

TECHNICAL REVIEWERS' COMMENTS

LRC-LXXVI(76)-B:

“Continuation of Underground Coal Gasification Study in Western North Dakota”

Submitted by: University of North Dakota Institute for Energy Studies;

Request for: \$299,958; Total Project Costs: \$719,958;

Principal Investigator: Scott Korom, Ph.D.

1. OBJECTIVES

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

Reviewer 13-13 (Rating: 4)

This project meets each of the statutory goals and purposes listed for the Lignite Research Council.

Reviewer 13-14 (Rating: 3)

The project's main objective is to continue researching underground gasification and liquids production to gain enough knowledge to conduct a feasibility evaluation. Although the project is eligible in two categories under section 43-03-02-02, the goal falls short of meeting the criteria for a priority ranking.

Reviewer 13-15 (Rating: 4)

Research could lead to job creation in utilization of ND lignite. Research could uncover a new opportunity in the lignite industry.

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 13-13 (Rating: 4)

The objectives appear to be achievable given the scope of the project. The value of a phased project is the opportunity to evaluate the ability of the management team to deliver on the earlier objectives. Although the first phase project is still in process (see my general comments) it appears to be on schedule.

Reviewer 13-14 (Rating: 4)

The seven specific objectives should be successfully completed with sufficient data in the time allotted. Most of the data should be available to begin developing the feasibility study in the 15th month.

Reviewer 13-15 (Rating: 4)

I believe the work can get accomplished in the time frame as described.

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 13-13 (Rating: 3)

The quality of the methodology appears good, but I would have preferred more detail regarding well construction. Proper well construction is a crucial part of this project.

Reviewer 13-14 (Rating: 4)

The methodology seems to be well designed to give the data sought and conduct the feasibility study.

Reviewer 13-15 (Rating: 3)

I believe environmental risk should have more discussion. It was mentioned as a technical issue, but not elaborated on.

4. **CONTRIBUTION**

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

Reviewer 13-13 (Rating: 4)

The information generated by this project should be very useful in future evaluations of the UCG potential of North Dakota lignite. If these lignites are well suited for UCG, subsidence potential will very likely become one of the most important criteria to be addressed. Since the vast majority of data on coal has been collected within 200 feet of the surface, any data on these deep coals is of value.

Reviewer 13-14 (Rating: 3)

The project will advance the underground gasification knowledge as well as the liquid production technology. The project will need substantial more research before it will significantly enhance more use of lignite or marketable processes in North Dakota.

Reviewer 13-15 (Rating: 3)

I believe it could be significant; however, I am uncertain about how it will be interpreted by environmental groups. How much environmental risk exists and how will environmental groups be convinced the risk is acceptable?

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 13-13 (Rating: 4)

While the references cited are not overly abundant, they do demonstrate knowledge of the more recent work in UCG and the involvement of several of the management team in that work.

Reviewer 13-14 (Rating: 5)

The principal investigator has included substantial references of research activity and published literature.

Reviewer 13-15 (Rating: 3)

FEED study already done by GNP will be very helpful.

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 13-13 (Rating: 4)

Members of the research team have strong backgrounds in lignite chemistry, groundwater and gasification and, to a lesser degree, UCG.

Reviewer 13-14 (Rating: 5)

The principal investigator and team are all highly qualified.

Reviewer 13-15 (Rating: 4)

I am a supporter of Dr. Benson. He works very hard to support ND lignite!

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 13-13 (Rating: 4)

The project management chart and the timetable and milestone log are well defined and reasonable. What is the significance of the decision points listed in Figure 10 and Table 1?

Reviewer 13-14 (Rating: 4)

Although the management chart does specify that counsel from the lignite research council is to be included in the management of the project, a specific communication plan seems to be lacking.

Reviewer 13-15 (Rating: 3)

I would guess the comprehensive assessment would be developed so work goes on; however, the chart only shows a quarter for work on it. The overall assessment is key to eventual development on the pilot plant!

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 13-13 (Rating: 2)

Only one piece of equipment is listed – a Grundfos pumping system. I believe you can rent this pump for \$600 per week. If it is only to be used for quarterly groundwater sampling that would come to \$2,400 rather than the \$5,400 purchase price.

Although it is a supply rather than equipment, I question the use of PVC to construct a well that is 1,000 feet deep. The deep monitoring wells that I am familiar with are constructed with steel pipe. I would verify that Mohl Drilling or some other entity has had success using PVC to that depth.

Reviewer 13-14 (Rating: 3)

The equipment purchase consists of a submersible pump for the well sampling with one quote provided.

Reviewer 13-15 (Rating: 4)

No major purchases.

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 13-13 (Rating: 4)

The laboratories noted in the proposal are more than adequate to perform most of these analyses. We have to assume that the bench-scale, pressurized fixed reactor that is being constructed under phase one of this project will be operational during this phase. See my overall comments.

Reviewer 13-14 (Rating: 4)

The project will have access to excellent facilities. Contractors and equipment purchase has been studied with quotes available for review.

Reviewer 13-15 (Rating: 3)

Would like to see age of equipment shown to be used to understand how up to date it is to earn a higher mark.

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 13-13 (Rating: 4)

A cash outlay of \$300,000 by the North Dakota Industrial Commission is reasonable given the scope of the project and its potential value along with the cash and in-kind match.

Reviewer 13-14 (Rating: 3)

In the abstract it states that the project is expected to be finished in 18 months, with a total budget of \$449,700, including a cash support of \$150,000 from Great Northern Properties. This is the cost of the actual work on this project including conducting the feasibility study. This would not meet the 50 percent cost share threshold. But additional in-kind support of \$270,000 is also provided which is FEED data and specification from the Junior GLT Project. However, the value of the FEED study was not substantiated or how the \$270,000 was determined.

Reviewer 13-15 (Rating: 3)

How much of the \$270,000 is involved in turning over a report?

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 13-13 (Rating: FUNDING MAY BE CONSIDERED)

Funding to be considered.

From a reviewer's standpoint, I feel this proposal was submitted too early. It would have been beneficial had the results from Task 3 of the earlier project been incorporated into this proposal. Since Task 3 is not scheduled for completion until the fourth quarter of 2013, this proposal should have been submitted in early 2014. I realize doing so would likely have jeopardized part of the 2014 field season.

Will the portion of the test hole drilled below the 1,000 foot mark be grouted prior to installation of the monitoring well? Based on Mohl's cost calculations it appears this would be the case. The screens have to be isolated from the rest of the borehole in order to obtain legitimate slug test data.

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.

It is unfortunate that the first proposal did not include the installation of a monitoring well in the test hole. At least one of the 2012 proposal reviewers recognized this shortcoming and asked what was going to happen to that test hole. *Reviewer 12-07* “*Will the wells be plugged and abandoned or left open for later hydrological testing or logging.*”

Reviewer 13-14 (Rating: FUNDING MAY BE CONSIDERED)

There are lots of challenges for lignite and coal in general at the current time. Part of the purpose of the Lignite Research Program is to fund projects that help give some answers to those challenges. Another part of the Lignite Research Program is to support research that will enhance the use of lignite and demonstrate marketable lignite products. This project will need additional research to meet the technical issues discussed in the proposal. I see many hurdles to overcome and high risks for the underground gasification developer.

Based on the weighting of the 10 criteria in the proposal I would recommend that funding may be considered.

Reviewer 13-15 (Rating: FUND)

I recommend funding to continue supporting results found in the last testing.