

R009-H: "Redesigning the Residential Wind Turbine (RWT) for Rural Areas with Abundant Wind Resources"

Submitted by Clean Republic, LLC

Principal Investigator: Yong Hou, Jing Shi

Request for \$186,000; Total Project Costs \$372,653

Technical Advisor Comments

- 2 reviewers recommended do not fund, 1 recommended fund.
- Applicant will provide a 25% cash match and a 25% in kind match. Of the \$93,653 cash match, \$65,000 will come from the company, \$25,653 will come from NDSU, and \$3,000 will come from UND. *(Note: University dollars come from development foundations or other grants and therefore not state funds.)*
- 1 reviewer felt that while achievable if focused, the timetable was aggressive. Another reviewer felt the timetable and budget were insufficient. That reviewer commented "Task 3 is a design of a new wind turbine and is totally unrealistic in projection of time required and cost. To meet the new AWEA Small Wind Turbine Standards and Certification will require at least 6 years. The 3rd reviewer did not comment, but gave the timetable and budget a score of 1 (not achievable)."
 - The applicants responded "Our phase-one goal is to demonstrate that this system design and technology will work, and we will develop a prototype by incorporating the key features with common components. We are confident that we can achieve the objectives in 2 years."
- 2 reviewers were concerned that wind shear was not addressed in the proposal.
 - The applicant responded to the wind shear concern stating that "...The wind shear effect is common knowledge for everyone, in particular for the proposer with numerous publications on wind modeling." They also commented that there are "some empirical models regarding the surface effect and we will try them..."
- All 3 were concerned about surface effects and reduced energy output. 1 stated "The wind resource estimation methods being proposed do not appear to take into consideration the differences in topography, surface roughness effects or obstacles between the measurement sites and the prediction sites. At the low elevations being proposed for turbine hub heights, the effects of these surface elements will significantly influence the wind speeds. Also, the energy available for capture at these low elevations is much less...the wind turbines would miss much the energy available many nights...With the lower wind energy content at these low hub heights, I am doubtful that any wind turbine would be financially viable...while it is true that ND law does require that electrical utilities provide net metering...this only applies to the regulated utilities which mainly serve metropolitan areas...inability to take advantage of net metering will have a significant impact on the financial feasibility and payback period for small wind turbines."
- 2 reviewers felt there was little benefit to mapping wind speeds at the proposed elevations.
 - The applicant stated that if the method becomes commercialized, it will benefit the NDIC. However, there was no further information.
- 2 reviewers felt the applicants lacked awareness of current research activity and 1 reviewer was concerned that the applicants only referred to the 1988 AWEA Standard, rather than the new standards that were adopted 12/09.
- 1 reviewer commented, "...Rotor diameter has not been identified, but could easily end up being too close to the ground, based on a 30-40 foot hub height. A typical rotor diameter for a 5 to 10 kW machine would be in the range of 20 to 30 feet. For a low wind regime such as that proposed, it may require a larger rotor to extract more wind energy in order to achieve better economics. A larger rotor combined with higher fatigue loading would be a difficult design challenge."
 - Applicants responded, "... We propose 16 feet rotor diameter and 24 feet level tower for 5kw machine; 21 feet rotor diameter and 36 feet regular tower for 10kw machine."
 - As this is smaller than what the reviewer suggested is the norm, more information would be beneficial.

Technical Advisor Recommendations

The applicants had an opportunity to provide clarification to the technical reviewers' comments. It was clearly stated that this opportunity is for the benefit of Commerce when drafting recommendations for the Council.

Unfortunately, the applicants utilized this opportunity many times to argue with the reviewers without providing any clarification/justification.

To confidently recommend that funding be considered, Commerce would have liked to have seen the following information:

- In response to the concern that they lack experience in small wind development, the applicant states that they have experience in new product development. Rather than forcing assumptions, a clear outline of how the experience they do have relates to small wind would have been appreciated.
- How wind shear will be addressed.
- How surface effects, turbulence, etc. will be addressed.
- How reduced energy output will be addressed.

Because this information was not provided, the Technical Advisor is left with too many questions regarding this proposal. The comment regarding the next phase of the project was concerning. If there is a larger scope of work than what was proposed, it would be beneficial for the Council to be aware of it. Additionally, while the proposal has industry involvement, there is not a valid roadmap to commercialization. Actual industry growth is vague.

The applicants indicate that they will be able to produce a small wind turbine that costs much less than what is currently on the market. However, there are no details regarding what the reduction in cost might be, or the potential market.

Suggested contingencies if funded:

- Applicants provide a more detailed budget. For example, \$20,000 is listed as the NDIC's share (and total project cost) for the wind resource assessment. Greater detail of what that \$20,000 will be used for should be provided.
- \$4,000 of the budget (cash from NDIC) has been devoted to team meetings. According to the proposal, the team will meet every 3 months, for a total of 8 times. This amounts to \$500 per meeting. This seems high considering the individuals are located approximately 1 hour apart. This should either be reduced or justified.
- Similarly, \$6,000 (\$3,000 NDIC, \$3,000 NDSU) of the budget is devoted to travel to the WINDPOWER conference. Reference to this was limited in the proposal by the applicants stating "The research results will also be disseminated to both academia and industry people by presenting at the annual WINDPOWER conference." The Council may wish to require further justification or decrease the amount.
- A full scope of work of the project is provided, including plans for subsequent phases.