TECHNICAL REVIEWERS' RATING SUMMARY

R009-A

Dakota Spirit AgEnergy Cellulosic Biorefinery

Great River Energy
Principal Investigator(s): Sandra Broekema
Request for $500,000; Total Project Costs $1,250,000

Rating Category	Weighting Factor	Technical Reviewer 1A Rating	1B Rating	1C Rating	Average Weighted Score
1. Objectives	9	5	5	2	36.00
2. Achievability	9	5	5	4	42.00
3. Methodology	7	3	5	2	23.33
4. Contribution	7	5	5	2	28.00
5. Awareness	5	1	4	2	11.67
6. Background	5	3	4	3	16.67
7. Project Management	2	3	5	3	7.33
8. Equipment Purchase	2	5	5	4	9.33
9. Facilities	2	5	5	3	8.67
10. Budget	2	3	4	2	6.00
Average Weighted Score		198	238	131	**189.00**
Maximum Weighted Score					**250.00**

OVERALL RECOMMENDATION

FUND	x	x	
FUNDING MAY BE CONSIDERED			
DO NOT FUND			x

R009-A
Dakota Spirit AgEnergy Cellulosic Biorefinery
Submitted by Great River Energy
Principal Investigator(s): Sandra Broekema
Request for $500,000; Total Project Costs $1,250,000

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 1A (Rating: 5)
The goals listed on page 3 match well with the NDIC/REC goals: renewable energy development, job creation, economic development, etc. However the actual objectives of this proposal are more specific, as described in the abstract: 1) to develop preliminary front end engineering & design, and prepare financial models that will be used to assess feasibility. These specific objectives should also be spelled out in this section.

The PI is accurate in stating that this type of information will be critical for federal grant applications to assist in construction costs. Getting this information early will be a definite advantage in the next round of applications.

Reviewer 1B (Rating: 5)
Objectives were clearly met with specific attention paid to new technology development (work with new technologies of European firm), wealth and job creation (REIS simulation), and the development of new markets for North Dakota agricultural concerns. The new market creation is likely to generate other renewable energy opportunities for the area as additional firms will wish to take advantage of the newly expanded infrastructure and production "partnerships". A successful project should contribute to an increased desire for the development and use of "environment-friendly" activities. While the ability of the concern to quantify the environmental impacts of the project is limited due to the "scarcity of commercial scale plants" the apparent desire to produce and deliver environmental impact mitigation is noted.

There is little mention of education of the general public on the issue/project; however it can be assumed that a successful long-term project and the interest generated from the project success (through media and other outlets) will serve as an education vehicle for the promise of renewable resources.

Reviewer 1C (Rating:2)
The two objectives of the proposal are described in paragraph three of page 2 are to expedite the development of the Pre-Feed Engineering Model and a Financial Model. A more detailed list objective list is provided on page 5. The list indicates that the major efforts will be to evaluate and understand the engineering and costs associated with the plant itself. It appears little to no effort will be devoted to the logistics of straw collection (which the authors indicate "doesn't exist today"), delivery or cost estimates. It also appears little to no effort will be devoted to

marketing or logistic issues related to two of the three end products (ethanol and feed grade molasses). The goals are clear but not particularly consistent with NDIC REC goals.

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 1A (Rating: 5)
The workload will be split between professionals at Inbicon and Great River Energy who have experience in developing these documents. The proposed budget seems in excess of what would actually be needed (see comments in section 10). Average monthly budget will be in excess of $100,000, which seems high. Assuming 8 people (4 from each group) would be working on the project full time, the average annual salary would be $156,000/person.

Reviewer 1B (Rating: 5)
While planning and execution of the plans are always problematic (and often underestimated in time and resource allocation), the establishment of a pre-existing facility in Europe provides support for estimates and thus a basis to assume achievable results.

Reviewer 1C (Rating: 4)
The grant proposal goals are modest and achievable.

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 1A (Rating: 3)
I can only assume that the parties involved have sufficient background and expertise in performing the drawings, process flow diagrams, and cost estimates needed…. at least they should based on their prior expertise. The information provided in Appendix 1: Process Description Report and Appendix 3 provide a complete outline of services to be performed, milestones, and scheduling.

In the methodology section they describe development of a supply chain for baled wheat straw, as well as a "balance of plant" study, but neither of these are explained in any detail. The former does not show up as a component of either the timeline or budget.

On the bottom of page 9 the authors describe a prior study "Feasibility Study of a Biomass Supply for the Spiritwood Industrial Park" but they fail to provide any details of the findings. It would seem that this study would have already quantified the amount and prices of wheat straw in the proposed area. This is a glaring omission.

Reviewer 1B (Rating: 5)
Clear, concise, and well-reasoned with partnership contributions well defined.

Reviewer 1C (Rating: 2)
The project proposes using "proven technology" from Inbicon. This technology needs to be scaled up and adjusted to meet US standards. It appears that since the general technology is "proven" that estimates could be generated to create a preliminary financial feasibility model to determine if an engineering design study should be completed. The preliminary model must address markets for feedstocks (quantity and price) and all final products produced.

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 1A (Rating: 5)
Biomass ethanol could be a tremendous boon to the midwest, as it already has for corn ethanol. Tying in this project with a CHP plant, and boosting efficiency from 43 to 66% is tremendous. The synergy of selling lignin pellets to the power plant and then using excess steam is a winning idea that is proven.

Reviewer 1B (Rating: 5)
The work (facility and infrastructure *planning*) to be conducted with the requested funding is necessary for the eventual completion of the final project (not part of this request). The successful implementation of the final product described has the potential to bring to North Dakota technology that is not only new to the state, but is new to almost everywhere.

Reviewer 1C (Rating: 2)
The authors indicate on page 6 that the technology is proven and the Inbicon has 14 years of handling wheat straw in Denmark. This project doesn't appear to be adding a great deal to the scientific or technical knowledge of the industry.

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 1A (Rating: 1)
No prior literature was cited. The main technical awareness is of the Inbicon process and general claims about their process. I have toured the Inbicon facility and am aware of the technology, which appears to have potential. However without that background I would be very suspicious of this proposal due to the lack of any data from their operating demonstration plant. This is a serious deficiency in the proposal.

Reviewer 1B (Rating: 4)
The PI's knowledge of the industry appears to be solid. While, there are elements of the project that may lie outside the PI's purview, this is information and technical "know-how" is provided by the project's partner. There is no literature of consequence referenced in the proposal.

Reviewer 1C (Rating: 2)
The proposal cites only a few other studies (most notably the "Feasibility Study of Biomass Supply for Spiritwood Industrial Park" which was authored by this proposal's PI). Because the application fails to reference other research it is unclear whether the principle investigator has significant awareness current research activity.

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 1A (Rating: 3)
PI's background indicates that this will be a new area, with prior experience limited to solar, wind, and industrial power generation. Other collaborators from the Great River Energy side will have background in electrical generation only. Expertise on the ethanol side will be provided by Inbicon, who is relatively new to ethanol production.

Reviewer 1B (Rating: 4)
Industry and technical background knowledge appears to be on a par with or beyond the level of knowledge displayed by most in the field.

Reviewer 1C (Rating: 3)
Few specifics of the PIs background are provided but the general information appears adequate.

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 1A (Rating: 3)
The proposal includes a schedule, but not a defined milestone chart. The management plan is weak in showing how communication and collaboration will occur between participants in ND and Denmark.

Reviewer 1B (Rating: 5)
All elements appear to be well thought out and developed in a logical manner. I would have liked to have seen more detail on the financial plan, however, the nature of the proposal limits that ability at this time.

Reviewer 1C (Rating: 3)

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 1A (Rating: 5)
NA

Reviewer 1B (Rating: 5)
I find no indication of equipment needs.

Reviewer 1C (Rating: 4)
No or very little equipment is required for this project.

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 1A (Rating: 5)
Office facilities are assumed to be sufficient. Inbicon's demonstration plant can provide valuable technical information.

Reviewer 1B (Rating: 5)
Facilities and equipment necessary for the project are assumed to be "state of the art" as the technology in use is new.

Reviewer 1C (Rating: 3)
This project appears to have support from the cooperating entities (Dakota Spirit AgEnergy LLC, Great River Energy, GRE's Spiritwood-coal fired combined heat and power plant & Inbicon/DONG Energy) for adequate facilities.

10. The proposed budget "value"[1] relative to the outlined work and the financial commitment from other sources is of: 1 – very low value; 2 – low value; 3 – average value; 4 – high value; or 5 – very high value. (See below)

Reviewer 1A (Rating: 3)
The budget appears to be on the heavy side. Some of the information on feedstock availability should be available from a prior funded study.

Reviewer 1B (Rating: 4)
This appears to be on the top end of budget value for this type of work.

Reviewer 1C (Rating: 2)
This project does not appear to have a financial/economic model completed at this point. Of the 7 "Goals and Purposes" of the NDIC Renewable Energy Council, three refer to economic attributes. The project proposes to devote $25,000 of the $1,250,000 budget to a financial model. This is clearly insufficient to complete an analysis of this scope.

[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.

10a. 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.

The minimum 50% cash match is demonstrated.

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 1A ***(Fund)***

a. I have serious questions about the value of molasses to the feed industry. The PI should have been able to provide at least estimates of the market size and price for this product. If livestock feed markets are already saturated with things like DDGS, corn solubles, sugarbeet molasses and pulp, then the molasses produced by this process will have little value. Part of this study should have evaluate alternative, higher value uses for the xylose, such as in producing chemicals or fuels to replace petroleum.
b. As noted previously, a prior funded study evaluated feedstock availability in the site region, and yet none of this information was provided in the proposal. The applicants should have been able to at least estimate wheat straw availability, location and price.
c. The proposal correctly notes that biomass to ethanol processes are frequently designed to use waste resources that have a negative value. Yet they propose to use wheat straw (which has some existing markets as bedding or for return to the soil). Moreover they indicate that this new market for straw will provide additional income for farmers. This dichotomy was not explained. What basis do they have to expect that this process will be economical, when the feedstock will have a cost? The applicants should have been able to provide some cost estimates for the economics of the process, based on Inbicon's demonstration facility.

Reviewer 1B ***(Fund)***
This project is recommended for funding by the reviewer. While many pitfalls may exist, the overall "gamble" is worthwhile as new alternative energy sources and uses for agricultural products are essential to move the state and the industry forward.

Reviewer 1C ***(Do Not Fund)***
This application fails to justify why this project is needed. The authors (on page 7 &8) indicate that there is insufficient market demand even for first generation supplies (of ethanol) with the E10 blend wall. The authors also indicate that "inadequate feedstock supply and/or logistics, lack of transportation & utility infrastructure, and undeveloped markets" are all potentially fatal issues. This project attempts to address none of these issues.

General estimates of input costs (delivered straw prices) and output revenues (ethanol, molasses and lignin pellets) are not provided. Until a basic financial/economic feasibility study for this project is completed that indicates the project is likely to be financially/economically viable the engineering study of the process (as proposed in this application) is not justified.