Staff report, Wind Energy Generation Ordinance: Mark Nahra, County Engineer

Comments:

1) Road damage: Concerns were expressed about road damage and disruption from wind turbine construction during the first hearing. The current ordinance requires a road use agreement be signed by the wind generation developer to maintain roads during construction, designate haul roads, and restore roads used during construction to pre-construction condition. I am not concerned about the county's ability to enforce a road use agreement.

2) Setbacks: Further review of the recommendations for appropriate turbine setback from residences from available research studies indicate that there may be merit to addressing setback distances based on overall turbine height. A setback of 3.5 times overall turbine height would result in a very low risk to nearby residential property and was the recommendation of the study "Analysis of Blade Fragment Risk at a Wind Energy Facility" (cited study number 6). Both research papers shown as 6 and 7 on the accompanying sheet recommended that a setback of 3 times turbine height provided protection from a "routine" risk of damage from thrown rotor fragments (cited from study number 6), corresponding to a 1 in 1,000,000 chance of occurrence (as noted in report number 7). Ice throw is also a risk, but the protective safe distance for ice is less than the distance necessary to provide protection from rotor fragments.

The proposed 591-foot-tall tower discussed by Mid American Energy at last week's meeting would call for a setback of 2068 feet based on research recommended setback of 3.5 times tower height.

The abstract for study number 6 reads as follows: ***"An analysis was performed to determine the risk posed by wind turbine fragments on roads and buildings at the National Wind Technology Center at the National Renewable Energy Laboratory. The authors used a previously developed model of fragment trajectory and took into account the wind speed/direction distribution at the site and the probability of rotor failure. The risk was assessed by determining the likelihood of impact and related consequences. For both the roads and buildings, the risk varied from low to routine, which was considered acceptable. The analysis was compared with previous recommendations on wind turbine setback distances. The results showed that a setback to property lines of 2 times the overall turbine height would be acceptable. However, the setback to dwellings should probably be increased from 3 to 3.5 times the overall turbine height for an acceptable risk."***

Staff Recommendation: The Board could consider a setback of 3.5 times tower height (base to tip of blade). The Board could add a minimum setback to that recommendation such as stating "Setback from residential structures shall be 3.5x tower height or (1600 feet, 2000 feet, or 2500 feet), whichever is greater. "

The advantage of basing the setback on tower height is that it will keep the ordinance relevant if turbine heights continue to increase as years go by. Research results were consistent between studies that note that for the most part, fragment, or ice throw distance increases with tower height.

Recommendations for setbacks from Research studies:		Residential Setback Distance (Feet)	
		Ice	Blade
1	Rutgers University Study, Author Terry Matilsky		1700'
2	"A method for defining wind turbine setback standards", Authors: Jonathan Rogers, Nathan Siegers, and Mark Costello, School of Aerospace Engineering, Georgia Institute of Technology		1439' to 1935'
3	"Wind Turbine Impacts 2009" Kurt C. Kielisch and Erik Kielisch, Appraisal Group One (recommendation based on author's reference search)		1500'-7920'
4	"Modelling of Ice Throws from Wind Turbines" Author: Joakim Renström, Department of Earth Sciences, Uppsala University, Uppsala Sweden	784' throw (1148' downwind)	
5	"Analysis of throw distances of detached objects from horizontal-axis wind turbines", Authors: Hamid Sarlak and Jens Sørensen Section of Fluid Mechanics, Department of Wind Energy, Technical University of Denmark, DK-2800 Lyngby, Denmark		2296'
6	"Analysis of blade fragment risk at a wind energy facility", authors: Scott Larwood (1) David Simms (2) (1)Department of Mechanical Engineering, University of the Pacific, Stockton, California, USA (2) National Wind Technology Center, National Renewable Energy Laboratory, Golden, Colorado, USA (September 2017)		3.5x turbine height
7	"Wind Turbine Rotor Fragments: Impact Probability and Setback Evaluation" Authors: Scott Larwood (1) and C.P. Van Dam (2) (1) University of the Pacific, (2) University of California, Davis (June 2015)		2-3x turbine height