Large Turbine Development Feasibility

Multiple comment letters have raised concerns that adoption of the proposed ordinance will eliminate opportunities for large (utility) scale turbine projects in the County and that the proposed low frequency noise provision is too restrictive. While utility scale turbine development is not a specific objective or goal of the project, County staff has considered the issue and provided a summary of the analysis below.

Analysis

It is important to first define "utility scale" turbines as comment letters are not specific and often only refer to "large scale turbine projects" which is a vague and subjective term. For purposes of this analysis, utility scale turbines are defined as a single turbine or multiple turbines with a rated capacity greater than 500 kilowatts. This definition is consistent with the California Energy Commission's utility scale classification system (Small: less than 50kW, Intermediate: 50kW-500kW, Large: greater than 500kW). Under the existing Zoning Ordinance, large turbines are restricted in size by blade swept area restrictions (6,400 square feet) and an 80-foot height limit. The County is unaware of any single turbine or configurations of multiple turbines that would enable permitting of utility scale turbine development under the existing ordinance.

The proposed two tiered ordinance system relies on a 50kW rated capacity for establishing the minimum size requirements for large wind turbines and does not specify an upper limit with regard to blade swept area, height or rated capacity. The primary restriction or upper limit with regard to large turbines is derived through low frequency noise setback requirements. County noise consultants have identified noise setback distances for typical 50 kW, 500kW, 1 MW, 1.5 MW and 2.3 MW wind turbines as follows (see attached memoranda dated February 21, 2012 and March 25, 2012):

Wind Turbine Size	Property Line Setback Distance
50 kW	475 Feet
500 kW	1,100 Feet
1 MW	1,500 Feet
1.5 MW	2,300 feet
2.3 MW	2,400 feet

Assumptions: The background sound level is assumed to be 25 dBA. Thus, the long-term background sound level is 30dBA at the property line. With this assumption the low frequency sound level shall not exceed 50dBC at the property line

It is important to note that many factors influence low frequency noise setbacks including type and size of turbine, number and location of turbines relative to other turbines, topography, and prevailing weather conditions. Based on the setbacks noted above, County staff applied the 50 kW and 500 kW low frequency noise setbacks on a 152.2 acre property located within the County's Wind Resource Area (See attached "Wind Turbine Noise Setback Distance" map). In

both cases the mapping indicates sufficient acreage of land for large (50kW and 500kW) turbine development.

Conclusions

Based on the analysis noted above, utility scale turbine development is feasible under the proposed ordinance amendment. A single 500 kW (utility scale) wind turbine can be sited on a lot approximately 150 acres in size. In addition, the analysis indicates that low frequency setback requirements are dynamic, with larger wind turbines requiring greater setbacks. Large turbine projects, by virtue of their size, location or availability of land, may not be permissible under the proposed ordinance. This fact does not, however, mean that the proposed ordinance would eliminate opportunities for utility scale turbine projects. It simply means that turbine selection (manufacturer, size, number of turbines) is important and must be balanced against the size and location of the proposed project site.

Attachments:
Memorandum from Mike Komula, dated February 21, 2012
Memorandum from Mike Komula, dated March 25, 2012
Wind Turbine Noise Setback Distance Map

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MEMORANDUM

To: Matthew Schneider, County of San Diego

From: Mike Komula, Dudek
Subject: Wind Turbine Noise Setback Distances
Date: February 21, 2012

This memorandum identifies noise setback distances for typical 50 kW, 500 kW and 1 MW wind turbines. Wind turbine sound levels were modeled to estimate the setback distances necessary to comply with the proposed County of San Diego's Amendments to the Zoning Ordinance Related to Wind Energy Systems. Specific to this memo, the noise criteria are relative to the low-frequency sound limit. Section 6952(f) Noise of the noted zoning ordinance, specifies that the low-frequency sound limit shall meet the following criteria:

The C-weighted sound level from each large wind turbine while operating shall not exceed the long-term background sound level by more than 20 dB as both sound levels are measured at each property line of the lot on which the large turbine is located.

The long-term background sound level is defined as the background sound level measured as L90 (A-weighting) plus 5 dBA. The background sound level (L90) is defined as the measurement of the average sound level during the quietest continuous ten minutes during a 24-hour period.

For the purposes of this analysis, the background sound level (L90) is assumed to be 25 dBA. Thus, the long-term background sound level (L90) will be 30 dBA at the property line. With this assumption, the wind turbine low frequency sound level shall not exceed 50 dBC at the property line.

Methodology

Noise levels were modeled for 50 kW, 500 kW and 1 MW wind turbines. The calculations assume standard point source geometrical divergence attenuation of 6 dB per doubling of distance and atmospheric attenuation per the International Organization for Standardization, *Acoustics Attenuation of Sound during propagation Outdoors*, ISO 9613-2:1996(E).

The sound levels generated by wind turbines of the same size vary between different manufactures and model types. Also, larger wind turbines produce greater sound levels than smaller wind turbines. Based on a review of manufactures and published octave band frequency data for 50 kW to 1 MW wind turbines, typical sound power levels (Lw) range from approximately 92 to 102 dBA based on a wind speed of 8 meters/second and measurement height of 10 meters.

Results

As shown in Table 1, a 50 kW wind turbine will require a 475 foot setback, a 500 kW wind turbine will require a 1,100 foot setback and a 1 MW wind turbine will require a 1,500 foot setback from the property line. As previously indicated, these setback distances assume a long-term background sound level of 30 dBA.

Table 1

Setback Distances for Various Wind Turbines

Wind Turbine	Sound Power Level (Lw)	Property Line Setback Distance (Long-Term Background is 30 dBA)	Wind Turbine Sound Level
50 kW	92 dBA	475 feet	50 dBC
500 kW	98 dBA	1,100 feet	50 dBC
1 MW	102 dBA	1,500 feet	50 dBC

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MEMORANDUM

To: Matthew Schneider, County of San Diego
From: Mike Komula, Dudek
Subject: Wind Turbine Noise Setback Distances
Date: March 25, 2012

This memorandum identifies noise setback distances for typical 1.5 MW and 2.3 MW wind turbines. Wind turbine sound levels were modeled to estimate the setback distances necessary to comply with the proposed County of San Diego's Amendments to the Zoning Ordinance Related to Wind Energy Systems. Specific to this memo, the noise criteria are relative to the low-frequency sound limit. Section 6952(f) Noise of the noted zoning ordinance, specifies that the low-frequency sound limit shall meet the following criteria:

The C-weighted sound level from each large wind turbine while operating shall not exceed the long-term background sound level by more than 20 dB as both sound levels are measured at each property line of the lot on which the large turbine is located.

The long-term background sound level is defined as the background sound level measured as L90 (A-weighting) plus 5 dBA. The background sound level (L90) is defined as the measurement of the average sound level during the quietest continuous ten minutes during a 24-hour period.

For the purposes of this analysis, the background sound level (L90) is assumed to be 25 dBA. Thus, the long-term background sound level (L90) will be 30 dBA at the property line. With this assumption, the wind turbine low frequency sound level shall not exceed 50 dBC at the property line.

Methodology

Noise levels were modeled for 1.5 MW and 2.3 MW wind turbines. The calculations assume standard point source geometrical divergence attenuation of 6 dB per doubling of distance and atmospheric attenuation per the International Organization for Standardization, *Acoustics Attenuation of Sound during propagation Outdoors*, ISO 9613-2:1996(E).

The sound levels generated by wind turbines of the same size vary between different manufactures and model types. Also, larger wind turbines produce greater sound levels than smaller wind turbines. Based on a review of manufactures and published octave band frequency data for 1.5 MW to 2.3 MW wind turbines, typical sound power levels (Lw) range from approximately 104 to 107 dBA based on a wind speed of 8 meters/second and measurement height of 10 meters.

Results

As shown in Table 1, a 1.5 MW wind turbine will require a 2,300 foot setback and a 2.3 MW wind turbine will require a 2,400 foot setback from the property line. As previously indicated, these setback distances assume a long-term background sound level of 30 dBA.

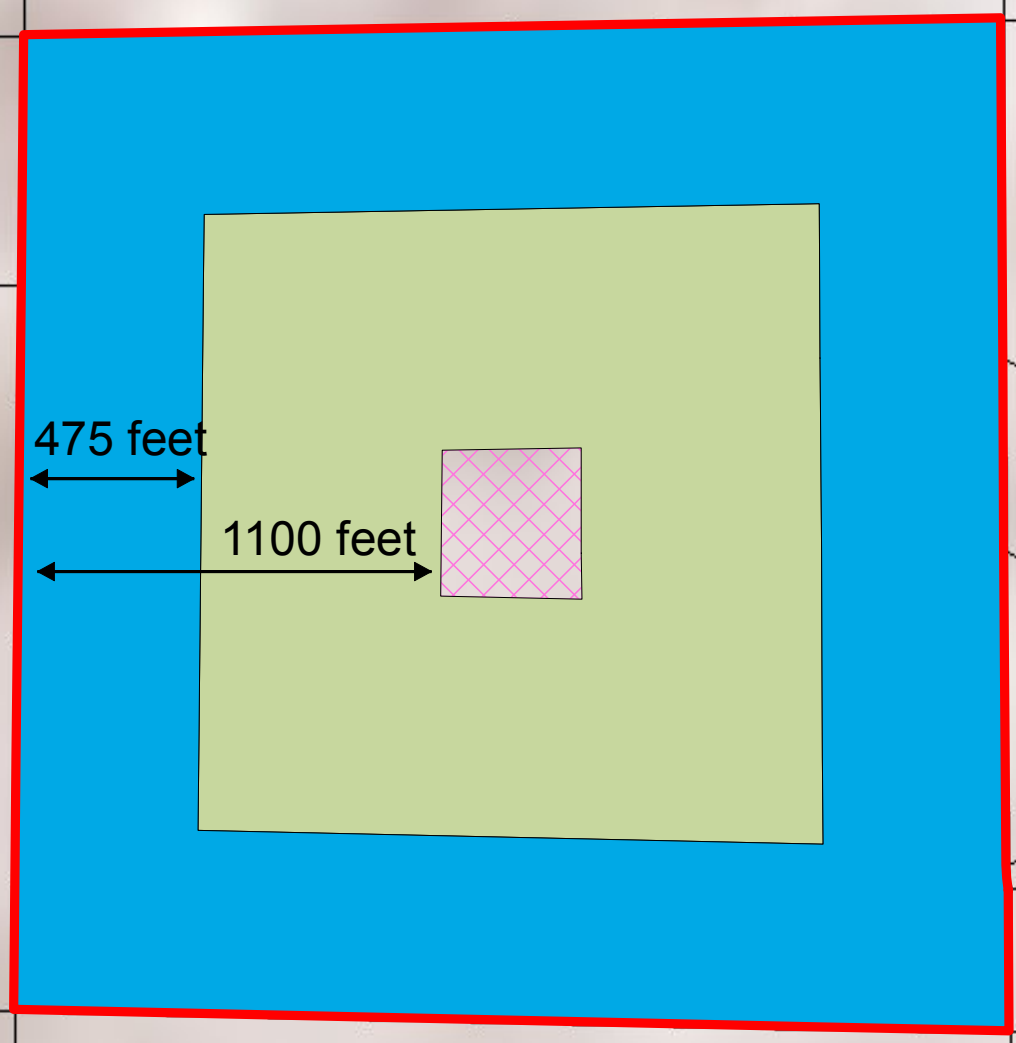
Table 1

Setback Distances for Various Wind Turbines

Wind Turbine	Sound Power Level (Lw)	Property Line Setback Distance (Long-Term Background is 30 dBA)	Wind Turbine Sound Level
1.5 MW	104 dBA	2,300 feet	50 dBC
2.3 MW	107 dBA	2,400 feet	50 dBC

Wind Turbine Noise Setback Distance

Project Size (acres)	Setback Distance	Setback Acres	Remaining Acres
152.2	475 feet	91.4	60.8
152.2	1100 feet	148.9	3.3



Legend

- Parcel Sample
- 475 Feet
- 1100 Feet
- Remaining Lands

N

0 250 500 Feet

LUEG GIS

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