

Wind Fact Sheet #4: Shadow Flicker

Noble Environmental Power, LLC



What is shadow flicker?

Any moving object that comes between a viewer and a light source can cause a flicker effect – for example, think of driving down a road lined with trees when the sun is low in the sky.

When does shadow flicker occur?

Three conditions must occur simultaneously to cause shadow flicker:

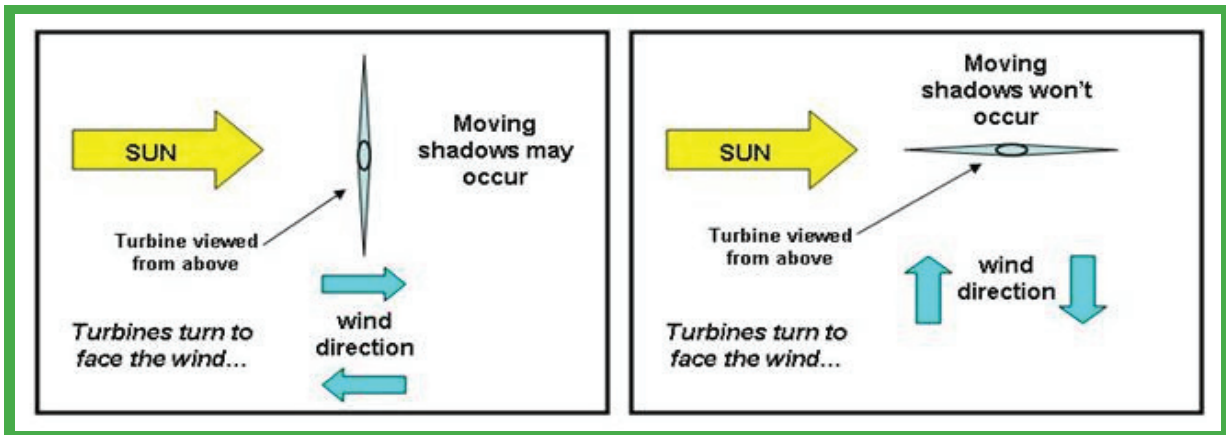
1. The sun must be shining and there is no cloud cover.
2. The moving object must be between the observer and the sun.
3. The observer has to be close enough to the object to be in its shadow.

Of course, shadow length can change depending on the angle of the sun in the sky, but even if the object is large and the sun is low in the sky, the shadow will only stretch a certain distance – after that, the light bends around the object and the shadow becomes diffuse (weak).

Do wind turbines cause shadow flicker?

They can...but for a wind turbine to cause shadow flicker, in addition to the three conditions listed above, a fourth condition is also necessary:

4. The blades have to be facing directly toward or away from the sun (so they are moving across the source of the light relative to the observer).



Is shadow flicker from turbines something I should be worried about?

No. Proper siting of wind turbines is key to reducing or eliminating shadowing. Complex computer programs that take into account the prevailing wind direction and the angle of the sun in the sky throughout the course of the year are used to indicate precisely where and when shadowing could occur. This information is then overlaid on a map showing residences, schools, and other structures in the area. By looking at the map, developers can tell if shadowing might be a problem. If the model indicates that a lot of shadowing is likely, means of mitigation will be determined. If the model indicates that a small amount of shadowing might occur (for example, 15 minutes a day for 20 days out of the year), the developer can speak with the owner of the residence and determine what, if any, further mitigation is needed.

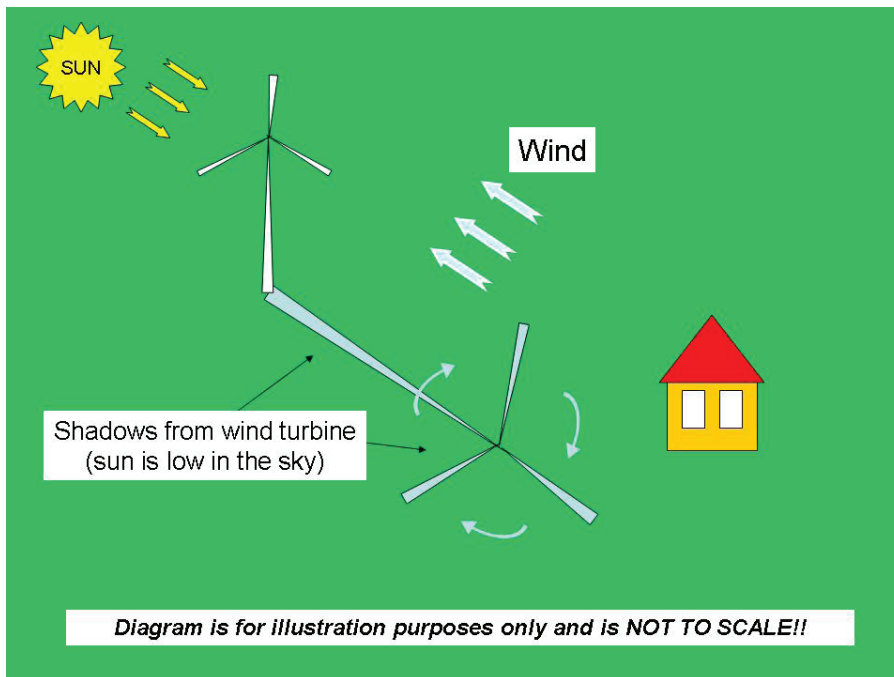
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Is there a connection between shadow flicker and epileptic seizures?

No. Shadow flicker from wind turbines cannot trigger epileptic seizures in individuals suffering from photosensitivity, as some wind energy opponents have claimed. The frequency, or the number of times something happens per second, is measured in Hertz (Hz). Shadow flicker from wind turbines has a frequency between 0.5 Hz and 1.25 Hz, which is equivalent to between 1 to approximately 1.25 alternations per second. This is well below the range of frequencies that can trigger epileptic seizures, which is 5 to 30 Hz, according to the American Epilepsy Foundation. Thus, shadowing from wind turbines poses absolutely no threat to the health of people with epilepsy or other individuals who are photosensitive.



Helpful Sites/Additional Reading:

Lawrence Technological University - *The Importance of Wind Turbine Shadow Flicker* - <http://www.ltu.edu/cm/attach/165D79C3-DD14-41EC-8A7F-CFA2D0C272DE/FlickerHandout.pdf>

Danish Wind Industry Association - *Shadow Casting from Wind Turbines* - www.windpower.org/en/tour/env/shadow/

WIND Engineers, Inc. - *Shadow Flicker Briefing* - <http://www.efsec.wa.gov/wildhorse/deis/apendices/05%20Wind%20Engineers%2011-20-03%20memo.pdf>

Epilepsy Foundation - *Shedding Light on Photosensitivity, One of Epilepsy's Most Complex Conditions* - <http://www.epilepsyfoundation.org/epilepsyusa/photosensitivity20060306.cfm>