

**Vestas**<sup>®</sup>

**V112**  
**3.0 MW**  
**ONSHORE**

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

# V112-3.0 MW

## Making wind even more profitable

### Large rotor diameter expands your opportunities

The impressive 54.65 m blades set completely new standards, making it possible to produce more energy from the same available wind. The blades deliver a remarkable capacity and yield that allows you to operate profitably at previously less viable onshore sites with medium and low winds.

### Reliable technology added new innovations

What's more, the V112-3.0 MW builds on the proven technology of previous Vestas turbines to deliver component reliability and durability. This reduces the risk of downtime and helps to ensure the stability of your investment. Due to the quality of our project engineering, logistics, construction and commissioning, we will deliver your wind turbines on time. In short, this game-changing platform is unmatched in its ability to maximise the return on your investment.

The V112-3.0 MW includes a number of new innovations, such as the power system. This features a permanent magnet generator to ensure wider operation range of the turbine and reduced loss of power, and a full-scale converter which provides excellent grid support, reduced drive-train loads and optimum energy production over a greater range of wind speeds.

# 54.65 M

The V112-3.0 MW sets completely new standards for production capacity at lower wind speeds by adding the impressive 54.65 m blades.

A close-up, low-angle shot of a wind turbine's nacelle and hub. The nacelle is a large, cylindrical structure with a complex internal layout of components visible through a circular opening. The hub is the central part where the blades are attached. The blades are long, white, and taper towards the tip. The background is a clear, bright blue sky. The lighting is dramatic, with strong highlights and deep shadows, emphasizing the metallic textures and the industrial nature of the machine.

# Less wind **More power**

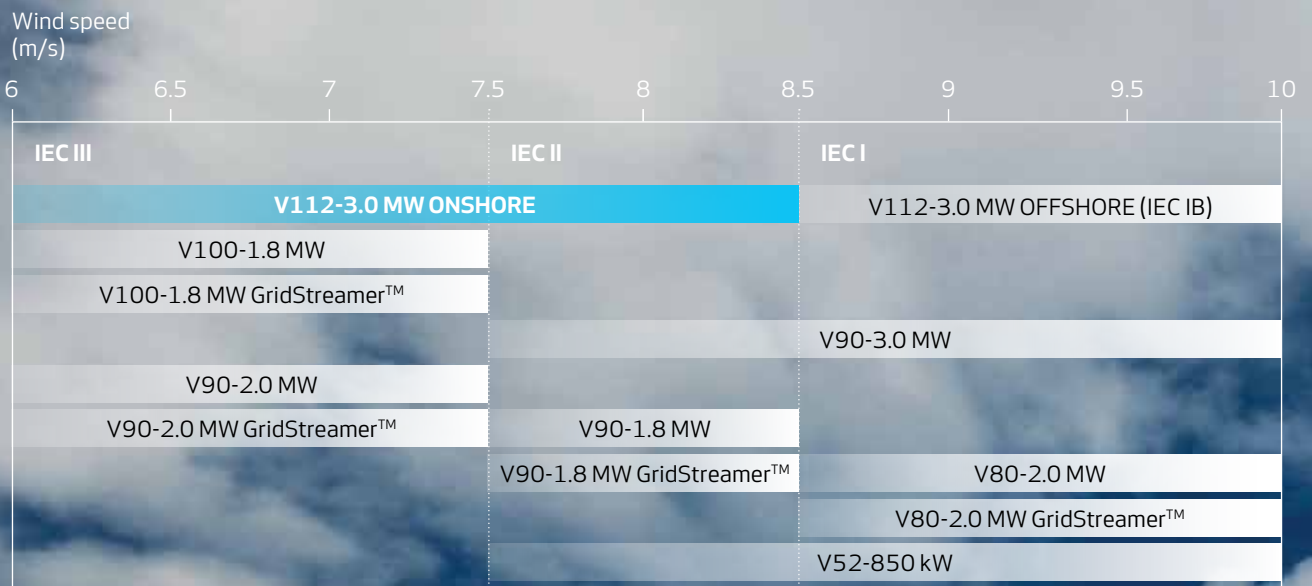
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**Wind.** It means the world to us.™  
Wind is all we do. We are relentlessly committed to the success of wind as a source of energy for the world, providing everything you need to succeed in your wind power ambitions.

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# Powering new opportunities

**DESIGNED FOR IEC IIA AND IEC IIIA**  
Vestas' latest wind turbine V112-3.0 MW



- -112 meter rotor diameter
- -3.075 MW rated power

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## Optimise energy production

- Designed for high productivity
- Reducing noise has minimal impact on power production
- Excellent grid support

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## Reduce energy costs

- Low Balance of Plant (BOP), installation and transportation costs
- Designed for serviceability
- Innovative CoolerTop® uses the wind's own energy

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## Secure your investment

- Proven technology
- Reliable and robust product
- Uninterrupted control of wind energy production

Here's an overview of selected features and benefits that optimise your energy production, lower your operating costs and strengthen the business case for choosing the V112-3.0 MW.

# Industry-leading technology generates more energy

## High productivity in every condition

The annual energy production of the V112-3.0 MW compares favourably to other products in the IEC III/II class, with a very high productivity record. What's more, the profile of these 54.65 m blades is optimised both for aerodynamic efficiency and to ensure that their structural strength is increased. The shape of the blades also makes them less sensitive to dirt and other airborne materials, resulting in a better production performance.

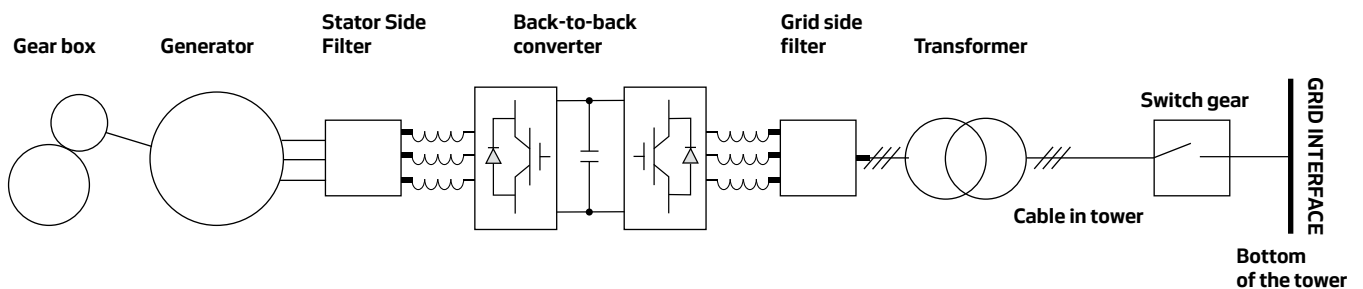
## Keep noise down and power up

The V112-3.0 MW has various noise modes to meet the operational sound-level restrictions specific to any site. In fact, you can run this turbine in configurable modes and keep within defined decibel ranges – all without a significant reduction in productivity. So even in areas where sound-level restrictions are in place, the V112-3.0 MW is often your most viable option.

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## Excellent grid support

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The new power system also accounts for the excellent grid support capabilities of the V112-3.0 MW, allowing it to meet a variety of demands worldwide. Having a permanent magnet generator and a full-scale converter makes it possible to fulfil the most advanced grid requirements on the market today.

The new power system has the capability to continue operating even when there is a severe grid voltage drop, and any power is converted to heat by a resistor in the full-scale converter without putting unnecessary load on the drive train components. In addition, the new power system is able to quickly down-rate to 20%.

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## THE NEW POWER SYSTEM

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### FULL GRID COMPLIANCE

Voltage range	0.9-1.1 pu
Frequency	47-53 Hz
FRT	Yes
Reactive current injection	Yes
Max short-circuit level	25 kA

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### FEATURES

- Designed for superior grid support
  - Power factor range: 0.9 capacitive / 0.83 inductive (HV transformer)
  - Zero Voltage Ride Through: 0.5 s
  - Fast run back to 20%, spinning reserve 20% to 100%
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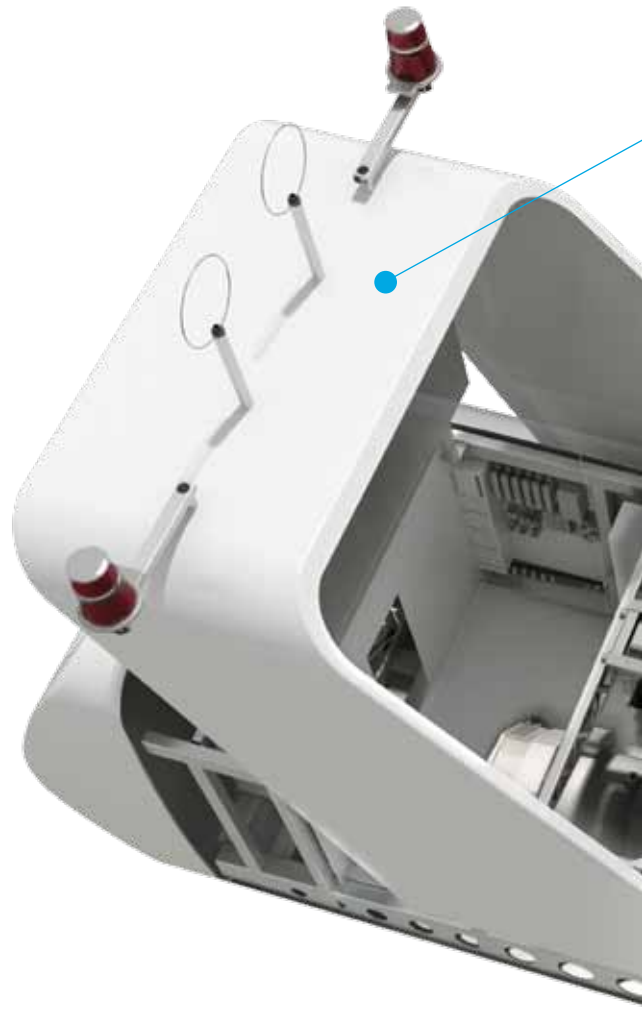
# Reduce wind energy costs by design

## Low Balance of Plant (BOP), installation and transportation costs

Just like other Vestas turbines, the V112-3.0 MW is designed to be transported easily (by rail, truck or barge) to virtually any site around the world. In terms of weight, height and width, all of its components comply with local and international limits for standard transportation. Specifically, not one of its components weighs more than 70 tonnes. Your foundation costs are also lowered with the V112-3.0 MW due to its improved load control. The innovative power system provides excellent grid support and is highly adaptable for future technical requirements. It also enables substations to be simpler and therefore more cost-effective.

## Easy-access serviceability

The V112-3.0 MW's new nacelle is ergonomically designed and maximises the internal space available (e.g. by integrating the power converter into the nacelle floor). This extra space also makes it easier for maintenance crews to gain access – reducing the time and cost spent on servicing and therefore maximising uptime. The automatic lubrication of the yaw system, main bearing and generator delivers the triple benefit of increased reliability, reduced maintenance time and less frequent servicing. Combined, these factors save you money and maximise your returns on the wind energy produced on low- and medium-wind onshore sites. The V112-3.0 MW can be put into place and maintained using tools and equipment that are standard within the installation and servicing industries – minimising ongoing maintenance costs.







## CoolerTop®

- Operation up to 1,500 m altitude without derating
- No power consumption for fans
- Minimal noise emission from cooling system

## Permanent magnet generator and full scale converter

- Simple and effective power system with high efficiency and excellent fault ride through capabilities
- PM generator designed by Vestas
- Reduced maintenance cost
- Highly adaptable for future requirements
- HCCBA bearings (High Capacity Bearing)

## Drive train

- Based on proven gear technology
- Integrated rotor lock system to improve maintenance ability
- Best performing gear solutions (proven from the Vestas Performance & Diagnostics Centre) implemented

## Blade

- Design based on our 44 m blades
- 55% larger swept area over V90-3.0 MW
- Large root diameter ( $\Phi 2.6$  m) ensures blade bearing longevity
- Lightning receptors and internal grounding cable integrated
- Robust performing profiles less sensitive to dirt
- Reduced noise level

## Pitch system

- Design based on V90-3.0 MW
- Double feeding pump system ensuring redundancy and reliability
- Solutions for safe work in hub integrated in design

## Innovative CoolerTop®

The CoolerTop® installed on the V112-3.0 MW uses the wind's own energy to generate the cooling required, rather than consuming energy generated elsewhere. The fact that the CoolerTop® has no moving parts means that it requires little maintenance, shaving costs once more. In addition, the absence of any electrical components ensures that the cooling system makes minimal noise – making it ideal for onshore sites near to populated areas – while simultaneously reducing the turbine's own energy consumption. Finally, the CoolerTop® provides sufficient cooling at altitudes of up to 1,500 m for the turbine to remain operational. This makes the V112-3.0 MW an ideal choice for those locations, high above sea level, that were once deemed unsuitable.

## Yaw system

- Design based on V90-3.0 MW and V90-2.0 MW
- 8 yaw gears
- Robust plain bearing with build in frictions (grease lubricated)



# The passion and experience to secure your wind energy **investment**

**+40,000**

The V112-3.0 MW advances the already proven technology powering over 40,000 installed Vestas turbines worldwide – more than any other supplier.

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## Life testing

The Vestas Test Centre has the unique ability to test complete nacelles using e.g. Highly Accelerated Life Testing (HALT). This rigorous testing of new components ensures the reliability of the V112-3.0 MW platform.



## Proven technology from the company that proved it

Since 1999, Vestas has installed over 1,300 V90-3.0 MW turbines and more than 6,500 2 MW turbines globally. These workhorses form the basis of the mighty V112-3.0 MW, which incorporates their thoroughly tested technologies – including the pitch, yaw and control systems, and the drive train concepts. This heritage makes the V112-3.0 MW your low-risk choice.

The V112-3.0 MW is based upon the proven technologies that underpin the 40,000+ 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 downtime – helping to give you the best possible return on your investment.

## Rigorous quality assurance, right from the start

The Vestas Test Centre is unrivalled in the wind industry and has the unique ability to test complete nacelles using e.g. Highly Accelerated Life Testing (HALT) to ensure reliability. At the critical component level, potential failure modes and mechanisms are identified, and specialised test rigs are used to ensure strength and robustness for the gearbox, generator, yaw and pitch system, lubrication system and accumulators. The Vestas quality-control system ensures that each component is produced to validated design specifications, and performs at site. We also employ a Six Sigma philosophy and aim to perform at Six Sigma levels by 2011. We have identified the critical manufacturing processes (both in-house and for sub-suppliers), and we systematically monitor measurement trends that are critical to quality, to identify variation and make changes before any defects occur.



# Uninterrupted control of wind energy production, at your **service**

## VestasOnline® Business

Vestas wind turbines benefit from the latest Supervisory Control and Data Acquisition (SCADA) system for modern wind power plants: VestasOnline® Business.

This flexible system includes an extensive range of monitoring and management functions that allow you to control your wind power plant in the same way as a conventional power plant. VestasOnline® Business enables you to optimise production levels, monitor performance and produce detailed, tailored reports from anywhere in the world while the system's power plant controller provides active and reactive power regulation, power ramping and voltage control.

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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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## Surveillance, maintenance and service

Vestas provides 24/7 monitoring, performance reporting and predictive maintenance systems to improve turbine uptime, production and availability. Operating a large wind power plant today calls for highly efficient management strategies, to ensure that power production is uninterrupted and that operational and maintenance expenses are controlled. The ability to predict when your critical components are most likely to break down is essential to this effort, as it helps to avoid costly emergency repairs and unscheduled interruptions to energy production.

The Vestas Condition Monitoring System performs this predictive maintenance function, assessing the status of the V112-3.0 MW by analysing measured signals such as vibrations and temperatures (e.g. in gearbox bearings and the main bearings).

For example, by measuring the vibration of the drive train, the system can detect faults at an early stage and monitor the progress of the damage. This information allows the service organisation to plan and execute the required maintenance work before the component fails, reducing repair costs and production loss.

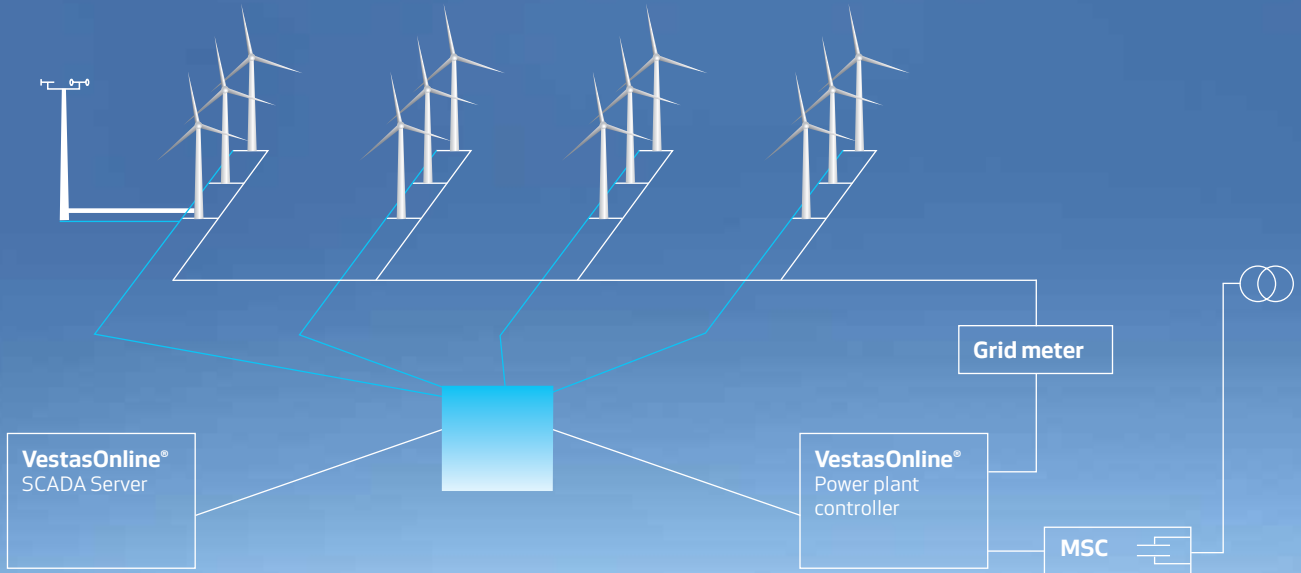
What's more, our Active Output Management® (AOM) concept provides detailed plans for service and maintenance, online monitoring, optimisation and troubleshooting, and includes a competitive insurance scheme. It is even possible to get a full availability guarantee, under which Vestas pays compensation if the turbine fails to meet the agreed availability targets.

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**VestasOnline®**

This SCADA system turns a group of wind turbines into a wind power plant

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# V112-3.0 MW

## some impressive data

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### POWER REGULATION

pitch regulated with variable speed

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### OPERATING DATA

Rated power	3,075 kW
Cut-in wind speed	3 m/s
Rated wind speed	13 m/s
Cut-out wind speed	25 m/s
Re cut-in wind speed	23 m/s
Wind class	IEC IIA and IEC IIIA
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 84 m, air density 1,225 kg/m<sup>3</sup>)

3 m/s	94.7 dB (A)
4 m/s	97.3 dB (A)
5 m/s	100.9 dB (A)
6 m/s	104.3 dB (A)
7 m/s	106.0 dB (A)
8 m/s	106.5 dB (A)

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### ROTOR

Rotor diameter	112 m
Swept area	9,852 m <sup>2</sup>
Nominal revolutions	12.8 rpm
Operational interval	6.2 - 17.7 rpm
Air brake	full blade feathering with 3 pitch cylinders

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### ELECTRICAL

Frequency	50/60 Hz
Generator type	permanent magnet generator
Converter	full scale converter

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### GEARBOX

Type	4-stage planetary/helical
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### TOWER

Type	tubular steel tower
Hub heights	84 m and 94 m (IEC IIA) 119 m (IEC IIIA)

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### BLADE DIMENSIONS

Length	54.65 m
Max. chord	4 m

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### NACELLE DIMENSIONS

Height for transport	3.4 m
Height installed (incl. CoolerTop®)	6.8 m
Length	12.8 m
Width	4.0 m

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### TOWER DIMENSIONS

Max. section length	30 m
Max. diameter	4.2 m

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### HUB DIMENSIONS

Max. transport height	3.74 m
Max. transport width	3.75 m
Max. transport length	5.42 m

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Max. weight per unit for transportation	70 metric tonnes
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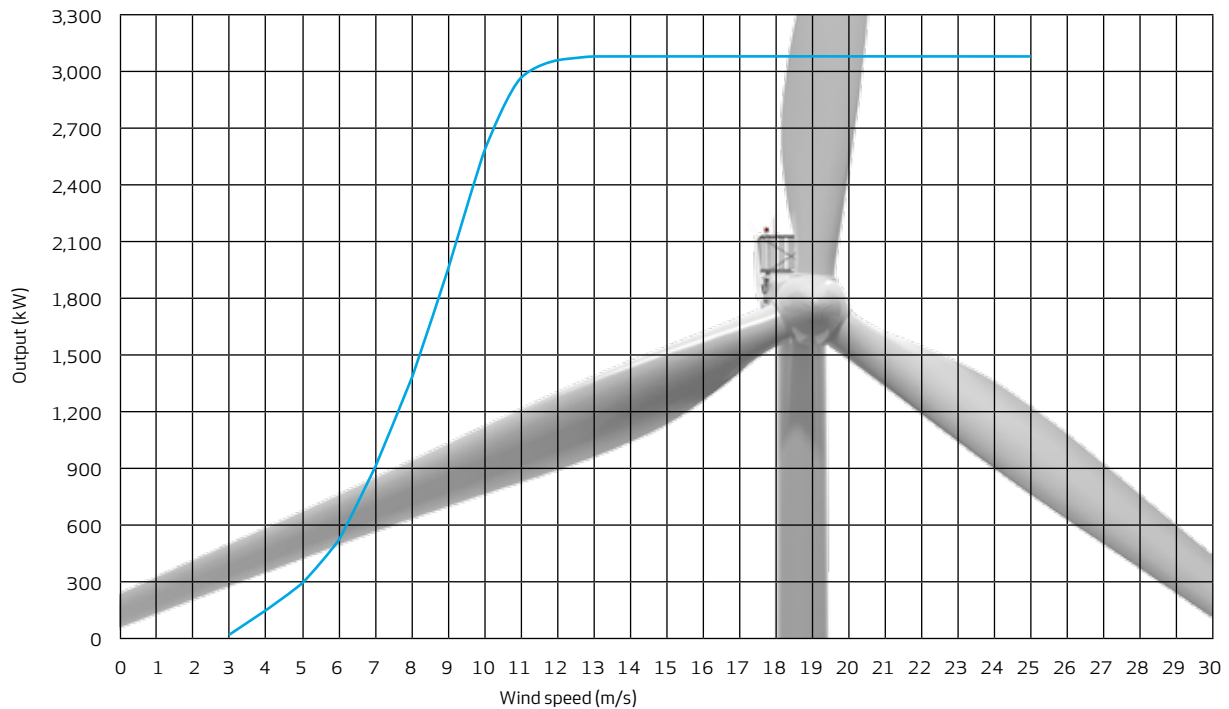
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# +20,000

Committed, highly-trained employees around the globe are always ready to help in any aspect of wind power production.

## POWER CURVE FOR V112-3.0 MW

Noise reduced sound power modes are available



## ANNUAL ENERGY PRODUCTION (AEP)

6.0 m/s	7,629 MWh
6.5 m/s	8,959 MWh
7.0 m/s	10,239 MWh
7.5 m/s	11,448 MWh
8.0 m/s	12,574 MWh
8.5 m/s	13,608 MWh
9.0 m/s	14,548 MWh

## Assumptions

No transmission losses;  
Park efficiency - 100%;  
Availability - 100%;  
Wind shape factor (C-factor) = 2;  
Air density = 1.225 kg/m<sup>3</sup>



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