University of Delaware

Technical Analysis for On-Site Wind Generation
Lewes Campus

Summary of Project Status

Prepared by:

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This report summary is designed to provide a brief overview of the detailed feasibility study performed for an on-site wind turbine development at the University of Delaware's Lewes campus. The full report was submitted to UD in May.

REPORT SUMMARY

Sustainable Energy Developments, Inc. (SED) performed a technical assessment for an on-site wind turbine(s) installation at the University of Delaware's (UD) campus located in the City of Lewes. The results of the study demonstrate positive characteristics necessary for a developable, financially beneficial 1.5MW on-site wind generation project. SED recommends that the University pursue the next stage of development for such a project.

1 - Site Analysis: SED performed an assessment of all property owned or controlled by the UD and adjacent properties owned by the State of Delaware for potential turbine locations. Preliminary siting considerations included: general wind climate; land ownership; proximity to residences and property lines; proximity to occupied buildings; buildability; proximity to wetlands; manufacturer siting requirements; and input from UD. In total, six sites were selected for further investigation based upon these preliminary criteria (see satellite image with sites below).

SED evaluated the locations using a series of criteria that considered the positive and negative attributes of each location using the specifications for a GE 1.5MW wind turbine; the locations can be expected to have similar characteristics if another turbine is installed such as the Gamesa 2.0 MW wind turbine. The siting requirements that were examined in this second level of site assessment included permitting and regulatory considerations, ease of interconnection, project costs and detailed wind resource. SED identified Location1 and Location 2 as its preferred locations for siting a GE 1.5MW wind turbine. A variety of aspects characterize these other locations that may impede the successful completion of a project and/or

economic benefit to the University, although some locations have advantages from a research and design perspective. The chart below provides a brief description of the positive and negative aspects of each location.

Site	Description	Pros	Cons
Location 1	Dredge spoils area	Adequate setback from residences and public ways; adequate area for construction; easy access and interconnection	Existing uses near turbine location; State-owned land; geotechnical concerns
Location 2	Southern edge of dredge area, forested	Adequate setback from residences and public ways; ease of interconnection; upland subsoil conditions	Permitting issues with proximity to wetlands; State owned land; clearing required for staging and access; inland location has lower wind resource
Location 3	Eastern edge of dredge area	Ease of interconnection and site access; adequate area for construction	Does not have adequate setback from residences and public ways; State-owned land
Location 4	Marsh area to west of campus	Adequate setback from residences and public ways; ease to interconnection	State-owned land; difficult to access; permitting issues with proximity to wetlands; geotechnical concerns
Location 5	Spit of land east of Pilottown Rd.	Land owned by University; good wind resource at coastal location	Does not have adequate setback from residences and public ways; permitting issues with location in wetland and proximity to canal; closest location to residences; access difficulties; geotechnical concerns
Location 6	Plum Island State Park	Strongest wind resource; Adequate setback from residences and public ways	Interconnection difficulties; no current access road; permitting issues resulting from site being a State Park; shoreline subsurface conditions

2 - Wind Resource Assessment and Turbine Output Modeling: SED created a computer model using one year of site-collected wind data, the wind turbine power curve provided by the manufacturer, a roughness map describing ground cover and a digital elevation map of the region. This model showed the detailed wind resource for the site and calculated electricity production at each of the identified locations within the modeled area for a GE 1.5 MW wind turbine. A summary of the model results is provided in the charts below.

	Rated Output	Rotor Diameter	Hub Height
GE SLE 1.5MW	1500kW	77m (252.6ft)	80m (262.5ft)

Potential Turbine Location	Mean Wind Speed at Hub Height	Annual Energy Output
Location 1	6.74meters/second (15.07 mph)	4,023,375kWh
Location 2	6.66meters/second (14.89 mph)	3,937,000kWh

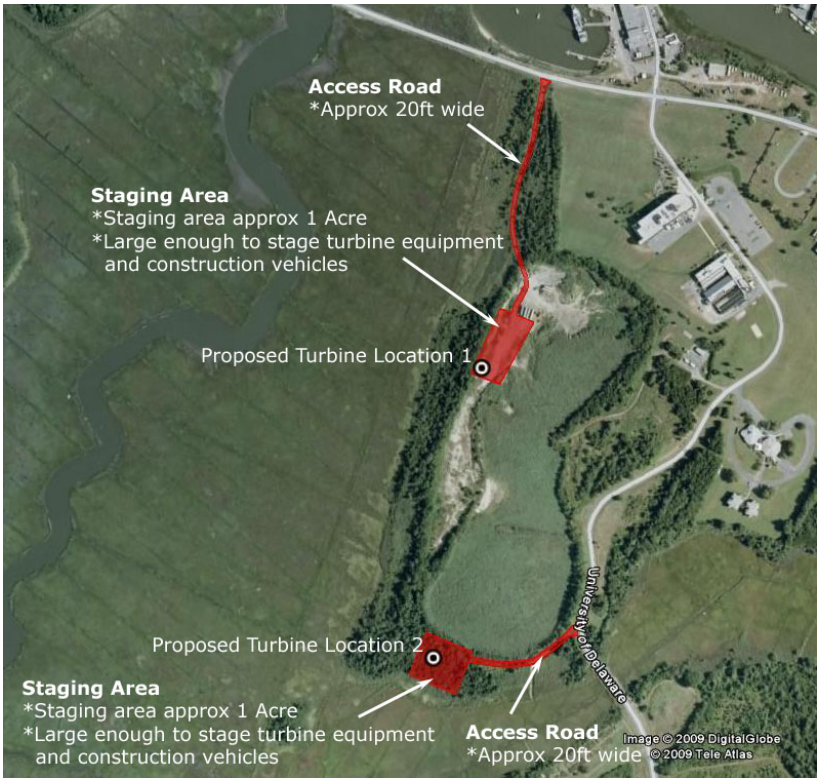
3 - Wind Generated Electricity Value: SED used the annual energy output from the model in combination with UD-Lewes' electrical usage and cost data to determine the value of wind generated electricity.

Annual Usage	Average Demand	Average Electricity Rate	Long-term average electricity Rate at 3% Escalation
~3,400,000kWh	383 kW	$0.12	$0.19

The Lewes campus is serviced with electricity by the Lewes Board of Public Works (BPW) who under State law is required to net meter qualified renewable energy systems up to 500kW in size, but have discretion on net metering larger systems. Net metering allows net excess electricity that is sent onto the grid to be valued at the electricity customer's retail rate. In other words, net metering—that is receiving credit from the BPW for the wind energy UD would generate—is valuable because there are times when the GE 1.5 MW wind turbine will generate more energy than UD will use. However, because e UD Lewes campus on average uses more than 1.5MWh (1500kWh) per hour throughout the year, with net metering, UD would get the full benefit of the wind-generated electricity, Nevertheless, for the purpose of this analysis, SED assumed that excess generation from the wind turbine would not be net metered. . Under that scenario, installing a 1.5 MW GE wind turbine would still be economical. However, it may be possible to negotiate a net metering agreement that would allow excess production to be credited towards other accounts or to be otherwise valued at the University's retail electricity rate. If this net metering agreement can be successfully negotiated, a larger wind turbine that produces more excess electricity to be fed onto the grid may be more financially beneficial.

5 - Buildability: There are no obstacles that would limit the physical installation of a multi-megawatt wind turbine at Locations 1 and 2. SED examined several key issues that will primarily determine the cost of construction including site access improvements, to allow for the transport of equipment to the site; site preparation for construction; and subsurface soil conditions that will determine the foundation design. The map below illustrates potential access routes and staging areas that would be necessary for constructing a 1.5MW wind turbine at location 1 or 2.

A desktop geotechnical analysis of the turbine locations suggests that a foundation design with deep pilings may be required due to the nature of subsoil conditions. This type of foundation consists of a thin spread footing style concrete block with piles or drilled shafts that extend deep into the subsurface.



6 - Permitting: SED performed a detailed overview of permitting and regulatory requirements that a wind turbine installation at UD-Lewes would require. All applicable federal, state and local regulations were evaluated and the process for maneuvering through these entities is provided.

Federal – Federal permitting will likely require the most effort on the part of the project team due to nearby federally designated wetland areas and proximity to the Prime Hook National Wildlife Refuge. Federal Aviation Administration approval is needed for all structures over 199 feet but will not hinder development based on the distance of the site to area airports.

State and Local – A special permit will likely be required by the City of Lewes. There will likely be some State level approvals necessary relating to wetland development.

Potential turbine Location 1 appears the easiest to obtain necessary permits. Potential turbine Location 2 could pose some challenges due to its proximity to designated wetland areas, which may trigger U.S. Army Corps of Engineers review to determine whether or not a section 404 wetland permit would be required.

A preliminary visual assessment of the wind turbine from a location to the northwest of the campus was performed. This simulation demonstrates the scale of the wind turbine compared with the surrounding landscape and the met tower (to the left

side of the photo). A more detailed visual assessment will be performed from a variety of angles/locations early in the Design stage once a wind turbine and site location are both selected.

Development Budget Timeline and Total Capital Cost: Detailed design and construction budgets were created for the development of a GE 1.5MW wind turbine based on SED's wind industry knowledge, past experiences and visits to the Lewes campus. The following chart shows design and construction budgets for the wind turbine at the two identified turbine locations.

	Location 1	Location 2
Total Design	$235,485	$235,485
Total Construction	$4,318,673	$4,569,014
Total Project Cost	**$4,554,158**	**$4,804,499**

SED has recommended an ambitious timeline for project development with the entire design and construction process being completed by the end of 2010.

Conclusion & Recommendation: This project possesses many of the aspects necessary for the successful development of a 1.5MW on-site wind project. The financial, research and development, and educational benefits of this project are significant. The immediate next steps for UD are: to finalize location selection, work on an agreement with the State should the location selected be on property owned or controlled by the State, prepare permit applications and formally file for project permits, and begin the process of gaining the support of the local population.