TECHNICAL REVIEWERS' RATING SUMMARY

R011-C

Trace Element Measurements During Biomass Gasification

Energy & Environmental Research Center
Principal Investigator: Nicholas Lentz
Request for $250,000; Total Project Costs $500,000

Rating Category	Weighting Factor	Technical Reviewer 3A Rating	3B Rating	3C Rating	Average Weighted Score
1. Objectives	9	3	3	4	30.00
2. Achievability	9	4	4	4	36.00
3. Methodology	7	3	3	3	21.00
4. Contribution	7	4	2	3	21.00
5. Awareness	5	4	3	4	18.33
6. Background	5	4	5	4	21.67
7. Project Management	2	3	3	4	6.67
8. Equipment Purchase	2	5	5	5	10.00
9. Facilities	2	4	5	5	9.33
10. Budget	2	4	2	3	6.00
Average Weighted Score		184	168	188	**180.00**
Maximum Weighted Score					**250.00**

OVERALL RECOMMENDATION

FUND			
FUNDING MAY BE CONSIDERED	x		x
DO NOT FUND		x	

R011-C
Trace Element Measurements During Biomass Gasification
Submitted by Energy & Environmental Research Center
Principal Investigators: Nicholas Lentz
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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 3A (Rating: 3)
The overall goal of this proposal is to characterize (detect) trace elements in the biomass-derived syngas. The objectives, however, are loosely put together and not well associated with the goal. The tasks do not reflect the objectives with integrity. Tasks 2 and 3 (which correspond to 2nd and 3rd objectives) are basically the same, even the language used is almost identical, except the feedstocks from which the syngas is generated are different. However, the significance of separating these two is not justified.

From reading the rest of the proposal, this reviewer understands that one aspect of the project is to evaluate the self-developed trace element testing ME-ST method and to compare with the reference EPA M29 method. The ME-ST method is being developed and claimed efficient and cost-effective, and promising in replace of the EPA M29 method. If so, it is a sound and valid objective for such a project. Otherwise, the proposed work as stated by the objectives would be considered an analytical routine for prestigious research institution like EERC in biomass gasification projects, not as an independent research project.

The proposed work is in support of biomass gasification projects and consistent with the ND Industrial Commission/Renewable Energy Council goals.

Reviewer 3B (Rating: 3)
The goal is to refine trace element analysis for gasification streams. Conventional methods are not well adapted to the reducing atmospheres of syngas. Trace element analysis is not as pressing a problem in bioenergy as it is in coal utilization. Thus, I scored this criterion lower for not being fully "consistent" with the ND IC/REC goals as I interpreted them.

Reviewer 3C (Rating:4)
The objectives were clear and trace elemental analysis is something that needs to be studied on the biomass gasification. It will provide a great technological contribution if an alternative method can be develop that is less expensive and reduces solvent use.

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 3A (Rating: 4)
The proposal does not set any measurable objectives other than to "characterize the trace element emissions", therefore, it is most likely achievable.

Reviewer 3B (Rating: 4)
The investigators apparently are proposing to continue development of an analytical method originally devised for analysis of trace elements released during coal gasification and apply it to biomass gasification. Although ASTM M29 has been established for measuring trace elements in combustion (oxidizing) environments, the reducing environment of syngas rapidly deplete the oxidizing solvents used to capture trace elements, reducing the effectiveness of this method for gasification environments. The investigators are exploring a non-solvent sorbent to overcome this difficult. It is hard to determine from the proposal how far along this method has previously been developed as no preliminary data is provided. Otherwise, I do not identify anything that would preent the objects from being reached.

Reviewer 3C (Rating: 4)
The ME-ST method is already developed. Facility is capable to gasify biomass.

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 3A (Rating: 3)
It is lack of details on methodology and no experimental plan in place. There are long paragraphs on the overall research and analytical capabilities at EERC, but not a detail on how the trace elements are to be characterized and by what means. It is even unclear what types trace elements are expected to be characterized in the project have they affect the characterization. There are not any preliminary data or literature analysis on how the trace elements would affect the emissions and/or syngas quality.

Reviewer 3B (Rating: 3)
The methodology section consisted of a workplan, which was sparse on details, making it difficult to judge whether the methodologies were adequate in terms of hypotheses to be evaluated and statistical methods to be applied.

Reviewer 3C (Rating: 3)
The methodology of the proposed project is adequate. Not a lot of detail on gasification conditions for the comparative study.

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 3A (Rating: 4)
Trace element characterization and detection are important to biomass gasification for syngas and are in support of high quality syngas production. If the ME-ST method is successfully implemented in gasification system to approve its efficiency and cost-saving benefit as claimed by the proposal, it would be a great contribution to the biomass gasification industry. It would be a greater contribution to the advancement of instrumentation in trace element measurements.

Reviewer 3B (Rating: 2)
I thought it was telling that the investigators did not tabulate the expected concentrations of trace elements in biomass compared to coal and estimate the syngas concentration. This would reveal that the concentrations for biomass were very small, which means they are both difficult to detect and, more importantly, there is little reason to try to detect them. The investigators ignore potassium, the most problematic trace element in biomass, responsible for ash fouling and corrosion in gasifier systems and downstream components.

Reviewer 3C (Rating: 3)
The analytical method development will be a significant technological contribution to standard setting organizations (EPA, ASTM, etc.) and researchers as an alternative method that is less expensive.

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 3A (Rating: 4)
Although not documented clearly in the proposal with literature review, it seems the PIs are long time experienced and have had expertise in trace element characterization/ emission analysis. Their awareness on the current development in the topic area is at least above average.

Reviewer 3B (Rating: 3)
Only three references were cited, and none of these are clearly addressing biomass gasification. The investigators appear knowledgeable relevant to trace elements in coal, but show little understanding of biomass inorganic content, which is distinct from that of coal. The investigators seem unaware of the most pressing issues in analysis of biomass gasification streams.

Reviewer 3C (Rating: 4)

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 3A (Rating: 4)
As mentioned above, the PIs seem well qualified and their expertise is above average.

Reviewer 3B (Rating: 5)
Well qualified team.

Reviewer 3C (Rating: 4)

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 3A (Rating: 3)
The research goal is straightforward and the project will be conducted within the EERC. The simple management statement in the proposal is adequate to this reviewer.

Reviewer 3B (Rating: 3)
Adequate.

Reviewer 3C (Rating: 4)

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 3A (Rating: 5)
The proposal does not request any equipment.

Reviewer 3B (Rating: 5)

Reviewer 3C (Rating: 5)

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 3A (Rating: 4)
EERC has tremendous analytical capabilities. Although not stated in details, the means of characterizing the trace elements, i.e., the ME-ST and EPA M29, are in place and ready for the project.

Reviewer 3B (Rating: 5)

Reviewer 3C (Rating: 5)
EERC facilities are capable of completing project.

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 3A (Rating: 4)
The budget (total $500k and $250k from this program) seems high for the scope of work, especially no additional equipment is needed. The gasifier is to be run just for this project, which involves quite high expenses, instead of working with the gasification research. The personnel cost is significant.

No industrial partners contribute as match.

Reviewer 3B (Rating: 2)
I simply do not understand why measuring trace elements emitted during biomass gasification is an important problem. The concentration in biomass is low.

Reviewer 3C (Rating: 3)
The budget seems reasonable for laboratory operations.

[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 3A ***(Funding May Be Considered)***

(1) This is not a very well written research proposal. The topic to be explored is valid but not well formulated.
(2) There is lack of details in methodology, literature review on current development in the topic area, and experimental plan.
(3) The outcome out of this project will provide useful information for gasification operation, and evaluate the ME-ST instrumentation for its efficiency and cost effectiveness.

It is recommended that the proposal be funded with a medium level priority.

Reviewer 3B ***(Do Not Fund)***

Good qualifications, good instruments. Weak on selecting a project that will actually advance biofuels. Trace elements are the least of the worries in producing clean syngas.

Reviewer 3C ***(Funding May Be Considered)***

The proposed project is the development of an alternative method for measuring trace elements in syngas steams. It will have a significant technological contribution to standard setting organizations and researchers as an alternative method that is less expensive than traditional techniques.