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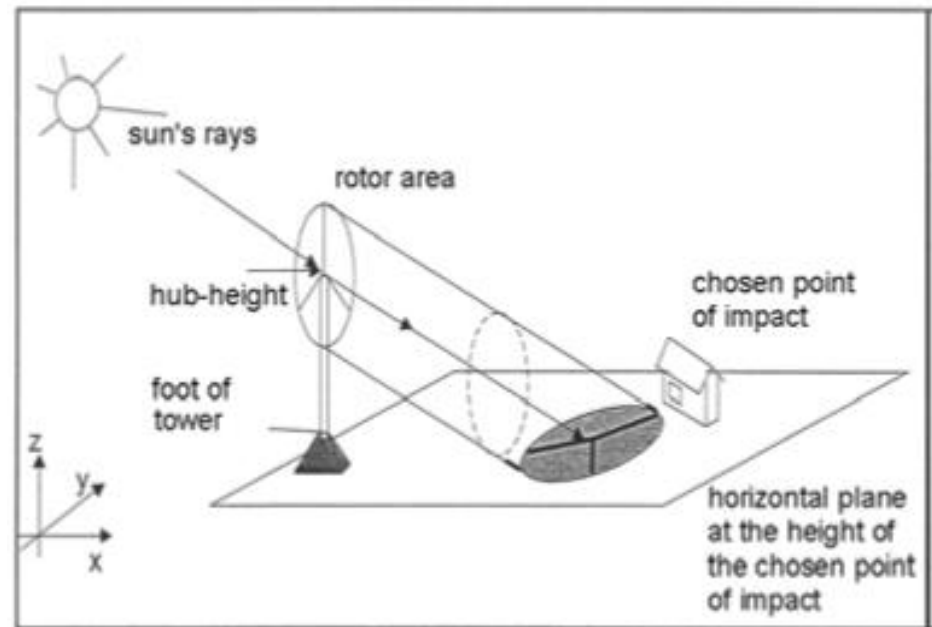
# Bright Stalk Wind Farm Shadow Flicker Assessment

McLean County Zoning Board of Appeals Hearing, 8 February 2018

**Shant Dokouzian, P.Eng.**  
**Senior Project Manager & Principal Engineer**

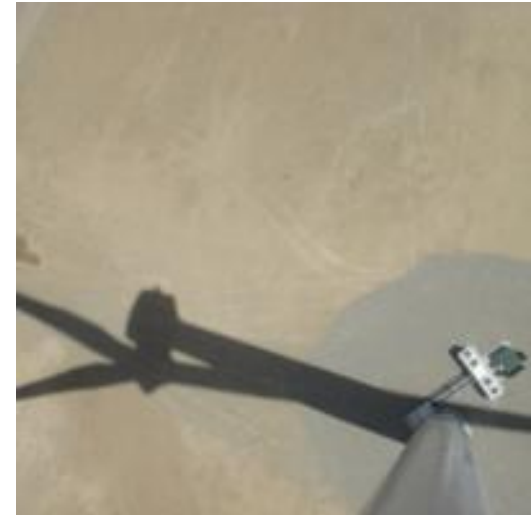
# Introduction to Shadow Flicker

- When the sun passes behind the rotating blades of a wind turbine, a moving shadow is cast in front of or behind the turbine.
- When viewed from a stationary position, the moving shadows produce periodic flickering, or the “shadow flicker” phenomenon.
- This effect is mostly noticed outside but can be noticeable inside buildings, when the flicker appears through a window opening.



# Factors That Influence the Potential for Shadow Flicker

- Wind direction, which impacts the angle of the blades relative to the sun.
- Orientation of buildings and windows relative to the turbine.
- Distance from the turbine.
- Turbine height and rotor diameter.
- Time of year and day.
- Weather conditions.
- Vegetation and other obstacles which can mask shadows.
- Operational status of turbines (shadow flicker only occurs when turbines are spinning).



# Overview of Modelling Methodology

## Modelling Methodology:

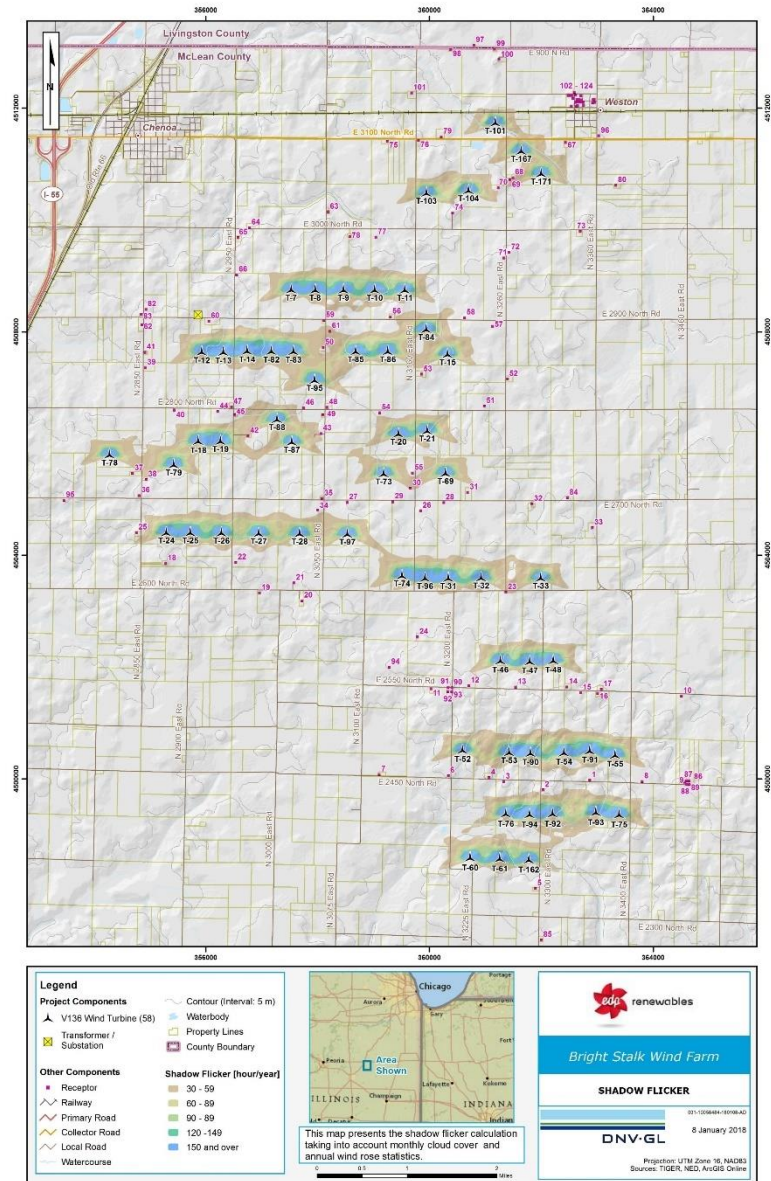
- Geometric analysis takes into account the relative positions of the sun, the wind turbines, and the viewer (i.e. residences). The position of the sun is known with high accuracy.
- 58 V136 3.6 MW turbines at a 99 meter hub height were modeled. The higher hub height is a worst-case scenario.
- 123 receptors (residences) located within 10 tip heights (1,670 m) of a turbine were considered.
- “Worst case” and “expected case” scenarios calculated.
  - “Worst case” is included for information only. It is not realistic as it doesn't consider any real life attenuation parameters.
  - “Expected case” considers cloud cover and wind direction for a more realistic estimate. However, it is still conservative.

## Conservative Assumptions:

- Turbines are assumed to be always operational.
- Vegetation, attenuation from air particles, or other shielding effects were not considered.
- The model assumes residence window is always facing the turbine.

# Bright Stalk Shadow Flicker Modelling Results

- There are no shadow flicker regulations in Illinois or McLean County.
- Highest modelled shadow flicker (“expected case”) is modelled to be 35 hours per year at two points of reception.
- The “expected case” results are still conservative as they do not include all real life parameters such as shielding from foliage, attenuation from pollutants in the air, etc.



# Questions?

**Contact Information:**

Shant Dokouzian, P.Eng.  
Senior Project Manager & Principal Engineer  
DNV GL  
[shant.Dokouzian@dnvgl.com](mailto:shant.Dokouzian@dnvgl.com)