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MEMORANDUM

TO: Phil Kern

FROM: Alan Brixius / Laurie Smith

DATE: October 5, 2009

RE: Wind Energy Conversion Systems (WECS) Ordinance

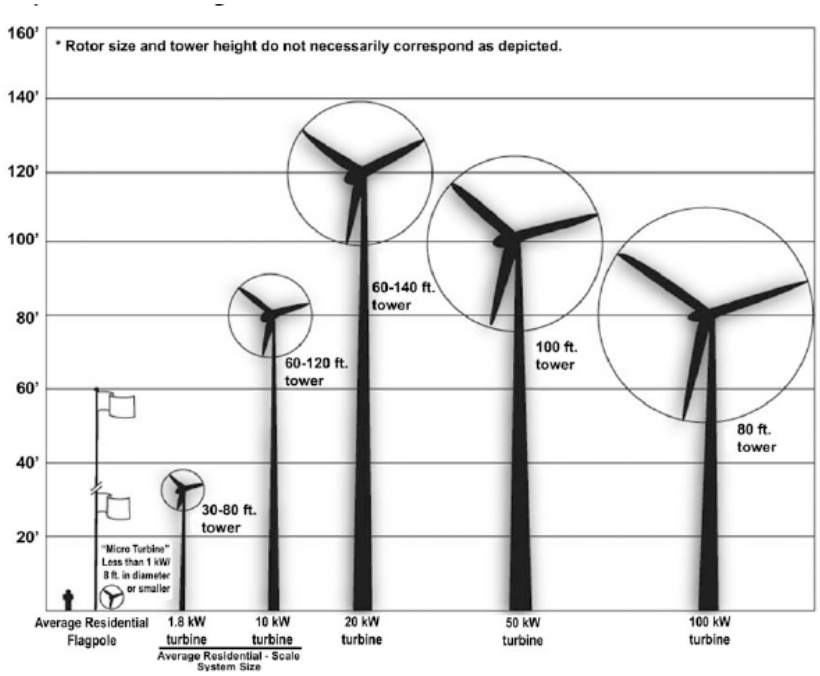
NAC FILE: 432.21

BACKGROUND

The City of Delano is considering the adoption of a Wind Energy Conversion Systems (WECS) Ordinance. The most important piece of the creation of a WECS Ordinance is to determine where these systems are and are not compatible with existing and future land uses. Ordinances regulating wind energy conversion systems at the local level are increasingly necessary as the development and popularity of wind turbines increases. These systems have the potential to cause negative impacts to surrounding properties, particularly visual impacts.

ANALYSIS

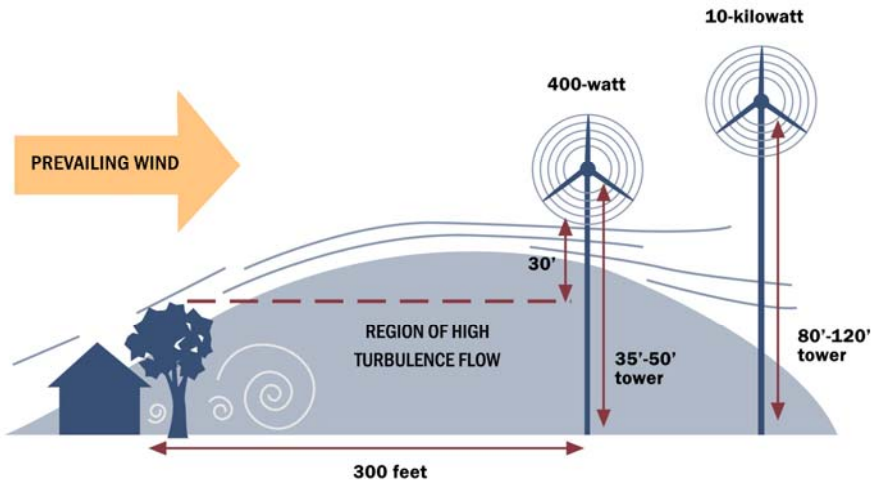
Types of WECS. Generally speaking, there are two different types of wind energy conversion systems – utility-scale and small-scale. According to the American Wind Energy Association (AWEA), utility wind generators are usually located within commercial wind farms and have rotor diameters ranging from 50 meters (164 feet) to 90 meters (295 feet) and a tower height upwards of 135 meters (442 feet). Small wind systems are usually intended for residential or small business use and most have rotors measuring 8 meters (26 feet) or less and tower heights of 40 meters (130 feet) or less based on research conducted by the AWEA.



Source: American Wind Energy Association

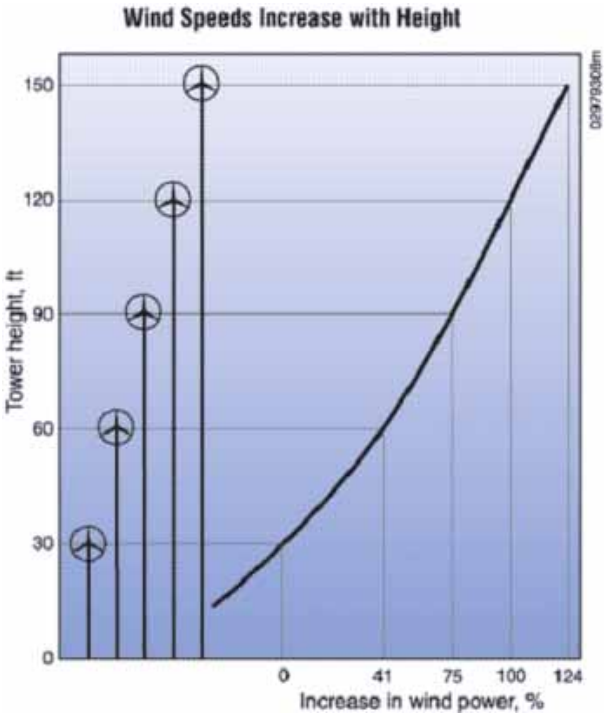
Energy Output. The energy output of a wind turbine depends on its size and the surrounding wind speeds. A typical 10 kW small wind system can generate around 10,000 kWh per year which is enough to power one house for one year. A large-scale 1 MW wind system can generate enough energy to provide power to up to 300 homes per year.

Design and Location of WECS. The productivity of a WECS greatly depends upon the location of the system and most importantly, the height of the system. The following graphics illustrate that the taller the tower, the greater the power generation.



Source: Northwest SEED; American Wind Energy Association

WECS manufacturers recommend that towers be installed so that there is at least a 30 foot clearance between the tallest tree, building or bluff within a 300-500 foot radius of the bottom of the rotor. This ensures that the WECS is free from wind turbulence and can operate to its highest capacity.



Source: American Wind Energy Association

Taller wind turbines generally produce more energy and offer a greater return on investment.

For a 10kW residential-scale turbine

Tower height (feet)	Wind speed (mph)	kWh/year	System cost	Incremental cost from 60′	Incremental energy output from 60′	Incremental energy ÷ incremental cost = ROI*
60	7.3	2,709	$48,665	---	---	---
80	9.3	6,136	$49,841	$1176 or 2.4%	226%	226% ÷ 2.4% = 94 to 1 ROI
100	10.7	9,338	$51,346	$2681 or 5.5%	344%	344% ÷ 5.5% = 63 to 1 ROI

* = Return on Investment Mick Sagrillo, AWEA Windletter, January 2006

Taller towers also reduce the amount of sound produced as the motor is located higher above homes and businesses. According to the AWEA, sound decreases four-fold with each doubling of distance from the wind turbine. This applies both to increases in

height above ground as well as separation distances on the ground. Tower height is not necessarily dictated by the size of the turbine, but rather the location of the system in relation to surrounding terrain, trees, buildings and wind availability.

The proposed WECS Ordinance sets maximum heights limits of 120 feet for small wind systems and 300 feet for large-scale systems. Due to the greater height allowed for large-scale utility systems, City staff is recommending that these systems be allowed only in Industrial Districts. Small wind systems are proposed to be allowed in all zoning districts provided all of the other regulations can be met.

The Planning Commission and Council should discuss the possibility of allowing large scale utility systems as part of a residential subdivision. The City of Elko-New Market recently received an application for a large scale utility system as part of a conservation subdivision development. Delano's Future Land Use map indicates that a large portion of future land uses are residential, as such, the possibility exists for a number of large scale utility systems to be constructed in the City if allowed in such zoning districts.

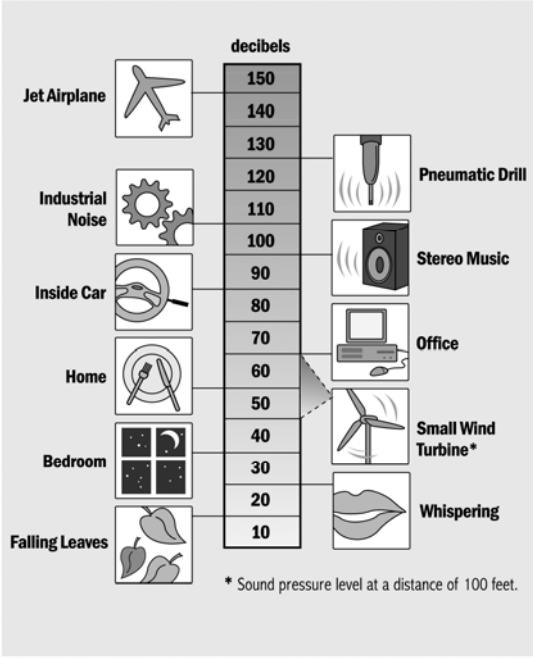
Setback distances can also vary from site to site. Most commonly, setback distances are equal to the total height of the WECS (tower height plus highest extension of the rotor blade). Setback requirements would apply to the distance from the WECS to all property lines, right-of-way and residential buildings. Not only would this allow sufficient separation from neighboring properties, it would allow for enough separation so that if the tower were to collapse, it would fall wholly on the property on which it is located. Separation distances from buildings on the same lot as the WECS are not regulated in the proposed ordinance.

Potential Nuisance Issues. The primary concerns for potential nuisances related to WECS are aesthetics and noise. One other potential concern, particularly in Minnesota, is that of ice build-up on the turbine blades. Similar to the need to de-ice airplane wings in order for the plane to fly, the rotors of a turbine must be free of ice build-up in order for them to rotate. As such, the risk of ice being flung from the rotors is practically nonexistent since the rotors would hardly rotate if covered in ice. According to the AWEA, the weight and aerodynamic interference of ice build-up slows the blades' rotation to a near stand-still, making any melting ice fall straight down rather than being thrown from the blade. Furthermore, a study titled "Assessment of Safety Risks Arising from Wind Turbine Icing" was conducted in Findland in 1998 to determine the effects of ice and snow falling from turbine blades. It was discovered in this study that the risk of personal or property damage from ice falling off a wind turbine is lower than the risk of being struck by lightning.

Noise generated by wind turbines is most often one of the reasons cited for not allowing them in areas of urban development. However, given the setback requirements and the latest technology, sound may not be as big of a concern. The following graphic illustrates where a small wind systems falls within a range of everyday noise emissions. The AWEA notes that noise complaints are rarely lodged against small wind turbines as

the noise from their blades tends to blend in with the background acoustic vibrations produced in windy conditions.

Aesthetic issues with WECS are a more subjective matter. As discussed earlier, in order to be effective wind turbines must be tall. As such, they are visible from quite a distance. It is important to remember that billboard, cellular towers, power lines, silos, radio antennas, telephone poles and the like are already acceptable structures within the urban and rural settings. Areas of historic significance, however, are most likely not suitable locations for WECS.



Source: American Wind Energy Association

The proposed WECS ordinance regulations include some rules for wind turbine aesthetics including a requirement that the WECS remain finished and/or painted in the manufacturer-issued colors, prohibition on the attachment of signs other than those stipulating warnings and manufacturer information and a requirement that WECS which are no longer in operation shall be removed within six months. It is important to point out that allowing WECS into the City will have a dramatic impact on the existing landscape. Currently, the City does not have many tall dominating features on the horizon so the Planning Commission and City Council, as well as the general public, should be aware that allowing these features may create a significant impact.

CONCLUSION

The proposed WECS ordinance has been designed to allow for the placement of WECS in the City of Delano to promote the use of renewable energy while controlling the potential negative impacts. The Planning Commission will be discussing the proposed WECS ordinance at their meeting on October 12, 2009.

c. Vince Vandertopp
Marlene Kittock
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Wendy Biel