Power Coefficient from a Measured Power Curve Point

Electrical and rotor power coefficients of a wind turbine from a measured power at a wind speed, with the air density, rotor size and drive-train efficiency.

Method: Power coefficient from measured performance

Input parameters

Unit system: SI

Parameter	Value	Unit
Wind speed (hub height, density-normalised)	8.0000	m/s
Measured electrical power	1,650.0	kW
Rotor diameter	120.00	m
Air density	1.2250	kg/m³
Drive-train and generator efficiency	94.000	%

Calculated results

Parameter	Value	Unit
Power in the wind	3,546.7	kW
Electrical power coefficient	0.46522	
Rotor power coefficient	0.49491	
Fraction of the Betz limit	83.516	%

Notes for this case

- C_P,e = P/(½ρAV³); rotor C_P = C_P,e/η. Modern turbines reach electrical C_P of about 0.45–0.48 at their best wind speed.

Formula and method

$$C_{P,e} = \frac{P}{\frac{1}{2}\rho A V^3}, \quad C_{P,r} = \frac{C_{P,e}}{\eta}$$

Variables

V	Wind speed (hub height, density-normalised)	m/s
P	Measured electrical power	W
D	Rotor diameter	m
ρ	Air density	kg/m³
η	Drive-train and generator efficiency	-
P_w	Power in the wind	W
$C_{P,e}$	Electrical power coefficient	-
$C_{P,r}$	Rotor power coefficient	-
$C_{P,r}/C_{Betz}$	Fraction of the Betz limit	-

Method and standards

Power coefficient from data.

Assumptions and limits

- Steady 10-minute averages.

References

Power coefficient from measured performance

Report details

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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-power-curve-cp

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.