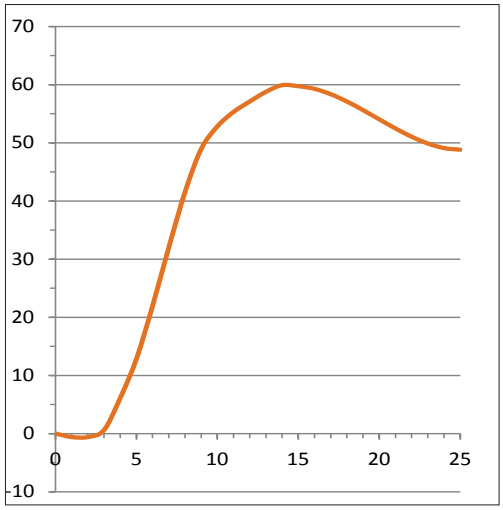
Specifications

Northern Power® 60-23
IEC Class III/S

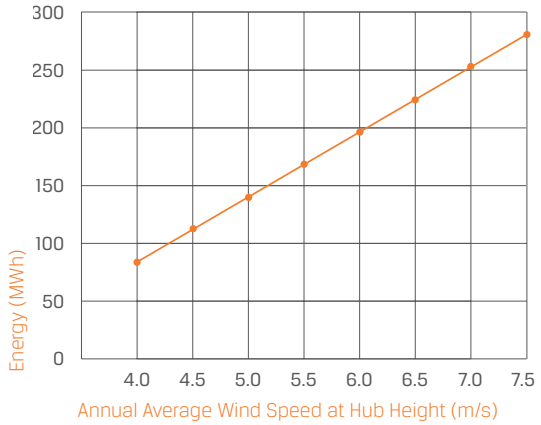
Power Curve: 23-Meter Rotor Standard Air Density (1.225 kg/m³)



Wind Speed (m/s)	Power (kWe)	Wind Speed (m/s)	Power (kWe)
1	-0.6	14	59.9
2	-0.6	15	59.7
3	0.6	16	59.3
4	6.1	17	58.4
5	12.8	18	57.1
6	21.9	19	55.6
7	32.0	20	54.0
8	41.5	21	52.5
9	48.9	22	51.0
10	52.8	23	49.9
11	55.3	24	49.1
12	57.1	25	48.8
13	58.8		

1 m/s = 2.24 mph

Annual Energy Production*: 23-Meter Rotor Standard Air Density, Rayleigh Wind Speed Distribution



Average Annual Wind Speed (mph)	Average Annual Wind Speed (m/s)	Annual Energy Output (MWh/yr)
8.9	4.0	80
10	4.5	110
11	5.0	146
12	5.5	174
13	6.0	201
15	6.5	226
16	7.0	250
17	7.5	271

*Annual energy production estimates assume standard conditions, 100% availability and no losses.

Northern POWER SYSTEMS

Specifications

GENERAL CONFIGURATION	DESCRIPTION
Model	Northern Power® 60-23
Design Class	IEC WTGS III/S (air density 1.225 kg/m^3, average annual wind below 7.5 m/s, 50-yr peak gust below 54 m/s)
Design Life	20 years
Hub Height Options	37 m (121 ft) / 30 m (98 ft) / 23 m (75 ft)
Tower Type	Tubular steel monopole
Orientation	Upwind
Rotor Diameter	23 m (69 ft)
Power Regulation	Variable speed, stall control
Certifications	CE compliant

PERFORMANCE	DESCRIPTION (standard conditions: air density of 1.225 kg/m^3, equivalent to 15°C (59°F) at sea level)
Rated Electrical Power	59.9 kW, 3 Phase, 480 VAC
Rated Wind Speed	11.0 m/s (25 mph)
Maximum Rotation Speed	50 rpm
Cut-In Wind Speed	3.0 m/s (7 mph)
Cut-Out Wind Speed	25.0 m/s (56 mph)
Extreme Wind Speed	54 m/s (120 mph)

WEIGHT	DESCRIPTION
Rotor (23-meter) & Nacelle (standard)	7,800 kg (17,160 lbs)
Tower (37-meter)	14,000 kg (30,800 lbs)

DRIVE TRAIN	DESCRIPTION
Gearbox Type	No gearbox (direct drive)
Generator Type	Permanent magnet, passively cooled

BRAKING SYSTEM	DESCRIPTION
Service Brake Type	Two motor-controlled calipers
Normal Shutdown Brake	Generator dynamic brake and two motor-controlled calipers
Emergency Shutdown Brake	Generator dynamic brake and two spring-applied calipers

YAW SYSTEM	DESCRIPTION
Controls	Active, electromechanically driven with wind direction/speed sensors and automatic cable unwind

CONTROL/ELECTRICAL SYSTEM	DESCRIPTION
Controller Type	DSP-based multiprocessor embedded platform
Converter Type	Pulse-width modulated IGBT frequency converter
Monitoring System	SmartView® remote monitoring system, ModBus TCP over ethernet
Power Factor	Set point adjustable between 0.9 lagging and 0.9 leading
Reactive Power	+/- 30 kVAR

NOISE	DESCRIPTION
Apparent Noise Level	55 dBa at 40 meters from nacelle (131 ft)

ENVIRONMENTAL SPECIFICATIONS	DESCRIPTION
Temperature Range: Operational	-10°C to 50°C (14°F to 122°F)
Temperature Range: Storage	-30°C to 55°C (-22°F to 131°F)
Lightning Protection	Receptors in blades, nacelle lightning rod and electrical surge protection
Icing Protection	Turbine designed in accordance with Germanischer Lloyd Wind Guidelines Edition 2003

All Specifications subject to change without notice.