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May 19, 2023

North Dakota Industrial Commission

Attn: Clean Sustainable Energy Program
State Capitol – Fourteenth Floor
600 East Boulevard
Bismarck, ND 58505

To whom it may concern:

Subject: Lignite Combustion Product Enhancement

Rainbow Energy Center is pleased to submit an original and one copy of the subject proposal in partnership with EcoMaterials Technologies, Inc. and Barr Engineering Co. The application solicits the support of the Clean Sustainable Energy Authority Program for the execution of a fully commercialized operation to optimize the beneficial use of both bottom ash material and flue gas desulfurization (FGD) materials at Coal Creek Station, an 1151-megawatt coal-fired power plant located between Washburn and Underwood, North Dakota. The proposed project will result in the commercial facilities necessary to process these materials to bring them to commercial grade for utilization as commodities as compared to permanent storage in solid waste facilities. Building on the experiences in other states, the project will launch a system of waste handling that is a first of its kind in North Dakota.

The project team proposes to advance on-site capabilities to manage coal combustion materials previously disposed of as waste and convert them into commodities ready to market through the region. The project team aims to serve as an example of how North Dakota can deploy additional technologies at existing coal-fired power plants to reduce CO₂ emissions, improve the marketability of coal combustion products, reduce waste and pursue Governor Burgum's goal of carbon neutrality by 2030.

If you have any questions, please contact Jessica Bell by phone at (701) 891-9708 or by e-mail at jessica.bell@rainbowenergycenter.com.

Sincerely,

A handwritten signature in black ink, appearing to read "Stacy L. Tschider".

Stacy L. Tschider
President

Enclosures

Clean Sustainable Energy Authority

North Dakota Industrial Commission

Application

Project Title: Lignite Combustion Product Enhancements

Applicant: Rainbow Energy Center

Date of Application: May 19, 2022

Amount of Request

Grant: \$0

Loan: \$42,500,000

**Total Amount of Proposed Project:
\$85,000,000**

**Duration of Project: 30 months
(May 2023 – October 2025)**

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ABSTRACT

Objective: The objective of this project is to support the Clean Sustainable Energy Authority (CSEA) goal that focuses on the reduced environmental impacts and increased energy sustainability. The project also brings increased value to North Dakota. To support these objectives, the project team proposes to complete a fully commercialized operation to optimize the beneficial use of both bottom ash material and flue gas desulfurization (FGD) materials at Coal Creek Station, an 1151-megawatt coal-fired power plant located between Washburn and Underwood, North Dakota. The proposed project will result in the commercial facilities necessary to process these materials to bring them to commercial grade for utilization as commodities as compared to permanent storage in solid waste facilities. Building on the experiences in other states, the project will launch a system of lignite coal combustion material transformation that is a first of its kind in North Dakota. Project details include a) detailed design and costing of materials to build the drying and grinding facilities; b) engineering and material balances required to file for all project permits; and c) materials needed to commercialize enhanced management of coal combustion materials. The project team proposes to advance on-site capabilities to manage coal combustion materials previously disposed of in solid waste facilities and convert them into commodities ready to market throughout the region.

Expected Results: This project will establish a design basis and cost estimate possessing sufficient detail to support the final construction of equipment on site at Coal Creek Station. Upon its completion, Coal Creek Station will have the equipment needed to convert coal combustion materials such as bottom ash and FGD materials to commodity-grade products, including bottom ash at ASTM- C618-23^{E 1} and quality gypsum material. Ultimately, this will result in technological advancements with our partners that reduce environmental impacts and increase sustainability of coal electricity production through reducing the amount of non-marketable products placed in permanent storage and CO₂ emissions. The project team aims to serve as an example of how North Dakota can deploy additional technologies at existing coal-fired power plants to reduce CO₂ emissions, improve the marketability of coal combustion products, reduce disposal of valuable products and pursue Governor Burgum's goal of carbon neutrality by 2030.

Duration: 30 months (May 2023 – October 2025)

Total Project Cost: The proposed total cost is \$85,000,000, with \$42,500,000 loan from the North Dakota Industrial Commission (NDIC) and \$42,500,000 cash from Rainbow Energy Center, LLC (Rainbow Energy Center).

Participants: The project lead is Rainbow Energy Center, and the project will be conducted in partnership with EcoMaterial Technologies, Inc., Barr Engineering Co. and NDIC through the Clean Sustainable Energy Authority.

PROJECT DESCRIPTION

Objectives: The objective of this project is to support the Clean Sustainable Energy Authority (CSEA) goal that focuses on the reduced environmental impacts and increased energy sustainability. The project also brings increased value to North Dakota. To support these objectives, the project team proposes to complete a fully commercialized operation to optimize the beneficial use of both bottom ash material and flue gas desulfurization (FGD) materials at Coal Creek Station, an 1151-megawatt coal-fired power plant located between Washburn and Underwood, North Dakota. The proposed project will result in the commercial facilities necessary to process these materials to bring them to commercial grade for utilization as commodities as compared to permanent storage in solid waste facilities. Building on the experiences in other states, the project will launch a system of lignite coal combustion material transformation that is the first of its kind in North Dakota. Project details include a) detailed design and costing of materials to build the drying and grinding facilities; b) engineering and material balances required to file for all project permits; and c) materials needed to commercialize enhanced management of coal combustion materials. The project team proposes to advance on-site capabilities to manage coal combustion materials previously disposed of in solid waste facilities and convert them into commodities ready to market throughout the region.

Methodology: The tasks for this project are outlined in the details below. Barr Engineering Co. will work concurrently with EcoMaterial Technologies and REC staff to implement the initiatives outlined in this proposal to be completed by June of 2025. Engineering and design details will be completed for both facilities prior to construction commencement. Upon completion of construction, facilities will operate as outlined in the details provided in this application.

Project Management and Planning: The management of all project activities will be performed by REC personnel over the duration of the project period of performance as well as the operation of the facilities. Barr Engineering Co and EcoMaterials Technology Inc will be resources for these tasks that include communication of project activities and direction with the project team to provide updates and obtain inputs to prioritize the project focus. Specific activities will include task coordination, risk management/mediation, managing budget resources and subcontractors, the preparation of a comprehensive final report, securing cost-share dollars, and planning and executing project status meetings.

Engineering and Design: This task will focus on the engineering and design of the bottom ash grinding, the FGD processing facilities, and the integration into plant operation. Barr Engineering Co has completed the development of the design for the FGD process and will utilize this design to complete construction and begin processing the FGD materials. EcoMaterials Technology Inc has recently completed a bottom ash grinding facility in Texas and will be able to reference this success through the development of this site to begin marketing the product into the commercial marketplace.

Anticipated Results: The project results will support the mission of the CSEA to develop and deploy large-scale commercial projects that reduce environmental impacts and increase the sustainability of energy production. Results will support advancement of the current state of the art technologies to include 1) oxidization of FGD material to industry specifications, 2) the grinding of bottom ash material to industry specifications, 3) elimination of the need to dispose of large amounts of lignite coal combustion materials in solid waste facilities and 4) reduction of carbon dioxide in concrete and other products. Deliverables will include a detailed design basis and on-site equipment that would result in the

production of products deliverable to the market for consumption in the region, growing and diversifying the state's economy.

Facilities: The project experts anticipate footprints of 7.5 to 8 acres for these facilities to process the coal ash products for beneficial application. Bottom ash handling will consist of dewatering the product and grinding the ash to combine with other coal ash products for market. This will require multiple siloes, heat, and a mill to create a marketable product that can be beneficial. FGD will be processed in a processing building of vacuum belts through oxidization resulting in a product prepared to bring into a market that requires an additional step of processing to be a wallboard or agricultural beneficial products. Partners for these processes are Barr Engineering to complete the FGD processing with specific application to the Coal Creek FGD stream and EcoMaterials as the marketing partner for these products.

Resources: A team of industry experts will perform all project activities with Rainbow Energy Center overseeing the project in its entirety. For over 25 years, EcoMaterials Technology Inc has successfully marketed Coal Creek Station's coal ash products into markets across the US. EcoMaterials and their subsidiary, Synmat, have expertise in marketing all products that are expected to be produced with these additional technologies. Barr Engineering Co has dedicated resources into specifically researching Coal Creek Station's FGD stream to develop a process that will be site specific for the material produced. Barr Engineering has over 55 years of experience working in various plant sites in the area and has historical expertise working at Coal Creek Station since the commissioning of the units into commercial operation. The engineering and scientific research staff is equipped with state-of-the-art analytical, modeling, and engineering facilities to address a wide variety of energy, environmental, and mineral resource research topics. Both EcoMaterials Technology, Inc. and Barr Engineering Co. are committed to providing all necessary personnel and resources to ensure the timely completion of all activities outlined in this proposal. Industry sponsor and future plant owner Rainbow Energy Center will provide additional project advisory services. EcoMaterials and Barr Engineering have been a part of project teams that have executed similar project scopes of work focused on North Dakota utilities and bring experience gained from design and construction multiple other facilities that are similar to these proposed for Rainbow Energy Center.

Techniques to Be Used, Their Availability, and Capability: The foundation of the techniques to be used for these processes is one that many other utilities have utilized to handle their coal ash materials. The intention is to tie multiple technologies together and create a beneficial use of the products to create and grow a revenue stream.

The Bottom Ash facility will consist of a dewatering area as well as a pulverizer that grinds the material into a usable size that is consistent with our currently marketed fly ash. Once that material passes through the pulverizer, it will be blended with the fly ash and marketed to end users. Once the project is complete and the site is operational, it will be running as an ongoing process for our site. It will be able to process and blend 350k tons of bottom ash that REC has identified as a maximum in the previous 5 years.

The FGD processing facility will be made up of a process that will dry the FGD material and process it through oxidization and vacuum filtering techniques. There are multiple markets that can be impacted by this production process as a beneficial use. These markets consist of agricultural uses, wallboard

production, and cement intergrind. The expectations for this FGD end-product will depend on the process chosen given the markets and costs associated with achieving required specifications for each operation. An estimation of 165k tons of FGD material has been identified as the capacity for this facility based on the current operational production at Coal Creek Station.

Environmental and Economic Impacts While Project Is under Way: The proposed projects will require new environmental permits as well as the modification of existing environmental permits from the North Dakota Department of Environmental Quality. These projects will not affect any existing or partner facilities.

Ultimate Technological and Economic Impacts: The lignite-fired power plants in ND present an opportunity to economically demonstrate the utilization of Coal Ash while reducing environmental impacts. The economic health of the central region of North Dakota is tied to energy jobs in the area. Currently, the lignite industry directly employs 3623 people, with another 9500 indirect employees supported by the industry, accounting for over \$5.4 billion in economic impact. Technology advances that continue the responsible use of lignite and bring new industries to the region are critically needed to sustain and grow these jobs. This project provides a basis to market coal ash materials. It is a large-scale commercial project that will reduce environmental impacts and increase sustainability of energy production and delivery.

Why the Project Is Needed: The management of coal combustion residuals is a priority for Coal Creek Station. Conversations with regulators at the state and federal levels have resulted in an even deeper look into options for beneficial uses of lignite coal combustion residuals. As the concrete market continually calls for more fly ash, already currently utilized for beneficial use in concrete, it was determined that Coal Creek Station's bottom ash could be utilized and sold in the same market as it's fly ash. Market specifications require the material to be dried and ground to qualify for beneficial use in the concrete market, as is requested in this proposal.

FGD material at Coal Creek Station is currently disposed of in a coal combustion residuals solid waste facility regulated by both the state of North Dakota's Department of Environmental Quality (DEQ) and the United States Environmental Protection Agency (EPA). If oxidized and dried, this material could qualify for beneficial use in several ways as gypsum. The EPA released a study in 2023 qualifying this oxidized and dried FGD material for beneficial use on agricultural lands. Industry spec gypsum can also be used in wallboard and cement. In order for proper oxidation and drying to occur, special equipment is needed, and the cost of that equipment is included in this proposal.

The beneficial use of fly ash, bottom ash, and FGD as gypsum reduces carbon dioxide (CO₂) emissions as they replace other products currently on the market that produce CO₂ emissions while being created and processed. Beneficial use also reduces the amount of material that needs to be disposed of in landfills decreasing environmental impact and footprints.

This project is set up for success, as it is driven by three major forces: markets, economics and environmental improvements. Markets continually demand additional ash for use in concrete, and the bottom ash will qualify as high-quality spec material to be included in that product. The business case for these sales continue to be strong, and Rainbow Energy Center is excited to partner with Eco Material Technologies to further penetrate that market. Eco Material Technologies will also play a large role in marketing the gypsum material once it is converted so that it can be used for agricultural purposes, wallboard creation or to further enhance concrete materials. Beneficial use of these materials has environmental benefits to improve the sustainability of our day to day life. The longevity of a project of

this size is immense, as this project will drastically reduce the need for permanent storage and disposal of coal combustion residuals.

The new drying and grinding facilities will produce high-grade materials, enhancing the byproduct markets and adding value to North Dakota through growing and diversifying the state's economy. By seeking a way to use these materials in a beneficial way, Coal Creek Station will be able to continue to utilize lignite to create electricity in a carbon-constrained world. This project supports the core mission of the CSEA to develop large-scale commercial projects which reduce environmental impacts and increase sustainability of energy production and delivery.

STANDARDS OF SUCCESS

This project accelerates environmental stewardship and the enhancement of carbon management at Coal Creek Station. The pathway for success for Coal Creek Station has been outlined through projects such as carbon capture technology and integration of renewables into the electricity production mix. Enhancing this vision by promoting beneficial use of materials previously disposed of is yet another example of the environmental excellence we strive for at Coal Creek Station. Reducing our carbon footprint helps the state of North Dakota get one step closer to achieving their goal of carbon neutrality by 2030. Taking the steps needed to add beneficial use of our products not only extends the life of Coal Creek Station, it enhances and diversifies North Dakota's economy in a way all citizens benefit from. This creation of jobs, both direct and indirect, also helps the local communities and economy remain strong.

BACKGROUND/QUALIFICATIONS

Rainbow Energy Center (REC) plans to dewater the solids generated by the Coal Creek Station Units 1&2 flue gas desulfurization (FGD) system. The FGD bleed stream solids are mostly calcium sulfite. The FGD will be sent to a new facility that will oxidize (inject air) to produce calcium sulfate or better known as Gypsum. The process entails oxidizing the FGD slurry in a series of large tanks. Once the oxidation occurs that material stream will go to a series of vacuum belts that will dewater the material to 15% moisture. The gypsum will then be loaded onto trucks or railcars to send out to market. Approximately 175,000 tons of gypsum will be produced each year.

Rainbow Energy Center plans to grind the solids generated by the Coal Creek Station Units 1&2 boiler bottom ash (BA) system. Conveyance of the BA will remain the same by sluicing it to a dewatering area. Once in the dewatering area the BA will be piled to dewater and transported by large haul trucks to a new processing system. BA will be pulverized and blended with our current flyash stream. The final blended product will then be loaded onto trucks or railcars to send out to market. Approximately 300,000 tons of BA will be processed each year.

Project Team: Rainbow Energy Center will serve as the lead organization for this project. Dwayne Rhodes, Doug Rhodes, and Jim Glass with EcoMaterials Technologies Inc will focus on the continued marketing and sales of the bottom ash and fly ash into their existing markets, as well as introduce the sale of gypsum into the market.

Rainbow Energy Center is committed to executing a fully commercialized operation to optimize the beneficial use of both bottom ash material and flue gas desulfurization (FGD) materials at Coal Creek Station. Key personnel from Rainbow Energy include Stacy Tschider (President), Jeff Jonson (Executive Vice President), Chris Faul (VP Operations), Lyndsey Roemmich (VP Finance), Jackie Fleck (Director of Business Development) Jessica Bell (Director of Government Relations & Public Affairs), Jon Price (Special Projects Manager) and John Bauer (current Plant Manager).

MANAGEMENT

REC is the lead organization for this project and will oversee all tasks and management activities associated with this project. REC will schedule regular internal and external meetings with project staff and advisors to ensure that the project is conducted using acceptable scientific methodologies and practices in accordance with the project plan (budget, schedule, deliverables, and milestones) and is meeting quality objectives. EcoMaterials Technology, Inc. in conjunction with their subsidiary Synmat, will research and develop the market for these products and identify additional infrastructure that may be needed to support logistical aspects of marketing these products. EcoMaterials Technology, Inc. will also use their previous experience from developing and completing their project to operation in order to complete the bottom ash processing facility. Barr Engineering Co. will be the developing engineer for the FGD processing facility and work with REC to complete the FGD processing to operation.

Once the project is initiated, the project team will engage in weekly conference calls to review project status and future directions. Quarterly reports will be prepared and submitted to project sponsors for review. Regular meetings will be held 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 Figures 1 and 2. The milestones and deliverables are at key times during the project design, permitting, and costing components of the project. 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

The project timeline can be found in Figures 1 and 2. The combination of both projects is scheduled for 30 months, with a projected start date of May 2023. The start date may depend on procurement of the Coal Creek Station by Rainbow Energy Center. This timeline is necessary to maintain a schedule that could allow for operation to begin by October 2025.

➔	▲ Engineering	215 days	Tue 5/9/23	Mon 3/4/24
➔	▸ Design Engineering	170 days	Tue 5/9/23	Mon 1/1/24
➔	▸ Permitting	160 days	Tue 7/25/23	Mon 3/4/24
➔	▲ Procurement	245 days	Tue 6/6/23	Mon 5/13/24
➔	Grinding Mill	44 wks	Tue 6/6/23	Mon 4/8/24
➔	Raw Ash Building	28 wks	Tue 8/15/23	Mon 2/26/24
➔	Switchgear	45 wks	Tue 7/4/23	Mon 5/13/24
➔	1500 ton silos	34 wks	Tue 9/5/23	Mon 4/29/24
➔	1000 ton silos	30 wks	Tue 9/5/23	Mon 4/1/24
➔	500 ton silo	30 wks	Tue 9/5/23	Mon 4/1/24
➔	▲ Implementation	461 days	Mon 5/1/23	Mon 2/3/25
➔	▸ Civil	271 days	Mon 5/1/23	Mon 5/13/24
➔	▸ Mechanical	255 days	Tue 10/24/23	Mon 10/14/24
➔	Electrical	35 wks	Tue 6/4/24	Mon 2/3/25
➔	Dry commissioning	6 wks	Tue 2/4/25	Mon 3/17/25
➔	Process commissioning	4 wks	Tue 3/18/25	Mon 4/14/25
➔	Turnover to Operations	1 day?	Tue 4/15/25	Tue 4/15/25
➔	Punchlist Items	7 wks	Tue 4/15/25	Mon 6/2/25
➔	Final Completion	0 days	Mon 6/2/25	Mon 6/2/25

Figure 1. Bottom Ash Project Gantt chart.

Task Name	Duration	Start	Finish
Coal Creek Station - FGD Dewatering	220 wks	Thu 7/15/21 8:00 AM	Wed 10/1/25 5:00 PM
Phase 1 - Preliminary Engineering	89.4 wks	Thu 7/15/21 8:00 AM	Sat 4/1/23 8:00 AM
Project Kick-off and Preliminary Engineering	6 wks	Fri 7/15/22 8:00 AM	Thu 8/25/22 5:00 PM
Prepare Design Basis Document (includes BoD, GA, PFD, prelim eqpt list)	12.6 wks	Fri 8/26/22 8:00 AM	Tue 11/22/22 5:00 PM
Submit Design Basis to client for review	18.6 wks	Mon 10/17/22 8:00 AM	Wed 2/22/23 5:00 PM
Phase 2 - Detailed Engineering	57.8 wks	Thu 3/2/23 8:00 AM	Tue 4/9/24 5:00 PM
Preliminary design: Oxidation sys; Dewatering sys; WW treatment; Major BOP	39.4 wks	Wed 3/15/23 8:00 AM	Thu 12/14/23 5:00 PM
Prepare oxidation & dewatering equipment RFP	11.8 wks	Wed 3/15/23 8:00 AM	Mon 6/5/23 5:00 PM
B&W engineering study, preliminary design	21.6 wks	Wed 3/15/23 8:00 AM	Fri 8/11/23 5:00 PM
Prepare other major equipment specifications	15.2 wks	Fri 8/11/23 5:00 PM	Mon 11/27/23 5:00 PM
Detailed Design	90.4 wks	Mon 7/18/22 8:00 AM	Tue 4/9/24 5:00 PM
Civil Site	6 wks	Mon 7/18/22 8:00 AM	Fri 8/26/22 5:00 PM
Geotechnical	27.4 wks	Mon 8/22/22 8:00 AM	Wed 3/1/23 8:00 AM
Phase 3 - Construction	90.6 wks	Mon 1/8/24 8:00 AM	Wed 10/1/25 5:00 PM
Procurement	66.2 wks	Mon 1/8/24 5:00 PM	Tue 4/15/25 5:00 PM
Major equipment procurement (transformer critical path)	66.4 wks	Mon 1/8/24 8:00 AM	Tue 4/15/25 5:00 PM
Startup and commissioning	10.6 wks	Mon 7/21/25 8:00 AM	Wed 10/1/25 5:00 PM

Figure 2. FGD Project Gantt chart.

BUDGET

The proposed budget is \$85,000,000, with \$42,500,000 loan from NDIC and \$42,500,000 cash from Rainbow Energy Center. The budget includes all engineering, equipment, building materials, construction, and commissioning of the facilities. The detailed breakdown is shown in Table 1. The budget notes can be found in Appendix G.

Table 1. Estimated Capital Costs				
Project Associated Expense	NDIC Grant	NDIC Loan	Rainbow Energy Center Share (Cash)	Total Project
Mobilization, demolition, and sitework	\$ -	\$ 999,146	\$ 999,146	\$ 1,998,291
Foundations and concrete	-	719,255	719,255	1,438,509
Engineering	-	105,000	105,000	210,000
Equipment		-	-	-
Mechanical	-	10,497,307	10,497,307	20,994,614
Electrical	-	2,992,633	2,992,633	5,985,265
Storage	-	2,087,500	2,087,500	4,175,000
Material Handling	-	1,428,901	1,428,901	2,857,802
Process	-	3,795,608	3,795,608	7,591,217
Other	-	294,500	294,500	589,000
Architecture, steel and building	-	4,128,184	4,128,184	8,256,369
Construction	-	-	-	-
Structural	-	2,855,500	2,855,500	5,711,000
Mechanical	-	2,950,830	2,950,830	5,901,659
Electrical	-	2,800,000	2,800,000	5,600,000
Other	-	834,594	834,594	1,669,188
Commissioning	-	606,127	606,127	1,212,255
Indirect costs	-	5,404,915	5,404,915	10,809,831
Total Project Costs	\$ -	\$ 42,500,000	\$ 42,500,000	\$ 85,000,000

TAX LIABILITY

Neither Rainbow Energy Center nor its parent company, REMC Assets, LP, have an outstanding tax liability owed to the State of North Dakota or any of its political subdivisions.