

TECHNICAL REVIEWERS' COMMENTS

LRC-LXXVIII (78)-B:

“Demonstration of Pilot-Scale Hydrogen and CO₂ Separation Membrane Technology on Lignite-Derived Syngas”

Submitted by: Energy & Environmental Research Center (EERC)

Request for: \$225,000; Total Project Costs: \$2,039,608

Principal Investigators: Joshua J. Stanislawski, Tyler J. Curran, Michael L. Swanson

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 15-04 (Rating: 4)

The objectives and goals for this project are very clear. This project is consistent with the clean coal technologies supported by the LRC/NDIC.

Reviewer 15-05 (Rating: 4)

The goals align very well with NDIC/LRC goals and testing success will certainly further the use of lignite.

Reviewer 15-06 (Rating: 4)

The objective of this proposal is to conduct a pilot-scale demonstration of advanced hydrogen and CO₂ separation technology on low-rank coal using warm-gas cleanup techniques and hydrogen separation membranes. The objectives are very clean and CO₂ emissions are a necessary concern for the lignite industry and consistent with NDIC/LRC goals.

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 15-04 (Rating: 4)

The first two of five tasks for the project are already in progress with existing sponsorship. The remaining tasks, which include three five-day test runs, followed by economic analysis and reporting, are very likely achievable.

Reviewer 15-05 (Rating: 4)

Barring some unforeseen problem (not likely as this proposed project appears very well thought-through) the objectives are certainly attainable.

Reviewer 15-06 (Rating: 4)

Given the projects approach, timeframe and budget, the objectives of the proposal are most likely achievable. The Standards of Success are specific for H₂, Cl₂, and S concentrations. Specific goals are established for the membrane material and module costs. Will the Aspen model be built around the WY PRB coal?

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 15-04 (Rating: 4)

The proposed methodology appears very well thought out with a phased approach.

Reviewer 15-05 (Rating: 5)

The applicants have presented a well thought methodology to attain the project's goals.

Reviewer 15-06 (Rating: 5)

The methodology displayed in this proposal is well above average. The proposal contains a brief SOW as a part of the Project Description. The utilization of expertise from various sources is noteworthy.

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 15-04 (Rating: 3)

The contribution of this technology holds great promise for lignite in ND. The economic capture of CO₂ is critical to the future of new lignite projects in ND.

Reviewer 15-05 (Rating: 5)

The success of this project has the potential to significantly promote the NDIC/LRC goals and cannot be understated. The combined effects of getting these technologies to the commercial scale would be a monumental step forward in both the hydrogen and CO₂ arenas.

Reviewer 15-06 (Rating: 4)

The scientific and technical contribution of the proposed work could be very significant in addressing the goals of the LRC/NDIC. The proposal addresses CO₂ capture an area of significant need for the lignite industry. Identifying the need for hydrogen to power automobiles was made in the 1970s. The market has not developed in the past 40-years.

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 15-04 (Rating: 4)

The investigators have great backgrounds. The principal investigator, Mr. Curran, has many years of direct experience with this technology.

Reviewer 15-05 (Rating: 4)

The principal investigator presents a very acute awareness of ongoing and state-of-the-art research and literature relative to what's currently out there in the research world.

Reviewer 15-06 (Rating: 3)

EERC submitted the proposal as a joint effort with Praxair and the state of Wyoming. The EERC Key Personnel are identified in the proposal. However, the key personnel, qualification and participation by Praxair and the state of Wyoming are not identified. The EERC PI and Key Personnel have demonstrated their scientific awareness by the discussions and citations contained in the proposal.

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 15-04 (Rating: 4)

As stated above, all the investigators have experience in the fields of gasification and/or hydrogen separation technology.

Reviewer 15-05 (Rating: 5)

Very impressive backgrounds that are directly related to this work.

Reviewer 15-06 (Rating: 4)

The background of the EERC personnel is exceptional. Are all investigators identified?

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 15-04 (Rating: 4)

The project management plan and detailed budget are very good.

Reviewer 15-05 (Rating: 4)

Very well planned project – specifically addresses milestones, schedule, finances, and communications.

Reviewer 15-06 (Rating: 4)

The project management plan identified in the proposal is very good. A Project Organizational Chart and identification of all key personnel is needed.

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 15-04 (Rating: 5)

Most of the equipment and supplies have already been acquired for the project.

Reviewer 15-05 (Rating: 4)

The planned equipment purchases correlate very well with project needs – the justifications are well explained.

Reviewer 15-06 (Rating: 5)

No comment.

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 15-04 (Rating: 5)

The EERC is well equipped to test this technology.

Reviewer 15-05 (Rating: 5)

The existing/proposed facilities and equipment will serve the project's potential for success very well.

Reviewer 15-06 (Rating: 4)

The facilities available at EERC are notably good for the proposed work.

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 15-04 (Rating: 4)

The \$225,000 requested is a relatively low cost investment. Most of the proposed project amount of \$2,039,608 has been secured from federal flow-through funding from Praxair and the state of Wyoming.

Reviewer 15-05 (Rating: 5)

The potential benefits from this study make it a great value to the lignite industry here in North Dakota.

Reviewer 15-06 (Rating: 4)

The budget value of the proposal relative to the outlined work is of high value. The project is highly leveraged by the contribution of others.

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 15-04 (Rating: FUND)

Finding an economical method of capturing CO₂ is vital for the coal industry to grow. Successful demonstration of the technology in this project will greatly benefit the lignite industry. I recommend this project be funded.

Reviewer 15-05 (Rating: FUND)

This project has been very well conceived and executed to this point. Its vision for potential success reflects the thoroughness of the project team from concept through completion. It can produce very positive long-term effects for the lignite industry as well as ancillary industries tied to the hydrogen and CO₂ produced.

Reviewer 15-06 (Rating: FUNDING MAY BE CONSIDERED)

This reviewer has two reservations with the proposal. All the Key Personnel and contacts are not identified. What is meant by “the state of Wyoming”? Is there a State of Wyoming government agency involved? Can a key individual be identified for Wyoming? Is there a reason why the reference to the state of Wyoming is ambiguous?

The cover page of the proposal shows the “Amount of Request: \$225,000” and the proposal is submitted to Karlene Fine North Dakota Industrial Commission. On page 1 of the proposal it is stated, “we anticipate to be matched with the proposed \$225,000 from the Lignite Energy Council (LEC)”. Again this wording is used on page 2 and page 24. Is the LEC matching the NDIC \$225,000? It is doubtful the intent of the proposal is to obtain a \$225,000 grant from LEC for NDSU. A key element of R&D and proposal preparation is attention to detail. Are other areas of detail missed in the proposal or proposed work?