and analyzers. A small material handling section will include equipment for sizing, conveying, bagging, and loading the carbon black product for sale. A flare will be included at the facility to provide safe routing of excess produced gases and to accommodate start-up, shutdown, and emergency operations. The system will be designed for automated operation and remote viewing via PLC control. It will not, however, operate unattended.

The entire plant will be housed inside metal buildings with office, lab, and maintenance spaces to facilitate year-round operation.

Resources:

Overall project execution responsibility lies with Extiel. For the initial engineering phase that is the subject of this grant application, Extiel will call on E-Force Services, LLC, Moore Control Systems International, Inc., and EERC for engineering support. In parallel, we will identify a suitable project site and establish relationships for gas supply, site support, and logistics concerns. For these activities we have enlisted the help of Triple Curl Resources and Gap Midstream, LLC.

For later project phases we have identified fabricators, detailed engineering resources, construction support and transportation companies. These relationships will be formalized during this initial engineering phase.

Techniques to Be Used, Their Availability and Capability:

Pyrolysis and gasification (partial oxidation) have been commercially viable for hundreds of years. The original "gas light district" was so named because the streets were illuminated by gas lamps providing light to extend the hours of operation for businesses in the area. This gas was produced from coal through primitive gasification techniques resulting in dirty syngas and hazardous byproducts. Nonexistent environmental regulations meant that these pollutants effected the soil and water tables requiring remediation many years later. The purity of this "synthesized" gas was not important and the only requirement being that it burned and sustained a flame to produce light. Today, synthesis gas can be produced in an environmentally responsible manner and must be free of impurities if it is to be used in fuel cells or any number of catalytic process applications including production of hydrogen.

This is why Extiel developed “Absolute Pyrolysis Technology” (APT). Poor gas quality and unwanted byproducts are the result of uneven temperature control and poor fixing of the feedstock. This occurs in the reactor itself. The balance of plant is comprised of off-the-shelf components that are commercially available from multiple vendors. Every pyrolysis/gasification system includes the following steps.

- Feedstock preparation – sizing, sorting, drying, pelletizing
- Material handling – conveyers, augers, hoppers, air locks
- SynGas processing – particulate separation, scrubbing, compression
- Pyrolysis reactor – application of heat (pyro) to the feed material to facilitate splitting (lysis) of the molecules

The APT plant relies on commercially available equipment for everything except the reactor. However, even the reactor design and subcomponents borrow heavily from reactors used in hundreds of electric arc furnaces (EAF) commercially operating in ore smelting and metal remelt applications. Carbon electrodes, electrode holders and retractors, refractory systems, and vessel fabrication methods, all borrowed from EAF, are directly applicable to the APT reactor. While EAFs operate at internal temperatures in the 2000 to 6000℃ range, APT operates at much less challenging temperatures, between 800 and 1200℃. EAFs typically have a tilting function to allow for dispensing of molten products. APT has no such requirement as temperatures are well below the melting point. Instead, we use common augers to extract solid carbon black, ash, and char from the bottom of the reactor. The mechanical design is much simpler than EAFs.

EAFs are highly scalable and commercially available from 1 MW to 200 MW. Our Pilot APT-500 requires 500 kw and we have plans to scale to 50 MW, well within the range of existing design/fabrication capabilities.

Our APT-500k project will be successful because 90% of the plant incorporates existing designs from experienced vendors. The final 10% will demonstrate that the quality of syngas generated by the APT reactor is significantly cleaner than any pyrolysis or gasification process on the market today. This process improvement means the gas processing train, that represents a significant portion of the capital and operating cost of current designs, will be greatly simplified.

With APT we can finally process a wide variety of sustainable and renewable feedstocks, gaseous, liquid, or solid, without the need for costly gas cleanup trains that consume chemicals and produce their own waste streams.

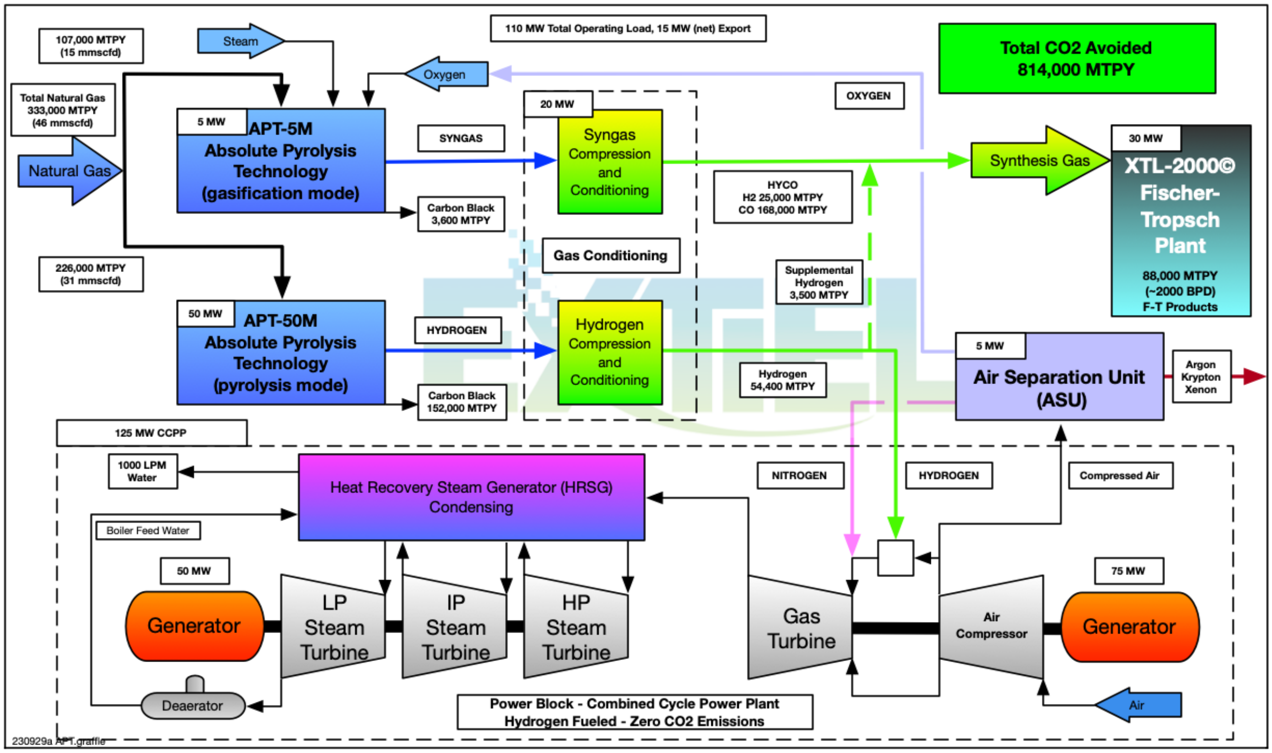
Using established technologies and applying them to the APT process will provide the end uses suggested. Heat recovery, separation, and hydrogen purification units, as well as combined cycle power plants (CCPP), all exist today. The capacity to run hydrogen through a gas turbine CCPP process is provided by companies such as Siemens, GE, and Mitsubishi. Fuel cells also show promise as a method of converting hydrogen into electricity.

Environmental and Economic Impacts while Project is Underway:
The project will utilize best industry practices for site development and construction means and methods to ensure minimal impact. From an economic perspective the project will generate several construction jobs and meet the needs of the State without putting additional pressure on the job market in The Bakken.

The project will mitigate existing flare gas impacts from the release GHG's such as CO2, SO2, NOx, and CH4 and the emission of hazardous combustion products formed inside the flare itself. Polycyclic Aromatic Hydrocarbons or PAHs have a known detrimental impact on human health. It has been reported that individuals within a 60-mile radius of flaring operations have a higher degree of respiratory issues. These health impacts have been reported in the February 2022 issue of The Journal of Public Economics. The articles author noted the cost of respiratory hospital visits in North Dakota in 2007 (in 2018 dollars) and what a nominal increase in flaring would cost. It has also been widely reported that flaring will likely increase as demand for shale oil, supported by higher prices, increases with a corresponding effect on health-related costs. Eliminating these flares and diverting the APG to beneficial use will have a dramatic impact on both health outcomes and health care costs.

Ultimate Technological and Economic Impacts:
This Pilot Project will provide North Dakota with a game changing pathway for eliminating GHG emissions and criteria air pollutants in a financially beneficial manner. The block flow diagram below outlines a system that consumes 46 mmscfd of APG and produces 2000 BPD of high value synthetic F-T products. Five such plants could essentially consume all APG currently flared in ND.

The Block Flow Diagram below illustrates the potential to use APT reactors in pyrolysis and gasification mode along with readily available gas turbine combined cycle power plants and proven Fischer-Tropsch technology to convert APT into high-value, beneficial products.



Only by reducing the technical risk of the APT reactor can we attract the capital necessary to realize these larger projects. This Pilot Project will provide the technical certainty needed to attract the capital necessary to tackle the larger APG flaring challenge.

Economics: Flare / Natural Gas to Fischer-Tropsch Liquids (solvents, lubes, waxes, fuels), carbon black

Process	Feedstock	Production	Conversion	Offtake
APT-5M + F-T Gasification Mode Zero CO2 Emissions Avoided CO2 vs Flaring: 261,000 MTPY	Power Input: 51 MW Flare Gas: 107,000 MTPY (15 mmscfd)	Clean Synthesis Gas: H2: 25,000 MTPY CO: 168,000 MTPY Low CI Carbon Black: 3,600 MTPY	Syngas to F-T: 88,000 MTPY (~2000 BPD) Water Produced: 200 LPM	Fischer-Tropsch Liquids: 88,000 MTPY (~2000 BPD) Carbon Black: 3,600 MTPY
APT-50M + CCPP Pyrolysis Mode Zero CO2 Emissions Avoided CO2 vs Flaring: 553,000 MTPY	Power Input: 65 MW Flare Gas: 226,000 MTPY (31 mmscfd)	Clean Hydrogen: 54,400 MTPY Low CI Carbon Black: 152,000 MTPY	Hydrogen CCPP 125 MW (gross) Water Produced: 1000 LPM	Power Out: 125-60-50= 15 MW (Net) Low CI Carbon Black: 152,000 MTPY

Source: 230928b APT Production Calculator

Key: MTPY = Metric Tons Per Year
LPM = Liters Per Minute
MW = Megawatts
mmscfd = million standard cubic ft/day

Why the Project is Needed:
Each day, oil and gas operators in The State of North Dakota flare over 500 mmscf of APG with a Henry Hub value of $550 million per year. Burning this amount of gas releases nearly 10 million MTPY of CO2 into the atmosphere (equivalent to 2.2 million passenger vehicles). Distributed APT units can convert this gas, at or near the wellhead, into 2.6 million MTPY of easy to transport carbon black creating a revenue stream of $2.6 billion annually. CO2 emissions and criteria air pollutants could be reduced to nearly zero and the coproduced hydrogen could create zero-carbon electricity for the grid. This project affords the State of North Dakota the opportunity to greatly reduce greenhouse gas emissions and hazardous air pollutants while monetizing a now wasted resource bringing more revenue to the state, resource owners, and operators while simultaneously improving human health and the environment.

STANDARDS OF SUCCESS

The first deliverable will be Pilot of APT's ability to convert APG to carbon black. Each kg of carbon black APT produces represents 3.67 kg of avoided CO2 release. The second deliverable will be the qualitative and quantitative analysis of produced hydrogen and/or syngas. This detailed gas analysis will provide the engineering inputs required to assess its usefulness in particular applications such as combustion in a microturbine or internal combustion engine. Further, this analysis will provide an accurate basis for designing purification equipment needed to produce high purity (99.99%) compressed hydrogen for industrial applications and for use on fuel cells for transportation and power generation.

While it may seem appropriate to measure the project's effect on air quality in the immediate vicinity of the plant, we are unlikely to see much impact due to the small size of the project in comparison to existing background pollution levels. However, point source readings at the plant will demonstrate that the process is clean and a non-contributor to GHG and criteria pollutant air emissions. This data compared to similar point source data from uncontrolled flares will demonstrate the potential positive impact of a large-scale project that mitigates a significant percentage of regional APG. This positive impact can be projected on areas like Fort Berthold, currently experiencing poor air quality related to flare gas operations and suffering the resulting health impacts.

Because the approach is scalable it can be applied near the wellhead where gathering pipelines are not practical but also at existing midstream processing centers as a method of reducing the load on these centers and downstream transmission pipelines. This can debottleneck existing gathering systems and free up capacity, reducing the need for upstream connected producers to flare their APG.

Through the project we will develop collaborative relationships with Bismarck State for job training as well as UND Fargo and work with the EERC, to both publish papers on the results as well as provide independent measured results on the progress. Finally, the project would both preserve North Dakota jobs as well as create new ones in fabrication, construction, and operations over an extended period.

Through this approach we believe the project will meet the needs of the Industrial Commission as it implements a program to further reduce the amount of flaring in the Bakken Shale Play.

BACKGROUND/QUALIFICIATIONS

Steven T. Wolf, Managing Director, Extiel Holdings, LLC

Steve Wolf is a founding member and Managing Director of Extiel Holdings, LLC, and President of Land And Natural Resource Development, Inc. (LNRD) an Alabama-based oil and gas company formed in 1987. LNRD drills and operates wells in the Paleozoics of the Black Warrior Basin in central Alabama and Mississippi, and the Cretaceous and Jurassic targets of the Salt Basin of southern Louisiana, Mississippi, Florida and Alabama. With LNRD he initiated and developed a $400 million coalbed methane project, which became a recognized field with over 500 wells. He has developed, funded, and managed the successful execution of $20-$50 million drilling and secondary recovery programs. Steve was a co-founder of Petrosakh U.S.A., which initiated development of a field on Sakhalin Island that became a 100-million-barrel field. In 2009, LNRD supervised the design, engineering, fabrication, construction, and commissioning of two gas processing plants in Kazakhstan. Early in his career he developed exploration Joint Ventures for the Eastern Exploration Region of ARCO Exploration Company. He earned a BBA in Accounting with honors and a JD Law both from the University of Texas, Austin.

Michael O'Brien, Director, Executive VP, Extiel Holdings, LLC

Michael O'Brien is a founder, Director and Executive Vice President of Extiel Holdings, LLC. Michael is also founder and President of Stranded Gas Services, Inc (SGS), formed in 2008 to develop technologies to monetize economically stranded gas that is currently capped or flared. Michael has executed hundreds of projects including fifty involving natural gas, associated gas, biogas, landfill gas, and synthesis gas streams resulting in the beneficial use of stranded resources. In 2009 through 2011, SGS participated in the project management, process design, engineering, fabrication, construction, and commissioning of two gas processing plants in Kazakhstan that recovered wasted flare gas for beneficial use. In 1995, Mr. O'Brien founded and served as President of South Coast Clean Air, Inc. (SCCA), a company dedicated to developing environmental compliance strategies for a wide variety of manufacturing processes. Michael's experience includes senior technical and business positions for GE Energy, NATCO Group, and Wheelabrator. He has authored and presented numerous technical papers at industry conferences focused on gas conditioning and environmental compliance. Michael holds a BS in Natural Gas Engineering from Texas A&M University, Kingsville, TX.

Mark Forsyth, Project Control Manager, Extiel Holdings, LLC

Mark Forsyth brings a wealth of experience in asset management, reliability, and project control. He has consulted across multiple industries on asset utilization solutions, including High Reliability Organizational (HRO) principles and Reliability and Asset Management transformation. At Chevron, Mark worked across the company's global network to drive reliability and implement best practices company wide. He managed a $3.1 billion power project for TengizChevrOil (TCO) in Kazakhstan, creating the structure for hiring, training, and certifying 700 personnel, including operating and maintenance procedures to ensure reliable and safe operation of a planned $34 Billion expansion of the TCO facilities. Mark served as Managing Director of UMS Group Sourcing Solutions, a business designed to provide outsourced process support for Asset Management, Asset Investment Strategy, Performance Management, Strategic Resource Management, Supply Chain Strategy and core Maintenance and Reliability processes. As Principal Consultant for the Asset Management Practice at UMS Group, Mark led the development of product templates, assessment guides, training programs, and information technology tools to support Strategic Asset Management. Mark graduated with honors from Excelsior College with a BS in Nuclear Engineering Technology.

Wayne Wolf – Senior Project Engineering Manager, Extiel Holdings, LLC

Wayne is a creative and solution-oriented leader who, for 30 years, has managed a wide range of projects from pilot though commercial scale in the areas of specialty water purification, GTL, hydrogen, industrial gases, biogas, and natural gas. Wayne has participated in every phase of product and project development from initial concept through design, fabrication, installation, and startup. He has directly managed or participated in the field installation of over 100 gas, water, and chemical process plants in two-dozen countries. His disciplines and capacities comprise intellectual property assessment, electrical & mechanical design, controls philosophy, reliability, serviceability, and remote monitoring/control. Previously, Wayne held CEO/CTO positions with Ozone Technology, Inc. and Omni Water Solutions, Inc. Wayne pioneered innovations in the gas phase generation of ozone (O_3) and implemented its innovative uses for water purification. Wayne is currently designing and building modular water treatment systems, complete with remote monitoring capabilities to ensure reliability, for remote communities in Africa and the Middle East that lack critical services and basic infrastructure. Wayne holds a BS in Architecture and Urban Planning from the University of Texas, Austin.

MANAGEMENT

NDeV-Extiel will form a steering committee consisting of top managers from NDeV, Extiel Technologies, E-Force Services, and GAP Midstream. The steering committee will meet monthly to review the strategic process of execution including project timeline, cost projections, regulatory approvals and other critical item highlighted by the working team.

Monthly Steering Team Meetings
Executive Review with the steering team to set objectives, evaluate progress, direct critical actions, evaluate risk, and check the project schedule.

The project execution team will draw personnel from Extiel, E-Force, Moore Control Systems International (MCSI), Gap Midstream. This group will direct the activities of the project, meeting on a weekly basis to ensure the project objectives are being met in the safest and most cost-effective manner.

Weekly Project Meetings
A kick-off meeting will be held wherein the scope, content, and logistics for the weekly meetings will be set. The purpose of the weekly meeting is to report ongoing progress to the team, anticipate required resources for the upcoming weeks and measure progress against the proposed project schedule.

The agenda will be as follows:
Safety Report
Last Week Accomplishments
Outstanding Action Items
Design Concerns
Calendar of Events
Project Schedule
Planned Field Trips
Key Milestones for the Coming Week

Weekly Reporting
The Project Manager will issue weekly progress reports describing the content of the weekly meeting. The project status will be compared to the project schedule and if deficiencies exist, the Project Manager will outline mitigating actions and resources needed to bring the project schedule back into compliance.

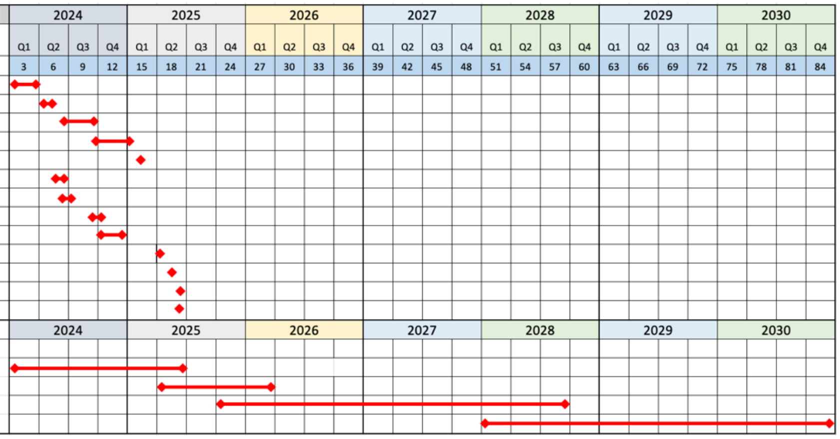
Proposed Project Team subject to availability.

Position	Person	Company
Operations Lead	Michael O'Brien	Extiel
Project Manger	Bill Zwerneman	MCSI
Lead Technologist	Yuri Kalashnicov	E-Force
Lead Process Engineer	Paul Johnston	MCSI
Lead Project Engineer	Jared Walker	MCSI
Start-up Manager	Wayne Wolf	Extiel

TIMETABLE

The project schedule below details the proposed $30 million Pilot Project along with a timeline to achieve the larger goal of scaleup and deployment of this concept to significantly reduce or altogether eliminate the practice of flaring associated gas to produce the underlying oil.

Phase I - APT-500k Demonstration Project Schedule Detail		Start Month	Finish Month	Duration (Months)
#	Activity	Project Month		
0	FEED	0	3	3
1	Detailed Design	3	5	2
3	Equipment: Materials	5	9	4
4	Equipment: Fabrication	8	13	5
5	Shipping	13	14	1
6	Land Acquisition and Prep	4	6	2
7	Permitting	5	7	2
8	Site Improvements	8	10	2
9	OSBL Utilities to Site	9	12	3
10	Installation	15	16	1
11	Startup and Commissioning	16	17	1
12	Operator Training	17	18	1
13	Plant Fully Operational	17	18	0
Four Phases - Demonstration through Integrated Commercial Plants				
Phase I	APT-500k Demontraton Project			18
Phase II	APT-5M Project			12
Phase III	APT-5M, APT-50M, XTL-2000 GTL Plant			36
Phase IV	APT-5M, APT-50M, XTL-2000 GTL Plant			36



Scalable Project Phases

The outline below outlines the project phases and scalability along with the cost associated with each phase.

Project Phases: Flare / Natural Gas to Fischer-Tropsch Liquids (solvents, lubes, waxes, fuels), carbon black

Phases	Proof of Concept	APT-500k	APT-5M	APT-5M + APT-50M	APT-5M + APT-50M
Timeline	***Completed***	Q4 2024	Q4 2025	Q3 2028	Q3 2031
Land Required	None	2 acre	5 acres	150 acres	150 acres
Gas Required	Wood Pellets	0.3 to 1.2 mmscfd	3.0 mmscfd	46 mmscfd	46 mmscfd
CO2 Avoided	N/A	25,000 MTPY	55,000 MTPY	810,000 MTPY	810,000 MTPY
Products	Syngas Biochar	Hydrogen, Carbon Black, Syngas, Power	Hydrogen, Carbon Black, Power	F-T Gasoline, Diesel, JetA, Carbon Black, Power	F-T Gasoline, Diesel, JetA, Carbon Black, Power
Equipment	• Construct APT-50k • ~100kg/h feed • Operated on wood • Batch mode • Prove quality of syngas • Prove quality of biochar	• APT-500k • 1300 kW Genset • Pyrolysis Mode (310 mscd) • Gasification Mode 1,200 mscfd)	• APT-5M • Pyrolysis mode • 14 MW Genset	• APT-50M • 125 MW Power Plant • APT-5M • 2000 BPD GTL Plant (XTL-2000)	• APT-50M • 125 MW Power Plant • APT-5M • 2000 BPD GTL Plant (XTL-2000)
TIC	$12M (invested)	$30M	~$90M	~$1.6B	~$1.4B
Duration	12 months	12-18 months	12 months	36 months	36 months

BUDGET

*Please use the table below to provide an **itemized list** of the project's capital costs; direct operating costs, including salaries; and indirect costs; and an explanation of which of these costs will be supported by the financial assistance and in what amount. The budget should identify all other committed and prospective funding sources and the amount of funding from each source. **Please feel free to add columns and rows as needed.** Higher priority will be given to projects with a high degree of matching private industry investment.*

Project Associated Expense	NDIC Grant	NDIC Loan	Applicant's Share (Cash)	Other Project Sponsor's Share	Total
	3,000,000	10,000,000		17,000,000	30,000,000
Total					

The applicant is also requesting a $10 Million loan from CSEA, This will be supported with, $14.5 Million is in the form of funding from the Inflation Reduction Act Tax Credit and $2.5 is in the form of investor equity. This grant and loan request is less than 50% of total project cost.

Below is the application of funds and timeline for the process based on uninterrupted funding. Any delay in availability of funds will alter the project schedule.

		Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12	Month 13
Pilot Project Soft Costs														
85,000	Legal	$ 25,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000
205,000	Management	$ 15,000	$ 20,000	$ 20,000	$ 20,000	$ 10,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000
35,000	Accounting	$ 3,000	$ 5,000	$ 2,000	$ 3,500		$ 10,000		$ 3,500			$ 3,000		$ 5,000
130,000	Lobbying	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000
18,000	Office	$ 5,000	$ 2,000	$ 1,000	$ 1,000	$ 1,000	$ 1,000	$ 1,000	$ 1,000	$ 1,000	$ 1,000	$ 1,000	$ 1,000	$ 1,000
66,000	Travel	$ 3,000	$ 3,000	$ 3,000	$ 3,000	$ 6,000	$ 6,000	$ 6,000	$ 6,000	$ 6,000	$ 6,000	$ 6,000	$ 6,000	$ 6,000
30,000	Social Media	$ 5,000	$ 1,000	$ 1,000	$ 1,000	$ 10,000	$ 1,000	$ 1,000	$ 1,000	$ 1,000	$ 1,000	$ 5,000	$ 1,000	$ 1,000
43,000	Grant Writing	$ 20,000	$ 3,000	$ 3,000	$ 2,500	$ 10,000	$ 2,000		$ 2,500					
114,000	Misc	$ 5,000	$ 10,000	$ 10,000	$ 10,000	$ 15,000	$ 25,000	$ 15,000	$ 2,000	$ 5,000	$ 2,000	$ 5,000	$ 5,000	$ 5,000
Pilot Project Hard Costs														
3,000,000	Engineeering	$ 750,000	$ 750,000	$ 800,000	$ 500,000	$ 75,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 20,000	$ 15,000	$ 15,000	$ 15,000
60,000	Legal	$ 25,000	$ 10,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000						
65,000	Site Lease	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000
50,000	Permitting		$ 25,000	$ 25,000										
49,000	Travel		$ 3,000	$ 3,000	$ 3,000	$ 3,000	$ 4,000	$ 4,000	$ 4,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000
150,000	EERC		$ 20,000		$ 20,000		$ 20,000		$ 20,000		$ 20,000	$ 20,000	$ 15,000	$ 15,000
900,000	Misc	$ 10,000	$ 25,000	$ 15,000	$ 50,000	$ 150,000	$ 100,000	$ 100,000	$ 100,000	$ 100,000	$ 100,000	$ 50,000	$ 50,000	$ 50,000
25,000,000	Construction			$ 500,000	$ 1,000,000	$ 2,000,000	$ 6,000,000	$ 6,000,000	$ 4,000,000	$ 4,000,000	$ 1,000,000	$ 500,000		
	(Includes 10% Contingency)													
Totals	**$ 30,000,000**	**$ 881,000**	**$ 897,000**	**$ 1,408,000**	**$ 1,639,000**	**$ 2,305,000**	**$ 6,224,000**	**$ 6,182,000**	**$ 4,190,000**	**$ 4,168,000**	**$ 1,190,000**	**$ 645,000**	**$ 133,000**	**$ 138,000**

IRA Calculation

Eligible basis	$ 29,617,000	$ 840,000	$ 870,000	$ 1,375,000	$ 1,614,000	$ 2,264,000	$ 6,180,000	$ 6,160,000	$ 4,162,000	$ 4,146,000	$ 1,168,000	$ 616,000	$ 111,000	$ 111,000
Rate														
45%	$ 13,327,650													
50%	$ 14,808,500													
60%	$ 17,770,200													

60% ITC for facilities with either domestic content bonus OR located in an "energy" community (but not both) AND with affordable housing bonus
The project may be eligible for up to 60% if we provide power to an affordable housing community

CONFIDENTIAL INFORMATION

The contents of this application include confidential information, including the attached presentation deck.

PATENTS/RIGHTS TO TECHNICAL DATA

US Patent No: 11753591

STATE PROGRAMS AND INCENTIVES

The applicant, as well as owners and managers of the applicant have not participated in any other State of North Dakota grant or loan programs.

INDUSTRIAL COMMISSION OF NORTH DAKOTA

CLEAN SUSTAINABLE ENERGY AUTHORITY

Governor
Doug Burgum
Attorney General
Drew H. Wrigley
Agriculture Commissioner
Doug Goehring

Clean Sustainable Energy Authority Technical Review Committee
January 23, 2024 9:00 AM
Bank of North Dakota Missouri River Conference Room
1200 Memorial Highway, Bismarck, ND
Or Microsoft Teams
Click here to join the meeting
Or call in (audio only)
+1 701-328-0950,,870483764#

(approximately 8:00 am)

I. Call to Order and Determination of Quorum and Opening Comments – *Rep. Glenn Bosch and Sen. Dale Patten, Co-Chairs*

   a. Updates from Industrial Commission and Introduction of New Staff – *Reice Haase*

(approximately 8:10 am)

II. Administration:

   a. **Consideration of July 25th, 2023 Clean Sustainable Energy Authority Meeting Minutes** (Attachment 1)
   b. **Declaration/Consideration of Conflicts of Interest** (Attachment 2)

(approximately 8:20 am)

III. Reports – *Reice Haase*:

   a. Project Management and Financial Report (Attachment 3)
   b. Report on January 16th, 2023 CSEA Technical Review Committee Meeting (Attachment 4)

(approximately 8:30 am)

IV. Presentation from North Dakota Development Fund – *Shayden Akason*

(approximately 9:00 am)

V. Review of Grant Round 5 Applications – Each application will include a summary from the Industrial Commission followed by a presentation by the Applicant and CSEA board member questions

   a. C-05-A – Clean H_2 and N-fertilizer Production Facility; Submitted by Prairie Horizon Energy Solutions LLC; Total Project Costs: $2,200,000,000; Amount Requested: $125,000,000 fertilizer loan (Attachment 5)

(approximately 9:30 am)

   b. C-05-B – Spiritwood Fertilizer Project; Submitted by NextEra Energy Resources Development, LLC; Total Project Costs: $1,293,000,000; Amount Requested: $125,000,000 fertilizer loan (Attachment 6)

Break – approximately 10:00 am

(approximately 10:15 am)

c. C-05-C – "Green" Pig Iron Production Facility; Submitted by Scranton Holding Company/North American Iron, Inc.; Total Project Costs: $2,000,000,000; Amount Requested: $12,000,000 grant (Attachment 7)

(approximately 10:45 am)

d. C-05-D – Unlocking the Full Potential of Produced Water (3rd Ask); Submitted by Wellspring Hydro; Total Project Costs: $324,730,000; Amount Requested: $5,000,000 grant, $25,000,000 loan (Attachment 8)

(approximately 11:15 am)

e. C-05-E – Blue Ammonia Facility; Submitted by Catalyst Midstream (USA) LLC; Total Project Costs: $960,000,000; Amount Requested: $10,000,000 grant (Attachment 9)

Break – approximately 11:45 am; Meeting will resume as a working lunch for Board Members

(approximately 12:00 pm)

f. C-05-G – Dickinson Renewable Fuel Facility Expansion; Submitted by EERC; Total Project Costs: $21,761,930; Amount Requested: $10,000,000 grant (Attachment 10)

(approximately 12:30 pm)

g. C-05-H – Energy Storage Technology for Lithium-Ion Batteries; Submitted by Dakota Lithium Materials; Total Project Costs: $10,250,000; Amount Requested: $4,000,000 grant (Attachment 11)

(approximately 1:00 pm)

h. C-05-I – Grand Power North Dakota Battery Manufacturing Plant; Submitted by Packet Digital; Total Project Costs: $56,558,592; Amount Requested: $10,000,000 grant, $17,355,992 loan (Attachment 12)

(approximately 1:30 pm)

i. C-05-J – Carbon Convert Prototype; Submitted by Carbon Convert; Total Project Costs: $4,500,000; Amount Requested: $500,000 grant (Attachment 13)

Break – approximately 2:00 pm

(approximately 2:15 pm)

j. C-05-K – Cerilon GTL (2nd Ask); Submitted by Cerilon; Total Project Costs: $3,600,000,000; Amount Requested: $20,000,000 grant, $80,000,000 loan (Attachment 14)

(approximately 2:45 pm)

k. C-05-L – NDeV Flare Gas Mitigation Project; Submitted by ND Energy Ventures; Total Project Costs: $30,000,000; Amount Requested: $3,000,000 grant, $10,000,000 loan (Attachment 15)

(approximately 3:15 pm)

Consideration of motion to enter Executive Session pursuant to N.D.C.C. 54-63.1-06 and 44-04-19.2

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l. *Review of Confidential Application Attachments* (Confidential Attachments 5-15)

VI. Review of Confidential Bank of North Dakota Information – *Todd Steinwand* (Confidential Attachment 16)

Meeting Returns to Open Session

(approximately 4:30 pm)

VII. **Vote on funding recommendations for each application**

VIII. Other Business

IX. Adjournment

***Bold items require Committee action.**