Minutes of the

RENEWABLE ENERGY COUNCIL

Monday, April 9, 2018 – 10:00 a.m. (CDT)
Icelandic Room, North Dakota Department of Commerce, Bismarck, ND

CALL TO ORDER

Members Present: Jay Schuler, Al Christianson, David Douglas, Randy Schneider, Rod Holth (phone), Terry Goerger (phone), Mark Nisbet (phone)

Others Present:
Andrea Pfennig, ND Industrial Commission/ND Department of Commerce
Karlene Fine, ND Industrial Commission
Bonnie Malo, ND Department of Commerce
Denise Faber, ND Department of Commerce
Brian Kalk, EERC
Chad Wocken, EERC
Ted Aulich, EERC
Dr. Jivan Thakare, EERC
Dr. Xiangfa.Wu, NDSU
Dave Thompson, Prairie Public

Jay Schuler, Chairman, called the Renewable Energy Council meeting to order.

WELCOME AND OPENING COMMENTS

Schuler welcomed everyone.

APPROVAL OF MINUTES

March 13, 2018, meeting minutes were reviewed.

Schneider moved to approve the minutes as presented. Christianson seconded the motion. All in favor. Motion carried.

PRESENTATION OF FINANCIAL SUMMARY

Fine presented the financial summary, which was also posted on the website. Uncommitted dollars available for projects as of February 28, 2018, is $3,121,024.52.

CONSIDERATION OF GRANT ROUND 36 APPLICATIONS

Pfennig stated that two applications were received for this grant round. One was rejected at staff level, and one was sent to technical reviewers for peer review.

R036-B: "Low-Pressure Electrolytic Ammonia Production"; Submitted by EERC; Principal Investigator: Ted Aulich; Project Duration: 3 years; Total Project Costs: $3,164,010; Request for: $437,000.

Pfennig gave an overview of the project. Total project costs are $3,164,010. $2.7 million is their match, which amounts to 86.2%. DOE is providing just under $2.5 million in cash; NDSU is providing $120,000 in-kind, Proton Onsite has $40,000 in-kind and UND Chemical is providing $69,027 in-kind. The project's objectives are to optimize the EERC-developed low-pressure electrolytic ammonia (LPEA) production process, with goals of demonstrating LPEA technical and economic viability and compatibility with renewable and/or off-peak electricity.

The key to the technical and economic viability of the LPEA process is a unique EERC-NDSU-developed polymer-inorganic composite (PIC) membrane capable of high-efficiency transport of protons at 300°C.

All reviewers recommended to fund (210, 210, and 177). Average weighted score was 199 out of 250.

All reviewers felt the project was likely achievable. One reviewer noted that this is an ambitious program with numerous parts. One reviewer felt that the delineation of the DOE award and the research plan pertaining to this proposal was unclear and noted that the commercialization plan would be contingent on successful achievement of the DOE goals.

Two reviewers felt the methodology was sufficient. One noted the methodology pertaining to deliverables for NDIC funded research was unclear. One felt that because some information was kept confidential in the proposal it was difficult to evaluate.

All three reviewers felt the scientific/technical contribution could be very significant if successful. One noted that work as it relates to specific REP goals was unclear.

All three reviewers were comfortable with the awareness of current research activity.

All three reviewers were comfortable with the knowledge of the project team. One reviewer noted that the addition of an individual with experience in NH_3 production could enhance the project team.

All three reviewers were comfortable with the project management plan.

For the budget, one reviewer felt the overall value was very high. Two had concerns: 1) one gave a lower score since the objectives pertaining to the REP was unclear; and 2) one noted a lack of private industry investment. Two felt that DOE's investment in the project added significant value and credibility.

Overall, one reviewer commended the partnership among universities along with industry involvement and noted that the project blends renewable and conventional energy objectives. The reviewer also stated the following: cautioned this is an early phase in a multi-stage project; comparative information on performance and cost of alternative energy options such as that contained in REFUEL CFDA #81.135 would have been appreciated; fails to identify any economic criteria for economic assessment phase.

EERC responded – 1) key success-determining deliverables include: fabrication of a PIC membrane-based LPEA system capable of 100 grams/day ammonia production; and, use of the system to acquire sufficient data to project commercial-scale ammonia production at a significant input energy reduction versus traditional HB-based technologies (a minimum 16% reduction targeted). 2) achieving this energy reduction target is key to the economic assessment, as it creates the ability to produce ammonia at reduced costs and at reduced scales versus HB technologies. Assessment will include all ancillary technologies necessary and derive capital and operating cost estimates for the fully integrated system at selected scales. 3) Key economic viability evaluation criteria will be: projected plant capital and operating costs at distributed scale selected to match renewable energy generation capacities specified by ND utilities; and projected overall per-ton ammonia production costs at selected ND locations.

Overall, one reviewer noted 1) proposed technology is novel and more compatible with the smaller scale and transient nature of

energy production attributable to renewable energy sources; and, 2) desirable outcomes include new and high-paying jobs, increased energy utilization, and a more robust and safer means of the production of ammonia. More information about the proposed labor expenses and differentiation of the DOE project and this program's proposal should be provided.

EERC responded - $437,000 represents a major portion of the cost share required by DOE. REP funds are expected to be spent throughout the project and contribute to: 1) meeting early and mid-project technical objectives related to polymer-inorganic composite membrane and membrane-electrode assembly development and performance assessment; 2) performing a technical and economic assessment of the low-pressure electrolytic ammonia process (LPEA); and, 3) developing a plan for LPEA commercialization (this includes plans for the pilot demonstration but not the actual demonstration).

Technical advisor recommendation is that funding may be considered. The potential significance of this technology is demonstrated by the level of investment of DOE. Proposal has an array of partners including NDSU and UND and the project is well leveraged. Private industry has indicated support of the project and interest in the demonstration phase indicating a greater likelihood of commercialization. Because the LPEA process is "hydrogen-agnostic" it could have applications for a variety of feedstocks abundant in ND. Additionally, it could positively impact the agriculture industry in the state. One of the reviewers had mentioned concerns about communication among partners. However, the performance history of the EERC, NDSU and UND does not indicate this to be an area of concern. There also has been discussion of a similar project occurring in Minnesota. Clarification from the applicant on how their proposal is unique would be beneficial. There are no suggested contingencies if funded.

Kalk introduced the project and provided background. Aulich presented the project. Schuler asked if we can speed up the timeframe. Aulich responded that they could, if things go well. They are going to try to do that. This is 60-80% of their work.

Schneider asked if they could accelerate things, do the dollars come quicker? If you're progressing rapidly, will money impede your speed? Kalk responded that they need to be very careful with this discussion. We have a timeline that is laid out with Department of Energy for milestones. Wocken commented that they are not driven nearly as much by calendar months as they are by milestones. So, if they get success and can move this along, they certainly have the time commitment of the key researchers, and there is a potential to move this along faster than the calendar prescribes. That's their best guess when they submit a proposal.

Kalk commented that he didn't think the money was a problem. If they hit the milestones, the money is allocated during the 36-month period, and if they have to move it up, it's not a big deal. The money is appropriated.

Schuler asked if there is something similar to this in the world right now, or is this just breaking completely new ground? Aulich responded that there are other researchers working on this. There are a few different proton exchange membrane-based processes, which is what this project is. There are Korean researchers that have a different architecture for their electro-

chemical process. This is the only project utilizing the polymer-inorganic composite proton exchange membrane-based approach. There is this idea out there that DOE has been encouraging research to make ammonia from air and water, and trying to do it at low temperature and low pressure. That can be done, and there are people working on that, but the outputs and the conversions are low. In terms of commercial relevance, they are way off. This proposal is trying to make this work at 300-350 C, which is in the range where you want to be to get some significant ammonia production and formation. There is a lot of work going on with ammonia. This proposal is fairly unique in the approach being taken with the membrane.

Christianson asked about what Minnesota is working on. Aulich responded that the University of Minnesota started out with the idea of using a wind turbine (which is installed in Morris), and then they were going to run that into a Haber-Bosch process. He saw the set-up and it was interesting. They had the turbine, and they had their Haber-Bosch process and it was in a semi-trailer type set up. It was a really nice system. But the efficiency just wasn't there. Haber-Bosch at a small scale can't compete. They decided they were going to try something else, so what they are working on now is a means of improving the Haber-Bosch process. They are taking the hydrogen that they generate from their wind turbine, and they are running it into an improved Haber-Bosch process.

Schuler asked how much overhead the EERC pays to UND. If REP puts in $437,000, what percent does UND take as overhead? Wocken responded that they don't have those numbers, but can get them to the council. Malo asked if that is the indirect cost. Wocken responded that there is the indirect rate which is their facilities and admin fee, and then there is a percentage of that that goes to UND to cover their cost of housing the EERC.

Pfennig asked Aulich that when he talked about manufacturing, is he talking about Proton Onsite coming and manufacturing in North Dakota, or else the company would have to license the technology that is being developed from this from onsite manufacturer. Aulich responded that Proton Onsite has a fairly small role in terms of the volume of work being done in the project. But it is a critical role in that they are going to apply their expertise in making membrane electrode assemblies, and they are going to develop a method for manufacturing membrane electrode assemblies using the EERC's input of catalysts and membrane. Pfennig clarified that either Proton Onsite will do the manufacturing in North Dakota or Proton Onsite will license it to someone to do it in North Dakota. Aulich responded correct.

Discussion of the proposal followed.

Schuler would like to fund the project, but would also like to see the overhead numbers. Schneider agreed. It was decided there would be no contingencies.

COMPLETION OF BALLOTS

R036-B: "Low-Pressure Electrolytic Ammonia Production"
Fund: 7 No: 0

There were no conflicts of interest.

ADMINISTRATIVE BUSINESS

Other Business – Draft Policy Revision Review

This draft policy is also listed on the website. There was discussion on this at the March 13, 2018, meeting, and also between Schuler, Christianson, Schneider, and Pfennig.

On page 2, **REC – 2.02 Eligible and ineligible projects**, we added the language *or advanced energy technology*. It was determined not to have a definition to keep it more flexible.

On page 9, **REC – 5.06 Disbursement of funds**, we revised paragraphs 2, 3, 4, 7 and 8. A copy of this revised draft was sent to EERC, UND, NDSU and Corey Kratcha and Chad Ulven of C2Renew because those entities had expressed an interest in this topic. Pfennig heard back from EERC, and their response was that none of the changes gave them concern. EERC did suggest defining "early stage," "commercialization ready" and "technology deployment." Pfennig asked the Council if they wanted those three categories. She noted that if those categories are kept, it may be beneficial not to define them in order to give the Council flexibility. With the current language, the Council designates whether it falls into those categories; it's not up to the applicant to decide what they fall into. EERC also advised a discussion regarding delineation of enforcement duties. Pfennig asked how the Council is going to get those documents from the recipients, and who is responsible for the administrative work behind that. Schneider replied that coming into the Renewable Energy Council, these are the policies and, as proposed, the Development Fund staff will be arbiter of whether or not they are in compliance. We have our system in place. Schuler and Schneider commented that they are good with the changes.

The Council determined the effective date is the next grant round.

Christianson made a motion to recommend to the Industrial Commission the revisions to the Renewable Energy Development Program Policies; Schneider seconded.

Roll Call Vote
Mr. Christianson – aye
Mr. Schneider – aye
Mr. Douglas – aye
Mr. Holth – aye
Mr. Goerger – aye
Mr. Nisbet - aye
Mr. Schuler – aye

The vote is unanimous.

ADJOURNMENT

Meeting adjourned at 11:42 a.m.

9/28/18
Jay Schuler Date
Chairman

Denise Faber 9/28/18
Denise Faber Date
Acting Recorder