Title: Feasibility Study: CO2 Free Coal Liquefaction and Germanium and Rare Earths Recovery from Coal Liquefaction Byproducts

Submitted By: **C2XX Corporation**

PM/PI: **Richard Bauman**

Duration: **18 Months**

Purpose:

C2XX is proposing a Class 3 Feasibility Study for an initial direct Microcat Coal Liquefaction (MCL) coal liquefaction facility with production capacity between 40,000 bpd and 160,000 bpd in the vicinity of Beulah, North Dakota. With our direct MCL technology we will be able to produce 3.5-4 barrels of jet fuel, diesel, and gasoline per ton of dry coal without CO2 emissions. The study will also include the viability of recovering germanium and other rare earths from direct coal liquefaction byproducts. In addition, TerraSync will be evaluated for CO2 carbon offset credits and increase in biomass production.

The proposed project is a great fit for the Lignite Research Program, as part of the pursuit of expanding markets for North Dakota lignite into a new industry. With our technology, North Dakota's recoverable lignite reserves can be looked at as an equivalent oil find of 60-100 billion barrels of motor and aviation fuel. Production by products would be an excellent source of germanium and other rare earths.

Funding: NDIC: $600,000; Total Project Costs: $1,200,000

Conflicts of Interest: N/A

Critical Partners: Flour Engineering, Accelergy

30SEP2025
Mr. Richard Bauman
Chief Executive Officer
C2XX Corporation
4611 Van Wick Lane
Bellingham Washington, 98226.

Dear Mr. Jordan Kannianen:

Subject: C2XX Proposal Entitled “Feasibility Study: CO2 Free Coal Liquefaction, and Germanium and Rare Earths Recovery from Coal Liquefaction Byproducts”

C2XX Corporation is pleased to submit the subject proposal to the Lignite Research, Development and Marketing Program. C2XX is appreciative of the opportunity to explore the feasibility of a fully operational Coal to Liquids (CTL) facility in central North Dakota. We are a self-funded organization. Assistance from the North Dakota Industrial Commission to fund our 3rd party feasibility study for our first facility is viewed to be highly valuable.

If you have any questions, please contact me by telephone at (650) 380-6877 or by email at rfbauman63@gmail.com.

Sincerely,

Richard Bauman
CEO, C2XX Corporation

Lignite Research, Development and Marketing Program

North Dakota Industrial Commission

Application

Project Title: Feasibility Study: CO2-Free Coal Liquefaction, and Germanium and Rare Earths Recovery from Coal Liquefaction Byproducts

Applicant: C2XX Corporation

Principal Investigator: Richard Bauman

Date of Application: 30SEP2025

Amount of Request: $600,000

Total Amount of Proposed Project: $1,200,000

Duration of Project: 18 months

Point of Contact (POC): Richard Bauman

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Bellingham, Washington 98226

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ABSTRACT

Direct Coal Liquefaction (DCL) is a method of processing various coals into motor and aviation fuels. DCL has been around since the 1930's. Our goal is to apply this technology into the 21st century. We are proposing a 40k to 160k bpd Coal to Liquid fuels (CTL) plant located potentially in west central North Dakota. We are confident that we can turn one ton of dry lignite into 3.5 - 4 barrels of primarily jet fuel and diesel. The Advanced MCL process is meticulously designed to maximize fuel product output and to minimize emissions. The research, pilot plant testing, and the plant design are Technically Ready for commercialization. Our next step is for Fluor Engineering to perform a Class 3 Feasibility Study to define capital investment with a variability of +/-30%. Since the construction of an operational facility is capital intensive, interested parties have requested C2XX to perform a Feasibility Study before proceeding with detailed engineering. Additional funding needs include legal, patent fees, engineering expenses, bench scale testing, etc. We are currently a self-funded organization seeking $600,000 from the NDIC, totaling $1.2 million in funding.

PROJECT OVERVIEW

C2XX BOTTOM LINE:

We are working on the first coal Advanced MCL project that will primarily produce high-performance jet fuel, diesel and a minor amount gasoline from North Dakota lignite feedstock, without CO2 emissions, with higher return on investment than refining of imported bitumen. Our team leader, Richard Bauman is a former director of R&D CTL Technologies with Exxon Mobil, later becoming the Chief Technical Officer of Accelergy Corp. Today, Rich is the founder and Chief Executive Officer of C2XX Corp where he and his highly experienced team have continued to improve on the technology. We are presently waiting on two revolutionary patents which are undergoing final review with the U.S. Patent Office. After the review, our brand of proprietary CTL technology will be ready for commercial use. Currently, we are at a funding bottleneck.

PROJECT SUMMARY:

There are sufficient proven coal reserves in the U.S. to produce 1,000 billion barrels of premium diesel, jet fuel and gasoline which is much larger than the 170 billion barrels of bitumen that can be produced in Canada and far exceed U.S. oil reserves. Current plant designs set capacity between 40k and 120k bpd with after tax operating returns between 12% and 25% respectively (parameters at $60 per barrel). The location will most likely be in west central North Dakota. Feedstock will be North Dakota lignite. Technology allows the plant to operate without CO2 emissions to mitigate regulation interference and to appease climate conscious financial institutions. TerraSync could also be utilized to offset emissions from mining, power generation or max MCL plant capacity. Currently, we are in talks with both out-of-state and in-state entities. Our preferred outcome would be to grow industries in the State of North Dakota for germanium and rare earths recovery, high-density jet fuel and diesel production, TerraSync for off-setting emissions from facilities such as power stations and providing a replacement for ammonia production.

MARKET POTENTIAL:

The timing is perfect. DCL is more than capable of meeting US domestic longer-term demands without reliance on foreign imports. US fracked shale crude is primarily used as feedstock for gasoline which does not match the current and long-term domestic market for jet and diesel fuel. Canadian bitumen represents limited hard-to-recover reserves, subjected to tariffs and emission penalties. Conflicts near key shipping lanes have increased transportation cost and OPEC nations are in volatile neighborhoods. In addition, Venezuelan crude is being phased

out of the western world markets. Russian and Iranian energy sanctions are expected to hold. Due to the Chinese one-belt one-road initiative, most African and Southeast Asian finds are heading to the Chinese market. Globally, the world market has about 50-70 years of recoverable oil reserves and there is only enough recoverable lithium on the planet for 400 million electric vehicles. That is a deficit of 1.6 billion vehicles. The world needs motor and aviation fuels and we can meet and exceed demand with coal.

DEFENSE APPLICATIONS:

Sixth generation advanced aircraft, such as the F47 and the RQ-180, performance will be enhanced by use of specialized high density aviation fuel that can be easily produced in the MCL process and can extend the range of cruise missiles and enhance the performance of hypersonic ramjets and scramjet engines. In general, coal derived synthetic jet fuels are consistent and can increase flight time by 10-15% while also achieving desired top speeds. Strategically, if the industry turns to utilizing solely North Dakota coal feedstock utilizing our technology, it is an equivalent to an oil find of 60-100 billion barrels or 1000+ billion barrels considering the United States' total coal reserves. F-35s, SR-47s, U2s, Global Hawks, TLAMs anything can fly faster, higher, and longer with our fuel. It will run in both the Army's AGT1500 turbine engine and the Navy's LM2500 turbine engine. The CCP already has an operational direct coal liquefaction plant (Shenhua) but Sinopec agrees that C2XX's MCL technology is far superior. Even so, they have approved construction of 2 additional projects. C2XX has been unwilling to provide our technology due to ITAR regulation and the unwillingness of the Chinese to pay a Technology Access Fee. There is, of course, the concerns of IP theft. In the event of conflict, supply lines will be severely disrupted, and domestic production of crucial fuels would be utmost critical. As mentioned above, the United State is not able to relay on its domestic reserves entirely and reliance on imports through vulnerable shipping lanes are not ideal.

RARE EARTHS AND GERMANIUM:

Germanium is a critical element in high demand in the defense and telecommunication industries. The DCL bottoms purge stream are high in germanium and rare earths. In the past, we evaluated recovery of our catalyst from the bottoms. We think the recovery technology for rare earth and germanium will also apply for recovery of the MCL catalyst. This will have a significant impact on the economics of the MCL application. We believe the best way forward would be collaboration with UND, EERC and Microbeam Technologies if the opportunity should arise.

TERRASYNC

TerraSync is ready for commercial, large-scale applications and will offset CO2 emissions from power plants and some advanced configurations of MCL. In the process, CO2 and water are converted into cyanobacteria (blue, green algae) and applied to fields via crop dusters. After application, the algae continues to grow and consume CO2, it also fixes nitrogen from the air to fertilize the fields and reduce the need for ammonia. Historically, it's the same mechanism that raised the carbon content of soil (fertility) and increased the oxygen content of the air we breathe.

ADDITIONAL DETAILS

MCL is the accepted worldwide leading DCL technology. C2XX has an active partnership with Sinopec. Multiple companies have requested Chinese projects. Execution did not occur due to the Chinese were unwilling to provide Technical Access Fees and U.S. limits on exporting jet fuel production technologies.

Sinopec agrees that our coal to MCL produces 50% more products than Fischer-Tropsch. Recent advances reduce CO2 emissions by utilizing coal liquefaction heat of reaction to eliminate slurry preheat furnace.

S, N, and O in products from liquefaction are readily removed in a distillate hydrotreater. Aromatics can be converted to naphthenes, which are ideal for production of premium diesel and jet fuels with a yield of greater than 60% of product having high BTU-per-gallon, low Pour or Freeze point and low carbon formation. The diesel meets low sulfur Arctic diesel specs. The jet fuel is superior to conventional refinery-derived diesel fuel. The superior properties of MCL jet fuel were confirmed at EERC. Shell Global Solutions ultimately declared Technical Readiness for upgrading of MCL distillate. The military has expressed interest in a Single Battlefield Fuel. MCL is the source of that fuel.

Un-hydrogenated MCL product that is hydrocracked to naphtha and catalytically reformed is also an excellent feed for a chemical plant for the production of aromatics or plastics. The aromatic content can be as high as 90 percent versus 50 percent from a typical refinery.

HOW NORTH DAKOTA BENEFITS

The proposed project positions North Dakota at the forefront of Advanced MCL by transforming its abundant lignite reserves into high-performance, zero-sulfur fuels, germanium, rare earths, and an alternative to Carbon Capture and Sequestration. By applying modern C2XX technologies, North Dakota's coal base can be converted into the equivalent of an oil find of 60-100 billion barrels, placing North Dakota between the UAE and Iraq in terms of reserves. This scale of potential production far exceeds the current conventional and unconventional petroleum reserves in the United States and establishes the state as a strategic leader in U.S. energy security and fuel independence.

The economic benefits for North Dakota are substantial. Construction of the first commercial facility, at a scale of 40,000–120,000 barrels per day, will require $4–6 billion in direct capital investment, generating over a thousand construction jobs and more than 200 permanent, high-paying operations positions, furthering the economic development for the region. The project will also sustain and expand lignite mining activity, ensuring steady demand for North Dakota lignite while producing significant property, income, and production tax revenues for state and local governments. Beyond direct employment, secondary benefits will extend to equipment suppliers, transport services, local businesses, and universities engaged in workforce development.

In parallel, the project enhances the environmental and strategic value of North Dakota's energy industry. The technology is designed to eliminate CO_2 emissions and deliver ultra-clean, zero-sulfur fuels that outperform conventional petroleum products. These fuels are critical not only for commercial markets but also for defense applications, where consistency and energy density provide measurable advantages for advanced aircraft and next-generation systems. The potential to recover germanium and rare earth elements from process byproducts positions North Dakota as a domestic source of critical minerals through its lignite reserved, reducing reliance on foreign suppliers all while not losing the utility of the lignite itself by processing the rare earths out of it.

Finally, with the prospect of the Heartland Hydrogen Hub providing abundant H2 feedstock to the State North Dakota, the combination of abundant lignite reserves, the federally backed H2 infrastructure, C2XX's advanced MCL coal liquefaction technology, and TerraSync's carbon capture/soil-enhancement platform positions North Dakota as the nation's model for innovative, carbon-free liquid fuel production. By integrating Hydrogen Hub into the MCL equation and leveraging TerraSync to further offset any partnered organization's carbon emissions, North Dakota can not only decarbonize fuel production but also add critical value through domestic energy security, agricultural benefits, and strategic minerals recovery.

STANDARDS OF SUCCESS

The primary standard of success for this project is the completion of a Class 3 Feasibility Study conducted by Fluor Engineering that provides a reliable capital cost estimate within +/-30% accuracy for a 40,000–120,000 barrel per day direct coal liquefaction facility in North Dakota. A successful outcome will be defined by Fluor's independent validation of the technical readiness, process design, and economic viability of the C2XX technology for commercial-scale deployment.

Specific measures of success include:

1. Technical Validation: Confirmation that the process design can reliably convert dry lignite feedstock into 4–5 barrels of clean fuels per ton of coal with zero CO_2 emissions, as projected in internal studies.
2. Economic Benchmarks: Independent analysis demonstrating after-tax operating returns in the range of 12–35% at $60/barrel oil prices.
3. Environmental Performance: Verification that the proposed design meets or exceeds regulatory requirements for emissions control, while producing ultra-clean, zero-sulfur products.
4. Byproduct Potential: Evaluation of the recovery of germanium and other critical minerals from plant byproducts, including preliminary economics of integrating this recovery into the facility.
5. Commercial Readiness: Production of a feasibility report that enables potential operators, investors, and government stakeholders to move confidently toward detailed engineering, financing, and construction of the first North Dakota plant.

Success will ultimately be measured by the ability of this feasibility study to de-risk the project, attract commercial partners, and accelerate investment decisions, thereby paving the way for construction of the first large-scale coal-to-liquids facility in North Dakota and the United States.