



See me, Feel me, Touch me, Heal me: Wind turbines, culture, landscapes, and sound impressions[☆]



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ABSTRACT

Community-based wind energy projects, with their small-scale, yet sizeable presence, provide a valuable opportunity to understand how individuals make sense of changes to their communities and to the surrounding landscape. Here, we examine the results of a 2013 mail survey of individuals residing in the vicinity of a 2 MW wind turbine that is located on the edge of the historic coastal town of Lewes, Delaware in the United States, and adjacent to Delaware Bay and the Great Marsh Preserve. The wind turbine, which was constructed in 2010, primarily serves the University of Delaware's coastal campus, and to a lesser extent the town of Lewes. Seventy-eight percent hold positive or very positive attitudes toward the wind turbine, with only 10% having negative or very negative attitudes, and 82% like the look of the wind turbine. Socially constructed aspects find more resonance than physical ones (e.g., attractiveness) in explaining this latter finding, with the wind turbine being reflective of a transformation to a clean energy future for those residents who like the way the turbine looks. On the other hand, those objecting to its look, find the turbine does not fit the landscape. Policy implications of these findings and others related to wind turbine sound are considered, and recommendations for better understanding of proposed developments from the vantage point of the affected communities, including how a community views itself and its surrounding landscape, are made.

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Introduction

Delaware is the second smallest of the 50 United States with a population of less than one million, although it has one of the highest population densities. Delaware is located on the eastern seaboard, with limited economically beneficial land-based wind resources at typical 80 m hub-heights other than those directly adjacent to Delaware Bay or along its 40 km Atlantic ocean coastline. In June 2010, the University of Delaware (UD) commissioned a single 2 MW Gamesa Technology Corporation wind turbine on land directly adjacent to UD's Lewes, Delaware campus. The Lewes wind turbine is the first, and as of the end of 2014, the only utility-scale wind turbine in Delaware; by comparison, the United States as a whole has more than 60 GW (60,000 MW) of wind power capacity. Almost all in-state electricity generation is fueled by natural gas,

coal or petroleum, with the Indian River coal plant situated directly adjacent to coastal Delaware, about 25 km from the town of Lewes. The Salem Nuclear Power Plant and the Hope Creek Nuclear Generating Station are approximately 85 km north of Lewes, just across the Delaware River in New Jersey.

Lewes, known as the "First Town in the First State," was settled in the 1600s and has a designated historic district that includes buildings dating back to the 1700s as well as many Victorian homes. The wind turbine is located approximately 0.4 km from the nearest University building, 0.67 km from the nearest home, and about 1.5 km as the crow flies from the closest edge of the historic district (map at http://www.ci.lewes.de.us/pdfs/HPC_User_Guide.pdf). It is also approximately 1 km from Delaware Bay and borders a large wetland complex to the north. The wind turbine's hub is at 78 m, and with a rotor diameter of 90 m, the tip of a blade at its aperture rises approximately 123 m. Although not visible from the historic downtown, it is visible from some parts of the town, including the Lewes Yacht Club, the town beach, and the surrounding area (e.g., from Highway 1). When most people in the town view the wind turbine they are likely oriented with the Great Marsh Preserve in the background. The town of Lewes, Delaware is bordered by Delaware Bay and Cape Henlopen State Park, which fronts the Atlantic Ocean.

Abbreviations: kW, kilowatt; MW, megawatt; REC, renewable energy credit; UD, University of Delaware.

[☆] From the song "See Me, Feel Me" written by Peter Townsend, The Who.

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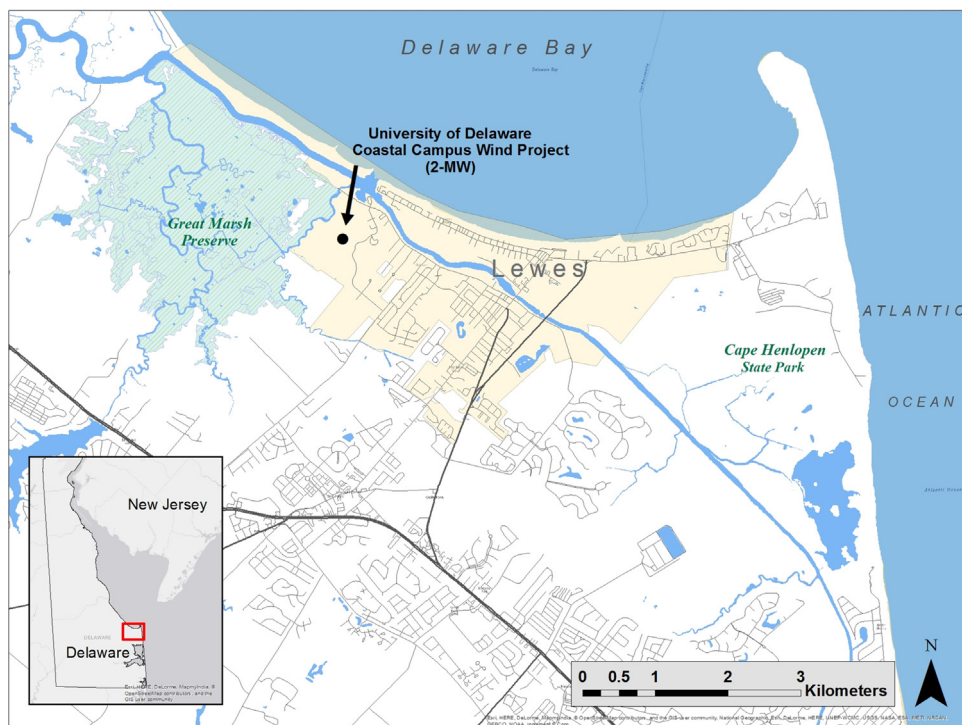


Fig. 1. Map showing the wind turbine and features in the vicinity. Features include the Great Marsh Preserve, the Town of Lewes, Delaware, Cape Henlopen State Park, Delaware Bay and the Atlantic Ocean (Lewes boundary denotes municipal boundaries, not survey sampling area).

With a population of approximately 2750 in 2010, a quaint historic district and coastal location, tourism plays a large part in Lewes' economy, see Fig. 1.

The average age of Lewes residents¹ is approximately 57, with roughly 55% of the population being female and 40% retired. The median household income is almost \$54,000, with households averaging just over two members. Lewes is a well-educated population with more than 47% having obtained at least a bachelor's degree. The town voted heavily for President Obama in the last election, with 63% giving their vote to him, 27% to Mitt Romney, and 4% to some other person, with just 6% not voting.

The wind turbine is owned and operated by a joint venture between the turbine manufacturer, Gamesa Technology Corporation (Gamesa), and a UD wholly owned corporation. Revenues from the wind turbine are dedicated toward wind power research and development. UD purchases the bulk of the electricity generated by the wind turbine to power its coastal campus. As part of the transaction, UD also received all of the renewable energy certificates (RECs) generated by the wind turbine. RECs are the "green attributes" associated with renewable generation that regulated utilities in many states are required to hold. In 2013, UD entered into an agreement with the municipal utility of which Lewes is a member, for the re-sale of RECs, with the proceeds going to support graduate scholarships in wind energy.

The town of Lewes is an important partner, although it holds no financial interest. The Lewes Board of Public Works (LBPW) "virtually" net meters six campus buildings (treating them as one and then net metering). The LBPW also purchases electricity not used by UD at avoided cost—that is, Lewes receives wind-generated, clean

¹ We use the term "Lewes residents" or "Lewes" as shorthand for those in the Lewes sampling strata (see methods), although there is not a precise one-to-one correspondence. The demographic figures here are either drawn from census data relevant to the sample or from the survey data itself (e.g., percent retired and Presidential voting).

energy for the same price it pays for electricity generated by an amalgam of sources, which is primarily comprised of fossil fuel-based electricity and nuclear power. Despite its lack of ownership interest, in an acknowledgment of the town, and due to a desire of the Lewes community, the town of Lewes, like Gamesa and UD, displays its name on the nacelle.

In December 2010, Tech Environmental, on behalf of Gamesa, undertook post-installation sound compliance monitoring. The monitoring occurred outdoors on property of one of the very closest residences to the wind turbine. The sound was below daytime and nighttime average sound limits and within the incremental limit of 10 dBA established under state law for residential areas. More specifically, Tech Environmental, Inc. (2011), found the wind turbine to increase ambient sound level by 1.1 A-weighted decibels (dBA) in the daytime and 2.9 dBA in the nighttime, and after binning hub height wind speeds 4.6 dBA (10.0–10.6 m/s bin) and 4.4 dBA (12.4–13.0 m/s bin). The turbine produces maximum sound when the wind speed is above 8.6 m/s. As noted in the report, the subject effect of a difference of 3 dB is "just perceptible"; 5 dB is "noticeable"; and 10 dB is twice as loud (decibels being a logarithmic scale).

In 2012, UD commenced a research project to better understand how residents of coastal Delaware and Greater Atlantic City, New Jersey perceive local land-based wind projects, proposed offshore wind demonstration projects and offshore cabling. Semi-structured interviews were undertaken in 2012. These interviews were exploratory in nature and were designed to provide insights to guide the content of the subsequent mail survey, which was disseminated late spring/early summer 2013.

Although we were somewhat limited in the number of questions we could pose regarding the Lewes wind turbine because the survey also sought information on two other topics, we were able to structure the survey around those aspects (visual, acoustic, and socio-cultural) that were of greatest resonance in the pre-survey semi-structured interviews. Given the limited number of probability sample-based surveys on community-developed and community-scale wind turbines/projects—and even fewer still that

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