

Cambridge Danehy Park Wind Turbine Preliminary Project Assessment



Overview

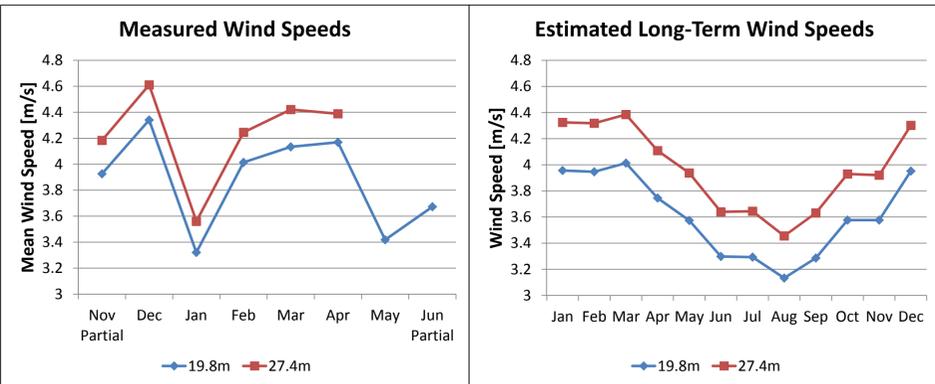
Our team investigated the potential wind resource available at Danehy Park in the City of Cambridge, to provide estimated power generation figures, environmental and community impact analysis, and rough financial estimates.



For the full report, please visit: <http://web.mit.edu/wepa/reports/>

Wind Resource Assessment

We collected wind speed data at the site over seven months using sensors mounted to a light pole at two different heights. We then correlated the data with historical data collected at Logan airport from 1997 to 2010 to estimate the long-term wind resource available at Danehy Park. The method used to perform the estimation is the binned linear regression Measure-Correlate-Predict (MCP). Please see our written report for additional details.



From these estimated wind speeds, we used an approximate wind shear scaling formula to compute a synthetic hourly wind speed time series at hub height for each of the turbines in our evaluation set. From these time series and the turbines' power curves, we computed estimated annual energy production for each turbine.

	Skystream 3.7	Polaris 20	Northern Power 100	Aeronautica 29-225	Polaris 500
Hub Height (m)	20	36.6	37	50	50
Est. Mean Wind Speed at Hub (m/s)	3.7	4.4	4.4	4.8	4.8
Annual Energy Production (kWh)	1,500	19,100	104,100	233,400	744,900

Financial Analysis

Using approximate values for purchase, installation, electricity generation, insurance, and maintenance, we computed net present values (NPVs) for each of the turbines in our evaluation set. These figures are very rough, as there were many details left out, notably the effects of clean energy incentives and potential complications arising from the site being built on capped landfill.

	Skystream 3.7	Polaris 20	Northern Power 100	Aeronautica 29-225	Polaris 500
Approximate Purchase and Installation Cost (\$)	20,000	140,000	450,000	1,300,000	1,800,000
Estimated Annual Energy Production (kWh)	1,500	19,100	104,100	233,400	744,900
Value of Electricity in First Year (\$)	220	2,900	15,600	35,000	111,700
Estimated NPV at 25 Years (\$)	-17,500	-105,600	-261,400	-877,200	-418,900
Production Incentive Required for \$0 NPV at 25 Years (\$ / kWh)	1.09	0.51	0.23	0.34	0.05

Turbine Evaluation Set

	Skystream 3.7	Polaris 20	Northern Power 100	Aeronautica 29-225	Polaris 500
Manufacturer	Southwest Windpower	Polaris America	Northern Power	Aeronautica Windpower	Polaris America
Rated Power (kW)	2.4	20	100	225	500
Approximate Cost (\$)	20,000	140,000	450,000	1,300,000	1,800,000
Hub height (m)	20	36.6	37	50	50
Rotor Diameter (m)	3.7	10	21	29	50
Cutin / Cutout Speeds (m/s)	3.5 / 25	2.5 / 25	3.5 / 25	4 / 25	2.5 / 25
Rated Wind Speed (m/s)	13	10	14.5	~15	12

The above turbines were chosen to provide broad representative coverage of current small to medium scale turbines that would likely be considered for installation at this site. Larger turbines would have to contend with increasingly burdensome noise and shadow flicker issues, greater financial risk, as well as the potential for greater community resistance.

Environmental Impact

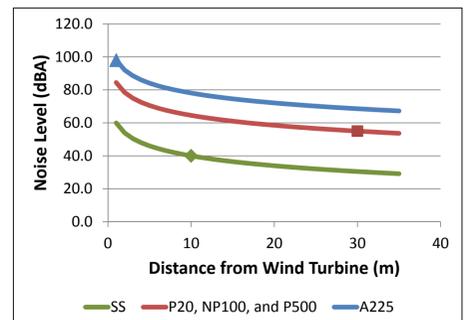
Danehy Park is located within a mile of Fresh Pond, a large body of water located in West Cambridge. Mass Audubon has indicated that birds concentrate in the area in significant numbers in breeding season, winter, and during migration.

Of the many bird species observed living near or migrating through the Fresh Pond area, the few that are listed as endangered or of special concern by the state are infrequently observed in the area. Also, several recent studies examining birds and wind turbines have observed that most birds usually avoid turbine blades. Please see our written report for additional details.



Community Impact

The size of the area in which shadow flicker from spinning blades is detectable by the human eye varies with turbine height and rotor diameter. The map below shows the potential areas of effect for the Polaris 20 (blue) and Northern Power 100 (yellow) in various locations. The area of shadow flicker effect for the Aeronautica 29-225 and Polaris 500 overlapped with neighboring residential areas.



Another community impact issue associated with wind turbine development is noise level. Each turbine has a noise (sound pressure) level that decreases as a function of distance from the turbine, as shown in the above graph.

The noise level from a turbine decreases by approximately half (6 dB) for every doubling in distance from the turbine. The markers in the graph above indicate the manufacturer-published noise levels. For reference, 55 dBA corresponds to the noise level of a busy office. The diameter of the yellow shaded area in the map is roughly 400 meters.