Wind Turbine Shadow Length and Flicker Frequency

Length of the shadow cast by a wind turbine rotor at a given sun elevation and the shadow flicker frequency from rotor speed and number of blades.

Method: Geometric shadow projection

Input parameters

Unit system: SI

Parameter	Value	Unit
Hub height	100.00	m
Rotor diameter	120.00	m
Sun elevation	5.0000	°
Rotor speed	12.000	rpm
Number of blades	3.0000	

Calculated results

Parameter	Value	Unit
Horizontal reach of the blade-tip shadow	1,828.8	m
Reach of the hub shadow	1,143.0	m
Flicker frequency	0.60000	Hz

Notes for this case

• Shadow reach = (H + D/2)/tan β on flat ground. At low sun the shadow is long but faint: assessments usually ignore sun below about 3° and count only distances where the blade covers a significant part of the sun (often within about 10 rotor diameters).

Formula and method

$$L_s = \frac{H + D/2}{\tan \beta}, \quad f = \frac{Bn}{60}$$

Variables

H	Hub height	m
D	Rotor diameter	m
β	Sun elevation	rad
n	Rotor speed	rad/s
B	Number of blades	-
L_s	Horizontal reach of the blade-tip shadow	m
L_h	Reach of the hub shadow	m
f	Flicker frequency	1/s

Method and standards

Shadow geometry.

Assumptions and limits

- Flat ground; sun as a point.

References

Geometric shadow projection

Report details

Report reference	FCC-WAB2-7DP6 (the same inputs always give the same reference)
Generated	23 November 2026, 17:34 UTC
Calculator	Wind Turbine Shadow Length and Flicker Frequency
Method last reviewed	17 November 2026
Software release	FireCAD Calc, release of 22 November 2026
Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/environmental/wind-power/wind-turbine-shadow-length

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.