WASCO COUNTY ENERGY ORDINANCE UPDATE
PROPOSED WIND TOWER NOISE STANDARDS OVERVIEW

A. Proposed Standards

1. Large Scale Commercial Wind Towers

"The energy facility shall comply with the noise regulations in OAR Chapter 340, Division 35. The applicant may be required to submit a qualified expert's analysis and written report."

While this proposed language is general, the review process will allow for a thorough evaluation of the potential impacts of noise. If there are concerns a noise study will be required which could result in the relocation of towers, or conditions of approval such as changing the cut-in speed of a tower to ensure residents are not impacted by noise.

2. Non-Commercial and Small Scale Commercial Wind Towers

a. Ministerial Review: This proposed ordinance allows for turbines to be placed without any type of review if Building Codes does not require a permit or through a non-discretionary review by the Planning Department if Codes does require a permit. In either case the same proposed noise standard is applicable.

" Manufacturer's maximum sound level estimate shall not exceed 60 decibels, and operation of the system shall be in compliance with noise regulations established by the Oregon Department of Environmental Quality in OAR 340-035-0035."

b. Subject to Standards Review:

If the manufacturer's sound level estimate exceeds 60 decibels or there is no manufacturer's sound level estimate, the applicant shall submit a qualified expert's analysis and written report to prove operation of the system shall be in compliance with noise regulations established by the Oregon Department of Environmental Quality in OAR Chapter 340, Division 35 with regard to any existing dwellings on non-participating landowners property.

B. Analysis & Justification

1. Noise Variables: When evaluating noise impacts to adjacent uses, there are three variables to consider.

a. Noise Source Point: This is the decibel level at the noise source. This can be determined using the manufacturer's sound level estimate.

b. Ambient Noise: Oregon DEQ defines this as "the all-encompassing noise associated with a given environment, being usually a composite of sounds from many sources near and far".

   Although turbine noise increases with wind speed, so does the background noise produced by the wind, nearby trees, cars, airplanes, etc... These background noises therefore can mitigate the increases in wind turbine noise.

c. Distance: The further away the noise source point the less decibel level is heard. This is based on the inverse square law which says "for a free field every doubling of the distance from the noise source, the sound pressure levels - $L_{p,}$ will be reduced by 6 decibels. A "free field" is defined as a flat surface without obstructions.
   http://www.engineeringtoolbox.com/inverse-square-law-d_890.html

   Shot of a Rifle and Decibel Level

Distance (feet)	Sound Pressure –L_p (decibel)
1.25	134
2.5	128
5	122
10	116
20	110
40	104
80	98
160	92
320	89
640	80
1,280	72
2,560	66
5,120	60

2. Annoyance: At what level does noise become an annoyance for adjacent residential uses?

   According to "Permitting Small Wind Turbines: A Handbook – Learning from the California Experience" (pages 12-13)
   http://www.bergey.com/School/Cal.Permitting.Handbook.pdf

   "A level of 40 db(A) – about the same as inside an average living room – is generally considered acceptable for neighboring structures. A level of 65 db(A) – noisier than a loud conversation – may cause annoyance."

3. Noise Level at Receptor/Residence adjacent to a property with a wind turbine having a Maximum Manufacturer Sound Level Estimate 60 at Db(A). The

following does not include any additional sound reduction based on ambient noise.

Tower Height = Min. Property Setback	Min. Adj. Property Setback	Min. Setback from Adj. Receptor/Residence	Approx. Noise Level at Residence Based on Inverse Square Law
35’	7’	42’	32 db(A)
50’	7’	57’	28 db(A)
100’	7’	107’	22 db(A)
150’	7’	157’	18 db(A)

4. Justification for Proposed Ministerial Standard: Staff has proposed the ministerial standard for the following reasons:

   a. It is non-discretionary: A Ministerial Review process requires all standards to be non-discretionary. That means the answer to any question raised by a specific standard must be either yes or no. An example would be meeting the 35’ height limitation standard. The proposal either meets it on its face or it does not. If we included a standard written in the same way as those in Section C – Other Noise Standards, this would add discretion into the process and necessitate a Subject to Standards review. This would require a more significant application including a noise study to verify the standard could be met, a staff report to be written by staff with legally defensible findings of fact, and a notice to adjacent property owners with the right to appeal.

      The two goals of these ordinances is to require the appropriate scale of review to encourage renewable energy uses and to ensure adjacent properties are protected. Staff concludes this standard achieves both of these goals.

   b. It is easy to understand and document: While the standards in Section C – Other Noise Standards are easy to understand, they provide no explanation for a person wanting to site a wind turbine to know if the will meet or exceed the noise thresholds. To be absolutely certain they would need to conduct a study which adds time, costs and discretion into the process.

   c. The standard protects adjacent residential uses: The thresholds listed in Section C – Other Noise Standards are all pretty consistent (50 -55 dBA at either the property line or the receptor which would be the residence.) As indicated in subsection 3 above, this standard will exceed this. In fact, the proposed standard would have to be raised to close to 90 dBA before it exceeded the Other Noise Standards in Section C.

   d. Most non-commercial wind turbines on the market will meet this standard: The following website includes links to small wind turbine manufacturers. Many of the manufactures include maximum sound level estimates.

http://www.ecobusinesslinks.com/small_wind_generators_turbines_manufacturers.htm

C. Other Noise Ordinances:

1. Draft Model Small Wind Ordinance for Maryland - March 2008
   5.3. SOUND LEVELS AND MEASUREMENT
   Audible sound due to Small Wind Energy System operations shall not exceed fifty (55) dBA for any period of time, when measured at the property line of any property containing an occupied building on the date of approval of any Small Wind Energy System Siting Permit. The level, however, may be exceeded during short-term events such as utility outages and/or severe windstorms.

2. New York State Energy Research and Development Authority – Model Wind Energy Ordinances
   Individual wind turbine towers shall be located so that the level of noise produced by wind turbine operation shall not exceed 55 dBA, measured at the site property line.
   or
   Audible noise due to wind energy facility operations shall not exceed fifty (50) dBA for any period of time, when measured at any residence, school, hospital, church or public library existing on the date of approval of the wind energy facility.

3. City of Portland Noise Control Program
   Section 18.10.010

FIGURE 1
PERMISSIBLE SOUND LEVELS
(7 am-10 pm, otherwise minus 5 dBA)

Zone Categories of Source	Zone Categories of Receiver (measured at property line)			
	Residential	Open Space	Commercial	Industrial
Residential	55	55	60	65
Open Space	55	55	60	65
Commercial	60	60	70	70
Industrial	65	65	70	75

Adjustments to Figure 1.

-During the night hours, the sound levels of Figure 1 shall be reduced 5 dBA.

-During all hours, the sound levels of Figure 1 shall be decreased 5 dBA for narrow band or steady sound (apply 1 only).

-The adjustments provided herein are cumulative.

4. "Permitting Small wind Turbines: A Handbook – Learning from the California Experience"
   For wind speeds in the range of 0-25 mph, small wind turbines shall not cause a sound pressure level in excess of 60 db(A), or in excess of 5 db(A) above the background noise, whichever is greater, as measured at the closest neighboring inhabited dwelling. This level, however, may be exceeded during short-term events such as utility outages and severe wind storms.

5. Oregon Department of Environmental Quality 340-035-0035 - Noise Control Regulations for Industry and Commerce

   The following are excerpted from the standards below:
   Ambient noise level assumed at 26db(A)
   10 db(A) above ambient shall not be allowed in any one hour; or
   50 db(A) maximum at the point of the receptor

   (B) New Sources Located on Previously Unused Site:
   (i) No person owning or controlling a new industrial or commercial noise source located on a previously unused industrial or commercial site shall cause or permit the operation of that noise source if the noise levels generated or indirectly caused by that noise source increase the ambient statistical noise levels, L10 or L50, by more than 10 dBA in any one hour, or exceed the levels specified in Table 8, as measured at an appropriate measurement point, as specified in subsection (3)(b) of this rule, except as specified in subparagraph (1)(b)(B)(iii).
   (ii) The ambient statistical noise level of a new industrial or commercial noise source on a previously unused industrial or commercial site shall include all noises generated or indirectly caused by or attributable to that source including all of its related activities. Sources exempted from the requirements of section (1) of this rule, which are identified in subsections (5)(b) - (f), (j), and (k) of this rule, shall not be excluded from this ambient measurement.
   (iii) For noise levels generated or caused by a wind energy facility:
   (I) The increase in ambient statistical noise levels is based on an assumed background L50 ambient noise level of 26 dBA or the actual ambient background level. The person owning the wind energy facility may conduct measurements to determine the actual ambient L10 and L50 background level .
   (II) The "actual ambient background level" is the measured noise level at the appropriate measurement point as specified in subsection (3)(b) of this rule using generally accepted noise engineering measurement

practices. Background noise measurements shall be obtained at the appropriate measurement point, synchronized with windspeed measurements of hub height conditions at the nearest wind turbine location. "Actual ambient background level" does not include noise generated or caused by the wind energy facility.

(III) The noise levels from a wind energy facility may increase the ambient statistical noise levels L10 and L50 by more than 10 dBA (but not above the limits specified in Table 8), if the person who owns the noise sensitive property executes a legally effective easement or real covenant that benefits the property on which the wind energy facility is located. The easement or covenant must authorize the wind energy facility to increase the ambient statistical noise levels, L10 or L50 on the sensitive property by more than 10 dBA at the appropriate measurement point.

(IV) For purposes of determining whether a proposed wind energy facility would satisfy the ambient noise standard where a landowner has not waived the standard, noise levels at the appropriate measurement point are predicted assuming that all of the proposed wind facility's turbines are operating between cut-in speed and the wind speed corresponding to the maximum sound power level established by IEC 61400-11 (version 2002-12). These predictions must be compared to the highest of either the assumed ambient noise level of 26 dBA or to the actual ambient background L10 and L50 noise level, if measured. The facility complies with the noise ambient background standard if this comparison shows that the increase in noise is not more than 10 dBA over this entire range of wind speeds.

(V) For purposes of determining whether an operating wind energy facility complies with the ambient noise standard where a landowner has not waived the standard, noise levels at the appropriate measurement point are measured when the facility's nearest wind turbine is operating over the entire range of wind speeds between cut-in speed and the windspeed corresponding to the maximum sound power level and no turbine that could contribute to the noise level is disabled. The facility complies with the noise ambient background standard if the increase in noise over either the assumed ambient noise level of 26 dBA or to the actual ambient background L10 and L50 noise level, if measured, is not more than 10 dBA over this entire range of wind speeds.

(VI) For purposes of determining whether a proposed wind energy facility would satisfy the Table 8 standards, noise levels at the appropriate measurement point are predicted by using the turbine's maximum sound power level following procedures established by IEC 61400-11 (version 2002-12), and assuming that all of the proposed wind facility's turbines are operating at the maximum sound power level.

(VII) For purposes of determining whether an operating wind energy facility satisfies the Table 8 standards, noise generated by the energy facility is measured at the appropriate measurement point when the

facility's nearest wind turbine is operating at the windspeed corresponding to the maximum sound power level and no turbine that could contribute to the noise level is disabled.

Table 8 - New Industrial and Commercial Noise Source Standards
Allowable Statistical Noise Levels in Any One Hour

7 am – 10 pm	10 pm – 7am
L50 – 55 dBA	L50 – 50 dBA
L10 – 60 dBA	L 10 – 55 dBA
L1 - 75 dBA	L 1 – 60 dBA