

MEETING MINUTES
LIGNITE RESEARCH COUNCIL

May 19, 2016

Ramada Bismarck Hotel (Judicial Room), Bismarck, ND

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

Jay Skabo - Montana-Dakota Utilities
Justin Dever – ND Department of Commerce
Wade Boeshans – BNI Coal
David Straley – NACoal/Coteau Properties Co.
Mike Holmes – EERC
Gerry Pfau – Minnekota Power Cooperative
Ray Holmberg – ND Senate
John Weeda – Great River Energy
Bill Sawyer – Minnesota Power
Mark Hager - IBEW
Ned Kruger – ND Geological Survey
Dave Glatt- NDDOH
Dave Smith - SaskPower
Dave Sauer – Dakota Gasification Company
Jason Bohrer – Lignite Research Council; chairman of the Lignite Research Council
Mike Jones – LEC
Rep. Jeff Delzer – North Dakota House of Representatives
Matt Greek – Basin Electric Power Cooperative
Charlie Bullinger – Great River Energy
Randy Christmann - ND Public Service Commission
Jay Kost – Falkirk Mine

OTHERS PRESENT:

Jacque Smith- LEC
Dave Allard - LEC
Jeremy Doctor – Expansion Energy LLC
Sandra Brockemol – Great River Energy
Jason Laumb – EERC
Bruce Folkedahl – EERC
John Simmons – Carbontec Energy Corporation
Steve Simmons – Carbontec Energy Corporation
Steve Benson – UND EERC & IES
Jay Volk – BNI Coal
Ryan Limb – NDSU
David Vandor – Expansion Energy LLC
Mark Hager- I.B.E.W
Bill Sawyer – Minnesota Power/ ALLETE
Mike McGroddy – 8 Rivers
Jim Sheldon – Basin Electric
Jessica Holdman – Bismarck Tribune
Tyler Hamman – LEC
Karlene Fine- NDIC

Lignite Research Council (LRC) Chairman, Jason Bohrer, called the LRC meeting to order at 1:35 p.m. (CDT) on May 19, 2016, at the Ramada Hotel, Bismarck, North Dakota.

Approval of November 17, 2015 LRC Meeting Minutes:

Bohrer asked for a motion to approve the minutes of the November 17, 2015 LRC meeting. Senator Holmberg so moved; seconded by Jay Kost. Motion carried.

Program Financial Summary:

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

Fine stated that the budget is the proposed LRC Annual budget allocation for the 2015-2017 biennium. She said the Program's available funding (as of 05/09/16) includes: \$750,000 for administration of the Program; \$1,500,000 for litigation (Minnesota); \$3,000,000 for non-matching Lignite Marketing Feasibility Study (LMFS) projects; \$6,597,500 for Small Research Projects; \$1,200,000 for Marketing Projects; and \$3,572,866 for Demonstration Projects.

Program's Project Updates:

Jones, Technical Advisor to the NDIC and the LRC, gave updates about active R&D projects (six carbon capture and storage projects, two gasification projects, one demonstration project, one Lignite Vision 21 Program (LV21) project, two metal emissions projects, two education/public relations projects, three NOx projects, one Lignite Beneficiation project, and one marketing. He also gave a non-confidential update about the Enhance, Preserve and Protect project, which included Environmental Tasks, Litigation, R&D tasks and LV21 tasks.

Jones also updated the council on the Lignite-Based Allam Cycle (Grant Round LXXIX (79) Grant Application LRC-LXXIX-E: "Pathway to Low-Carbon Lignite Utilization" Submitted by: The Energy & Environmental Research Center) project proposed to the LRC Meeting on November 17, 2015, elaborating on the developmental roadmap of the project, including task structure and key findings thus far in the project.

Grant Round LXXX (80) Grant Application LRC-LXXX-A: "Investigation of Rare Earth Element Extraction from North Dakota Coal-Related Feedstocks" Submitted by: University of North Dakota Institute for Energy Studies; Request for \$94,000; Total Project Costs \$936,847; Principal Investigator: Dr. Steve Benson; Project Duration: 18 months

Jones said the project objective focuses on the University of North Dakota Institute for Energy Studies teaming with Barr Engineering and Pacific Northwest National Laboratory to determine the technical and economic feasibility of concentrating rare earth elements (REEs) from the reject streams of a North Dakota lignite drying process.

Jones said that the three technical peer reviewers for this proposal gave the proposal an average weighted score of 213.3 out of 250 points. The weighted score was 209 out of 250 points from reviewer 17-01, 215 out of 250 from reviewer 17-02, and 216 out of 250 from reviewer 17-03. Technical peer reviewers 17-01, 17-02, 17-03 all recommended funding the project.

As Technical Advisor to the NDIC and LRC, Jones recommended that the project be funded, contingent on the following: Matching funding received and a Technical Advisor participates in advisory group.

Jones said that Great River Energy and North American Coal are conflicts of interest for proposal LRC-LXXX-A.

Steve Benson with the University of North Dakota Institute for Energy Studies did a presentation in support of LRC-LXXX-A.

Grant Round LXXX (80) Grant Application LRC-LXXX-B: "Managing Aerosol Emissions from CO2 Capture Systems" Submitted by: Energy & Environmental Research Center (EERC); Request for \$300,000; Total Project Costs \$600,000; Principal Investigators: Bruce C. Folkedahl and John P. Kay; Project Duration: 10 months

Jones said the Energy & Environmental Research Center (EERC) project objective is to determine the potential impacts of low-rank coal combustion system aerosol formation, abundance, and chemistry in flue gas downstream of particulate and sulfur dioxide control systems; determine their effect on solvent aerosol formation in post-combustion CO2 capture (PCC) systems; and identify methods to control the formation of aerosols.

Jones said that the three technical peer reviewers for this proposal gave the proposal an average weighted score of 208 out of 250 points. The weighted score was 212 out of 250 points from reviewer 17-04, 230 out of 250 from reviewer 17-05, and 182 out of 250 from reviewer 17-06. Technical peer reviewers 17-01, 17-02, 17-03 all recommended funding the project.

As Technical Advisor to the NDIC and LRC, Jones recommended that the project be funded, contingent on the following: Matching funding received and a Technical Advisor participates in advisory group.

Jones said that Minnkota Power and ALLETE are conflicts of interest for proposal LRC-LXXX-B.

Bruce Folkedahl and team from the EERC did a presentation in support of LRC-LXXX-B.

Grant Round LXXX (80) Grant Application LRC-LXXX-C: "Pathway to Low-Carbon Lignite Utilization – Phase 1B & 2A" Submitted by: Energy & Environmental Research Center (EERC); Request for \$3,500,000; Total Project Costs \$10,300,000; Principal Investigator: Michael Holmes; Project Duration: 19 months

Jones said the objective of this project is to support the increased power need by continued evaluation and development of a low-carbon pathway to lignite utilization for electric power generation. The technology to achieve this objective, termed the Allam Cycle, is a direct-fired, supercritical CO2 (sCO2) power cycle with the potential for significant efficiency advantages over conventional steam-based Rankine systems. In addition, the Allam Cycle also allows for inherent CO2 separation and pressurization to comply with carbon capture regulations.

Jones said that the three technical peer reviewers for this proposal gave the proposal an average weighted score of 215.67 out of 250 points. The weighted score was 206 out of 250 points from reviewer 17-07, 223 out of 250 from reviewer 17-08, and 218 out of 250 from reviewer 17-09. Technical peer reviewers 17-01, 17-02, 17-03 all recommended funding the project.

Jones stated the project proposal requests a waiver for the requirements listed in Section 43-03-06-04 of the North Dakota Administrative Code in reference to having all manufacturing of new technology or systems substantially occur in the state of North Dakota

As Technical Advisor to the NDIC and LRC, Jones recommended that the project be funded, contingent on the following: Matching funding received and a Technical Advisor participates in advisory group.

Jones said that Minnesota Power, BNI Energy, Basin Electric Power Cooperative and Dakota Gasification Company are conflicts of interest for proposal LRC-LXXX-C.

Mike Holmes from the EERC and team did a presentation in support of LRC-LXXX-C.

Grant Round LXXX (80) Grant Application LRC-LXXX-D: "Management practices to improve soil and vegetation perimeters of reclaimed North Dakota Coal Mine Lands" Submitted by: Department of Soil Science

- School of Natural Resource Sciences (NDSU); Request for \$587,187; Total Project Costs \$1,156,374; Principal Investigator: Ryan Limb; Project Duration: 5 years

Jones stated NDSU proposes to partner with BNI Energy, Coteau Properties Company, Coyote Creek Mining Company, and Falkirk Mining Company to evaluate existing soil management practices and implement and evaluate land remediation field trials designed to improve soil properties and native vegetation. The project is broken into three phases spanning five years where we will evaluate management techniques incorporating both mechanical and biological actions to: 1) improve water movement between soil horizon boundaries, 2) decrease both shallow and deep soil compaction, 3) increase root abundance and depth and 4) reduce exotic grass abundance.

Jones said that the three technical peer reviewers for this proposal gave the proposal an average weighted score of 186.7 out of 250 points. The weighted score was 166 out of 250 points from reviewer 17-10, 212 out of 250 from reviewer 17-11, and 182 out of 250 from reviewer 17-12. Technical peer reviewers 17-10 and 17-12 proposed the funding to be considered. 17-11 recommended funding the project.

As Technical Advisor to the NDIC and LRC, Jones recommended that the project be funded, contingent on the following: Matching funding received and a Technical Advisor participates in advisory group.

Jones said BNI Energy, Coteau Properties Company, Falkirk Mining Company and Coyote Creek Mining Company are conflicts of interest for proposal LRC-LXXX-D.

Ryan Limb from North Dakota State University did a presentation in support of LRC-LXXX-D.

Grant Round LXXX (80) Grant Application LRC-LXXX-E: "Carbon Capture & Utilization Using "VCCSTM Cycle" Technology - Phase I: Mineralization of Acidic Flue Gas CO₂ via Chemical Reaction with Alkaline Lignite Fly Ash + Extraction of Marketable Minerals & Other Commodities from Lignite Fly Ash" Submitted by: Expansion Energy; Request for \$45,000; Total Project Costs \$145,000; Principal Investigator: David Vandor; Project Duration: 16 weeks

Jones explained the objective of the project was for Expansion Energy LLC ("XE"), with participation and support from Great River Energy ("GRE"), proposes a Phase I project ("Project") to design and estimate the capital costs for a modular pilot plant ("Pilot Plant") utilizing XE's patented "VCCSTM Cycle" carbon capture & utilization technology, which neutralizes CO₂ from power plant flue gas by chemically reacting it with alkaline lignite coal ash, yielding marketable solid mineral materials, including high-value rare earth elements and metals. The VCCS technology also has the potential to reduce the need for SO₂ and particulate emissions control systems at lignite-fired power plants.

Jones said that the three technical peer reviewers for this proposal gave the proposal an average weighted score of 185 out of 250 points. The weighted score was 177 out of 250 points from reviewer 17-13, 191 out of 250 from reviewer 17-14, and 187 out of 250 from reviewer 17-15. Technical peer reviewers 17-13, 17-14, and 17-15 all recommended funding the project.

As Technical Advisor to the NDIC and LRC, Jones recommended that the project be funded, contingent on the following: Matching funding received and a Technical Advisor participates in advisory group.

Jones said Great River Energy is conflict of interest for proposal LRC-LXXX-E.

David Vandor with Expansion Energy and team did a presentation in support of LRC-LXXX-E.

Grant Round LXXX (80) Grant Application LRC-LXXX-F: "Capture and Capture/Sequestration of Carbon Dioxide - The CEC/MTU Clearite Carbon Dioxide Capture/CO₂ Production Process" Submitted by: Carbontec

Energy Corporation/Michigan Technological University; Request for \$48,000; Total Project Costs \$96,000; Principal Investigator: John Simmons; Project Duration: 12 months

Jones stated the objective for this project is for the investigators to develop a patented technology that captures CO2 from flue gas using a solution of alkaline material and then regenerates the material with heat and a catalyst resulting in a stream of CO2 suitable for use in enhanced oil recovery.

Jones said that the three technical peer reviewers for this proposal gave the proposal an average weighted score of 143.7 out of 250 points. The weighted score was 168 out of 250 points from reviewer 17-16, 121 out of 250 from reviewer 17-17, and 142 out of 250 from reviewer 17-18. Technical peer reviewers 17-17 and 17-18 recommended funding to be considered for this project. 17-16 recommended funding the project.

As Technical Advisor to the NDIC and LRC, Jones recommended that the project funding may be considered contingent on the following: Matching funding received and a Technical Advisor participates in advisory group.

Jones said Great River Energy is conflict of interest for proposal LRC-LXXX-F.

John Simmons from Carbontec Energy Coporation gave a presentation in support of LRC-LXXX-F.

Next LRC Meeting & NDIC meeting to consider LRC's recommendations, 2016 Grant Round deadlines:

Bohrer announced that the next LRC meeting is scheduled for November 17, 2016.

The application deadline date for submitting proposals to the NDIC for the next grant rounds is October 1, 2016.

Ballot Results:

Bohrer announced the results of the LRC's non-confidential ballots concerning the LRC's recommendations to the NDIC regarding the six Grant Round LXXX (80) proposals as follows:

- Grant Round LXXX (80) Grant Application LRC-LXXX-A: "Investigation of Rare Earth Element Extraction from North Dakota Coal-Related Feedstocks"

Fund: 18 votes

Do Not Fund: 1 vote

Abstain: 1 vote

- Grant Round LXXX (80) Grant Application LRC-LXXX-B: "Managing Aerosol Emissions from CO2 Capture Systems"

Fund: 18 votes

Do Not Fund: 1 vote

- Grant Round LXXX (80) Grant Application LRC-LXXX-C: "Pathway to Low-Carbon Lignite Utilization – Phase 1B & 2A"

Fund: 19 votes

Do Not Fund: 0 votes

- Grant Round LXXX (80) Grant Application LRC-LXXX-D: "Management practices to improve soil and vegetation perimeters of reclaimed North Dakota Coal Mine Lands"

Fund: 16 votes

Do Not Fund: 2 votes

Abstain: 1 vote

- Grant Round LXXX (80) Grant Application LRC-LXXX-E: "Carbon Capture & Utilization Using "VCCSTM Cycle"

Fund: 17 votes

Do Not Fund: 2 votes

- Grant Round LXXX (80) Grant Application LRC-LXXX-F: "Capture and Capture/Sequestration of Carbon Dioxide - The CEC/MTU Clearite Carbon Dioxide Capture/CO2 Production Process"

Fund: 11 votes

Do Not Fund: 7 votes

Abstain: 1 vote

Adjournment:

There being no further business, Bohrer requested a motion for adjournment of the LRC meeting. John Weeda so moved; seconded by Dave Straley. Motion carried.

Jacque Smith, recording secretary
