Wind Turbine Rated Wind Speed and Specific Rating

Rated wind speed at which a turbine reaches rated power from rotor size, power coefficient and drive-train efficiency, with the specific rating in W/m².

Method: Rotor power equation at rated conditions

Input parameters

Unit system: SI

Parameter	Value	Unit
Rated electrical power	3.5000	MW
Rotor diameter	130.00	m
Rotor power coefficient near rated	0.45000	
Drive-train and generator efficiency	94.000	%
Air density	1.2250	kg/m³

Calculated results

Parameter	Value	Unit
Rated wind speed	10.059	m/s
Specific rating	263.69	W/m²
Swept area	13,273	m²

Notes for this case

• U_r = [2P_r/(ρAC_Pη)]^(1/3). Low specific rating (about 200–300 W/m²) suits low-wind sites and raises the capacity factor; offshore machines run near 350–450 W/m².

Formula and method

$$U_r = \left(\frac{2P_r}{\rho A C_P \eta}\right)^{1/3}, \quad \frac{P_r}{A} = \frac{4P_r}{\pi D^2}$$

Variables

P_r	Rated electrical power	W
D	Rotor diameter	m
C_P	Rotor power coefficient near rated	-
η	Drive-train and generator efficiency	-
ρ	Air density	kg/m³
U_r	Rated wind speed	m/s
P_r/A	Specific rating	W/m²
A	Swept area	m²

Method and standards

Rated-power balance.

Assumptions and limits

- Steady wind; C_P constant up to rated.

References

Rotor power equation at rated conditions

Report details

Report reference	FCC-C8H9-CYX9 (the same inputs always give the same reference)
Generated	23 November 2026, 17:34 UTC
Calculator	Wind Turbine Rated Wind Speed and Specific Rating
Method last reviewed	17 November 2026
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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-rated-wind-speed

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.