

TECHNICAL REVIEWERS' COMMENTS

LRC-LXXX-C: "Pathway to Low-Carbon Lignite Utilization – Phase 1B & 2A"

Submitted by: Energy & Environmental Research Center (EERC)

Principal Investigator: Michael Holmes

Project Duration: 19 months

Request for: \$3,500,000; Total Project Costs: \$ 10,300,000

1. OBJECTIVES

The objectives or goals of the proposed project with respect to clarity and consistency with North Dakota Industrial Commission/Lignite Research Council goals are: 1 - very unclear; 2 - unclear; 3 - clear; 4 - very clear; or 5 - exceptionally clear.

Reviewer 17-07 (Rating: 5)

The project goals match the goals of the NDIC/LRC which are to find ways for the continued use of lignite for future power generation.

Reviewer 17-08 (Rating: 4)

The Allam cycle technology could be the basis for the next generation of lignite-fired power plants in North Dakota. If proven, this technology would significantly increase the efficiency of electrical generation, reduce emissions, and maintain or increase jobs and lignite utilization in the state. The proposed project is the next logical step towards proving the feasibility of a lignite-fired Allam Cycle power plant. As such, the NDIC/LRC goals are very clearly being met.

Reviewer 17-09 (Rating: 4)

The objective is the proposal is to support the evaluation and development of a low-carbon pathway to lignite. To achieve this objective the Allam Cycle technology is to be evaluated and developed.

2. ACHIEVABILITY

With the approach suggested and time and budget available, the objectives are: 1 - not achievable; 2 - possibly achievable; 3 - likely achievable; 4 - most likely achievable; or 5 - certainly achievable.

Reviewer 17-07 (Rating: 4)

This research team has the experience to most likely achieve the targeted objectives within the time and budget allotted.

Reviewer 17-08 (Rating: 5)

The proposal's approach, timetable, and budget all seem to be aligned, making the objectives highly likely to be achievable.

Reviewer 17-09 (Rating: 4)

It is most likely the objective to support evaluation and development of the Allam Cycle is achievable.

3. METHODOLOGY

The quality of the methodology displayed in the proposal is: 1 - well below average; 2 - below average; 3 - average; 4 - above average; or 5 - well above average.

Reviewer 17-07 (Rating: 3)

The tasks appear to be fairly normal for this type of research.

Reviewer 17-08 (Rating: 4)

The approach and methodologies described in the proposal are very logical and well thought out.

Reviewer 17-09 (Rating: 4)

The quality of the methodology is above average. The project applicant has assembled capable and experience staff, industry partners and developed an above average management plan.

4. **CONTRIBUTION**

The scientific and/or technical contribution of the proposed work to specifically address North Dakota Industrial Commission/LRC goals will likely be: 1 - extremely small; 2 - small; 3 - significant; 4 - very significant; or 5 - extremely significant.

Reviewer 17-07 (Rating: 4)

Lignite usage for future power generation will decline if barriers for alternate uses of lignite for this purpose can't be found. The usage is very significant to the NDIC/LRC goals.

Reviewer 17-08 (Rating: 4)

The proposed project's scientific and technical contributions will be very important to meeting NDIC's goals. Generating plants based on the Allam Cycle will control CO₂, as well as other emissions. The project will take the next technical step towards commercializing an Allam Cycle plant by further defining the requirements of processes and materials to make it possible.

Reviewer 17-09 (Rating: 4)

The quality of the methodology is above average. The project applicant has assembled capable and experience staff, industry partners and developed an above average management plan.

5. **AWARENESS**

The principal investigator's awareness of current research activity and published literature as evidenced by literature referenced and its interpretation and by the reference to unpublished research related to the proposal is: 1 - very limited; 2 - limited; 3 - adequate; 4 - better than average; or 5 - exceptional.

Reviewer 17-07 (Rating: 4)

Based on the list of references, the staff at the EERC appear to be very aware of other activities in this area of research.

Reviewer 17-08 (Rating: 5)

The PI's grasp of research regarding the Allam Cycle appears to be very good and may be as complete as anyone in the world.

Reviewer 17-09 (Rating: 5)

The PI and staff are exceptionally qualified. The proposer references current published literature and the entire organization is exceptionally experienced in this area.

6. **BACKGROUND**

The background of the investigator(s) as related to the proposed work is: 1 - very limited; 2 - limited; 3 - adequate; 4 - better than average; or 5 - exceptional.

Reviewer 17-07 (Rating: 4)

The work associated with this proposal seems to be right on par with the expertise and experience of the staff at the EERC.

Reviewer 17-08 (Rating: 5)

The resumes in the proposal indicate that the PI team has broad and detailed experience, covering all aspects of the proposal's various tasks.

Reviewer 17-09 (Rating: 5)

The background of the PI and staff are exceptionally qualified in this area.

7. **PROJECT MANAGEMENT**

The project management plan, including a well-defined milestone chart, schedule, financial plan, and plan for communications among the investigators and subcontractors, if any is: 1 - very inadequate; 2 - inadequate; 3 - adequate; 4 very good; or 5 - exceptionally good.

Reviewer 17-07 (Rating: 4)

The EERC and its partners in this research have proposed a very good plan to complete this project.

Reviewer 17-08 (Rating: 4)

The management plan detailed in the proposal would appear to be well thought out and should meet the needs for successful project completion.

Reviewer 17-09 (Rating: 5)

The project management plan is exceptionally good with organization, task, and timeframe charts.

8. **EQUIPMENT PURCHASE**

The proposed purchase of equipment is: 1 – extremely poorly justified; 2 – poorly justified; 3 – justified; 4 – well justified; or 5 – extremely well justified. (Circle 5 if no equipment is to be purchased.)

Reviewer 17-07 (Rating: 5)

It appears the majority of the equipment utilized in this research project already exists at all the participants facilities.

Reviewer 17-08 (Rating: 5)

No equipment is being purchased for the project.

Reviewer 17-09 (Rating: 5)

9. **FACILITIES**

The facilities and equipment available and to be purchased for the proposed research are: 1 – very inadequate; 2 – inadequate; 3 – adequate; 4 – notably good; or 5 – exceptionally good.

Reviewer 17-07 (Rating: 5)

The project participants (mainly EERC, 8 Rivers, & Cermatec) possess or have access to facilities and equipment that are an excellent match to this research project.

Reviewer 17-08 (Rating: 5)

The equipment and facilities at EERC identified in the proposal are world class and well suited to meet the research needs.

Reviewer 17-09 (Rating: 5)

The facilities and equipment are exceptionally good.

10. **BUDGET**

The proposed budget "value"¹ relative to the outlined work and the financial commitment from other sources² is of: 1 - very low value; 2 - low value; 3 - average value; 4 - high value; or 5- very high value.

Reviewer 17-07 (Rating: 4)

The financial contributions from other sources for both in-kind services and direct financial support appear to be very good related to the likely success of the project.

Reviewer 17-08 (Rating: 4)

While the total budget of the proposed project is \$10.3 million, the work (as outlined) is critical to the next steps of developing the Allam Cycle for a commercial plant. With the matching funds from other sources, the State is being asked for only 34% of the total, further increasing the value of the project to the State.

Reviewer 17-09 (Rating: 5)

The proposed budget if of very high value of the \$10,300,000 total cost, \$3,500,000 is requested from NDIC LRC.

¹ "Value" – The value of the projected work and technical outcome for the budgeted amount of the project, based on your estimate of what the work might cost in research settings with which you are familiar.

² Financial commitment from other sources – A minimum of 50% of the total project must come from other than Industrial Commission sources to meet the program guidelines. Support greater than 50% from Industrial Commission sources should be evaluated as favorable to the application.

OVERALL COMMENTS AND RECOMMENDATION:

Please comment in a general way about the merits and flaws of the proposed project and make a recommendation whether or not to fund.

Reviewer 17-07 (Rating: FUND)

The project continues work on barriers identified in previous research toward using lignite in the Allam Cycle and is critical to the future lignite industry in North Dakota. I recommend to fund.

Reviewer 17-08 (Rating: FUND)

Overall, the proposal is very good and meets the NDIC's goals and guidelines. The project would move the state's coal industry a step closer to technology that may become its future. As such, my recommendation is to fund the proposal.

Reviewer 17-09 (Rating: FUND)

This is an opportunity for the NDIC to participate in development of new power generation cycle, which specifically addresses the currently largest threat to the industry. The proposal is of a very high quality and the participants are exceptional. The major flaw is the question of the specific beneficial nature to NDLC.