

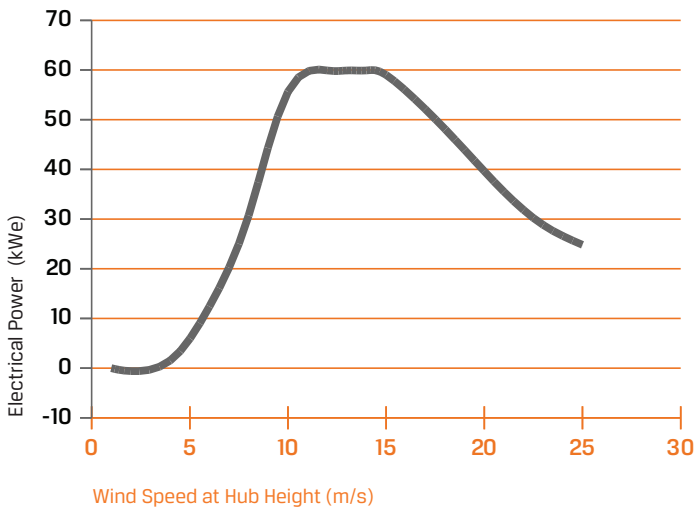
Specifications

NPS 60-23 Class III/S Power Curve

23m Rotor, 43rpm, Standard Density

| wind speed (m/s) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|----------------------|------|------|-----|---|------|------|------|------|------|------|
| electric power (kWe) | -0.6 | -0.6 | 1.5 | 6 | 12.4 | 20.5 | 30.7 | 40.5 | 49.2 | 55.6 |

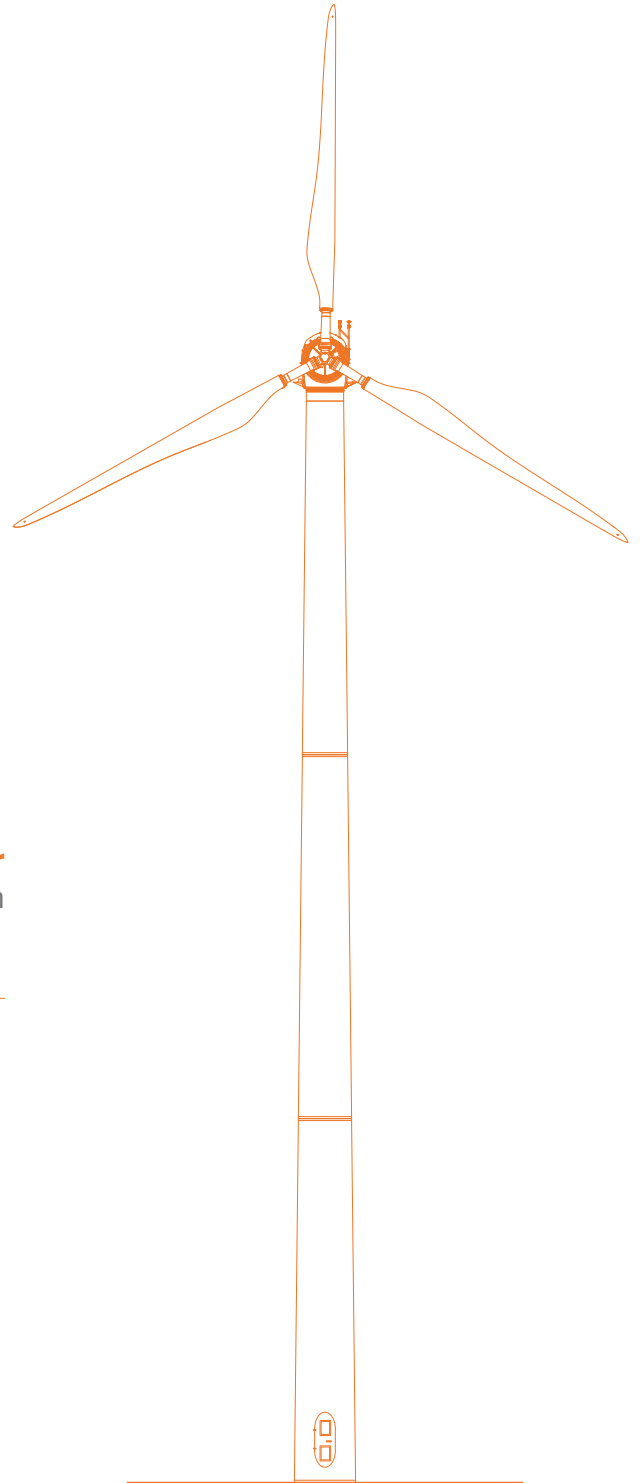
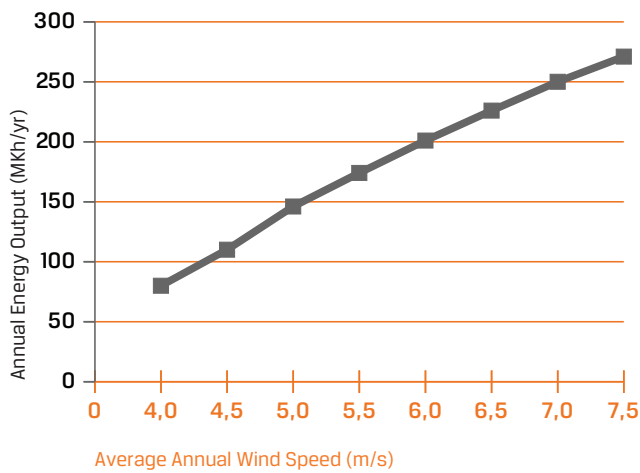
| | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |
|--|----|------|----|------|------|----|------|----|------|------|------|------|------|------|----|
| | 59 | 59.9 | 60 | 59.9 | 59.9 | 59 | 56.1 | 52 | 47.9 | 43.9 | 39.5 | 35.5 | 31.9 | 28.8 | 26 |



Annual Energy Production: 23-Meter Rotor

Standard Air Density, Rayleigh Wind Distribution

| | (mph) | 8.9 | 10 | 11 | 12 | 13 | 15 | 16 | 17 |
|---------------------------------|-------|-----|-----|-----|-----|-----|-----|-----|-----|
| Average annual wind speed (m/s) | | 4.0 | 4.5 | 5.0 | 5.5 | 6.0 | 6.5 | 7 | 7.5 |
| Annual energy output (MWh/yr) | | 80 | 110 | 146 | 174 | 201 | 226 | 250 | 271 |



NPS 60-23

IEC Class III/S



General Configuration

| | |
|---------------------------|---|
| 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 (16 mph), 50-yr peak gust below 54 m/s (121 mph) |
| Design Life | 20 years |
| Rotor Diameter | 23 m (69 ft) |
| Tower Types | Tubular steel monopole |
| Hub Height Options | 37 m (121 ft) / 30 m (98 ft) / 23 m (75 ft) on tubular monopole |
| Orientation | Upwind, 3 blade |
| Yaw System | Active yaw drive with wind direction/speed sensors and automatic cable unwind |
| Power Regulation | Variable speed, stall control |
| Certification | CE compliant, CEI 0-21 |

Performance

| | |
|---------------------------|------------------|
| Rated Wind Speed | 14 m/s (31 mph) |
| Cut-in Wind Speed | 3 m/s (7 mph) |
| Cut-out Wind speed | 25 m/s (56 mph) |
| Extreme Wind Speed | 54 m/s (120 mph) |

Weight

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

Drive Train

| | |
|-----------------------|---------------------------|
| Gearbox Type | No gearbox (direct drive) |
| Generator Type | Permanent magnet |

Braking System

| | |
|---|--|
| Redundant Braking System (per IEC 61400-1) | Generator dynamic brake and multiple spring-applied calipers |
|---|--|

Control System

| | |
|--------------------------|---|
| Controller Type | DPS-based multiprocessor embedded platform |
| Converter Type | Pulse-width modulated IGBT frequency converter |
| Monitoring System | SmartView® remote monitoring system, ModBus TPC over ethernet |

Electrical System

| | |
|-------------------------------|--|
| Rated Electrical Power | 59.9 kW, 3 Phase, 400 VAC, 50Hz |
| Power Factor | Set point adjustable between 0.9 lagging and 0.9 leading |
| Reactive Power | +/- 30 kVAR |
| Grid Interconnect | Utility approved protective relay included |

Noise

| | |
|-----------------------------|--|
| Apparent Noise Level | 55dBA at 40 meters from nacelle (131 ft) |
|-----------------------------|--|

Environmental Specifications

| | |
|--------------------------------------|--|
| 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 |

All specifications subject to change.

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* Standard conditions: air density of 1.225 kg/m³, equivalent to 15°C (59°F), at sea level.
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