

# 2 MW PLATFORM

# Are you looking for the maximum return on **your investment** in wind energy?

Wind energy means the world to us. And we want it to mean the world to our customers, too, by maximising your profits and strengthening the certainty of your investment in wind power.

That's why, together with our partners, we always strive to deliver cost-effective wind technologies, high quality products and first class services throughout the entire value chain. And it's why we put so much emphasis on the reliability, consistency and predictability of our technology.

These aren't idle words. We have over 40 years' experience in wind energy. During that time, we've delivered more than 132 GW of installed capacity and we currently monitor over 43,000 wind turbines across the globe. Tangible proof that Vestas is the right partner to help you realise the full potential of your wind site.

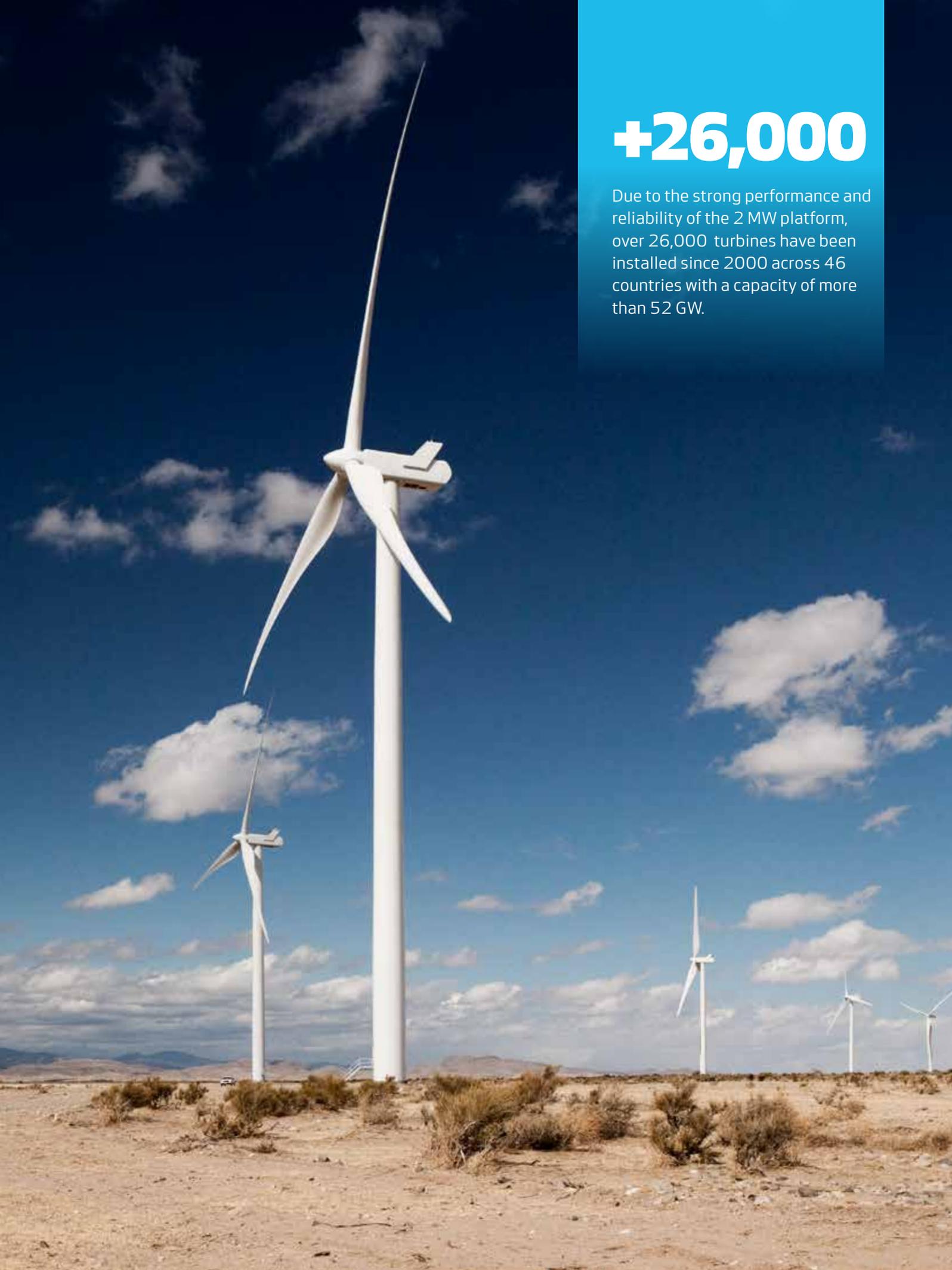
## **What is the 2 MW platform?**

Our 2 MW platform provides industry-leading reliability, serviceability and availability. Durable and dependable, the platform is built on technology that has been proven in the field over more than a decade. The 2 MW platform reduces your costs, minimises the risk of turbine downtime and helps to safeguard your investment.

You can choose from four turbines on the 2 MW platform:

- V90-2.0 MW™ IEC IIA/IEC S
- V100-2.0 MW® IEC IIB
- V110-2.0 MW® IEC IIIA
- V120-2.2 MW™ IEC IIB/IEC S

Each 2 MW turbine incorporates enhancements that improve performance and reliability, reducing your cost of energy. The platform's predictability allows you to forecast confidently, strengthening the business case for investment, while the tried-and-tested design ensures you can produce energy on ultra-low, low, medium and high-wind onshore sites at the lowest possible cost, even in extreme weather conditions. In addition, remote monitoring and easy servicing keep operational costs at a minimum, while its highly-tested components and power and control systems enhance reliability.



# +26,000

Due to the strong performance and reliability of the 2 MW platform, over 26,000 turbines have been installed since 2000 across 46 countries with a capacity of more than 52 GW.

# How does the 2MW platform increase **reliability** and **performance**?

Created with future generations of turbines in mind, the 2 MW platform's single-piece bed frame and strong main bearing housing provide a better foundation for loads. The frame and housing – each made from single-piece castings – work in conjunction to absorb higher loads from the rotor.

Additionally, the housing ensures correct alignment during bearing assembly, making the process accurate and efficient and distributing loads evenly.

## **A reliable performer**

The 2 MW platform is an extremely reliable turbine, which is documented through its strong availability performance. With the newest addition of rotor sizes, the 2 MW platform offers a competitive selection of turbines for all wind segments.

## **Thoroughly tested**

The current 2 MW platform is built on unique knowledge from more than a decade of operational experience. We constantly monitor the majority of the installed 2 MW turbines, providing us with very detailed and invaluable information about how the turbine operates under all kinds of site conditions.

Our quality-control system ensures that each component is produced to design specifications and performs to peak potential at site. We also employ a Six Sigma philosophy and have identified critical manufacturing processes (both in-house and for suppliers). We systematically monitor measurement trends that are critical to quality, locating defects before they occur.

## **Innovative CoolerTop®**

Our exclusive CoolerTop® technology uses the wind's own energy to generate the cooling required, rather than consuming energy from the wind turbine generator. CoolerTop® has no moving parts and requires little maintenance. Furthermore, the absence of cooling fans contributes to turbine efficiency and makes no noise.

## **Power Optimised Modes increase energy output**

The 2 MW platform supports Power Optimised Modes, used to maximise energy production under specific wind and site conditions. Based on a site analysis and under mild wind conditions, V90-2.0 MW™, V100-2.0 MW™, V110-2.0 MW™, can be upgraded up to 2.2 MW - maximising annual energy production.

The 2 MW platform covers a wide range of wind segments enabling you to find the best turbine for your specific site.

## WINDCLASSES - IEC

TURBINE TYPE	IEC III (6.0 – 7.5 m/s)	IEC II (7.5 – 8.5 m/s)	IEC I (8.5 – 10.0 m/s)
<b>2 MW TURBINES</b>			
V90-2.0 MW™ IEC IIA/IEC S		■ Standard IEC conditions	■ Site dependent
V100-2.0 MW® IEC IIB		■ Standard IEC conditions	■ Site dependent
V110-2.0 MW® IEC IIIA	■ Standard IEC conditions	■ Site dependent	■ Site dependent
V120-2.2 MW™ IEC IIB/IEC S	■ Standard IEC conditions	■ Standard IEC conditions	■ Site dependent

■ Standard IEC conditions   
 ■ Site dependent

### Low Balance of Plant, installation and transportation costs

At Vestas, we use technology tailored to control loads on specific tower heights. We have applied this principle to the 2 MW platform by reducing both the weight of the turbine and the loads on the tower and foundation. This reduces foundation costs, saving you unnecessary expense.

All 2 MW turbines are easy to transport (by rail, truck or ship) to virtually any site around the world. In terms of weight, height and width, all components comply with local and international standard transportation limits, ensuring you incur no unforeseen costs. In addition, 2 MW turbines are built and maintained using tools and equipment that are standard in the installation and servicing industries – minimising maintenance costs.

### Vestas Online® Business

All Vestas wind turbines benefit from Vestas Online® 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 in the same way as a conventional power plant. Vestas Online® Business enables you to optimise production levels, monitor performance, and produce detailed, tailored reports from anywhere in the world. The system's power plant controller provides active and reactive power regulation, power ramping and voltage control.

### 24/7 remote surveillance with VMP Global® and Vestas Online® Business

To reduce the cost of energy, the 2 MW platform is equipped with VMP Global®, our latest turbine control and operation software. Developed to run this latest generation of turbines, VMP Global®, combined with Vestas Online® Business, automatically manages the turbine 24/7 and ensures maximum power generation. The application also monitors and troubleshoots the turbines – both onsite and remotely – saving further expense on servicing.

### Designed for serviceability

Service is facilitated by the overall design of the 2 MW platform and components are specifically positioned for easy access.

### Options available for the 2 MW platform

- Power Optimised Modes up to 2.2 MW (site specific)
- Condition Monitoring System
- Vestas Ice Detection
- Smoke Detection
- Shadow Detection
- Low Temperature Operation to -30°C
- Aviation Lights
- Aviation Markings on the Blades
- Vestas IntelliLight™
- Vestas Bat Protection System

# The knowledge to control

## **The wind project planning is key**

When planning a wind power plant, there are a broad range of factors over its entire lifecycle that will impact its success in the long-term. These range from financing and siting, to grid requirements and the regulatory framework. One of the first and most important steps is to identify the most suitable location for your wind power plant. Vestas' siting capabilities cover all the steps from finding a site, until delivering a fully optimised power plant set up.

Using the largest weather library in the industry, site-specific met mast campaigns and advanced analytical tools, Vestas examines a broad spectrum of wind and weather data to evaluate potential sites and establish which of them can provide optimum conditions for your project. In addition, Vestas can optimise the layout of your wind power plant and the technology selection with high accuracy by implementing detailed simulations of the conditions on site and analyse their effects over the whole operating life of the plant. Put simply, it finds the optimal balance be-

tween the estimated ratio of annual revenue to operating costs over the lifetime of your plant, to determine your project's true potential and provide a firm basis for your investment decision.

The complexity and specific requirements of grid connections vary considerably across the globe, making the optimal design of electrical components for your wind power plant essential. By identifying grid codes early in the project phase and simulating extreme operating conditions, Vestas' Electrical PreDesign provides you with an ideal way to build a grid compliant, productive and highly profitable wind power plant. It allows customised collector network cabling, substation protection and reactive power compensation, which boost the cost efficiency of your business.

## **Designed for high park performance**

Supported by Vestas' vast operational experience, site specific design capabilities and sophisticated load models, the 2 MW platform technology allows customers to choose the optimal turbine configuration for each unique site.



# +43,000

The Vestas Performance and Diagnostics Centre monitors more than 43,000 turbines worldwide. We use this information to continually develop and improve our products and services.

The 2 MW platform has been strengthened through selected component upgrades. The control system of the 2 MW platform turbines has been proven since 2,000 and optimised for a range of rotor diameters from 80m to 120m. The result is a confident control and a robust aerodynamic performance.

All wind turbines of the Vestas 2 MW platform can benefit from Vestas SCADA system, which includes an extensive range of monitoring and management functions to control your wind power plant, optimise production levels, monitor performance and obtain reports from anywhere in the world. The Vestas SCADA system ensures efficient operation of the power plant, including integration of balance of plant and additional equipment needed to meet specific grid requirements.

### **Condition monitoring and maintenance**

Operating a large wind power plant calls for efficient management strategies to minimise downtime and operational expenses. Vestas offers 24/7 monitoring, performance reporting and

predictive maintenance solutions to improve turbine performance and availability.

Vestas Condition Monitoring Solution (CMS) enables to predict the failure of components by analysing vibration signals, preventing major equipment damages and enabling to optimise the service planning according to the energy production and weather conditions.

Additionally, Vestas' Active Output Management® (AOM) provides detailed plans and long-term agreements for maintenance, online monitoring, optimisation and troubleshooting. It is possible to get a full scope contract, combining turbine technology with guaranteed time or energy-based availability performance targets, thereby creating a solid base for your power plant investment.



# V90-2.0 MW™

## IEC IIA/IEC S

### Facts & figures

#### POWER REGULATION

Pitch regulated with variable speed

#### OPERATING DATA

Rated power	2,000 kW
Cut-in wind speed	4 m/s
Cut-out wind speed	25 m/s
Re cut-in wind speed	23 m/s
Wind class	IEC IIA/IEC S
Standard operating temperature range from	-20°C* to 40°C

#### SOUND POWER

Maximum 104 dB\*

\* Sound Power Modes available

#### ROTOR

Rotor diameter	90 m
Swept area	6,362 m <sup>2</sup>
Air brake	full blade feathering with 3 pitch cylinders

#### ELECTRICAL

Frequency	50/60 Hz
Generator type	4-pole (50 Hz)/6-pole (60 Hz) doubly fed generator, slip rings

#### GEARBOX

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

Hub heights	80 m (IEC S) Site and country specific
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#### NACELLE DIMENSIONS

Height for transport	4 m
Height installed (incl. CoolerTop®)	5.4 m
Length	10.4 m
Width	3.5 m

#### HUB DIMENSIONS

Max. transport height	3.4 m
Max. transport width	4 m
Max. transport length	4.2 m

#### BLADE DIMENSIONS

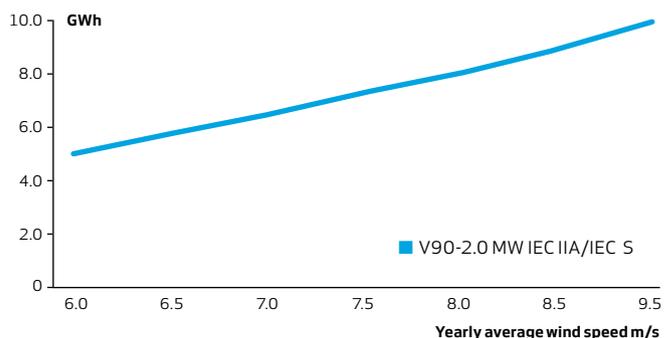
Length	44 m
Max. chord	3.9 m

Max. weight per unit for transportation 70 metric tonnes

#### TURBINE OPTIONS

- Power Optimised Modes up to 2.2 MW (site specific)
- Condition Monitoring System
- Vestas Ice Detection
- Smoke Detection
- Shadow Detection
- Low Temperature Operation to -30°C
- Aviation Lights
- Aviation Markings on the Blades
- Vestas IntelliLight®
- Vestas Bat Protection System

#### ANNUAL ENERGY PRODUCTION



**Assumptions**  
One wind turbine, 100% availability, 0% losses, k factor =2,  
Standard air density = 1.225, wind speed at hub height

# V100-2.0 MW<sup>®</sup>

## IEC IIB

### Facts & figures

#### POWER REGULATION

Pitch regulated with variable speed

#### OPERATING DATA

Rated power	2,000 kW
Cut-in wind speed	3 m/s
Cut-out wind speed	22 m/s
Re cut-in wind speed	20 m/s
Wind class	IEC IIB
Standard operating temperature range from	-20°C* to 45°C

#### SOUND POWER

Maximum 105 dB\*

\* Sound Power Modes available

#### ROTOR

Rotor diameter	100 m
Swept area	7,854 m <sup>2</sup>
Air brake	full blade feathering with 3 pitch cylinders

#### ELECTRICAL

Frequency	50/60 Hz
Generator type	4-pole (50 Hz)/6-pole (60 Hz) doubly fed generator, slip rings

#### GEARBOX

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

Hub heights	80 m (IEC IIB) and 95 m (IEC IIB)
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#### NACELLE DIMENSIONS

Height for transport	4 m
Height installed (incl. CoolerTop <sup>®</sup> )	5.4 m
Length	10.4 m
Width	3.5 m

#### HUB DIMENSIONS

Max. transport height	3.4 m
Max. transport width	4 m
Max. transport length	4.2 m

#### BLADE DIMENSIONS

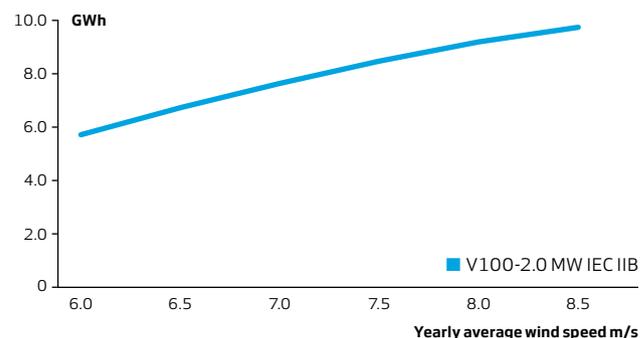
Length	49 m
Max. chord	3.9 m

Max. weight per unit for transportation 70 metric tonnes

#### TURBINE OPTIONS

- Power Optimised Modes up to 2.2 MW (site specific)
- Condition Monitoring System
- Vestas Ice Detection
- Smoke Detection
- Shadow Detection
- Low Temperature Operation to -30°C
- Aviation Lights
- Aviation Markings on the Blades
- Vestas IntelliLight™
- Vestas Bat Protection System

#### ANNUAL ENERGY PRODUCTION



**Assumptions**  
 One wind turbine, 100% availability, 0% losses, k factor =2,  
 Standard air density = 1.225, wind speed at hub height

# V110-2.0 MW<sup>®</sup>

## IEC IIIA

### Facts & figures

#### POWER REGULATION

Pitch regulated with variable speed

#### OPERATING DATA

Rated power	2,000 kW
Cut-in wind speed	3 m/s
Cut-out wind speed	21 m/s
Re cut-in wind speed	18 m/s
Wind class	IEC IIIA
Standard operating temperature range from	-20°C* to 45°C

#### SOUND POWER

Maximum 107.6 dB\*

\* Sound Power Modes available

#### ROTOR

Rotor diameter	110 m
Swept area	9,503 m <sup>2</sup>
Air brake	full blade feathering with 3 pitch cylinders

#### ELECTRICAL

Frequency	50/60 Hz
Generator type	4-pole (50 Hz)/6-pole (60 Hz) doubly fed generator, slip rings

#### GEARBOX

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

Hub heights	75 m (IEC IIIA), 80 m (IEC IIIA), 95 m (IEC IIIA/IEC IIIB), 110 m (IEC IIIB), 120 m (IEC IIIB) and 125 m (IEC IIIB)
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#### NACELLE DIMENSIONS

Height for transport	4 m
Height installed (incl. CoolerTop®)	5.4 m
Length	10.4 m
Width	3.5 m

#### HUB DIMENSIONS

Max. transport height	3.4 m
Max. transport width	4 m
Max. transport length	4.2 m

#### BLADE DIMENSIONS

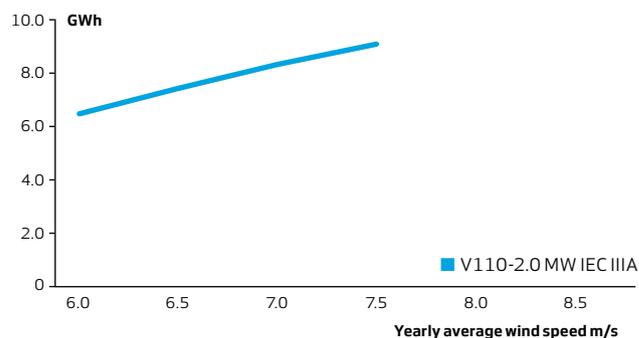
Length	54 m
Max. chord	3.9 m

Max. weight per unit for transportation 70 metric tonnes

#### TURBINE OPTIONS

- Power Optimised Modes up to 2.2 MW (site specific)
- Condition Monitoring System
- Vestas Ice Detection
- Smoke Detection
- Shadow Detection
- Low Temperature Operation to -30°C
- Aviation Lights
- Aviation Markings on the Blades
- Vestas IntelliLight™
- Vestas Bat Protection System

#### ANNUAL ENERGY PRODUCTION



**Assumptions**  
 One wind turbine, 100% availability, 0% losses, k factor =2,  
 Standard air density = 1.225, wind speed at hub height



# V120-2.2 MW™

## IEC IIB/IEC S

### Facts & figures

#### POWER REGULATION

Pitch regulated with variable speed

#### OPERATING DATA

Rated power 2,000 kW/ 2,200 kW  
 Cut-in wind speed 3 m/s  
 Cut-out wind speed 20 m/s  
 Re cut-in wind speed 18 m/s  
 Wind class IEC IIB/IEC S  
 Standard operating temperature range from -20°C\* to 45°C

#### SOUND POWER

Maximum 110.5 dB\*

\* Serrated Trailing Edge technology available to reduce sound power level

#### ROTOR

Rotor diameter 120 m  
 Swept area 11,310 m<sup>2</sup>  
 Air brake full blade feathering with 3 pitch cylinders

#### ELECTRICAL

Frequency 50/60 Hz  
 Generator type 4-pole (50 Hz)/6-pole (60 Hz) doubly fed generator, slip rings

#### GEARBOX

Type one planetary stage and two helical stages

#### TOWER

Hub heights 80 m (IEC S), 92 m (IEC S), 118 m (IEC S), 122 m (IEC S), 137 m (IEC S)

#### NACELLE DIMENSIONS

Height for transport 4 m  
 Height installed (incl. CoolerTop®) 5.4 m  
 Length 10.4 m  
 Width 3.5 m

#### HUB DIMENSIONS

Max. transport height 3.6 m  
 Max. transport width 4 m  
 Max. transport length 4.2 m

#### BLADE DIMENSIONS

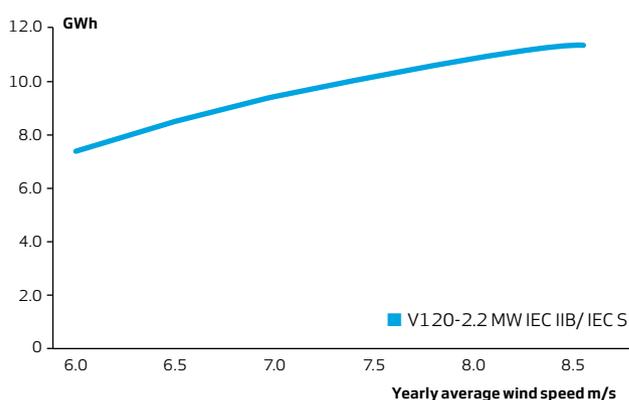
Length 59 m  
 Max. chord 3.9 m

Max. weight per unit for transportation 70 metric tonnes

#### TURBINE OPTIONS

- Power Optimised Modes up to 2.2 MW (site specific)
- Condition Monitoring System
- Vestas Ice Detection
- Smoke Detection
- Shadow Detection
- Low Temperature Operation to -30°C
- Aviation Lights
- Aviation Markings on the Blades
- Vestas IntelliLight™
- Vestas Bat Protection System

#### ANNUAL ENERGY PRODUCTION



#### Assumptions

One wind turbine, 100% availability, 0% losses, k factor =2, Standard air density = 1.225, wind speed at hub height

# Ensuring Business Case Certainty.

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Our business depends on your success. We are committed to delivering maximum certainty on the revenue and costs of your wind farm.

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Vestas Wind Systems A/S  
Hedeager 42 . 8200 Aarhus N . Denmark  
Tel: +45 9730 0000 . Fax: +45 9730 0001  
vestas@vestas.com . [vestas.com](https://www.vestas.com)

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