

MEETING MINUTES
LIGNITE RESEARCH COUNCIL
Tuesday, May 15, 2018 – 1:30 p.m. (CT)
Ramada Bismarck Hotel (Judicial Room), Bismarck, ND

LIGNITE RESEARCH COUNCIL MEMBERS (or their authorized alternates) PRESENT:

Jason Bohrer – Lignite Energy Council (LEC)
Ray Holmberg – N.D. Senate
Randy Christmann – North Dakota Public Service Commission
Wade Boeshans – BNI Energy
John Bauer – Great River Energy
Al Rudeck – ALLETE Energy
Mark Hager – IBEW
David Straley – North American Coal Company
Zoe Wergeland – North Dakota Dept. of Commerce
Craig Bleth – Minnkota Power Cooperative
Gerard Goven – The Falkirk Mining Company
Dave Glatt – North Dakota Dept. of Health
Rich Southwick – Great Northern Properties
Ed Steadman – Energy & Environmental Research Center (EERC)
Rita Faut – Landowners
Ned Kruger – North Dakota Geological Survey
John Philips – Coal Conversion Counties
Dave Smith – SaskPower
Maverick Thompson – Otter Tail Power Company

OTHERS PRESENT:

Mike Holmes – Lignite Research Program
Laney DeGraw- LEC
Dave Allard – LEC
Karlene Fine – North Dakota Industrial Commission
Geoff Simon – Western Dakota Association
Paul Gandola – Matton Power Enterprises, LLC
Greg McRae – Massachusetts Institute of Technology
Paul Pansegrau – Technical Research Investigations, LLC
Bruce Folkedahl - Energy & Environmental Research Center (EERC)
Dan Laudal – Institute of Energy Studies, UND
Bill Sawyer – ALLETE
Andrea Pfenning - North Dakota Industrial Commission
Jason Ehlert – State Building & Construction Trades Council

Lignite Research Council (LRC) Chairman, Jason Bohrer, called the LRC meeting to order at 1:35 p.m. (CT) on May 15, 2018 at the Ramada Inn, Bismarck, North Dakota.

Approval of November 16, 2017 LRC Meeting Minutes:

Bohrer asked for a motion to approve the minutes of the November 16, 2017 LRC meeting. David Straley so moved; seconded by John Bauer. Motion carried.

Program Financial Summary:

Karlene Fine gave a financial summary regarding the Lignite Research, Development and Marketing Program.

Fine stated the Lignite Research Program Cash Balance for the 2017-2019 biennium as of September 30, 2017 is \$ 24,966,795.40. She reviewed the current outstanding commitments which total \$11,337,001.34. She stated that the estimated revenues for the biennium are \$15,637,500.00, and the General Fund one-time appropriation has a remaining balance of \$435,735.60

Lignite Research, Development and Marketing Program Updates

Mike Holmes gave an updates of the Lignite Research, Development & Marketing Program.

Research & Development Priorities for the LRC:

- Support continued options to enhance performance of the existing fleet
- Invest in transformational research (Next generation of Lignite conversion systems that integrate CO₂ capture)
- Focus on Carbon Capture Utilization & Storage (CCUS)
- Leverage international R&D breakthroughs
- Renewed Focus
 - Additional value propositions for lignite
 - Polygeneration opportunities

Historical Successes:

- Thriving with high-sodium coal
 - Optimized operations and cleanability
- Meeting regulations for primary pollutants
 - Addressing potential future NO_x challenges
- Addressing Hg and trace elements
 - Costs reduced by more than 20X
- Spiritwood – industrial complex
- Dryfining – coal upgrading
- Lignite mining, use, and reclamation advances through data, instrumentation & controls
- Support of only US coal-to-synfuels plant
 - DGC adding urea to product suite

Carbon Management

- North Dakota has an ideal situation for CO₂ management
 - CO₂ emission sources are in close proximity to CO₂ storage targets
 - Between 23 and 78 Gt of storage available within the state between saline formations and oil reservoirs

North Dakota Integrated Carbon Storage Complex Feasibility Study

- Led by EERC – Wes Peck, with industry partners: ALLETE Clean Energy, BNI Energy, Basin Electric Power Cooperative, and Minnkota Power Cooperative
 - Outreach
 - Outreach events held at both sites (includes school tours & classroom presentations)
 - Test Wells
 - Drilling Completed at Mercer County (analysis of cores and well logs underway)
 - Drilling Completed at Oliver County (analysis of cores and well logs underway)
 - Modeling Underway for both sites
 - Economic Evaluation Based on Results Continues

- Management and Reporting
 - Conference calls with project team continue with a primary focus on outreach.
 - Reporting underway to complete various milestones

Project Carbon:

- Led by EERC – Jason Laumb, with industry partners: ALLETE Clean Energy, BNI Energy, and Minnkota Power Cooperative
 - Pilot-scale Amine Testing
 - Planning for amine tests with KS-1 solvent in June.
 - Testing at MRY scheduled for late summer 2018.
 - Economics of Carbon Capture
 - Tasks will be in full swing following amine testing.
 - Aerosol Management
 - Procured equipment to support sampling activities.
 - Completed Construction of amine emission reduction unit in support of pilot-scale tests. System shakedown completed and used for amine test.
 - Management and Reporting
 - Weekly conference calls with MHIA and MHI Japan.
 - Meeting held in Tokyo with MHI and key stakeholders to discuss Project Carbon.

Allam Cycle / Pathway to Low-Carbon Lignite Utilization

- Led by EERC – Jason Laumb with industry partners: Minnesota Power / ALLETE Clean Energy, BNI Energy, Basin Electric Power Cooperative, and Dakota Gasification Company
 - Corrosion Management
 - Dynamic tests completed, final analysis underway. Several materials performed favorably.
 - Gasifier Selection
 - Three gasifier platforms identified for use with lignite coal. SE (ECUST), BGL, SES (U-Gas)
 - Impurity Management
 - Impurity management tests completed. Final data analysis and reporting to be completed in coming months.
 - Syngas Combustion
 - La Porte facility has received combustor test rig. First natural gas fire in April.
 - Pilot-scale Planning
 - Identified two locations of hosting coal Allam Cycle Demonstration. La Porte and DGC.
 - Management & Reporting
 - Draft final report submitted on 12/29/2017, Final Version June 2018 .
 - Weekly conference calls with technical team.
 - Additional DOE award (\$700K) to expand engineering for demonstration plant; Phase 1 of 3 possible.

Additional Value Opportunities for Lignite

- Current Commercial Uses
 - Lignite goes into syngas CO2 heat through Direct or Indirect Liquefaction which can be used for Liquid Fuels and Additives, Gasoline, Jet Fuel, Diesel, EOR, Nitrogen Fertilizers, chemicals, and electricity
- Technology Developments
 - Carbon Based Projects
 - Activated Carbon
 - Facility in final design stages in Valley City, North Dakota

- Carbon Black
 - Semi-continuous pilot unit at the EERC, proof-of-concept complete
- Carbon Fiber
 - Coal-derived pitch has unique properties
 - High value product with growing market
- Carbon Nanotubes and graphite
 - High value product with growing markets
- High Value Material Extraction
 - Pioneering work by the North Dakota Geologic Survey has led to a number of funded projects investigating recovery of high value materials from coal and byproducts:
 - Characterization study of coal and byproducts across North America
 - Rare earth element extraction from North Dakota lignite
 - Rare earth element extraction from coal combustion byproducts
 - Technology development is needed to optimize and improve economics of processes that extract and concentrate rare earth elements and other high value minerals.
 -

Grant Round LXXXVI (86) Grant Application

LRC-LXXXVI (86)-B: “To Test, Confirm, and Initiate Commercial Design of a Post-Combustion “Bolt-On” CO2 Capture System Suitable for At-Scale, Royalty-Free Retrofit of Existing North Dakota Lignite and Coal Fired Power Generating Facilities (with North Dakota Manufacturing Opportunity to reach National and International Markets).” Submitted by: Mattoon Power Enterprises LLC; Request for: \$649,860; Total Project Costs: \$1,580,800; Principal Investigator: Paul Gandola; Project Duration: 12 months

Holmes stated that the objective of the A focus of the proposed work is to demonstrate and measure the effectiveness of new methods for a cost effective “bolt-on” solution capable of reducing the cost of CO2 capture for 60% - 90% of the CO2 in coal and lignite flue gas. The approach is based on technical innovations for a proven potassium carbonate process to operate at atmospheric and near-atmospheric conditions, and a broader view of the overall economics, which include benefits to North Dakota in its lignite, coal, energy production, and manufacturing sectors.

Holmes said that the three technical peer reviewers gave the proposal an average weighted score of 185.7 out of 250 points. The weighted score was 162 out of 250 points from reviewer 19-01, 202 out of 250 from reviewer 19-02, and 193 out of 250 from reviewer 19-03. Technical peer reviewers 19-02 and 19-03 recommended that funding may be considered for the project. Reviewer 19-01 recommended to fund the project.

As the Technical Advisor for this project, Holmes recommended **fund or funding may be considered** with consideration based on responses to review comments by the project team in the written materials and the presentation. This is an alternative to amines that has the potential to reduce capture costs and the request is within our available budget. The project team has been asked to address the reviewer comments including low pressure operation, cost-share questions, and the project organization. In addition, the team has recently adjusted the demonstration site to the UND steam plant due to availability of the facility at Spiritwood.

Holmes said that Great River Energy, Basin Electric Power Cooperative, North American Coal Corporation, and UND Institute for Energy Studies all have conflicts of interest for this project.

Paul Gandola of the Mattoon Power Enterprises, LLC & Greg McRae of Massachusetts Institute of Technology presented on behalf of the application.

LRC-LXXXVI (86)-C: “Economical Extraction and Recovery of Rare-Earth Elements and Production of Clean Value-Added Products from Low-Rank Coal Fly Ash”

Submitted by: EERC; Request for: \$30,000; Total Project Costs: \$510,000; Principal Investigators: Bruce C. Folkedahl & Daniel A. Laudal; Project Duration: 18 months

Holmes stated that the objective of this application is: The University of North Dakota (UND) Energy & Environmental Research Center (EERC) and Institute for Energy Studies (IES), with assistance from Pacific Northwest National Laboratory (PNNL), propose this project with the objective to develop an economically viable and tailorable rare-earth element (REE) extraction and concentration method for low-rank coal (LRC) fly ash and bottom ash that produces a concentrate containing ≥ 2 wt% total REEs.

Holmes said that the three technical peer reviewers gave the proposal an average weighted score of 223.7 out of 250 points. The weighted score was 214 out of 250 points from reviewer 19-04, 226 out of 250 from reviewer 19-05, and 232 out of 250 from reviewer 19-06. Technical peer reviewers 19-04, 19-05 and 19-06 recommend funding the project.

As the Technical Advisor for this project, Holmes recommended **fund** as three technical reviewers recommended funding, the REE opportunity addresses new value added uses for lignite and the project is a 16 to 1 leveraging of NDIC / Lignite Research Program funding.

Holmes said that UND EERC, UND Institute for Energy Studies, Basin Electric, and Great River Energy.

Bruce Folkedahl of the Energy and Environmental Research Center presented on behalf of the application.

It was moved by Al Rudeck and seconded by Zoe Wergeland that under the authority of North Dakota Century Code Sections 44-04-17.1, and 44-04-19.2 the Lignite Research Council close the meeting to the public and enter executive session for the purpose of considering the following application that the applicant has requested confidentiality pursuant to N.D.C.C. 54-17.5-06 and N.D.C.C. 44-04-18.4(2)(c)(5).

The Lignite Research Council meeting is reconvened at 3:33 p.m. and the public has been invited to return to the meeting room.

Next LRC Meeting and 2018 Grant Round deadline:

Bohrer announced that the next LRC meeting is scheduled for November 15, 2018.

The application deadline date for submitting proposals to the NDIC for the next grant round is October 1, 2018.

Ballot Results:

Bohrer announced the results of the LRC's non-confidential ballots concerning the LRC's recommendations to the NDIC regarding the Grant Round LXXXVI (86) proposal as follows:

- **LRC-LXXXVI (86)-A: Continued Funding for Regional Lignite Public Affairs Program "Coalition for a Secure Energy Future"**

Submitted by: Lignite Energy Council; Request for: \$1,800,000; Total Project Costs: \$3,600,000; Principal Investigator: Lignite Energy Council; Project Duration: 3 year

Fund: 19 votes

Do Not Fund: 0 vote

Abstain: 0 vote

- **LRC-LXXXVI (86)-B: To Test, Confirm, and Initiate Commercial Design of a Post-Combustion "Bolt-On" CO2 Capture System Suitable for At-Scale, Royalty-Free Retrofit of Existing North Dakota Lignite and Coal Fired Power Generating Facilities with North Dakota Manufacturing Opportunity to reach National and International Markets.**

Submitted by: Mattoon Power Enterprises LLC; Request for: \$649,860; Total Project Costs: \$1,580,800;
Principal Investigator: Paul D. Gandola; Project Duration: 12 months

Fund: 15 votes

Do Not Fund: 4 vote

Abstain: 0 vote

- **LRC-LXXXVI (86)- C: Economical Extraction and Recovery of Rare-Earth Elements and Production of Clean Value-Added Products from Low-Rank Coal Fly Ash**

Submitted by: University of North Dakota EERC ; Request for: \$30,000; Total Project Costs: \$510,000;
Principal Investigator: Bruce Folkedahl; Project Duration: 18 months

Fund: 19 votes

Do Not Fund: 0 vote

Abstain: 0 vote

Adjournment:

There being no further business, Bohrer requested a motion for adjournment of the LRC meeting at 3:47 p.m.
David Straley so moved; seconded Rita Faut. Motion carried.

Laney DeGraw, recording secretary
