Wind Shear: Power Law and Log Law Speed at Hub Height

Wind speed at a new height from a measured speed by the power law and by the logarithmic law with surface roughness, and the change in wind power density.

Method: Power-law and logarithmic wind profiles

Input parameters

Unit system: SI

Parameter	Value	Unit
Measured wind speed	6.5000	m/s
Measurement height	10.000	m
Height of interest (hub height)	100.00	m
Power-law exponent (1/7 = 0.143 open land)	0.14300	
Surface roughness length (0.03 m open grassland)	0.030000	m

Calculated results

Parameter	Value	Unit
Speed at z_2, power law	9.0347	m/s
Speed at z_2, log law	9.0764	m/s
Power density ratio, power law	2.6853	
Power density ratio, log law	2.7227	
Power-law exponent equivalent to the log law between z_1 and z_2	0.14500	

Notes for this case

• Power law $U_2 = U_1(z_2/z_1)^{\alpha}$ and log law $U_2 = U_1 \ln(z_2/z_0)/\ln(z_1/z_0)$ for a neutral atmosphere. Both are rough guides: stability, terrain and forests change the profile; measure at or near hub height for financing.

Formula and method

$$U_2 = U_1 \left(\frac{z_2}{z_1}\right)^{\alpha}, \quad U_2 = U_1 \frac{\ln(z_2/z_0)}{\ln(z_1/z_0)}$$

Variables

U_1	Measured wind speed	m/s
z_1	Measurement height	m
z_2	Height of interest (hub height)	m
α	Power-law exponent (1/7 = 0.143 open land)	-
z_0	Surface roughness length (0.03 m open grassland)	m
U_2	Speed at z_2, power law	m/s
$(U_2/U_1)^3$	Power density ratio, power law	-
α_{eq}	Power-law exponent equivalent to the log law between z_1 and z_2	-

Method and standards

Wind profile laws.

Assumptions and limits

- Neutral stability; flat homogeneous terrain.

References

Power-law and logarithmic wind profiles

Report details

Report reference	FCC-BYZJ-4DXX (the same inputs always give the same reference)
Generated	23 November 2026, 17:34 UTC
Calculator	Wind Shear: Power Law and Log Law Speed at Hub Height
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-shear-power-log-law

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.