

TECHNICAL REVIEWERS' RATING SUMMARY

R028-B

Integrated Carbon Capture and Storage for
North Dakota Ethanol Production

EERC

Principal Investigator: Kerryanne Leroux
Request for \$490,000; Total Project Costs \$980,000

<u>Rating Category</u>	<u>Weighting Factor</u>	<u>Technical Reviewer</u>			<u>Average Weighted Score</u>
		<u>1B</u>	<u>2B</u>	<u>3B</u>	
1. Objectives	9	5	5	4	42.00
2. Achievability	9	5	4	4	39.00
3. Methodology	7	5	5	4	32.67
4. Contribution	7	5	5	3	30.33
5. Awareness	5	4	5	5	23.33
6. Background	5	5	5	5	25.00
7. Project Management	2	4	3	5	8.00
8. Equipment Purchase	2	5	5	5	10.00
9. Facilities	2	5	4	5	9.33
10. Budget	2	5	5	4	9.33
Average Weighted Score		243	235	209	229.00
Maximum Weighted Score					250.00

OVERALL RECOMMENDATION

FUND	X	X	X
FUNDING MAY BE CONSIDERED			
DO NOT FUND			

R028-B
Integrated Carbon Capture and Storage for
North Dakota Ethanol Production
Submitted by EERC
Principal Investigator: Kerryanne Leroux
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- 1. The objectives or goals of the proposed project with respect to clarity and consistency with North Dakota Industrial Commission/Renewable Energy Council goals are: 1 – very unclear; 2 – unclear; 3 – clear; 4 – very clear; or 5 – exceptionally clear.**

Reviewer 1B (Rating: 5)

The stated objectives, to assess technical feasibility, develop a field implementation plan, and evaluate the economic feasibility of CCS associated with ethanol production, are extremely clear and appropriate. These objectives are certain to benefit the State of North Dakota and are consistent with the North Dakota Industrial Commission/Renewable Energy Council goals. The proposed project will promote economic and environmentally sound development of ND's vast renewable energy resources, especially in the area of biofuels. The project will provide economic growth and opportunities in the renewable energy industry by laying the foundation of research upon which ethanol producers (and other industries) can assess and understand the potential for CCS in ND, while potentially realizing the benefit from 45Q tax credits. This project also promotes public awareness, new technologies, and may add wealth for landowners and agricultural producers. Furthermore, the project will generate information and knowledge that brings new renewable energy companies to ND by highlighting the potential for carbon storage within in ND. This project will help maximize market potential for biofuels while providing an environmentally sound method for storage/management of carbon dioxide, a by product of the ethanol production process. The proposed project will also develop baseline feasibility information that can lead to other projects for ethanol producers, as well as cement and other manufacturers.

Reviewer 2B (Rating: 5)

This project would hit almost every one of the council goals. A very good and clear fit.

Reviewer 3B (Rating: 4)

Sustainable carbon capture and storage from a bioethanol biorefinery is within NDIC. The proposed development of carbon capture would lead to compliance of partner organization RTE's bioethanol product with California's Low-Carbon Fuel Standard (LCFS), which can bring profit to North Dakota via jobs and revenue.

- 2. 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 1B (Rating: 5)

The project as proposed is highly achievable and has the appropriate level of resources dedicated to the project success. The balance of funding and in-kind contributions assure that the project team will bring this project in on time and within budget. The paper feasibility study primarily requires time and human resources, of which the project team has sufficient allocation. The approach is an excellent balance of data review, modeling for new results, and design/preparation for implementation.

Reviewer 2B (Rating: 4)

6 months is a very short time for a study like this. They have the manpower and the budget looks sufficient, but it takes time to gather all the relevant data together before you can even begin to analyze it.

Reviewer 3B (Rating: 4)

The EERC is a leader in carbon sequestration technology. Through their Partnership for CO₂ Capture program, the EERC has expertise in the evaluation, scale-up, and implementation of carbon capture technology. Their evaluations of the sub-terrestrial properties of the region near the RTE facility suggest carbon storage is likely to be successful. The EERC has expertise in the implementation of the Monitoring, Verifying, and Accounting (MVA) for CO₂ in storage sites. Proposed subcontractors possess the expertise to prepare economic analyses and a Field Implementation Plan (FIP).

3. 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 1B (Rating: 5)

The methodology proposed for this project represents the state-of-the-art approach to assess feasibility, development of a field implementation plan, and evaluation of economic feasibility. EERC's PCOR team has considerable experience all aspects of carbon storage, especially in the areas of site characterization, geologic modeling and simulation, permitting, well design, MVA, and risk assessment. EERC also has demonstrated expertise in carbon capture and life cycle analysis. They have also brought in industry experts in carbon dioxide compression, and well design and testing. In fact, the EERC is one of three or four groups in the United States prepared to undertake such a comprehensive and meaningful approach to understanding storage from ethanol production specifically in ND. This is in large part due to the combination of their experience and their unique knowledge of the geologic subsurface in ND.

Reviewer 2B (Rating: 5)

The methods proposed are time-tested in the oil industry, and have been adapted to CCS. EERC has clearly embraced the best methods known to date.

Reviewer 3B (Rating: 4)

Methodologies are applicable.

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

Reviewer 1B (Rating: 5)

The scientific/technical contribution of this work is extremely significant in that it has the potential to match major sources of renewable energy with the reduction of associated byproduct. The project will generate new knowledge specifically for ethanol producers that can use this information to advance biofuel production in ND, while being prepared for future carbon emissions reductions soon to be in place, keeping ND viable in this important industry. The feasibility study can lead to the preservation of existing jobs and creation of new jobs as ND strengthens its geologic storage of carbon dioxide knowledge and increases the potential for biofuels production in the state. This project has the potential to be a springboard for much future development in an economically viable and environmentally sound manner.

Reviewer 2B (Rating: 5)

If they can find a way to make an economic case for CCS with ethanol the impact will be significant. That said, there would be no reason for the ethanol industries in other states like Iowa to adapt the same business model.

Reviewer 3B (Rating: 3)

This proposal addresses the first NDIC goal: “promote efficient, economic, and environmentally sound development and use of North Dakota’s vast renewable energy resources .. biofuels”. Jobs and revenue may be created through the implementation of the proposal leading to LCFS compliance for RTE’s bioethanol product

- 5. 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 1B (Rating: 4)

The awareness of the current research activity is very suitable and focused on EERC work. The team will benefit from engagement with Trimeric Corporation and their work on another CCS from ethanol project in Illinois.

Reviewer 2B (Rating: 5)

They have brought in the most knowledgeable companies in North America on each of the specialties needed. So they have obviously spent a lot of time looking into current research activities.

Reviewer 3B (Rating: 5)

EERC is a national leader in carbon sequestration technology. The partnering entities who will complete some of the design work are well capable of completing their tasked deliverables.

6. 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 1B (Rating: 5)

Ms. Leroux has an excellent background and many years worth of experience in conducting oilfield operations. She has experience leading a team of researchers and has served as principal investigator. The team pulled together by Ms. Leroux is very strong and will support project activities. This project team draws from an excellent pool of researchers, field experience, modeling expertise, and industry experts.

Reviewer 2B (Rating: 5)

Lots of relevant experience in all facets of the project.

Reviewer 3B (Rating: 5)

Ms. Leroux and her team are very capable of completing the proposed R&D plan.

7. 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 1B (Rating: 4)

The project management plan included schedules for completion, budget justification, and appropriate level of detail with respect to execution of the technical aspects of this work. Milestones and tasks are clearly defined and described, and represent a logical workflow necessary to meet the project timeline. The project management plan fully describes how the project team (investigators and subawardees) will communicate with each other.

Reviewer 2B (Rating: 3)

For such a short time frame they will need tight communications and agreed milestones. Not a lot of these are documented, although they are noted as something needed.

Reviewer 3B (Rating: 5)

The applicants will leverage EERC's "adaptive management approach to project design" which has already been developed.

8. 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 1B (Rating: 5)

No equipment purchase proposed.

Reviewer 2B (Rating: 5)

Not applicable.

Reviewer 3B (Rating: 5)

No equipment is to be purchased.

- 9. 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 1B (Rating: 5)

The EERC has exceptional facilities and capability available to the project team.

Reviewer 2B (Rating: 4)

Since this is a paper study there will be mostly office facilities needed, with enough computing horsepower to run the simulations quickly. From what I know they are fine in this regard.

Reviewer 3B (Rating: 5)

EERC has outstanding facilities for the R+D of carbon sequestration. Partnering organizations also have the necessary facilities to complete their deliverables.

- 10. 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. (See below)**

Reviewer 1B (Rating: 5)

The value of the work proposed is exceptional. The project will accomplish three major objectives for a very reasonable amount of funding. There is a significant commitment in matched funds from RTE and EERC, the majority of which are cash funding. A study of this sort can, in my experience, cost considerably more depending on the nature of the work to be completed. This project proposes a reasonable amount of work in a reasonable amount of time, resulting in high value to the State of North Dakota and the North Dakota Industrial Commission.

Reviewer 2B (Rating: 5)

The financial ask is very reasonable for what they are proposing. With the potential impact this could have on the council goals, the value is very high. So the rating is very high.

Reviewer 3B (Rating: 4)

Applicants have procured substantial matching fund commitments, including \$290K from biofuel producer RTE. The value of this proposal is directly tied to the potential value affiliated with the production of bioethanol compliant with California’s LCFS. Approximately 1/3 of the proposed N Dak state-supported NDIC funds are attributable to Indirect Costs by EERC, a research center affiliated with a state university.

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 sources to meet the program guidelines. Higher priority is to be given if the application has private industry investment equal to or at least 50% or more of total cost.

Section C. Overall Comments and Recommendations:

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 1B (Fund)

This is an excellent project, which has the potential to expand markets and carbon storage potential in the State of North Dakota. The project team represents some of the best people and companies in the CCS research arena, especially EERC, Trimeric, and Schlumberger who all have extensive CCS project experience that bears directly on this project. The timeline seems a bit aggressive, but is suitable with dedicated effort. The project management is very good. However, it could have been more rigorously defined if proposal page limits allowed, but is not lacking in anyway. Overall, this is a very interesting and valuable project that will benefit the State of North Dakota and the global CCS community, while bringing further opportunities to link renewable energy production with carbon storage. I give this proposal my highest recommendation.

Reviewer 2B (Fund)

No comments provided.

Reviewer 3B (Fund)

The proposal focuses upon technical and economic feasibility development to introduce carbon capture and storage processing at RTE, a bioethanol producer located in western North Dakota, to enable the latter to achieve compliance with the California Low Carbon Fuel Standard, which is anticipated to bring additional tax revenue to the State of North Dakota as well as jobs. The proposed R&D plan focuses upon development of carbon capture technology selection and design, risk assessment, an LCA, plans for Field Implementation and carbon storage, and an economic analysis. The applicants, EERC, are national leaders in carbon sequestration-related technologies: their development and implementation. Their preliminary results suggest that the sub-terrestrial geology of the RTE biorefinery site will be effective for carbon storage. I believe the applicants possess the necessary expertise to complete the deliverables. The direct value of carbon sequestration to the government and peoples of North Dakota, and the timing thereof, are dependent upon politics at the national level, particularly relating to carbon taxes and the like. This project would serve as an investment by the state government in green technology that may pay dividends in the future.