

ATTACHMENT 3 Fact Sheet Template

EPC-16-310

Researching and developing VAWTs potential to double capacities of California's wind resource regions while preventing harm to birds – Phase I

The Issue

Most of the windiest locations in California have already been built out with wind farms. Because horizontal axis wind turbines (HAWTs) experience fatigue problems if placed either too close together or near the ground, they cannot be added into existing wind farms. Thus, to produce new wind energy in the state, expensive off-shore projects must be developed, or wild land in bird- and bat-sensitive areas must be zoned and permitted for wind farms. Both result in more costly wind energy for California ratepayers.



Figure 1. Graphic of VAWTs installed in rows among HAWTs in Southern California wind farm.

Project Description

This project uses Wind Harvest International's 66-foot tall G168 VAWTs installed first as a pair of turbines and then as a 280 kW, four-turbine array on the Emigh family ranch in southern Solano County. By changing the blade direction on a pair of VAWTs, different downwind wakes will result. Field data will be collected from Doppler LiDAR, sonic anemometers and other sensors. This data will be empirically analyzed and used by Stanford University's CFD Large Eddy Simulation (LES) model to validate a methodology for predicting how the wake from coupled pairs of VAWTs in different length arrays spreads and decays within an atmospheric boundary layer. This will be key to wind farm owners granting permission to conduct Phase II studies among their HAWTs.

The second part of the project will test the hypothesis that birds see and avoid VAWTs. If they don't, then the DTBird motion detection device will be programmed to slow down or stop the VAWTs if its dissuasion tools are ineffective. A field mortality study will supplement the video data.

Anticipated Benefits for California

General Benefits

WHI predicts that this research will open the door to 10,000 MWs of new VAWT wind energy projects being developed in California by 2040. It also predicts that VAWTs in the understory of HAWTs will be the least-expensive source of any energy option within five years and continue with that status throughout the full build-out of VAWT wind projects in the state. The massive amount of low-cost renewable energy that could result from this R&D proposal would produce

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major downward pressure on energy prices for IOU ratepayers. In addition, if, as anticipated, VAWTs do not cause harm to birds and bats, then their widespread use will be better for state wildlife populations, particularly by reducing the pressure to develop new wind farms in raw habitat where no roads or development currently exist.

Specific Benefits

- Lower costs: On-shore, in-state wind farms in the state's windiest areas provide the least expensive source of energy available. This grant will open up those wind farms to the potential for at least doubling their capacity and energy output.
- Economic development: This R&D work could lead to an additional \$15 billion in new VAWT wind farms in California by 2040 at \$1.5 million per MW installed.
- Environmental benefits: If 8600 MWs of new VAWTs are added between 2020 and 2040, more than 100 million metric tons of CO2 emissions and related pollutants will, in theory not have been emitted into the atmosphere.
- Public health: Large-scale displacement of fossil fuel combustion by renewables, such as VAWTs, has the potential to produce benefits to the public health.
- Consumer appeal: If, as predicted, VAWTs are bird friendly, then they will have more consumer appeal than traditional wind turbines. Also, contributing to consumer appeal is VAWTs' shorter height, which makes them less intrusive in the landscape.
- Energy security: A massive increase in wind energy by VAWTs in the state's Wind Resource Areas, with much of it being produced after the sun sets, significantly increases the state's energy security.

Project Specifics

Contractor: Wind Harvest International
Partners: Emigh Land LP for property lease
SJSU for LiDAR and sensor data and analysis
Stanford for CFD LES modeling
Garcia and Associates for bird studies

Amount: \$1.25 million request
Co-funding: \$291,000 in matching funds
Term: begins Nov. 15, 2017 and is completed before Nov. 15, 2020

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