Wind Turbine Analysis Report

Input Parameters

Parameter	Value
Blade Radius	25.0 m
Wind Speed	8.0 m/s
Air Density	1.225 kg/m³
Power Coefficient	0.4
Generator Efficiency	90.0%
Cut-in Speed	3.0 m/s
Cut-out Speed	25.0 m/s

Basic Calculations

Parameter	Value
Swept Area	1963.50 m²
Theoretical Power	615.75 kW
Actual Power	221.67 kW
Generator Rated Capacity	266.00 kVA
Generator Output Current	319.95 A
Annual Energy	679.64 MWh
Capacity Factor	56.3%

Power Curve

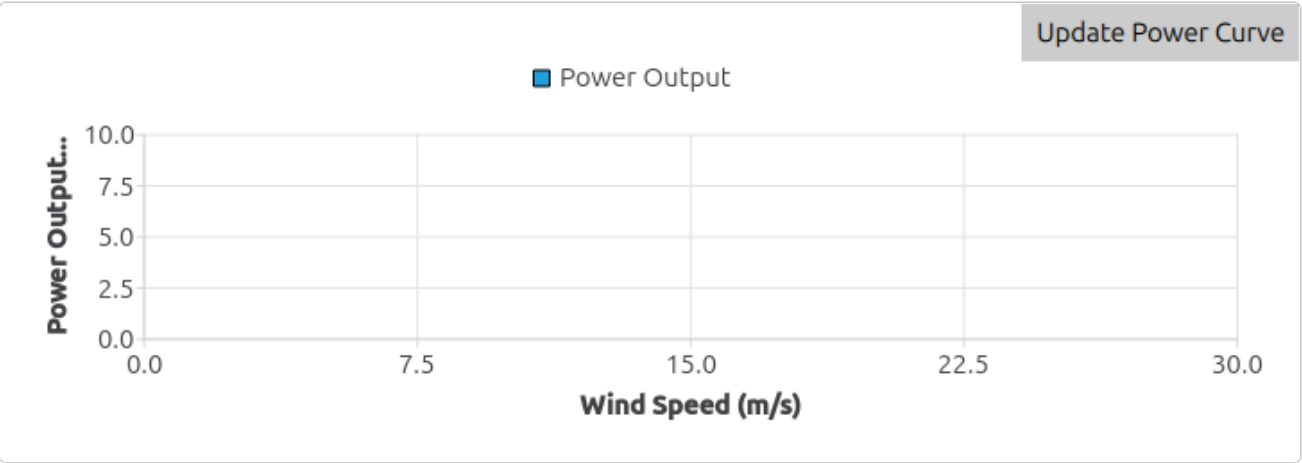

Figure 1: Wind Turbine Power Output vs Wind Speed

Generator Protection Requirements

Protection Type	Setting
Over/Under Voltage	±10% of nominal (360V - 440V)
Over/Under Frequency	47.5 Hz - 51.5 Hz
Rate of Change of Frequency	0.5 Hz/s
Overcurrent	125% of rated current
Earth Fault	5A residual current
Reverse Power	-10% of rating
Loss of Excitation	Power factor < 0.85 leading
Anti-Islanding	Active/Reactive power shift method

Technical Notes

• Power calculation: $P = ½ \times \rho \times A \times Cp \times v^3 \times \eta$
• Betz limit sets theoretical maximum Cp at 0.593
• Generator sized at 120% of maximum power output
• Protection settings comply with G99 requirements
• Annual energy calculation assumes typical wind distribution