

***Vestas***<sup>®</sup>

# V90

## 3.0 MW

**Wind.** It means the world to us.<sup>™</sup>

# V90-3.0 MW®

## A better wind business by design.

### **Reliable turbines through proven technology**

Vestas has installed more than 3,000 V90-3.0 MW® turbines on- and offshore – the equivalent of more than 9 GW – around the world.

The V90-3.0 MW® builds on proven technology ensuring reliability, serviceability and yield. It is a uniquely tested platform that provides the safest way to a better wind business and a higher return on investment.

### **Innovative low-weight design drives down the cost of energy**

Through Vestas' unique, innovative nacelle design and integrated drive train, the V90-3.0 MW® minimises weight and loads.

The result is a turbine that can generate more power without an appreciable increase in size, weight and tower loads. In this way the innovative design optimises energy production and drive down the overall cost of energy.

# +3,000

turbines installed, equivalent of more than 9 GW around the world.



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**Wind.** It means the world to us.™  
Wind is all we do. We are relentlessly committed to the success of wind as a source of energy for the world, providing everything you need to succeed in your wind power ambitions.

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Low weight  
High **return**





# How does our technology generate **more energy?**

## **Proven technologies**

The V90-3.0 MW<sup>®</sup> is a low-risk choice, based upon the proven technologies that underpin the +58,000 Vestas turbines installed around the world. Using the best features from across the range, as well as some of the industry's most stringently tested components and systems, this turbine's reliable design minimises your downtime – helping to give you the best possible return on your investment.

## **Reliable and robust**

The Vestas Test Centre is unrivalled in the wind industry. We test most nacelle components using Highly Accelerated Life Testing (HALT) to ensure reliability. For critical components, HALT identifies potential failure modes and mechanisms.

Specialised test rigs ensure strength and robustness for the gearbox, generator, yaw and pitch system, lubrication system and accumulators. Our quality-control system ensures that each component is manufactured to design specifications and performs at site. We systematically monitor measurement trends that are critical to quality, locating defects before they occur.



# Optimise energy production and **reduce** the operational costs.

Designed to let you take advantage of high and medium wind speed sites, the V90-3.0 MW<sup>®</sup> allows you to increase productivity by extracting more power from the available wind while minimising your downtime and maintenance costs. Here's an overview of selected features that optimise your energy production, reduce operational costs and strengthen the business case for choosing the high-performing V90-3.0 MW<sup>®</sup>.

## **Innovative drive train**

The V90-3.0 MW<sup>®</sup> minimises weight and loads through its innovative nacelle design and high-efficiency integrated drive train. The result is a turbine that can generate more power without an appreciable increase in size, weight, or tower load.

## **Tried and tested blade design**

Blades are made out of a glass fibre/carbon spar with glass fibre airfoil shells creating one of the lightest 44 m blade on the market. As a result the V90-3.0 MW<sup>®</sup> blades maximise production while reducing the loads transferred to the nacelle.

## **Grid support**

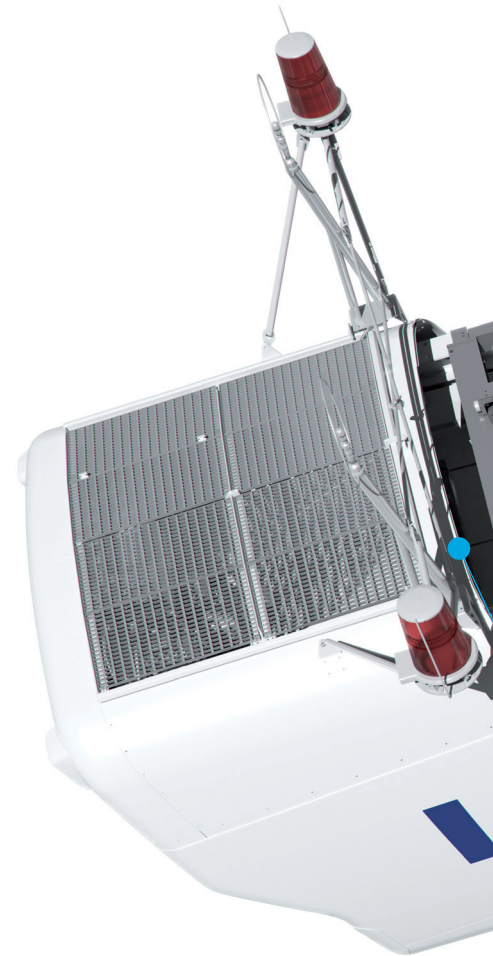
The turbine features control of reactive power capability which stabilises the frequency and the voltage of the grid. The V90-3.0 MW<sup>®</sup> is also able to support the grid according to various applicable grid requirements.

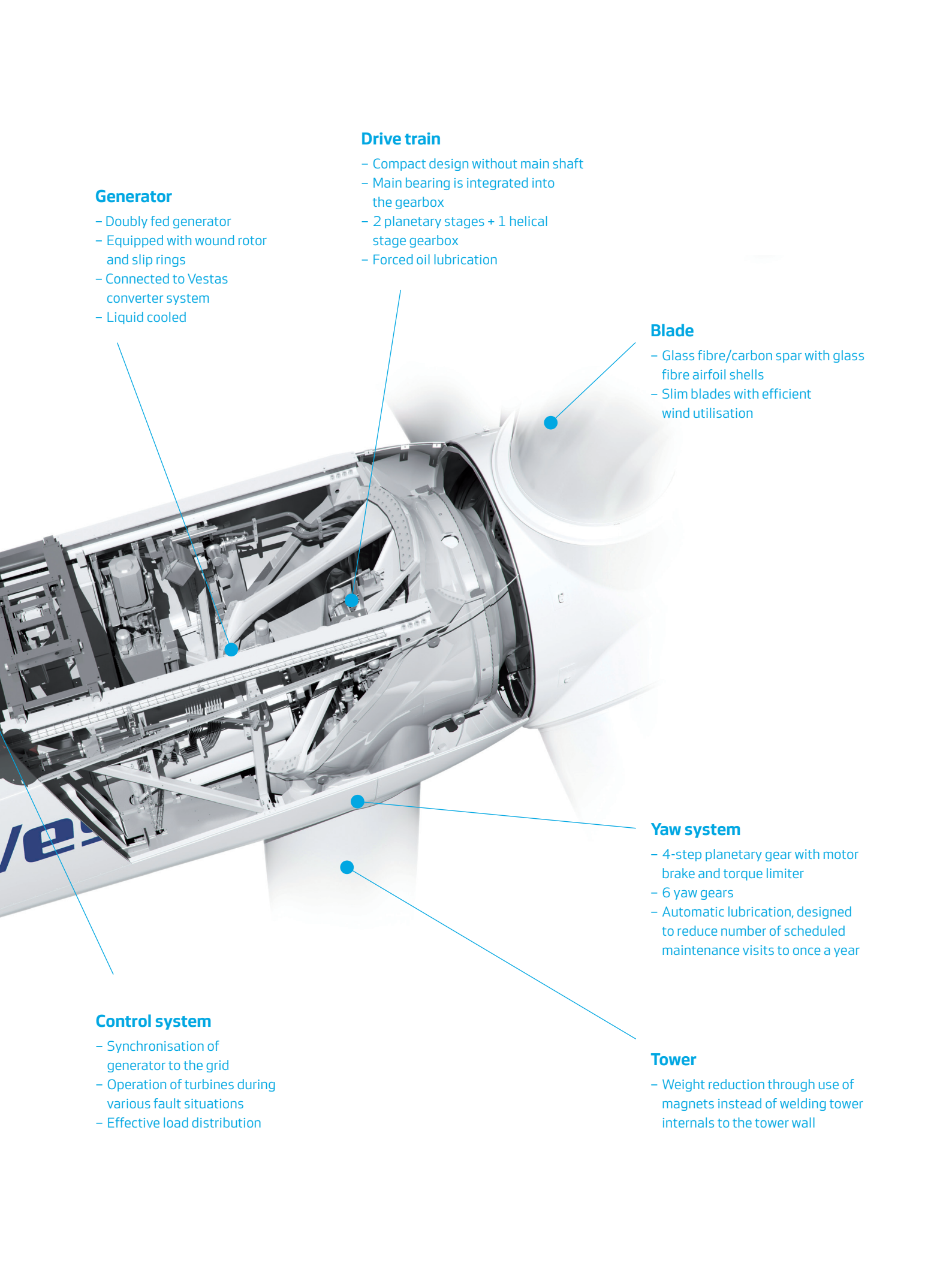
## **Designed for easy service**

The V90-3.0 MW<sup>®</sup> is designed for a 12 month service interval instead of usual 6 months. This means that you can plan your maintenance for the season avoiding the windiest months and minimising lost production.

## **Designed for uncomplicated transport and reduced installation costs**

The V90-3.0 MW<sup>®</sup> is designed to be transported easily to virtually any site around the world. All of its components comply with local and international limits for standard transportation. The nacelle does not require on-site assembly – lowering your installation costs, as less activity is needed. We also use anchor bolts in our foundation design, which allows faster erection on-site and simpler tower realignment.





### Generator

- Doubly fed generator
- Equipped with wound rotor and slip rings
- Connected to Vestas converter system
- Liquid cooled

### Drive train

- Compact design without main shaft
- Main bearing is integrated into the gearbox
- 2 planetary stages + 1 helical stage gearbox
- Forced oil lubrication

### Blade

- Glass fibre/carbon spar with glass fibre airfoil shells
- Slim blades with efficient wind utilisation

### Yaw system

- 4-step planetary gear with motor brake and torque limiter
- 6 yaw gears
- Automatic lubrication, designed to reduce number of scheduled maintenance visits to once a year

### Control system

- Synchronisation of generator to the grid
- Operation of turbines during various fault situations
- Effective load distribution

### Tower

- Weight reduction through use of magnets instead of welding tower internals to the tower wall



# **Full control** through service experts and a global surveillance system.

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Vestas turbines include a range of additional features that give you the control you need to maximise your production and ensure a high return on your investment. Thanks to our superior operations and maintenance capabilities, we also provide a level of service unparalleled in the industry.

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# +33,000

The Vestas Performance and Diagnostics Centre monitors more than 33,000 turbines worldwide. We use this information to continually develop and improve our products and services.

## **Advanced monitoring and real-time plant control**

All our wind turbines can benefit from VestasOnline® Business, the latest Supervisory Control and Data Acquisition (SCADA) system for modern wind power plants.

This flexible system includes an extensive range of monitoring and management functions to control your wind power plant. VestasOnline® Business enables you to optimise production levels, monitor performance and produce detailed, tailored reports from anywhere in the world. The VestasOnline® Power Plant Controller offers scalability and fast, reliable real-time control and features customisable configuration, allowing you to implement any control concept needed to meet local grid requirements.

## **Surveillance, maintenance and service**

Operating a large wind power plant calls for efficient management strategies to ensure uninterrupted power production and to control operational expenses. We offer 24/7 monitoring, performance reporting and predictive maintenance systems to improve turbine performance and availability. Predicting faults in advance is essential, helping to avoid costly emergency repairs and unscheduled interruptions to energy production.

Our Condition Monitoring System (CMS) assesses the status of the turbines by analysing vibration signals. For example, by measuring the vibration of the drive train, it can detect faults at an early stage and monitor any damage. This information allows pre-emptive maintenance to be carried out before the component fails, reducing repair costs and production loss.

Additionally, our Active Output Management® (AOM) concept provides detailed plans and long term agreements for service and maintenance, online monitoring, optimisation and troubleshooting. It is possible to get a full scope contract, combining your turbines' state-of-the-art technology with guaranteed time or energy-based availability performance targets, thereby creating a solid base for your power plant investment. The Active Output Management® agreement provides you with long term and financial operational peace of mind for your business case.

# V90-3.0 MW<sup>®</sup>

## Facts and figures

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### POWER REGULATION

pitch regulated with variable speed

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### OPERATING DATA

Rated power	3.0 MW
Cut-in wind speed	3.5 m/s
Rated wind speed	15 m/s
Cut-out wind speed	25 m/s
Re-cut in wind speed	20 m/s
Wind class	IEC IA and IEC IIA
Operating temperature range	standard range: -20 °C to 40 °C low temperature option: -30 °C to 40 °C

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### SOUND POWER

(Mode 0, 10 m above ground, hub height 80 m, air density 1,225 kg/m<sup>3</sup>)

4 m/s	97.9 dB (A)
5 m/s	100.9 dB (A)
6 m/s	104.2 dB (A)
7 m/s	106.1 dB (A)
8 m/s	107.0 dB (A)
9 m/s	106.9 dB (A)

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### ROTOR

Rotor diameter	90 m
Swept area	6,362 m <sup>2</sup>
Nominal revolutions	16.1 rpm
Operational interval	8.6 - 18.4 rpm
Air brake	full blade feathering with 3 pitch cylinders

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### ELECTRICAL

Frequency	50/60 Hz
Generator type	4-pole doubly fed generator

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### GEARBOX

Type	two planetary stages and one helical stage
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### TOWER

Type	tubular steel tower
Hub heights	65 m and 80 m (IEC IA) 105 m (IEC IIA)

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### BLADE DIMENSIONS

Length	44 m
Max. chord	3.5 m

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### NACELLE DIMENSIONS

Height for transport	4 m
Length	9.65 m
Width	3.65 m (3.85 m installed)

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### HUB DIMENSIONS

Max. diameter	3.6 m
Max. width	4.2 m
Length	4.4 m

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Max. weight per unit for transportation	70 metric tonnes
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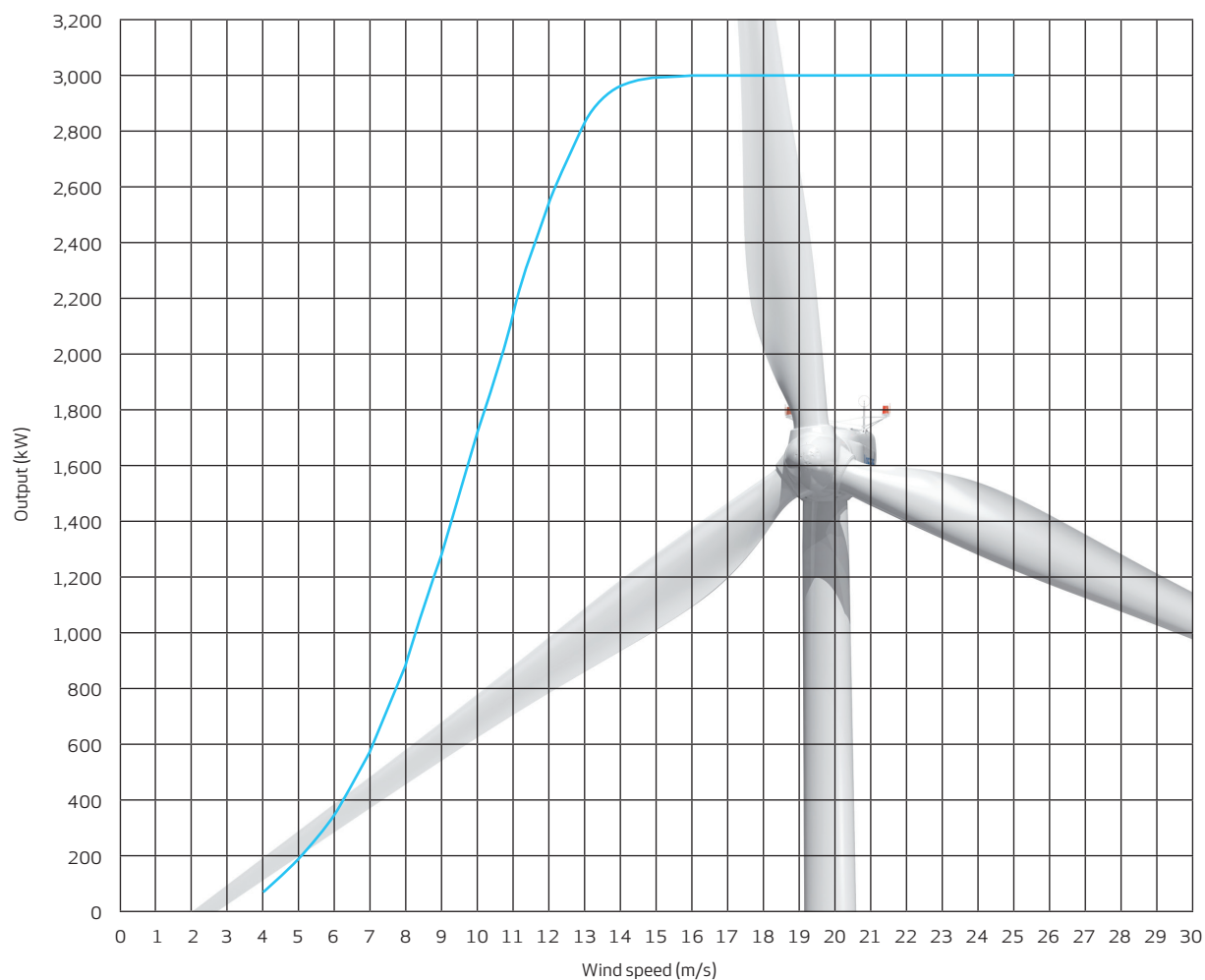
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### POWER CURVE FOR V90-3.0 MW<sup>®</sup>

Noise reduced sound power modes are available



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