

MEETING MINUTES

LIGNITE RESEARCH COUNCIL – GRANT ROUND 97

Wednesday, November 17, 2021 - 1:30 p.m. (CT)

Bismarck State College - NECE Room 335

LRC VOTING MEMBERS (or their authorized alternates) PRESENT:

Jason Bohrer – Lignite Research Council, Chairman
John Bauer – Great River Energy
Mike Heger – BNI Coal, Ltd.
Brian Kroshus– North Dakota Public Service Commission
Rita Faut – ND Farm Bureau
Jason Laumb - Energy & Environmental Research Center (EERC)
Gerard Goven – Falkirk Mining Company
Gavin McCollam – Basin Electric Power Cooperative
Ned Kruger – North Dakota Geological Survey
Gerry Pfau – Minnkota Power Cooperative
John Phillips – Coal Conversion Counties
Brad Zimmerman – Otter Tail Power Company
Dave Glatt – ND Dept of Environmental Quality
Randy Bartsch – IBEW 11th District ND
Bryan Walther – Couteau Properties

OTHERS PRESENT:

Karlene Fine – North Dakota Industrial Commission
Mike Holmes – Lignite Research Council
Angie Hegre - Lignite Energy Council
Dave Allard – Lignite Energy Council

GUESTS:

Greg Henthorn, AmeriCarbon Products (presenter)
Dave Berry, AmeriCarbon Products (presenter)
Matt Fuka, Microbeam Technologies, Inc. (presenter)
Steve Benson, Microbeam Technologies, Inc. (presenter)

I. CALL TO ORDER

Meeting called to order:

Lignite Research Council (LRC) Chairman, Jason Bohrer, called the LRC meeting to order at 1:30 p.m. (CT) on November 17, 2021, at BSC – NECE Room 335. Introductions were made around the room.

II. APPROVAL OF MINUTES

Approval of May 13, 2021, LRC Meeting Minutes:

Bohrer asked for a motion to approve the minutes from the May LRC Meeting. He shared the modification on page three under the Williston Basin Core CM project. The modification included adding a paragraph describing this project to reflect the more comprehensive explanation. Rita Faut so moved; seconded by Gerry Pfau. Motion carried.

III. PROGRAM FINANCIAL SUMMARY

Program Financial Summary:

Karlene Fine presented the financial summary regarding the Lignite Research, Development and Marketing Program. (A copy of the financial summary is available in the Lignite Research Program files.)

Fine reviewed the 2019-2021 budget spreadsheet with the group and noted the following:

- Beginning Cash Balance July 1, 2019 was \$29.9 million.
- Revenues totaled \$19.3 million. This was lower than the \$19.8 million that had been estimated.
- Expenditures totaled \$27.4 million
- Cash balance as of June 30, 2021, was \$21.8 million.

Outstanding commitments of \$15.2 million so non-committed cash funding available is \$6.5 million. Fine reviewed the 2021-2023 budget spreadsheet with the group and noted the following:

- Beginning Cash Balance July 1, 2021 was \$21.8 million.
- Revenues through September 30 total \$686,295.93
- Expenditure's total \$659,651.04 through September 30
- Cash balance as of September 30, 2021, of \$21.8 million.
- Outstanding commitments of \$18.3 million including \$1 million estimated for litigation costs for 2021-2023. Leaving non-committed cash funding in the amount of \$3.5 million.
- Estimated revenues for the 21-23 biennium are \$18.7 million.

Fine presented a proposed 2021-2023 budget of \$40.5 million, with \$19 million committed, leaving a balance of \$21.4 million for consideration of projects throughout the biennium.

IV. PROGRAM UPDATES

Emerging Markets and Value-Added Opportunities

Holmes shared his appreciation for the budget information and how it reflects the great Legislative session and the support for advancing energy technology. He shared that in addition to this support, there is now the addition of the Clean Sustainable Energy Authority (CSEA). He reminded the group of this funding option for those projects nearing commercial application.

Holmes touched on LRC research priorities of emerging markets and value-added opportunities for using our lignite resource in the state. He shared some of the projects currently in place to include the following.

R&D Updates

Carbon Technology Overview Capture testing performed at Milton R Young and Coal Creek Stations over the past year

- Primary focus in 2021 was on reducing amine losses.
- Testing has been completed, and the engineering and design work is ongoing.
 - Pre-FEED study at Coal Creek is scheduled to be completed in 2021.
 - Milton R Young FEED study scheduled to be completed this year with the report available in early 2022.

Project Tundra Update

- Project Tundra is well into the FEED study.
- Economic Evaluations continue with focus on reducing economic risks.
- Storage evaluations continue and include increased focus on storage near the mine and plant.

- Work continues on the policy and financing challenges with an eye on determining commercial viability.

Capture Testing Background

- Amine emissions on post combustion CO₂ capture systems can be increased when aerosol concentrations are >10⁷ particles / cm³.
- Lignite-fired utilities have been shown to contain flue gas with aerosol concentrations >10⁷ particles / cm³.
- Wet electrostatic precipitators (WESPs) are considered a viable option to reduce aerosol emissions but have not been tested in conjunction with post combustion capture technologies or on lignite-derived flue gas.

Summary Of Research Conclusions – Tundra WESP

- WESPs can be effective at removing aerosols to acceptable levels prior to post combustion capture equipment.
- WESPs can be effective at increasing aerosols to acceptable levels prior to post combustion capture equipment.
- SO₂ to SO₃ conversion can be problematic with a WESP.
- SO₂ concentration entering the WESP is an important consideration.
- WESP placement is also an important consideration.

Preliminary Front End Engineering and Design (pre-feed) Study for a full-scale carbon dioxide capture system at Coal Creek Station (CCS2)

- Pre-FEED study is progressing well.
- All pilot system testing completed, and data analysis is ongoing.
- Economic Evaluations have been initiated.
- Geologic storage evaluated separately under Midwest Ag project.

Coal Creek Station Capture Testing in 2021 - Objectives

- The goal of the Subtask 2.7 project was to fully characterize aerosol behavior with various control technologies installed to better optimize aerosol mitigation technology for CO₂ capture.
- Objectives included:
 - Determine the effectiveness of a wet electrostatic precipitator (wESP) on mitigating formation of problematic aerosols at a low-rank coal-fired power station.
 - Determine the effectiveness of a proprietary post capture solvent recovery system on reducing aerosol emissions and extending solvent life.
 - Determine the impact of aerosols on the efficiency and degradation products of both commercial and advanced solvents.

Capture Testing Research Conclusions

- When used with KS-1, MHI's AERU was effective at recovering amine from the flue gas exiting the absorber column.
 - Aerosols were substantially higher when using MEA and a standard water wash column.
- Use of KS-21 further reduced aerosol loading at the system outlet.
- Adding MEA-based CCS to Coal Creek Station is modeled to show expected reduction in net power output and increased COE. These impacts can be reduced through
 - Solvents that require less regeneration energy than standard MEA
 - Better heat integration (e.g. a new turbine)
 - Lower CO₂ delivery pressures

- For MEA, use of a wESP to control aerosol emissions is estimated to be most cost effective when MEA makeup rates are >18 tons/day and can be reduced by 90% with the use of a wESP.
- MHI's advanced solvent and AERU technology were both effective at reducing aerosol emissions without significant solvent degradation at Coal Creek Station.

Carbon Utilization and Storage

- PCOR continues as one of four regional partnerships in the U.S. - PCOR Initiative to Accelerate CCUS Deployment
- Project Tundra includes the continuation of the Carbon SAFE work with a focus on storage adjacent to the plant.
- Midwest AgEnergy storage project nearing completion - Drill Stratigraphic Test Well & Determine Feasibility of Central ND Geology to Safely and Permanently Store Carbon Dioxide
 - Found 84 ft. of Broom Creek Formation

CO₂ Storage Resource in the PCOR Partnership Region

Several deep saline formations throughout the PCOR region have been evaluated for CO₂ storage. North Dakota formations have the ability to store between 76 billion and 252 billion tonnes of CO₂.

Project Tundra Accomplishments

- Two stratigraphic test wells & 12-mi² seismic survey validated Broom Creek & Deadwood Formations as storage targets.
- Two CCS Storage Complex Permit applications submitted to ND DMR on May 28, 2021.
- FEED study for capture plant in final stages.

Project Tundra Geologic Storage Components

- Two injection wells into the Broom Creek Formation can inject 4 million tonnes CO₂ / year for at least 20 years.
- One injection well into the Black Island/Deadwood interval (contingency target up to 1 million tonnes CO₂ / year).
- One monitoring well that extends to the Black Island/Deadwood (NRDT-1).
- USDW monitoring well in the Fox Hills Formation.
- One Class I wastewater disposal well into the Inyan Kara Formation.

CO₂ Storage Assessment for Coal Creek Station and Blue Flint

- Evaluation of CO₂ storage adjacent to Coal Creek Station and Blue Flint Ethanol.
- Complete Stratigraphic Test Well to enable modeling of CO₂ storage potential.
- Project results provide coal users and reserve owners highly accurate information regarding feasibility of CO₂ sequestration
- McLean County has 1.5 billion tons economically mineable lignite

Enhance Preserve and Protect (EPP) Project

Holmes shared that we will be having a special grant round in January. At that time, John Weeda, NDTA will be presenting as well. He shared that Weeda has focused on regional transmission needs and has included growing involvement in MISO and SPP discussions. Holmes shared not only are we working on R&D, strategic studies, marketing, policy, legal strategy but we are also working on environmental strategies including CCR, water, ACE, and regional haze.

White Paper Studies

- Additional Value Opportunities for Lignite / Update
- Regional Haze White Paper

- MISO and SPP Impacts
- Evaluation of Demand Growth / Update
- Forecast of EV Impacts on regional demand and the grid
- NDSU Economic Impact (2022)
 - Regional Economic Impact of CCUS (TBD)
- Evaluation of ESG Impacts on Lignite
- Research Priorities
- Others to be identified jointly between industry and the Industrial Commission

Holmes reminded the group that if there are any ideas for R&D and/or white papers, he is open to requests or suggestions.

V. GRANT ROUND XCVII (97) APPLICATION

LRC-XCVII (97) A: “Production of Germanium and Gallium Concentrates for Industrial Processes”

Submitted by: Microbeam Technologies, Inc.

Request for: \$20,000

Total Project Costs: \$189,943

Principal Investigator: Steve Benson

Project Duration: 9 months

Holmes shared that Microbeam Technologies Incorporated (MTI) is proposing to lead a team with UND and North American Coal, to develop a conceptual design of a process to extract, separate, recover and purify germanium and gallium from lignite coal-derived rare earth element concentrates. The team has received award from the DOE, providing a strong leveraging of NDIC project funding. The process will be integrated into the University of North Dakota’s (UND) rare earth extraction process and will be designed to co-produce germanium and gallium concentrates. The overall effort involves an integrated development that spans feedstock sourcing, feedstock optimization, extraction/concentration/separation/refining, and product use in industrial applications.

Holmes said the three technical peer reviewers gave the proposal an average weighted score of 226 out of 250 points. The weighted score was 223 out of 250 points from reviewer 27-01, 227 out of 250 points from reviewer 27-02, and 229 out of 250 points from reviewer 27-03. All Technical peer reviewers recommended to **fund**.

As the Technical Advisor for this project, Holmes recommended **fund** based on all three of the technical reviewers’ feedback to fund and the proposed effort fitting well with the priorities of the Lignite Research Program. Holmes stated that he felt the proposed project is a great fit for the Lignite Research Program, as part of the pursuit of emerging markets for North Dakota lignite. The project enhances the potential value of Rare Earth Element extraction by adding Germanium and Gallium as targets. The project provides strong leveraging of state funding at over 9-to-1.

Holmes recommended that funding be subject to the Technical Advisor participating in project reviews, discussing standards of success and making them measurable and reviewing the project management plan with the project team.

Holmes stated conflicts of interest include North American Coal.

Steve Benson, Microbeam Technologies, Inc., presented on behalf of the applicant. (A copy of their Power Point presentation is available in the LRP files.)

LRC-XCVII (97) B: “North Dakota Lignite Coal-Based Pitch for Production of High Value Carbon Products”

Submitted by: AmeriCarbon Products, LLC

Request for: \$550,000

Total Project Costs: \$1,209,794

Principal Investigator: David Berry

Project Duration: 18 months

Holmes shared that AmeriCarbon is proposing to utilize their pilot-scale, patented/proprietary LCP (Liquid Carbon Pitch) process to demonstrate the successful and economically viable conversion of North Dakota lignite coal into a valuable pitch intermediate chemical used in carbon products manufacturing. A secondary objective will be to outline a development pathway based on performance and technoeconomic results for a next-stage commercial pitch plant based in North Dakota to enhance lignite coal production, high-wage jobs and increased economic opportunities with pitch and downstream carbon manufacturing. AmeriCarbon is teaming with North American Coal on the evaluation and plans to provide pitch samples to carbon products manufacturers for evaluation.

Holmes said the three technical peer reviewers gave the proposal an average weighted score of 202 out of 250 points. The weighted score was 160 out of 250 points from reviewer 27-04, 227 out of 250 points from reviewer 27-05, and 219 out of 250 points from reviewer 27-06. One Technical peer reviewers recommended **funding may be considered** and two recommended to **fund**.

As the Technical Advisor for this project, Holmes recommended to **fund**. He shared that the proposed project is a good fit for the Lignite Research Program. Emerging markets for North Dakota lignite are a key focus of the roadmap. There was a question on the target of a commercial plant in three years and the cost share is lower than some. Cost share is from North American Coal including labor and supply of materials. The proposed project would integrate well with other lignite-based materials development efforts that are progressing in the lignite research program. The effort would fit into an established facility and development effort.

Holmes recommended that funding be subject to the Technical Advisor participating in project reviews and reviewing the project management plan with the project team. Also to evaluate timeline and budget.

Holmes stated conflicts of interest include North American Coal.

Dave Berry and Greg Henthorn, AmeriCarbon Products, presented on behalf of the applicant. (A copy of their Power Point presentation is available in the LRP files.)

LRC-XCVII (97) C: “Development of Novel Sintered Coal Building Materials”

Submitted by: Microbeam Technologies Inc.

Request for: \$62,500

Total Project Costs: \$649,407

Principal Investigator: Matt Fuka

Project Duration: 12 months

Holmes shared that Microbeam Technologies Incorporated (MTI) is proposing to lead a team with UND and North American Coal, to develop value-added products from lignite coal for use in the fabrication of a prototype carbon-based building. The team is developing a method for producing high-value carbon-based building materials by using a flexible manufacturing process that can be adapted into either a batch or continuous manufacturing process. Their sintered coal building materials (SCBM) technology has been used to produce sintered lignite and additive composites (LIG2) at UND and MTI laboratories, and preliminary analysis shows great opportunity for the technology to be scaled up to the pilot scale and eventually the commercial level. These materials show great potential to be used in masonry brick veneer applications as well as others. The team has been notified of a funding award by the DOE.

Holmes said the three technical peer reviewers gave the proposal an average weighted score of 198 out of 250 points. The weighted score was 221 out of 250 points from reviewer 27-07, 201 out of 250 points from reviewer 27-08, and 172 out of 250 points from reviewer 27-09. One technical peer reviewer recommended **funding may be considered** and two technical reviewers recommended to **fund**.

As the Technical Advisor for this project, Holmes recommended to **fund** based on the project being a fit for the lignite industry roadmap target of addressing value-added opportunities for use of North Dakota lignite by creating building materials. The project would have North Dakota industry participation and create strong leveraging of State funding with the associated U.S. Department of Energy funding.

Holmes recommended that funding be subject to the Technical Advisor participating in project reviews and reviewing the project management plan with the project team. Also, review standards of success (make measurable) and address comparison to complexity of materials manufacturing in ceramics industry.

Holmes stated conflicts of interest include North American Coal.

Matt Fuka and Steve Benson, Microbeam Technologies, Inc, presented on behalf of the applicant. (A copy of their Power Point presentation is available in the LRP files.)

VI. 2021 CALENDAR

Bohrer announced that the next NDIC meeting is tentatively scheduled for November 29, 2021. Bohrer reminded the group that the upcoming grant application deadline is April 1, 2022, and the next LRC meeting is scheduled for May 12, 2022.

VII. OTHER BUSINESS

Voting: Paper ballots were distributed by Karlene Fine to the voting members.

GRANT ROUND XCVII (97) Ballot Results:

LRC-XCVII (97) A: "Production of Germanium and Gallium Concentrates for Industrial Processes"

Submitted by: Microbeam Technologies, Inc.

Request for: \$20,000

Total Project Costs: \$189,943

PI: Steve Benson

Project Duration: 9 months

FUND: 15

DO NOT FUND: 0

LRC-XCVII (97) B: “North Dakota Lignite Coal-Based Pitch for Production of High Value Carbon Products”

Submitted by: AmeriCarbon Products, LLC
Total Project Costs: \$1,209,794
Project Duration: 18 months

Request for: \$550,000
PI: David Berry

FUND: 12 DO NOT FUND: 3

LRC-XCVII (97) C: “Development of Novel Sintered Coal Building Materials”

Submitted by: Microbeam Technologies Inc.
Total Project Costs: \$649,407
Project Duration: 12 months

Request for: \$62,500
PI: Matt Fuka

FUND: 15 DO NOT FUND: 0

The North Dakota Industrial Commission meeting, when these recommendations will be considered, will be held on November 29, 2021.

Adjournment: There being no further business, Jason Bohrer requested a motion for adjournment of the LRC meeting. John Bauer so moved, seconded Bryan Walther. Motion carried.

Angie Hegre, recording secretary