# Quick Wind Capacity Factor from Mean Speed and Rotor Size

Quick estimate of a wind turbine's capacity factor and annual energy from the mean hub-height wind speed, rated power and rotor diameter for Rayleigh winds.

**Method:** Empirical capacity-factor correlation for Rayleigh winds

## Input parameters

Unit system: SI

| Parameter | Value | Unit |
|---|---|---|
| Mean wind speed at hub height | 7.0000 | m/s |
| Rated power | 3.0000 | MW |
| Rotor diameter | 120.00 | m |

## Calculated results

| Parameter | Value | Unit |
|---|---|---|
| Capacity factor | 40.067 | % |
| Annual energy | 10,530 | MWh |
| Rating over diameter squared (kW/m²) | 0.20833 | |

**Notes for this case**

• Empirical fit CF = 0.087V̄ − P_R/D² (V̄ in m/s, P_R in kW, D in m) to Rayleigh-wind results for real power curves; use for screening between about 0.2 and 0.5 only. For a site's own wind distribution and power curve use the Weibull energy calculator.

## Formula and method

$$CF = 0.087\bar{V} - \frac{P_R}{D^2}, \quad E = CF \cdot P_R \cdot 8,760\,\mathrm{h}$$

### Variables

| | | |
|---|---|---|
| $\bar{V}$ | Mean wind speed at hub height | m/s |
| $P_R$ | Rated power | W |
| $D$ | Rotor diameter | m |
| $CF$ | Capacity factor | - |
| $E$ | Annual energy | J |
| $P_R/D^2$ | Rating over diameter squared (kW/m²) | - |

### Method and standards

Empirical capacity factor.

### Assumptions and limits

- Rayleigh winds; typical pitch-regulated power curves; no losses.

### References

Empirical capacity-factor correlation for Rayleigh winds

## Report details

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|---|---|
| Report reference | FCC-TY3V-KFXY (the same inputs always give the same reference) |
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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-capacity-factor-rayleigh-estimate

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.