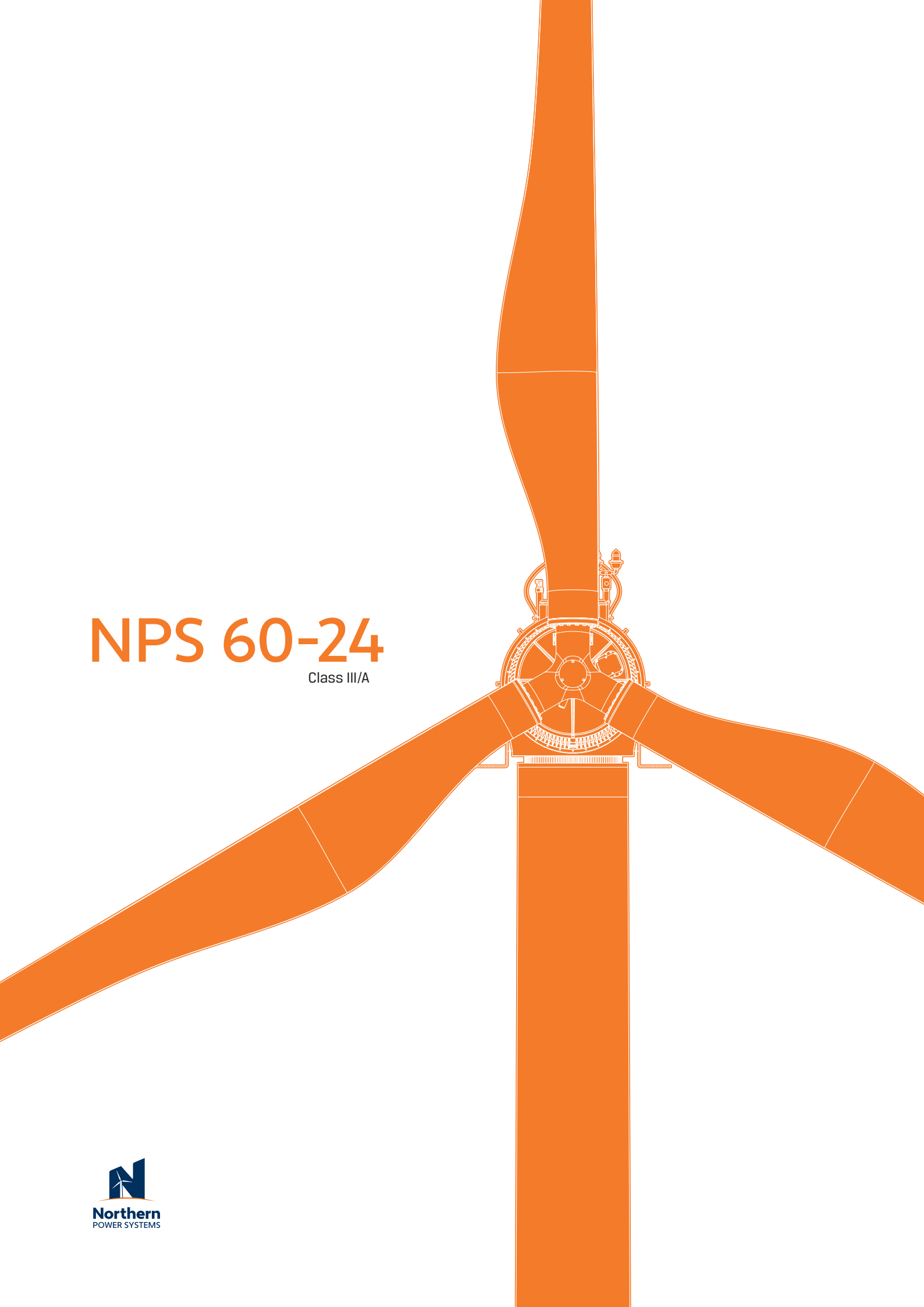


# NPS 60-24

Class III/A





## The Next Generation High Output Wind Turbine for Low Wind Regimes

# NPS 60-24

Class III/A

» Introducing the NPS 60-24, the next generation of our industry leading permanent magnet/direct drive distributed wind turbines.

» A new 24-meter rotor features state-of-the-art hub and blade technology with superior aerodynamics providing a larger swept area. This increases the annual energy production (AEP) 14% over the previous NPS 60-23 model.

» Optimized to generate high output, our turbines begin making power at wind speeds as low as 3 meters per second and provide clear economic benefits in all kinds of wind regimes.

» The turbine is a complete redesign of NPS' distributed wind platform that has been deployed around the world since 2008. The nacelle is now 30% smaller with a completely new tower configuration. This results in lower weight and load characteristics reducing foundation and installation costs.

» Further improvements include a new best in class brake system, a new industry leading yaw configuration, an enhanced electrical layout, more efficient generator cooling, and an ultrasonic wind vane and anemometer.

» Over 5 million hours of cumulative run time makes the NPS 60 turbine series one of the most reliable and proven wind turbines in the world. The average availability of Northern Power's global fleet currently stands at 99.5%.

» This is made possible through an engineering advancement in simplicity and precision. Our permanent magnet direct drive (PMDD) technology maximises energy capture, outperforms conventional gearbox designs, and reduces maintenance costs.

# Specifications

## Key Benefits

### General Configuration

Model	Northern Power® 60-24
Design Class	IEC WTGS III/A air density 1.225 Kg/m <sup>3</sup> , average annual wind below 7.5 m/s, 50-yr peak gust below 52.5 m/s
Design Life	20 years
Rotor Diameter	24.4 m
Tower Types	Tubular steel monopole
Hub Height	37 m, 29 m, 23 m
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	11 m/s
Cut-in Wind Speed	3 m/s
Cut-out Wind Speed	25 m/s
Extreme Wind Speed	52.5 m/s

### Weight

Rotor (24 m) & Nacelle	7,800 kg
Tower (37 m)	14,000 kg

### Drive Train

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

### Braking System

Redundant Braking System (per IEC 61400-1ed3)	Generator dynamic brake and multiple hydraulic calipers
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### Control System

Controller Type	DSP-based multiprocessor embedded platform
Converter Type	Pulse-width modulated IGBT frequency converter
Monitoring System	SmartView® remote monitoring system, ModBus TCP

### Electrical System

Rated Electrical Power	59.9 kW, 3 Phase, 400 VAC, 50 Hz
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	55 dBa at 40 metres from nacelle
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### Environmental Specifications

Temperature Range Operational	-10°C to 40°C
Temperature Range Storage	-20°C to 50°C
Lightning Protection	Receptors in blades, nacelle lightning rod and electrical surge protection

#### » Optimized for low wind regimes

The NPS 60-24 starts making power at wind speeds as low as 3 meters per second and provides maximum generation at 11-15 mps

#### » Superior Income Generation

At 60 kilowatts of rated power, with a 24m rotor, the NPS 60-24 can produce substantial amounts of electricity to generate a healthy income stream. It provides long-term benefits with lower ownership costs over the lifetime of the wind turbine. It meets the energy needs for residential, farm, and small business installations while also providing valuable income from Feed-in-Tariffs where available

#### » Simplified grid connection

Ideal for weak grids. State-of-the-art full power converter design provides smooth, clean power to local grids, simplifying grid interconnect and adding to grid stability

#### » Plug and play

Supplied with an approved 400-volt transformer, an RTU data logger and a utility grid protective relay interface all built into the tower of the wind turbine

#### » Robust reliability

99.5% availability across the Northern Power global fleet makes the NPS 60-24 one of the most reliable small wind turbines available

#### » Permanent Magnet Direct Drive technology

The 24-meter rotor maximizes energy capture, outperforms conventional gearbox designs, and reduces maintenance costs

## 10-Year Performance Guarantee Program (PGP)

The 10-Year PGP covers 10 years of operation and maintenance costs, including parts, labour and expenses for the NPS 60. This is the only such warranty offered by a manufacturer for a small wind turbine in Britain.

The annual cost is based on the performance of the NPS 60. This is backed by an **availability guarantee** and **performance to power curve guarantee**.

During the programme NPS will be the sole service provider. This gives peace of mind that the wind turbine will produce maximum energy and return on investment while offering the lowest total cost of ownership for the turbine's 20+ year life.

With the 10-Year Performance Guarantee Program, Northern Power Systems is financially invested in the success of your wind turbine.

Other services in the Northern Power PGP include:

- **24x7 monitoring and reporting:** Operation teams in the UK, Italy and the United States oversee the performance and operation of your wind turbine to ensure maximum availability
- **Global Spares Management Program:** New parts for the NPS 60 dispatched for same-day or next-day delivery

# Power Curves

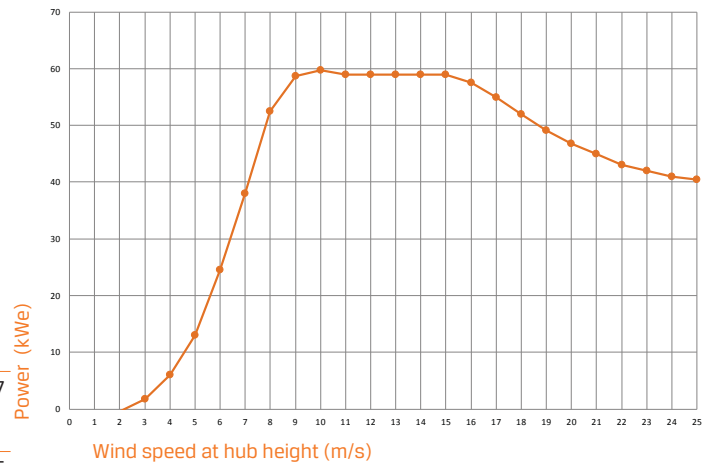
## NPS 60-24 Class III/A Power Curve

24m Rotor, Standard Conditions\*

wind speed (m/s)	1	2	3	4	5	6	7	8	9	10
electric power (kWe)	-0.5	-0.5	1.7	6.0	13.0	24.5	38.0	52.5	58.7	59.7

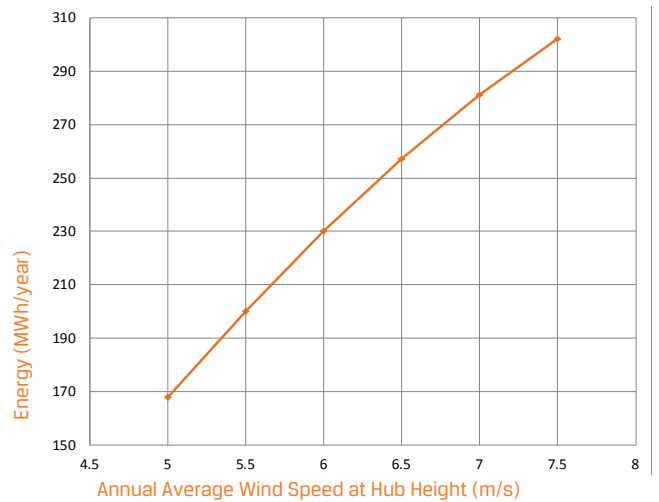
	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	59.9	59.9	59.9	59.9	59.9	57.5	55.0	52.0	49.1	46.8	45.0	43.0	42.0	41.0	40.5



## Annual Energy Production: 24-Metre Rotor

Standard Conditions,\* Rayleigh Wind Distribution

	(mph)	11	12	13	14.5	16	17
Average annual wind speed	(m/s)	5.0	5.5	6.0	6.5	7	7.5
Annual energy output	(MWh/yr)	168	200	230	257	281	302



\* Standard conditions: air density of 1.225 kg/m<sup>3</sup>, equivalent to 15°C (59°F) at sea level

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