

4 MW  
platform

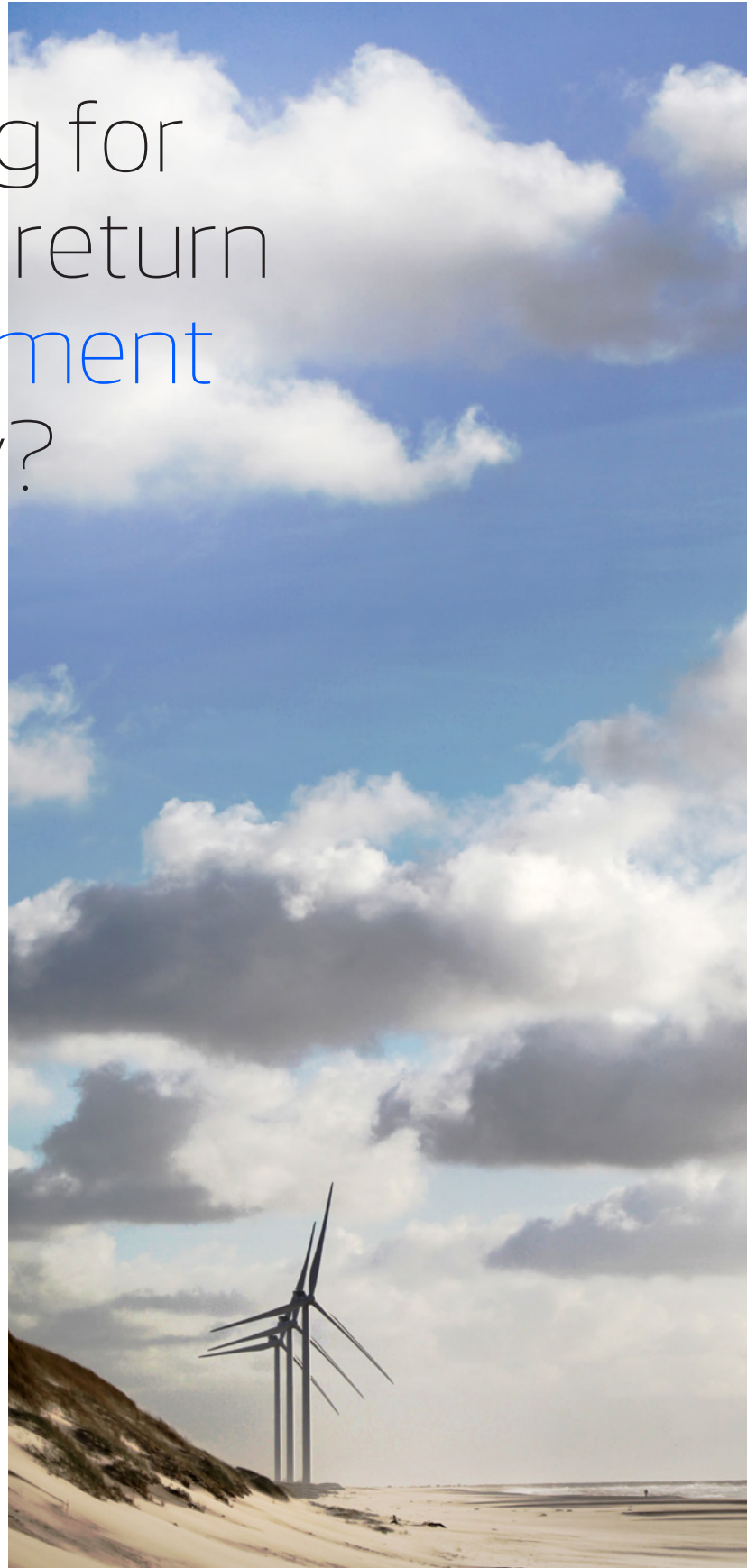


# Are you looking for the maximum return on **your investment** in wind energy?

Wind energy means the world to us. And we want it to mean the world to you – 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 efficient solutions and wind technologies, high quality products and first-class services throughout the entire value chain. And it's why we put so much emphasis on reliability, consistency and predictability of our technology.

We have over 40 years' experience in wind energy. During that time, we've delivered more than 166 GW of installed capacity in 88 countries. That is more than anyone else in the industry. We currently monitor over 49,000 wind turbines across the globe. All tangible proof that Vestas is the right partner to help you realise the full potential of your wind sites.





### What is the 4 MW Platform today?

The Vestas 4 MW platform is designed for a broad range of wind and site conditions, applicable for either land- or capacity-constrained markets. Since the introduction in 2010 with the launch of the V112-3.0 MW<sup>®</sup>, the platform was upgraded, and new variants are introduced utilising the untapped potential of the platform.

All variants of the 4 MW platform are based on the proven technology of the V112-3.0 MW<sup>®</sup> with a full-scale converter, providing you with superior grid performance.

All variants carry the same nacelle dimension, and the hub design has been re-used to the largest extent possible. The same ergonomically designed and very spacious nacelle makes it easier for maintenance crews to gain access, so they can reduce the time spent on service while maximising the uptime without compromising on safety.

All turbines can be installed or maintained using standard installation or servicing tools and equipment, further reducing operational and maintenance costs by minimising your stock level of spare parts.

The V112-3.45 MW<sup>®</sup> and the other 4 MW variants advance the already proven technology powering over 85,000 installed Vestas turbines worldwide - more than any other supplier.

Turbines worldwide

+85,000

In addition, our engineers have increased the nominal power across the entire platform improving your energy production significantly. With this expansion, the 4 MW platform covers all IEC wind classes with a variety of rotor sizes and a rated output power of up to 4.5 MW.

The 4 MW platform has now evolved to power 8 rotor sizes represented by 12 official variants. Leveraging Vestas Modular Product Development, standard interfaces between interchangeable components allow for configuration flexibility in our offerings and enable efficiency in technology response. Combined with a large catalogue of optional features and tower options, the 4 MW platform portfolio allows you to mix turbines across your site or portfolio of sites, delivering industry-leading reliability, serviceability and exceptionally efficient energy capture. Leveraging the well-established global supply network, our 4 MW platform is all about optimising your business case.

You can choose from the following turbines on the 4 MW platform:

- V105-3.45 MW<sup>™</sup> – IEC IA
- V112-3.45 MW<sup>®</sup> – IEC IA
- V117-3.45 MW<sup>™</sup> – IEC IB/IEC IIA
- V117-4.2 MW<sup>™</sup> – IEC IB-T/IEC IIA-T/IECS-T
- V126-3.45 MW<sup>®</sup> – IEC IIB/IEC IIA
- V136-3.45 MW<sup>®</sup> – IEC IIB/IEC IIIA
- V136-4.2 MW<sup>™</sup> – IEC IIB/IEC S
- V136-4.5 MW<sup>™</sup> – IEC IIB
- V150-4.2 MW<sup>™</sup> – IEC IIIB/IEC S
- V150-4.5 MW<sup>™</sup> – IEC IIIB
- V155-3.6 MW<sup>™</sup> – IEC S
- V163-4.5 MW<sup>™</sup> – IEC IIIB

To date, over 17,000, totalling +65 GW of the 4 MW platform turbines have been installed globally. Benefitting from operational insights, continuous development with a modular approach and the future of energy in mind, the 4 MW platform – backed by its well-established and efficient global supply network – forms a central part of the Vestas' product and solutions offerings and represents a portfolio of turbines delivering flexible and highly efficient wind energy solutions to power the global energy transition.

# How does our technology generate more energy?

## More power for every wind site

The V112-3.45 MW<sup>®</sup>, the V117-3.45 MW<sup>®</sup>, the V117-4.2 MW<sup>™</sup>, the V126- 3.45 MW<sup>®</sup>, the V136-3.45 MW<sup>®</sup>, the V136-4.2 MW<sup>™</sup>, the V136 -4.5 MW<sup>™</sup>, the V150-4.2 MW<sup>™</sup> and the V150-4.5 MW<sup>™</sup> are available with several Sound Optimised Modes to meet sound level restrictions with an optimised production. The power system enables superior grid support, and it is capable of maintaining production across severe drops in grid voltage, while simultaneously minimising tower and foundation loads. It also allows rapid down-rating of production to 10 percent nominal power.

## Proven technologies - from the company that invented them

The 4 MW platform is a low-risk choice. It is based on proven technologies that underpin more than 85,000 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, the platform's reliable design minimises downtime – helping to give you the best possible return on your investment.

With an operating range that covers all wind classes, our 4 MW platform delivers unrivalled energy production. The proven blade technology from the V112-3.0 MW<sup>®</sup> is used on the V105-3.45 MW<sup>™</sup>, the V112-3.45 MW<sup>®</sup>, the V117-3.45 MW<sup>®</sup> and the V117-4.2 MW<sup>™</sup>. The industry known structural shell blades are used on the V126-3.45 MW<sup>®</sup>, V136-3.45 MW<sup>®</sup>, V136-4.2 MW<sup>™</sup>, V136-4.5 MW<sup>™</sup>, V150-4.2 MW<sup>™</sup>, V150-4.5 MW<sup>™</sup>, V155-3.6 MW<sup>™</sup> and V163-4.5 MW<sup>™</sup> - a technology which is also used on the 2 MW V110-2.0 MW<sup>®</sup>, the V116-2.1 MW<sup>™</sup> and the V120-2.2 MW<sup>™</sup> variants.

## Reliable and robust

The Vestas Test Centre is unrivalled in the wind industry. We test most nacelle components using accelerated life testing under mixed and aggregated environmental conditions. For critical components, Highly Accelerated Life Testing (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.

## Options available for the 4 MW platform

An option is an extra feature that can be added to the turbine to suit a project's specific needs. By adding options to the standard turbine, we can enhance the performance and adaptability of the wind power project and facilitate a shorter permitting cycle at restricted sites. The options can even be a decisive factor in realising your specific project, and the business case certainty of the investment.

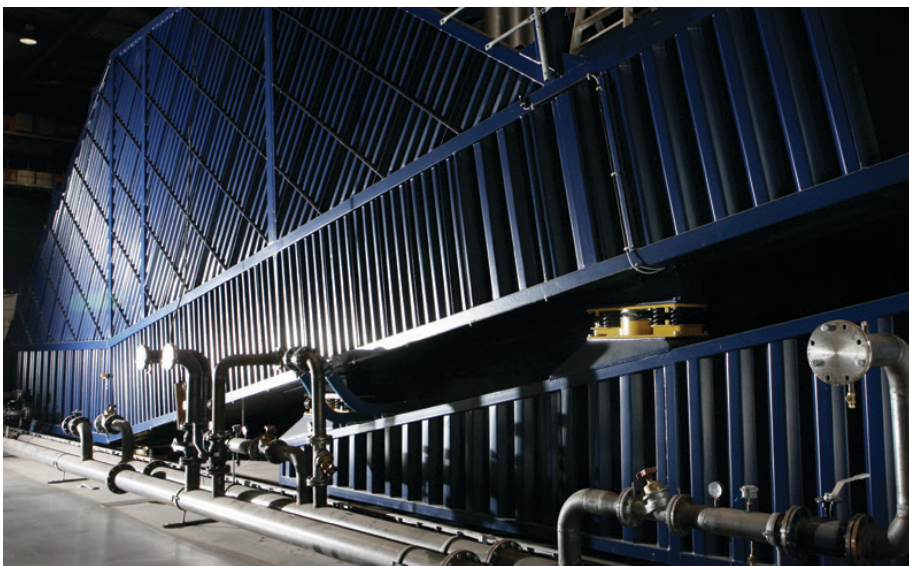
## Here is a list of the options available for the 4 MW platform:

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- Power Optimised Modes
- Load Optimised Modes
- Condition Monitoring System
- Service Personnel Lift
- Vestas Ice Detection
- Vestas De-Icing
- Vestas Anti-Icing System™
- Low Temperature Operation to - 30°C
- Fire Suppression
- Shadow Flicker Control System
- Vestas Bat Protection System
- Aviation Lights
- Aviation Markings on the Blades
- Vestas IntelliLight™
- Nacelle Hatch for Air Inlet

	Low Wind Speeds	Medium Wind Speeds	High Wind Speeds
<b>4 MW turbines</b>			
V105-3.45 MW™ IEC IA			█
V112-3.45 MW® IEC IA			█
V117-3.45 MW® IEC IB/IEC IIA			█
V117-4.2 MW™ IEC IB-T/IEC IIA-T/IEC S-T			█
V126-3.45 MW® IEC IIA/IEC IIB		█	
V136-3.45 MW® IEC IIB/IEC IIIA		█	
V136-4.2 MW™ IEC IIB/IEC S		█	
V136-4.5 MW™ IEC IIB		█	
V150-4.2 MW™ IEC IIIB/IEC S	█		
V150-4.5 MW™ IEC B	█		
V155-3.6 MW™ IEC S	█		
V163-4.5 MW™ IEC B	█		

The 4 MW platform covers all wind segments enabling you to find the best turbine for your specific site.



#### Life testing

The Vestas Test Centre has the unique ability to test complete nacelles using technologies like Highly Accelerated Life Testing (HALT). This rigorous testing of new components ensures the reliability of the 4 MW platform.



# Is the 4 MW platform the optimal choice for your specific site?

## One common nacelle – nine different rotor sizes

The wind conditions on a wind project site are often not identical. The 4 MW platform features a range of turbines that cover all wind classes. Combined across your site, they help maximise the energy output of your power plant.

## Tip-height restrictions and strict grid requirements

With a rotor size of 105 m, the V105-3.45 MW™ IEC IA is the turbine that fits the most severe wind conditions. It has an extremely robust design for tough site conditions and is especially suited for markets with tip-height restrictions and high grid requirements.

Like all the other 4 MW turbines, the V105-3.45 MW™ is equipped with a full-scale converter ensuring full compliance with the challenging grid codes in countries like the UK and Ireland.

## Cold climates

The V112-3.45 MW®, V117-3.45 MW®, V117-4.2 MW™, V126-3.45 MW®, V136-3.45 MW® can be combined with Vestas De-Icing and Vestas Ice Detection ensuring optimum production in cold climates. Vestas Anti-Icing System™ is available for the V136-4.2 MW™, the V150-4.2 MW™ and the V150-4.5 MW™.

## High- and medium-wind sites

The V112-3.45 MW® IEC IA is a high-wind turbine and has a high capacity factor. Similar to the other 4 MW turbines, the V112-3.45 MW® IEC IA turbine makes efficient use of its grid compatibility and is an optimal choice for sites with MW constraints.

On medium-wind sites, the V117-3.45 MW® IEC IB/IEC IIA, V126-3.45 MW® IEC IIA/IEC IIB, V136-3.45 MW® IEC IIB/IEC IIIA, V136-4.2 MW™ IEC IIB/IEC S, V136-4.5 MW™ IEC IIB and V163-4.5 MW™ IEC IIIB are excellent turbine choices.

A combination of the variants can optimise your site layout and improve your production significantly on complex sites. V117-4.2 MW™ IEC IB -T/IEC IIA -T/IEC S -T and V136-4.2 MW™ IEC IIB/ IEC S are designed for application on sites exposed to severe climate events.

## Low-wind sites

Built on the same proven technology as the V150-4.2 MW™ IEC IIIB/IEC S and V150-4.5 MW™ IEC IIIB and the V163-4.5 MW™ IEC IIIB are our best performers on low-wind sites. The larger rotors enable greater wind capture, which in turn produces more energy when it matters most at low wind conditions. The result is exceptional profitability in areas with low wind, and new frontiers for wind energy investment.

Large Diameter Steel Towers (LDST) support the added rotor size and rating of Vestas turbines to increase Annual Energy Production on low-wind sites. LDST is specially designed with a larger diameter in the bottom section that allows for optimal strength at high hub heights.

## Maximising old permits

Although the V150-4.2 MW™, the V150-4.5 MW™ and the V163-4.5 MW™ are some of the highest producing low wind turbines available, some old permits may simply be too tight to accept it. Although the V117-3.45 MW®, V126-3.45 MW®, V136-3.45 MW®, V136-4.2 MW™ and V136-4.5 MW™ are medium-wind turbines, they still deliver an excellent business case on low-wind sites.

Due to the similar electrical properties and nacelle design, it is easy to mix and match the turbines from the 4 MW platform to maximise production on heavily constrained sites.

# Would you benefit from uninterrupted control of wind energy production?

## **Knowledge about wind project planning is key**

Getting your wind energy project up and operating as quickly as possible is fundamental to its long-term success. One of the first and most important steps is to identify the most suitable location for your wind power plant. Vestas' SiteHunt® is an advanced analytical tool that 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, SiteDesign® optimises the layout of your wind power plant. SiteDesign® runs Computational Fluid Dynamics (CFD) software on our powerful in-house supercomputer Firestorm to perform 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 between 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, 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.

## **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.

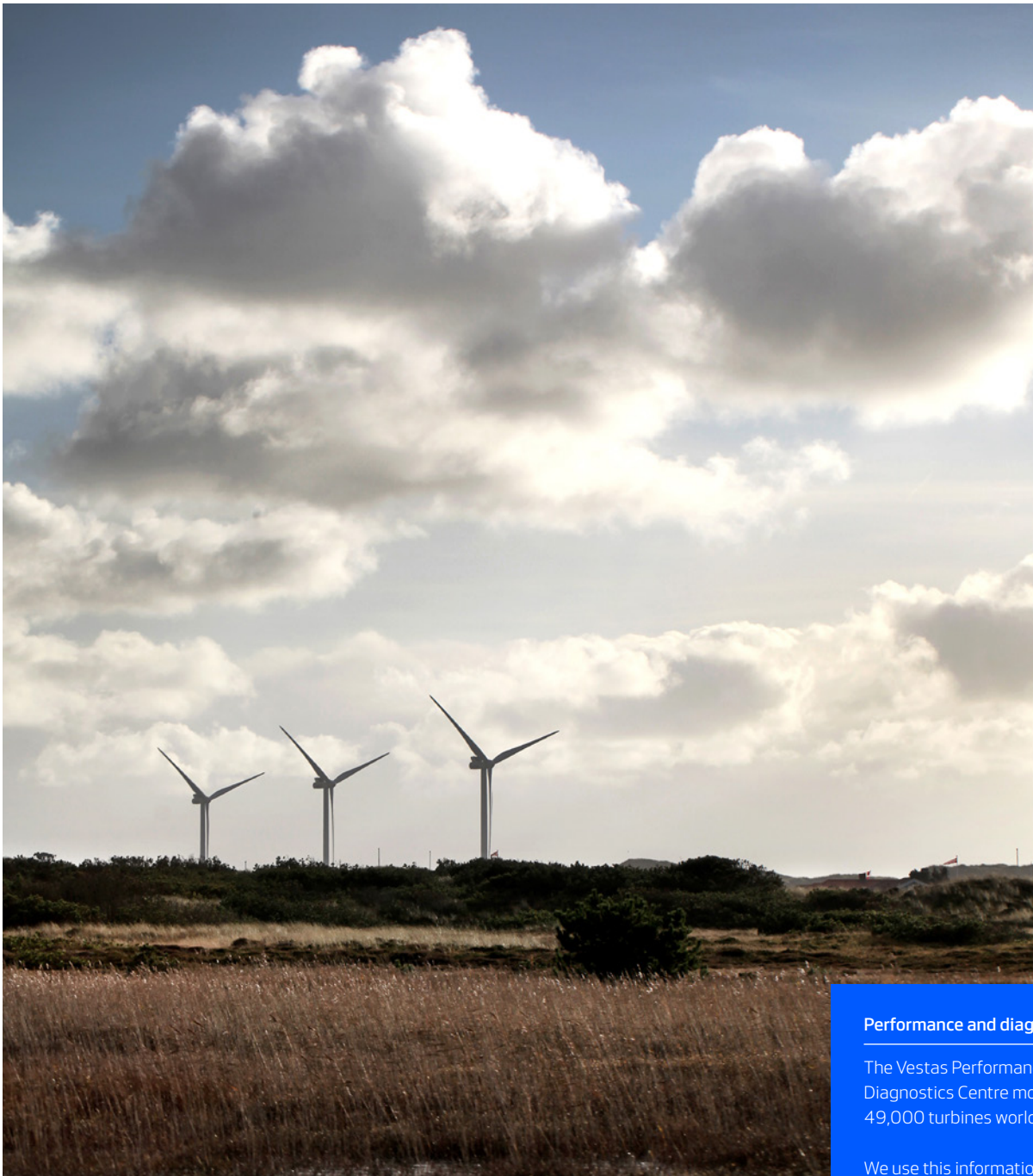
This flexible system includes an extensive range of monitoring and management functions to control your wind power plant. VestasOnline® Business enables you to optimise production levels, monitor performance and produce detailed, tailored reports from anywhere in the world. The VestasOnline® Power Plant 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.



#### Performance and diagnostics

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The Vestas Performance and Diagnostics Centre monitors more than 49,000 turbines worldwide.

We use this information to continually develop and improve our products and services.

Turbines monitored

+ 49,000

# Vestas' transparency towards Sustainability

## **Vestas Sustainability**

In 2020 we introduced our sustainability strategy, Sustainability in Everything We Do. At Vestas we are working to improve our own environmental performance, create value for local communities, promote a safe, diverse, and inclusive workplace, while leading the transition to a world powered by sustainable energy. We believe these efforts will help elevate the standards of our industry as a whole. Read more about Vestas sustainability strategy at [www.vestas.com/en/sustainability](http://www.vestas.com/en/sustainability).

## **Life Cycle Assessments (LCA)**

Since 1999, we have been developing wind turbine LCAs to give 'cradle-to-grave' evaluations of the environmental impact of our products and solutions. These evaluations concentrate on two key actions: documenting the environmental performance of Vestas wind turbines and analysing the results to reduce the environmental impact of our turbines. The LCAs provide environmental impact transparency to help customers achieve their own sustainability ambitions. To view our current portfolio of Life Cycle Assessments visit the following page: [www.vestas.com/en/sustainability/reports-and-ratings](http://www.vestas.com/en/sustainability/reports-and-ratings).

As part of our commitment to customers, we also offer customised wind power plant LCAs, called Vestas® SiteLCA™.

These assessments determine key indicators of environmental performance, taking the wind turbine type, site specific conditions and production supply chain into consideration. SiteLCA™ provides customers or project developers with transparent environmental facts for a specific wind power plant.





g/kWh

4.4 - 7.6

1002

CO<sub>2</sub> comparison between  
the 4 MW platform and  
a coal power plant



Energy neutral

4.8-7.6

months of operation



Energy return

21 - 50

times



Recyclability rate

82.8%-

88.5%



Sustainability metrics depending  
on project and site specific  
conditions

# V105-3.45 MW™ IEC IA

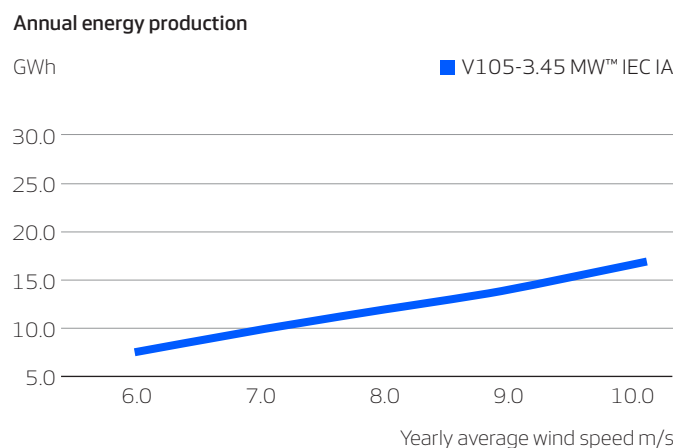
<b>Power regulation</b>	Pitch regulated with variable speed
<b>Operating data</b>	
Rated power	3,450kW
Cut-in wind speed	3m/s
Cut-out wind speed	25m/s
Re cut-in wind speed	23m/s
Wind class	IEC IA
Standard operating temperature range from -20°C* to +45°C with de-rating above 30°C	
* Subject to different temperature options	
<b>Sound power</b>	
Maximum	104.5dB(A)**
**Sound Optimised Modes dependent on site and country	
<b>Rotor</b>	
Rotor diameter	105m
Swept area	8,659m <sup>2</sup>
Air brake	full blade feathering with 3 pitch cylinders
<b>Electrical</b>	
Frequency	50/60Hz
Converter	full scale
<b>Gearbox</b>	
Type	two planetary stages and one helical stage
<b>Tower</b>	
Hub height	72.5m (IEC IA)
<b>Nacelle dimensions</b>	
Height for transport	3.4m
Height installed (incl. CoolerTop®)	6.9m
Length	12.8m
Width	4.2m
<b>Hub dimensions</b>	
Max. transport height	3.8m
Max. transport width	3.8m
Max. transport length	5.5m

<b>Blade dimensions</b>	
Length	51.2m
Max. chord	4.0m
Max. weight per unit for transportation	70 metric tonnes

- Turbine options**
- High Wind Operation
  - Power Optimised Mode up to 3.6 MW (site specific)
  - Load Optimised Modes down to 3.0 MW
  - Condition Monitoring System
  - Service Personnel Lift
  - Vestas Ice Detection
  - Low Temperature Operation to -30°C
  - Fire Suppression
  - Shadow Detection
  - Vestas Bat Protection System
  - Aviation Lights
  - Aviation Markings on the Blades
  - Vestas Intelilight®
  - Nacelle Hatch for Air Inlet

<b>Sustainability</b>	
Carbon Footprint	4.8g CO <sub>2</sub> e/kWh
Return on energy break-even	5 months
Lifetime return on energy	47 times
Recyclability rate	83.5%

Configuration: 72.5m hub height and wind class IECIB. Depending on site-specific conditions. Metrics are based on an externally reviewed Life Cycle Assessment available on vestas.com



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

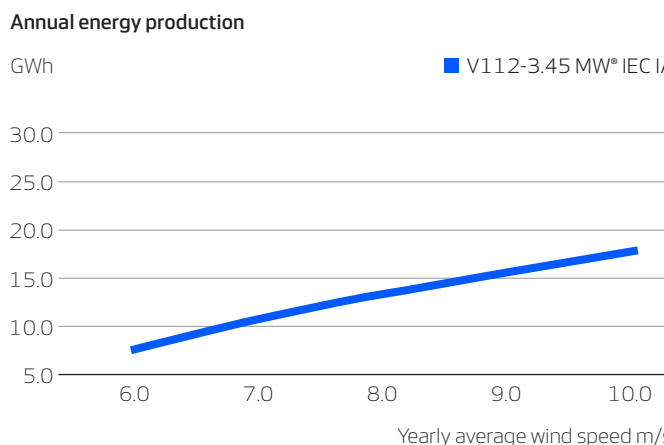
# V112-3.45 MW<sup>®</sup> IEC IA

<b>Power regulation</b>	Pitch regulated with variable speed
<b>Operating data</b>	
Rated power	3,450kW
Cut-in wind speed	3m/s
Cut-out wind speed	25m/s
Re cut-in wind speed	23m/s
Wind class	IEC IA
Standard operating temperature range from -20°C* to +45°C with de-rating above 30°C	
*Subject to different temperature options	
<b>Sound power</b>	
Maximum	105.4dB(A)**
**Sound Optimised Modes dependent on site and country	
<b>Rotor</b>	
Rotor diameter	112m
Swept area	9,852m <sup>2</sup>
Air brake	full blade feathering with 3 pitch cylinders
<b>Electrical</b>	
Frequency	50/60Hz
Converter	full scale
<b>Gearbox</b>	
Type	two planetary stages and one helical stage
<b>Tower</b>	
Hub heights	69m (IEC IA) 94m (IEC IA)
<b>Nacelle dimensions</b>	
Height for transport	3.4m
Height installed (incl. CoolerTop <sup>®</sup> )	6.9m
Length	12.8m
Width	4.2m
<b>Hub dimensions</b>	
Max. transport height	3.8m
Max. transport width	3.8m
Max. transport length	5.5m

<b>Blade dimensions</b>	
Length	54.7m
Max. chord	4.0m
Max. weight per unit for transportation	70 metric tonnes

- Turbine options**
- High Wind Operation
  - Power Optimised Mode up to 3.6 MW (site specific)
  - Load Optimised Modes down to 3.0 MW
  - Condition Monitoring System
  - Service Personnel Lift
  - Vestas Ice Detection
  - Vestas De-Icing
  - Low Temperature Operation to -30°C
  - Fire Suppression
  - Shadow detection
  - Vestas Bat Protection System
  - Aviation Lights
  - Aviation Markings on the Blades
  - Vestas Intelilight<sup>®</sup>
  - Nacelle Hatch for Air Inlet

<b>Sustainability</b>	
Carbon Footprint	5.3g CO <sub>2</sub> e/kWh
Return on energy break-even	5.4 months
Lifetime return on energy	45 times
Recyclability rate	86%
Configuration: 94m hub height and wind class IECIB. Depending on site-specific conditions. Metrics are based on an externally reviewed Life Cycle Assessment available on vestas.com	



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

# V117-3.45 MW<sup>®</sup>

## IEC IB/IEC IIA

<b>Power regulation</b>	Pitch regulated with variable speed
<b>Operating data</b>	
Rated power	3,450kW
Cut-in wind speed	3m/s
Cut-out wind speed	25m/s
Re cut-in wind speed	23m/s
Wind class	IEC IB/IEC IIA
Standard operating temperature range from -20°C* to +45°C with de-rating above 30°C	
*Subject to different temperature options	
<b>Sound power</b>	
Maximum	106.8dB(A)**
**Sound Optimised Modes dependent on site and country	
<b>Rotor</b>	
Rotor diameter	117m
Swept area	10,751m <sup>2</sup>
Air brake	full blade feathering with 3 pitch cylinders
<b>Electrical</b>	
Frequency	50/60Hz
Converter	full scale
<b>Gearbox</b>	
Type	two planetary stages and one helical stage
<b>Tower</b>	
Hub heights	80m (IEC IB) 91.5m (IEC IB) 116.5m (IEC IB/IEC IIA/DIBtS)
<b>Nacelle dimensions</b>	
Height for transport	3.4m
Height installed (incl. CoolerTop <sup>®</sup> )	6.9m
Length	12.8m
Width	4.2m
<b>Hub dimensions</b>	
Max. transport height	3.8m
Max. transport width	3.8m
Max. transport length	5.5m

### Blade dimensions

Length	57.2m
Max. chord	4.0m
Max. weight per unit for transportation	70 metric tonnes

### Turbine options

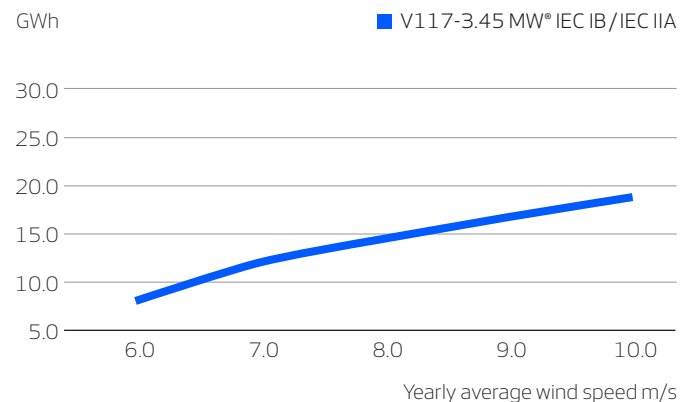
- High Wind Operation
- Power Optimised Mode up to 3.6 MW (site specific)
- Load Optimised Modes down to 3.0 MW
- Condition Monitoring System
- Service Personnel Lift
- Vestas Ice Detection
- Vestas De-Icing
- Low Temperature Operation to -30°C
- Fire Suppression
- Shadow detection
- Vestas Bat Protection System
- Aviation Lights
- Aviation Markings on the Blades
- Vestas Intelilight<sup>®</sup>
- Nacelle Hatch for Air Inlet

### Sustainability

Carbon Footprint	5.1g CO <sub>2</sub> e/kWh
Return on energy break-even	5.2 months
Lifetime return on energy	46 times
Recyclability rate	85%

Configuration: 91.5m hub height and wind class IECIB. Depending on site-specific conditions. Metrics are based on an externally reviewed Life Cycle Assessment available on vestas.com

### Annual energy production



#### Assumptions

One wind turbine, 100% availability, 0% losses, k factor = 2.5  
Standard air density = 1.225, wind speed at hub height

# V117-4.2 MW<sup>TM</sup>

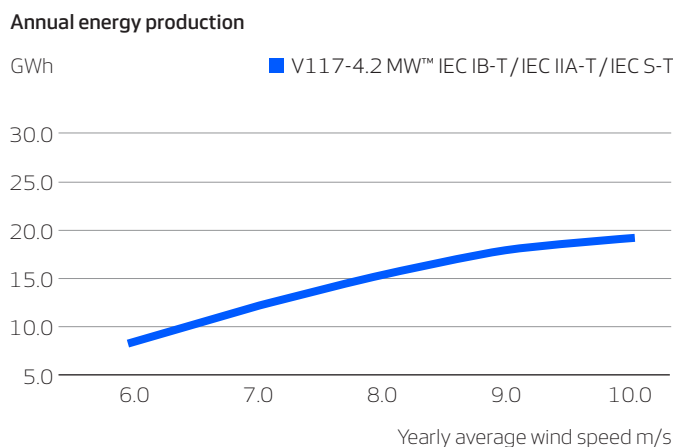
## IEC IB-T/IEC IIA-T/IEC S-T

<b>Power regulation</b>	Pitch regulated with variable speed
<b>Operating data</b>	
Rated power	4,000kW/4,200kW
Cut-in wind speed	3m/s
Cut-out wind speed	25m/s
Re cut-in wind speed	23m/s
Wind class	IEC IB-T/IEC IIA-T/IEC S-T
Standard operating temperature range from -20°C* to +45°C with de-rating above 30°C (4,000kW)	
* Subject to different temperature options	
<b>Sound power</b>	
Maximum	106dB(A)**
**Sound Optimised Modes dependent on site and country	
<b>Rotor</b>	
Rotor diameter	117m
Swept area	10,751m <sup>2</sup>
Air brake	full blade feathering with 3 pitch cylinders
<b>Electrical</b>	
Frequency	50/60Hz
Converter	full scale
<b>Gearbox</b>	
Type	two planetary stages and one helical stage
<b>Tower</b>	
Hub heights	91.5m (IEC IB) 84m (IEC IIA)
<b>Nacelle dimensions</b>	
Height for transport	3.4m
Height installed (incl. CoolerTop®)	6.9m
Length	12.8m
Width	4.2m
<b>Hub dimensions</b>	
Max. transport height	3.8m
Max. transport width	3.8m
Max. transport length	5.5m

<b>Blade dimensions</b>	
Length	57.2m
Max. chord	4.0m
Max. weight per unit for transportation	70 metric tonnes

- Turbine options**
- High Wind Operation
  - 4.2 MW Power Optimised Mode (site specific)
  - Load Optimised Modes down to 3.6 MW
  - Condition Monitoring System
  - Service Personnel Lift
  - Vestas Ice Detection
  - Vestas De-icing
  - Low Temperature Operation to -30°C
  - Fire Suppression
  - Shadow detection
  - Vestas Bat Protection System
  - Aviation Lights
  - Aviation Markings on the Blades
  - Vestas Intelilight®
  - Nacelle Hatch for Air Inlet

<b>Sustainability</b>	
Carbon Footprint	4.4g CO <sub>2</sub> e/kWh
Return on energy break-even	4.8 months
Lifetime return on energy	50 times
Recyclability rate	84.7%
Configuration: 91.5m hub height and wind class IECIB. Depending on site-specific conditions. Metrics are based on an externally reviewed Life Cycle Assessment available on vestas.com	



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

# V126-3.45 MW<sup>®</sup> IEC IIB/IEC IIA

**Power regulation** Pitch regulated with variable speed

**Operating data**

Rated power	3,450kW
Cut-in wind speed	3m/s
Cut-out wind speed	22.5m/s
Re cut-in wind speed	20m/s
Wind class	IEC IIB/IEC IIA
Standard operating temperature range from -20°C* to +45°C with de-rating above 30°C	

\* Subject to different temperature options

**Sound power**

Maximum	104.4dB(A)**/ 107.3dB(A)**
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\*\*Sound Optimised Modes dependent on site and country

**Rotor**

Rotor diameter	126m
Swept area	12,469m <sup>2</sup>
Air brake	full blade feathering with 3 pitch cylinders

**Electrical**

Frequency	50/60Hz
Converter	full scale

**Gearbox**

Type	two planetary stages and one helical stage
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**Tower**

Hub heights	87m (IEC IIB/IEC IIA) 117m (IEC IIB/IEC IIA/DIBtS) 137m (IEC IIIA/DIBtS) 147m (IEC IIIA) 149m (DIBtS) 166m (DIBtS)
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**Nacelle dimensions**

Height for transport	3.4m
Height installed (incl. CoolerTop <sup>®</sup> )	6.9m
Length	12.8m
Width	4.2m

**Hub dimensions**

Max. transport height	3.8m
Max. transport width	3.8m
Max. transport length	5.5m

**Blade dimensions**

Length	61.7m
Max. chord	4.0m

Max. weight per unit for transportation	70 metric tonnes
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**Turbine options**

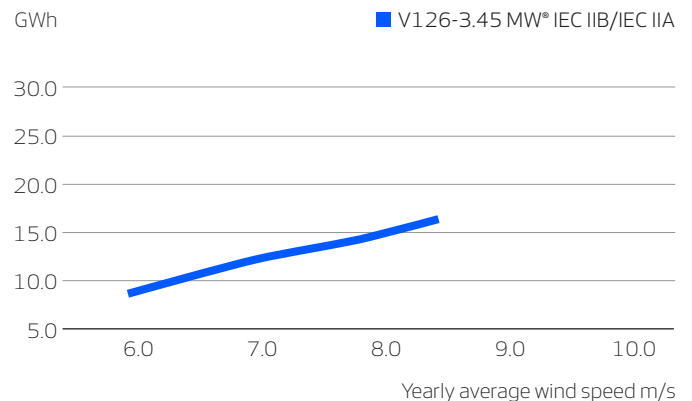
- High Wind Operation
- Power Optimised Mode up to 3.6 MW (site specific)
- Load Optimised Modes down to 3.0 MW
- Condition Monitoring System
- Service Personnel Lift
- Vestas Ice Detection
- Vestas De-Icing
- Low Temperature Operation to -30°C
- Fire Suppression
- Shadow detection
- Vestas Bat Protection System
- Aviation Lights
- Aviation Markings on the Blades
- Vestas IntelLight<sup>®</sup>
- Nacelle Hatch for Air Inlet

**Sustainability**

Carbon Footprint	6.4g CO <sub>2</sub> e/kWh
Return on energy break-even	6.5 months
Lifetime return on energy	37 times
Recyclability rate	87.5%

Configuration: 117m hub height and wind class IEC IIA. Depending on site-specific conditions. Metrics are based on an externally reviewed Life Cycle Assessment available on vestas.com

**Annual energy production**



**Assumptions**

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

# V136-3.45 MW<sup>®</sup> IEC IIB/IEC IIIA

<b>Power regulation</b>	Pitch regulated with variable speed
<b>Operating data</b>	
Rated power	3,450kW
Cut-in wind speed	3m/s
Cut-out wind speed	22.5m/s
Re cut-in wind speed	20m/s
Wind class	IEC IIB/IEC IIIA
Standard operating temperature range from -20°C* to +45°C with de-rating above 30°C	
* Subject to different temperature options	
<b>Sound power</b>	
Maximum	105.5dB(A)**
**Sound Optimised Modes dependent on site and country	
<b>Rotor</b>	
Rotor diameter	136m
Swept area	14,527m <sup>2</sup>
Air brake	full blade feathering with 3 pitch cylinders
<b>Electrical</b>	
Frequency	50/60Hz
Converter	full scale
<b>Gearbox</b>	
Type	two planetary stages and one helical stage
<b>Tower</b>	
Hub heights	82m (IEC IIB/IEC IIIA) 105m (IEC IIIA) 112m (IEC IIB/IEC IIIA) 132m (IEC IIB/IEC IIIA/ DIBt2) 142m (IEC IIIA) 149m (DIBtS) 166m (DIBtS)
<b>Nacelle dimensions</b>	
Height for transport	3.4m
Height installed (incl. CoolerTop <sup>®</sup> )	6.9m
Length	12.8m
Width	4.2m
<b>Hub dimensions</b>	
Max. transport height	3.8m
Max. transport width	3.8m
Max. transport length	5.5m

<b>Blade dimensions</b>	
Length	66.7m
Max. chord	4.1m
Max. weight per unit for transportation	
	70 metric tonnes
<b>Turbine options</b>	
<ul style="list-style-type: none"> <li>- High Wind Operation</li> <li>- Power Optimised Mode up to 3.6 MW (site specific)</li> <li>- Load Optimised Modes down to 3.0 MW</li> <li>- Condition Monitoring System</li> <li>- Service Personnel Lift</li> <li>- Vestas Ice Detection</li> <li>- Vestas De-Icing</li> <li>- Low Temperature Operation to -30°C</li> <li>- Fire Suppression</li> <li>- Shadow detection</li> <li>- Vestas Bat Protection System</li> <li>- Aviation Lights</li> <li>- Aviation Markings on the Blades</li> <li>- Vestas IntelLight<sup>®</sup></li> <li>- Nacelle Hatch for Air Inlet</li> </ul>	
<b>Sustainability</b>	
Carbon Footprint	7.6g CO <sub>2</sub> e/kWh
Return on energy break-even	7.5 months
Lifetime return on energy	32 times
Recyclability rate	88.5%
<small>Configuration: 132m hub height and wind class IEC IIIA. Depending on site-specific conditions. Metrics are based on an externally reviewed Life Cycle Assessment available on vestas.com</small>	
<b>Annual energy production</b>	
GWh	■ V136-3.45 MW <sup>®</sup> IEC IIB/IEC IIIA
30.0	
25.0	
20.0	
15.0	
10.0	
5.0	
6.0	7.0
8.0	9.0
10.0	
Yearly average wind speed m/s	
<b>Assumptions</b> <small>One wind turbine, 100% availability, 0% losses, k factor =2  Standard air density = 1.225, wind speed at hub height</small>	

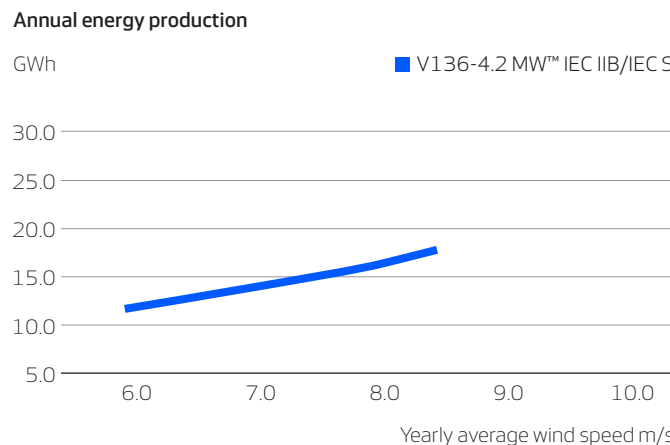
# V136-4.2 MW™ IEC IIB/IEC S

<b>Power regulation</b>	Pitch regulated with variable speed
<b>Operating data</b>	
Rated power	4,000kW/4,200kW
Cut-in wind speed	3m/s
Cut-out wind speed	25m/s
Re cut-in wind speed	23m/s
Wind class	IEC IIB/IEC S
Standard operating temperature range from -20°C* to +45°C with de-rating above 30°C (4,000kW)	
*Subject to different temperature options	
<b>Sound power</b>	
Maximum	103.9dB(A)*
*Sound Optimised Modes dependent on site and country	
<b>Rotor</b>	
Rotor diameter	136m
Swept area	14,527m <sup>2</sup>
Air brake	full blade feathering with 3 pitch cylinders
<b>Electrical</b>	
Frequency	50/60Hz
Converter	full scale
<b>Gearbox</b>	
Type	two planetary stages and one helical stage
<b>Tower</b>	
Hub heights	105m (IEC) 112m (IEC/ DIBt) 117m (IEC) 149m (DIBt) 166m (DIBt)
<b>Nacelle dimensions</b>	
Height for transport	3.5m
Height installed (incl. CoolerTop®)	8.4m
Length	12.96m
Width	3.98m
<b>Hub dimensions</b>	
Max. transport height	3.5m
Max. transport width	3.7m
Max. transport length	5.5m

<b>Blade dimensions</b>	
Length	66.7m
Max. chord	4.1m
Max. weight per unit for transportation	70 metric tonnes

- Turbine options**
- 4.2 MW and 4.5 MW Power Optimised Modes (site specific)
  - High Wind Operation
  - Load Optimised Modes down to 3.6 MW
  - Condition Monitoring System
  - Service Personnel Lift
  - Vestas Anti-Icing System
  - Vestas Ice Detection™
  - Low Temperature Operation to -30°C
  - Fire Suppression
  - Shadow detection
  - Vestas Bat Protection System
  - Aviation Lights
  - Aviation Markings on the Blades
  - Vestas IntelliLight®
  - Nacelle Hatch for Air Inlet

<b>Sustainability</b>	
Carbon Footprint	5.6g CO <sub>2</sub> e/kWh
Return on energy break-even	6.1 months
Lifetime return on energy	40 times
Recyclability rate	87.4%
Configuration: 112m hub height and wind class IEC IIB. Depending on site-specific conditions. Metrics are based on an externally reviewed Life Cycle Assessment available on vestas.com	

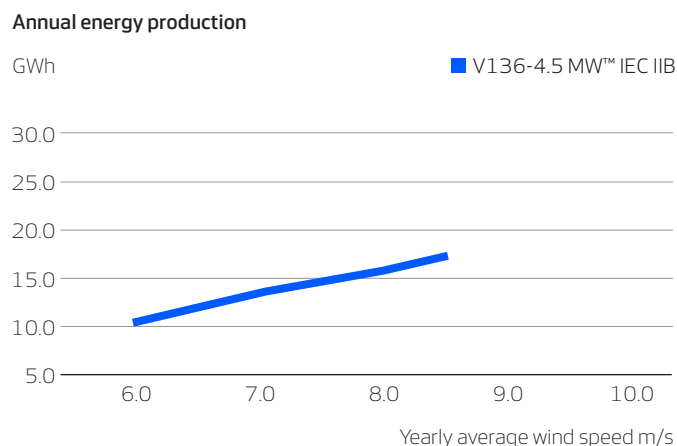


**Assumptions**  
 One wind turbine, 100% availability, 0% losses, k factor = 2  
 Standard air density = 1.225, wind speed at hub height

# V136-4.5 MW™ IEC IIB

<b>Power regulation</b>	Pitch regulated with variable speed
<b>Operating data</b>	
Rated power	4,500kW
Cut-in wind speed	3m/s
Cut-out wind speed	32m/s
Re cut-in wind speed	28m/s
Wind class	IEC IIB
Standard operating temperature range from -20°C* to +45°C with de-rating above 23°C	
*Subject to different temperature options	
<b>Sound power</b>	
Maximum	103.9dB(A)*
*Sound Optimised Modes dependent on site and country	
<b>Rotor</b>	
Rotor diameter	136m
Swept area	14,527m <sup>2</sup>
Air brake	full blade feathering with 3 pitch cylinders
<b>Electrical</b>	
Frequency	50/60Hz
Converter	full scale
<b>Gearbox</b>	
Type	two planetary stages and one helical stage
<b>Tower</b>	
Hub heights	112m (IEC IIB)
<b>Nacelle dimensions</b>	
Height for transport	3.5m
Height installed (incl. CoolerTop®)	8.4m
Length	12.96m
Width	3.98m
<b>Hub dimensions</b>	
Max. transport height	3.5m
Max. transport width	3.7m
Max. transport length	5.5m

<b>Blade dimensions</b>	
Length	66.7m
Max. chord	4.1m
Max. weight per unit for transportation	70 metric tonnes
<b>Turbine options</b>	
<ul style="list-style-type: none"> <li>- High Wind Operation</li> <li>- Condition Monitoring System</li> <li>- Service Personnel Lift</li> <li>- Vestas Ice Detection™</li> <li>- Low Temperature Operation to -30°C</li> <li>- Fire Suppression</li> <li>- Shadow detection</li> <li>- Vestas Bat Protection System</li> <li>- Aviation Lights</li> <li>- Aviation Markings on the Blades</li> <li>- Vestas IntelliLight®</li> <li>- Nacelle Hatch for Air Inlet</li> </ul>	
<b>Sustainability</b>	
Carbon Footprint	4.9g CO <sub>2</sub> e/kWh
Return on energy break-even	5.2 months
Lifetime return on energy	46 times
Recyclability rate	87.4%
<small>Configuration 132m hub height and wind class IEC IIIA. Depending on site-specific conditions. Metrics are based on a preliminary stream-lined analysis. An externally-verified Lifecycle Assessment will be made publicly available on <a href="https://vestas.com">vestas.com</a> once finalised.</small>	



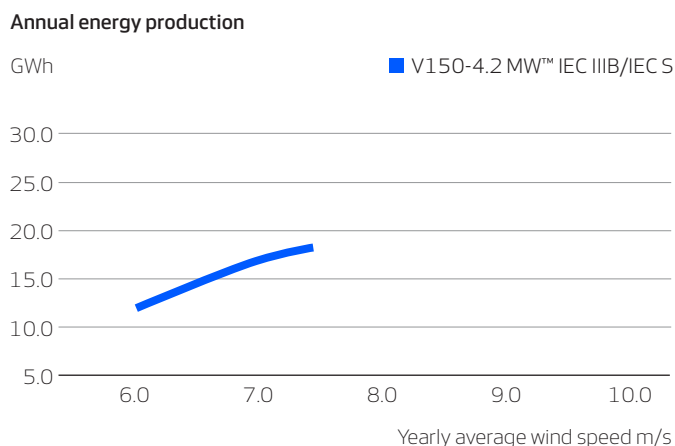
**Assumptions**  
 One wind turbine, 100% availability, 0% losses, k factor = 2  
 Standard air density = 1.225, wind speed at hub height



# V150-4.2 MW™ IEC IIIB/IEC S

<b>Power regulation</b>	Pitch regulated with variable speed
<b>Operating data</b>	
Rated power	4,000kW/4,200kW
Cut-in wind speed	3m/s
Cut-out wind speed	24.5m/s
Re cut-in wind speed	22.5m/s
Wind class	IEC IIIB/IEC S
Standard operating temperature range from -30°C* to +45°C with de-rating above 30°C (4,000kW)	
*Subject to different temperature options	
<b>Sound power</b>	
Maximum	104.9dB(A)*
*Sound Optimised Modes dependent on site and country	
<b>Rotor</b>	
Rotor diameter	150m
Swept area	17,671m <sup>2</sup>
Air brake	full blade feathering with 3 pitch cylinders
<b>Electrical</b>	
Frequency	50/60Hz
Converter	full scale
<b>Gearbox</b>	
Type	two planetary stages and one helical stage
<b>Tower</b>	
Hub heights	105m (IEC) 123m (DIBt) 145m (DIBt) 155m (IEC) 166m (DIBt)
<b>Nacelle dimensions</b>	
Height for transport	3.5m
Height installed (incl. CoolerTop®)	8.4m
Length	12.96m
Width	3.98m
<b>Hub dimensions</b>	
Max. transport height	3.5m
Max. transport width	3.7m
Max. transport length	5.5m

<b>Blade dimensions</b>	
Length	73.7m
Max. chord	4.2m
Max. weight per unit for transportation	70 metric tonnes
<b>Turbine options</b>	
<ul style="list-style-type: none"> <li>- 4.2 MW and 4.5 MW Power Optimised Modes (site specific)</li> <li>- Load Optimised Modes down to 3.6 MW</li> <li>- Condition Monitoring System</li> <li>- Service Personnel Lift</li> <li>- Vestas Anti-Icing System™</li> <li>- Vestas Ice Detection</li> <li>- Low Temperature Operation to -30°C</li> <li>- Fire Suppression</li> <li>- Shadow detection</li> <li>- Vestas Bat Protection System</li> <li>- Aviation Lights</li> <li>- Aviation Markings on the Blades</li> <li>- Vestas IntelliLight®</li> <li>- Nacelle Hatch for Air Inlet</li> </ul>	
<b>Sustainability</b>	
Carbon Footprint	7.3g CO <sub>2</sub> e/kWh
Return on energy break-even	7.6 months
Lifetime return on energy	21 times
Recyclability rate	88.1%
<small>Configuration: 1.55m hub height and wind class IECIIIB. Depending on site-specific conditions. Metrics are based on an externally reviewed Life Cycle Assessment available on vestas.com</small>	



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

# V150-4.5 MW™ IEC IIIB

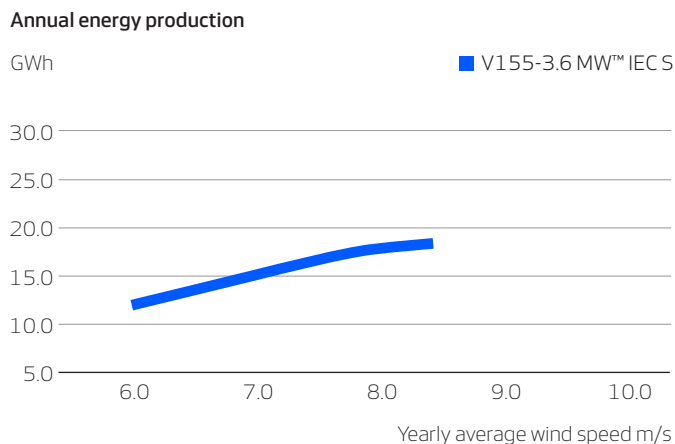
<b>Power regulation</b>	Pitch regulated with variable speed
<b>Operating data</b>	
Rated power	4,500kW
Cut-in wind speed	3m/s
Cut-out wind speed	24.5m/s
Re cut-in wind speed	22.5m/s
Wind class	IEC S
Standard operating temperature range from -30°C* to +45°C with de-rating above 23°C	
*Subject to different temperature options	
<b>Sound power</b>	
Maximum	105.0dB(A)*
*Sound Optimised Modes dependent on site and country	
<b>Rotor</b>	
Rotor diameter	150m
Swept area	17,671m <sup>2</sup>
Air brake	full blade feathering with 3 pitch cylinders
<b>Electrical</b>	
Frequency	50/60Hz
Converter	full scale
<b>Gearbox</b>	
Type	two planetary stages and one helical stage
<b>Tower</b>	
Hub heights	90m (IEC IIIB) 105m (IEC IIIB)
<b>Nacelle dimensions</b>	
Height for transport	3.5m
Height installed (incl. CoolerTop®)	8.4m
Length	12.96m
Width	3.98m
<b>Hub dimensions</b>	
Max. transport height	3.5m
Max. transport width	3.7m
Max. transport length	5.5m

<b>Blade dimensions</b>	
Length	73.7m
Max. chord	4.2m
Max. weight per unit for transportation	70 metric tonnes
<b>Turbine options</b>	
<ul style="list-style-type: none"> <li>- Condition Monitoring System</li> <li>- Service Personnel Lift</li> <li>- Vestas Anti-Icing System™</li> <li>- Vestas Ice Detection</li> <li>- Low Temperature Operation to -30°C</li> <li>- Fire Suppression</li> <li>- Shadow detection</li> <li>- Vestas Bat Protection System</li> <li>- Aviation Lights</li> <li>- Aviation Markings on the Blades</li> <li>- Vestas IntelliLight®</li> <li>- Nacelle Hatch for Air Inlet</li> </ul>	
<b>Sustainability</b>	
Carbon Footprint	5.6g CO <sub>2</sub> e/kWh
Return on energy break-even	5.9 months
Lifetime return on energy	41 times
Recyclability rate	82.8%
<small>Configuration: 105m hub height and wind class IEC IIIB. Depending on site-specific conditions. Metrics are based on an externally reviewed Life Cycle Assessment available on vestas.com</small>	
<b>Annual energy production</b>	
GWh	■ V150-4.5 MW™ IEC IIIB
30.0	
25.0	
20.0	
15.0	
10.0	
5.0	
6.0	7.0
8.0	9.0
10.0	
Yearly average wind speed m/s	
<b>Assumptions</b> <small>One wind turbine, 100% availability, 0% losses, k factor =2                      Standard air density = 1.225, wind speed at hub height</small>	

# V155-3.6 MW™ IEC S

<b>Power regulation</b>	Pitch regulated with variable speed
<b>Operating data</b>	
Rated power	3,600kW
Cut-in wind speed	3m/s
Cut-out wind speed	18m/s
Re cut-in wind speed	16m/s
Wind class	IEC S
Standard operating temperature range from -20°C* to +45°C with de-rating above 30°C	
*Subject to different temperature options	
<b>Sound power</b>	
Maximum	107.2dB(A)**
**Sound Optimised Modes dependent on site and country	
<b>Rotor</b>	
Rotor diameter	155m
Swept area	18,869m <sup>2</sup>
Air brake	full blade feathering with 3 pitch cylinders
<b>Electrical</b>	
Frequency	50/60Hz
Converter	full scale
<b>Gearbox</b>	
Type	two planetary stages and one helical stage
<b>Tower</b>	
Hub heights	Site and country specific
<b>Nacelle dimensions</b>	
Height for transport	3.4m
Height installed (incl. CoolerTop®)	6.9m
Length	12.8m
Width	4.2m
<b>Hub dimensions</b>	
Max. transport height	3.8m
Max. transport width	3.8m
Max. transport length	5.5m

<b>Blade dimensions</b>	
Length	76.2m
Max. chord	4.2m
Max. weight per unit for transportation	70 metric tonnes
<b>Turbine options</b>	
<ul style="list-style-type: none"> <li>- Condition Monitoring System</li> <li>- Service Personnel Lift</li> <li>- Vestas Ice Detection</li> <li>- Low Temperature Operation to -30°C</li> <li>- Fire Suppression</li> <li>- Shadow detection</li> <li>- Vestas Bat Protection System</li> <li>- Aviation Lights</li> <li>- Aviation Markings on the Blades</li> <li>- Nacelle Hatch for Air Inlet</li> </ul>	
<b>Sustainability</b>	
Carbon Footprint	5.9g CO <sub>2</sub> e/kWh
Return on energy break-even	6.6 months
Lifetime return on energy	36 times
Recyclability rate	83%
<small>Configuration: 105m hub height, Vavg=7.5m/s, k=2.4. Depending on site-specific conditions. Metrics are based on an internal streamlined assessment.</small>	



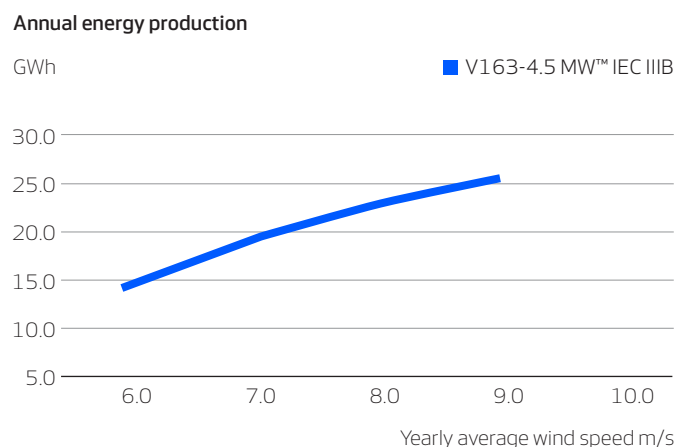
**Assumptions**  
 One wind turbine, 100% availability, 0% losses, k factor = 2  
 Standard air density = 1.225, wind speed at hub height



# V163-4.5 MW™ IEC IIIB

<b>Power regulation</b>	Pitch regulated with variable speed
<b>Operating data</b>	
Rated power	4,500kW
Cut-in wind speed	3m/s
Cut-out wind speed	24m/s
Re cut-in wind speed	22m/s
Wind class	IEC IIIB
Standard operating temperature range from -30°C* to +45°C with de-rating above 30°C	
*Subject to different temperature options	
<b>Sound power</b>	
Maximum	108.0dB(A)**
**Sound Optimised Modes dependent on site and country	
<b>Rotor</b>	
Rotor diameter	163m
Swept area	20.867m <sup>2</sup>
Air brake	full blade feathering with 3 pitch cylinders
<b>Electrical</b>	
Frequency	50/60Hz
Converter	full scale
<b>Gearbox</b>	
Type	two planetary stages and one helical stage
<b>Tower</b>	
Hub heights	Site and country specific
<b>Nacelle dimensions</b>	
Height for transport	3.5m
Height installed (incl. CoolerTop®)	8.4m
Length	12.96m
Width	3.98m
<b>Hub dimensions</b>	
Max. transport height	3.7m
Max. transport width	4.0m
Max. transport length	5.5m

<b>Blade dimensions</b>	
Length	80.1m
Max. chord	4.3m
Max. weight per unit for transportation	70 metric tonnes
<b>Turbine options</b>	
<ul style="list-style-type: none"> <li>- Condition Monitoring System</li> <li>- Service Personnel Lift</li> <li>- Low Temperature Operation to -30°C</li> <li>- Fire Suppression</li> <li>- Vestas Shadow Flicker Control System</li> <li>- Vestas Bat Protection System</li> <li>- Aviation Lights</li> <li>- Aviation Markings on the Blades</li> <li>- Nacelle Hatch for Air Inlet</li> </ul>	
<b>Sustainability</b>	
Carbon Footprint	4.7g CO <sub>2</sub> e/kWh
Return on energy break-even	5 months
Lifetime return on energy	45 times
Recyclability rate	83%
<small>Configuration: 98m hub height, Vavg=7.9m/s, k=2.6. Depending on site-specific conditions. Metrics are based on an internal streamlined assessment. An externally reviewed Life Cycle Assessment will be made available on vestas.com once finalised.</small>	



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





