Sandia National Laboratories
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PROJECT EXECUTIVE SUMMARY

Lead Institution: Sandia National Laboratories

Principal Investigator(s): Matthew Barone, Ph.D.

Project Title: Innovative Offshore Vertical-Axis Wind Turbine Rotors

Topic Area: 415/3.1 Advanced Rotor Technologies

Project Objectives:
The overall goal of the project is to demonstrate the potential of offshore machines based on a Vertical-Axis Wind Turbine (VAWT) rotor architecture to overcome the major technology barriers to large-scale deployment of offshore wind energy. The most critical barrier to offshore wind, large cost-of-energy (COE), is specifically targeted with the overall goal of achieving a 20% reduction in COE through application of VAWT rotor technology. This goal will be achieved by:

1. Development of innovative VAWT rotor designs that enable reliable, cost-effective, and easily manufactured rotors for deep-water offshore machines at the 10-20 MW scale.
2. Demonstration of the potential for greater than 20% reduction in COE for a deep-water, floating VAWT system compared to current shallow-water HAWT systems.
3. Development of manufacturing techniques, certification test methods, and a commercialization plan for offshore VAWT rotors in order to accelerate deployment of the technology.
4. Wind tunnel and combined wind-wave tank testing and proof-of-concept of a sub-scale, deep-water floating offshore wind turbine generator employing a VAWT rotor.

Project Description:
During this five-year project, a collaborative team consisting of members from a Department of Energy research lab, several universities, and a major U.S. wind blade manufacturer will design, build, and test advanced Vertical-Axis Wind Turbine (VAWT) rotors for application to deep water offshore wind energy production. The team will design VAWT rotors employing advanced load alleviation and speed control technologies, enabling cost-effective and reliable operation in the challenging offshore environment. System design and cost studies will be performed to determine optimal turbine scale and to identify the potential reduction in cost of energy (COE) offered by deep water offshore VAWTs. Challenges related to manufacture of very large VAWT rotor blades will be addressed through research on design-for-manufacturability and advanced manufacturing strategies for VAWT blades. The team will develop protocols for material, substructure, and full VAWT blade certification testing. Subscale wind tunnel testing will be performed to validate the aero-elastic properties of the novel rotor designs. A subscale prototype floating platform VAWT system will be designed, manufactured, and tested in a wind/wave tank test facility. This test will provide proof-of-concept of the deep water VAWT, as well as data for validation and improvement of design methods. If successful, this project will lead to a potentially transformational approach to offshore wind energy generation. Impacts of this research on the U.S. offshore wind market will be accelerated through completion of a detailed commercialization plan for exploitation of the newly developed technologies.

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