Wind. It means the world to us.™

This is for **you**

Our complete product portfolio

Vestas®

Together we
power the future

For more than 30 years, we have put all our passion and expertise into raising the profile of wind as a mainstream energy source. We are proud of our achievements so far, but we will not rest until wind is on a par with oil and gas as a predictable and competitive source of energy.

Wind. It means the world to us.™

Predictable, competitive cash flows… **Together**!

Business case certainty

As with any industry, wind energy investors need the confidence that comes from a robust business case. That is why we have developed cutting-edge technology to mitigate the unpredictable nature of wind projects, enabling returns which are consistent and easy to forecast.

Providing the most predictable return on your investment

Cost and revenue are the two variables which profitability depends on. That is why we become genuine partners on your wind project for its entire 20-year lifespan, striving to ensure the biggest possible return on your investment.

Cost certainty

Thanks to highly-specialised product design, rigorous testing and continual monitoring, you can be confident that your turbines will perform as predicted. Access to real-time diagnostics of the industry's largest installed turbine fleet give us unrivalled knowledge in the technical field, and we test all critical components to the highest standard in our Highly Accelerated Life Testing (HALT) facility which is unique in the industry.
As a Vestas customer, we also provide you with accurate forecasts of any necessary component renewals over the lifetime of your project.

Revenue certainty

We understand that you need power generation to start on time and at agreed levels in order to hit your project's yearly forecasts. That is why we are committed to delivering on our three key elements, to ensure these fundamental expectations are met:

- On-time initiation: We have a proven track record for ensuring turbines begin generating power – and income – on time.
- Guaranteed performance: We strive to deliver the yields that you need to meet your revenue plan.
- Maximum uptime: We strive to eliminate lost production to safeguard predicted revenues.

Partnership

We work closely and openly with you to understand your business goals and how best to meet your needs, collaborating toward innovative long-term solutions.

Solutions that revolve around you

Each customer and project is unique, which is why we take the time to understand your specific requirements, and then work with you to plan the most effective way to meet them.

Every Vestas employee will cooperate with you throughout the lifetime of your project to bring you the highest return on your investment. We will be open and honest with you every step of the way, providing you with status reports and progress updates through a dedicated customer portal.

Developing a wind power plant is a complex process involving multiple stakeholders, from insurance companies to financiers to regulators. We are well versed in interacting with all these partners to ensure your project is delivered on time and on budget.

Low costs of energy

By constantly developing more efficient products and services, we help optimise your power generation and drive down project costs, thereby increasing your return on investment.

Your power generation is increased

Our Siting team has more than 30 years' experience in choosing the best sites for turbines and forecasting production potential. In fact, we have the largest and most detailed database of wind data in the world, channelled into ensuring you earn the biggest return on your investment. We use Computational Fluid Dynamics (CFD) to evaluate complex sites such as ridge tops and forest areas.

You receive quality products, on time, every time

We manufacture each component to validated design specifications and monitor the entire value chain intensively to ensure the highest possible quality standards. Our Construction Excellence Centre, staffed by industry-leading technicians, is devoted to developing uniform global processes. We employ Six Sigma philosophy and aim to perform at Six Sigma levels across our whole production process by 2011.

You can accurately plan operations and maintenance

You need to know your turbines will meet production forecasts. That is why the Vestas Performance and Diagnostics Centre (VPDC) monitors 130 data points from over 18,000 turbines worldwide to anticipate potential component failures. All of our products are designed with efficiency and durability in mind, so unplanned downtime is rare.

Safety and citizenship

We are conscientious global citizens, dedicated to protecting our people and the planet. Working with Vestas gives you access to the industry's top technical and business talent, all striving to ensure you hit your commercial goals. At the same time, we are working together to move our society one step closer to a more sustainable global energy mix.

Protecting people, protecting our world

All our operations and products are as environmentally-friendly and safe as possible. We are dedicated to safeguarding our planet and its resources, while ensuring the welfare of employees and the communities in which we operate.

To minimise workplace dangers, we constantly reassess our safety performance and adapt our processes. We have a zero tolerance policy for actions and decisions that may undermine safety in even the smallest way. Our practices have contributed to an approximately 80% improvement in the Lost Time Injury Rate* since 2006.

* Injury with one day or more of absence.

Meeting your **needs**

At Vestas, wind means the world to us. We are dedicated to working in partnership with you to deliver the lowest cost of energy and maximum return on your investment in wind energy.

To reflect this, we have deliberately structured the content in this catalogue to align with your wind project value chain. Our products and services are divided into four main areas, corresponding to the key steps and decisions in a typical wind power plant:

- **Wind project planning**
- **Procurement**
- **Construction**
- **Power plant optimisation**

Wind project value chain

Wind project planning ▸

Financing. Siting. Grid requirements. Local policy and regulations. You need to consider a wide range of crucial factors when you invest in a wind power plant. And not just at the planning stage, but for the whole lifecycle of the project.

After installing over 43,000 wind turbines worldwide, we have a huge amount of expertise in these critical areas. We will work closely with you during the planning phase to capitalise on our insights and our first hand experience to maximise the certainty of your business case.

Procurement ▸

When you choose a wind power supplier, you need a business partner with a track record of innovation, commitment and success in wind energy. A partner like Vestas.

Our knowledge and practical insights in procurement and supply chain management have been built up over three decades at the forefront of wind energy. We run our own test centres where our turbines are put through the most rigorous checks and tests, and we continuously capture the performance data from over 18,000 Vestas turbines around the world, helping us refine our development process for new and existing turbines, wherever the location and whatever the wind conditions.

Page Title

Construction

Partnership is one of our core values. There is a huge number of tasks involved in building a power plant and connecting it to the grid. A transparent partnership based on mutual respect and understanding is essential in ensuring they are carried out efficiently and effectively.

The specific responsibility for tasks will vary from project to project. But what does not vary is our commitment to delivering the best possible wind energy project, and our flexibility to meet your needs. Working as partners with you, we can provide everything from an all-inclusive package, where we supply, install and operate the plant, to simply supplying the turbines.

Power plant optimisation

Building a wind power plant is one thing. Operating it at optimum efficiency is another. Whether it is managing and maintaining the turbines, training your people to operate them or securing the best insurance deal.

Prediction and prevention are the two cornerstones of our power plant optimisation services. We use cutting edge predictive and preventive maintenance techniques to identify potential problems before they arise – and then we take action to address them.

With our flexible, holistic approach to operational and service support, we help you find the most efficient solution for your wind power project

Wind Project Planning

Plant Siting and **Power Systems**

Sited for success

At Vestas, we devote all our efforts to getting you the best possible return on your investment in wind energy.

Siting is about more than just placing the turbines where the wind blows the most; it is about the total cost of harvesting wind, including wear and tear on the turbines, efficient design loads and minimal operating costs. In addition, it is about cost effective and grid compliant plant design to achieve your expected return on investment from day one of your plant's operation.

This is where our expertise counts. With more than 30 years' experience in the industry, we know that our customised cost-of-energy approach will increase your business case certainty.

Industry specialists – all working for you

Our siting engineers, located around the world, are here to make your business goals a reality. We employ PhDs, mathematicians, statisticians, meteorologists and other experts to analyse the detailed wind data we have collected over our three decades of experience. This enables us to calculate the commercial potential of a site with maximum accuracy. With the siting work taken care of, our dedicated global team of power system engineers, control engineers and other electrical experts, model and simulate the plant design against the site specific grid codes and point-of-common coupling requirements to arrive at documented, grid compliant technical solutions. Through our dedicated global business units we communicate this information to you, the customer, to help you make well-informed decisions.

With our extensive expertise in turbine choice and micro-siting, we are able to optimise the layout of even the most complex sites and most demanding grids, extracting full value from every opportunity. Our siting and power systems capabilities include:

- 100+ siting professionals with access to data from across our fleet
- Industry's largest dedicated siting team
- 70+ power systems, control and electrical engineers and professionals with access to our global grid code library
- Active participation in grid code development around the world
- In-house supercomputer - among the most powerful in the Industry
- In-house real-time digital simulation system – for pre-construction verification of plant design and control schemes against grid codes
- Industry standard tools supplemented by specific Vestas tools for dedicated plant siting and power system analysis.

Layout and location

We undertake Computational Fluid Dynamics (CFD) analyses to design the optimal layout for your wind power plant. CFD predicts and simulates wind flow over a given terrain, providing in depth insight into the wind conditions at each turbine location. We also undertake a Vestas Site Check simulation, to ensure that turbine structural loads are within design specifications, and maximising business case certainty. Then follows our Electrical PreDesign analysis for an early optimisation of plant design and grid code compliance. Our power system engineering teams bring valuable experience from power plant design, construction and operation to your project, ensuring you benefit from our total power grid expertise.

Keeping you informed

We conduct site visits to gather information that cannot be acquired from a desktop study, to confirm the results from the study, and to identify possible obstacles to the proposed wind turbine locations. You are welcome to join our specialists on these visits.

The better understanding we have of the site and the grid code requirements, the more accurate our siting and electrical plant design analysis will be. So everything from topography to vegetation and local power system parameters and requirements are factored into our highly-reliable calculations.

Based on these studies, we generate site specific reports identifying optimised layouts and detailing an early grid compliant solution. All leading to better business case certainty for you.

We promise you:

- Early opportunities to discuss locations with our siting engineers and grid compliant plant design with our power system engineers
- Early identification of potential risks, along with mitigation plans
- Early information about siting optimisation – how to make a location work best for you
- Early advice on which of our turbines will be most suitable for your site
- Early advice on how to achieve grid compliant plant design
- Early identification of site specific control strategies and solutions.

Knowledge is **power**

What do we offer?
We provide customers with detailed siting reports. These include suggested project layouts and energy assessment estimates. Our estimates are a reliable guide, marrying specific site data to our unique long term reference database.

You will be able to compare estimates for different wind turbine configurations and different plant layouts. Armed with the world's best data, we empower you by giving you more control over your investment.

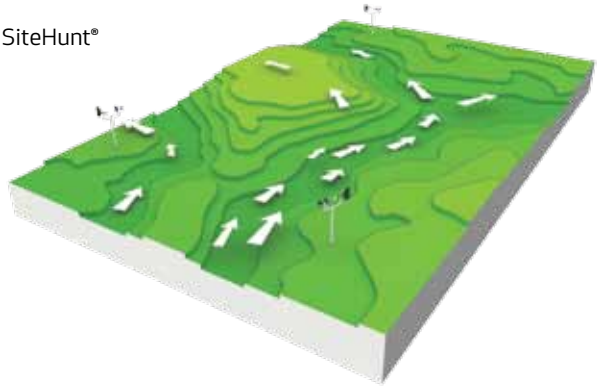
Site visit
As a customer, you need as much information as possible to make an informed choice about your investment in wind energy.

Our local sales business units will carry out site visits with you and produce a detailed report outlining local conditions. We examine topography, vegetation, risks and mitigations. By compiling all this information, we can advise you on how attractive the site is for a wind power plant and what types of turbines would be best suited.

Wind power plant assessment report
In the wind energy business, power production is key to profits. To make sure your planned wind power plant represents a sound investment, our experts carry out a detailed site analysis to calculate the estimated annual energy production. We combine wind data collected on site with figures from our unique global database to produce the most accurate forecasts possible. From the outset, you will be able to work with site engineers to plan the optimal layout for your plant - one which makes the most of the topography and climatic conditions. Invaluable advice that can make a big difference to your bottom line.

The siting reports gives you what you need the most - business case certainty.

SiteHunt®



SiteHunt® – your virtual site portfolio

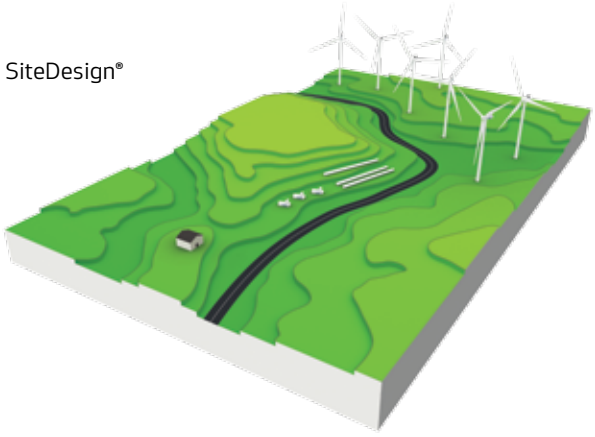
Our SiteHunt® database holds a global record of hourly wind conditions for every 27km x 27km, going back 11 years. By combining the wind data for your site with your financial criteria, we can create a virtual portfolio of potential wind power plant investment opportunities anywhere in the world.

Our exclusive SiteHunt® service combines operational information from our unique database of turbine information with data from more than 35,000 meteorological stations across the globe, meteorological models, CFD and supercomputers. It is a powerful tool for determining the future profitability of your wind power plant, adding extra certainty to your business case.

The SiteHunt® report includes range of information, from details on the wind resources of a particular region, to a shortlist of potential wind power plant sites and their key characteristics. We can also advise you on where best to erect a met mast on the site in order to collect the most representative on-site wind measurements.

With SiteHunt®, users can typically reduce their time to market by six to 12 months.

SiteDesign®

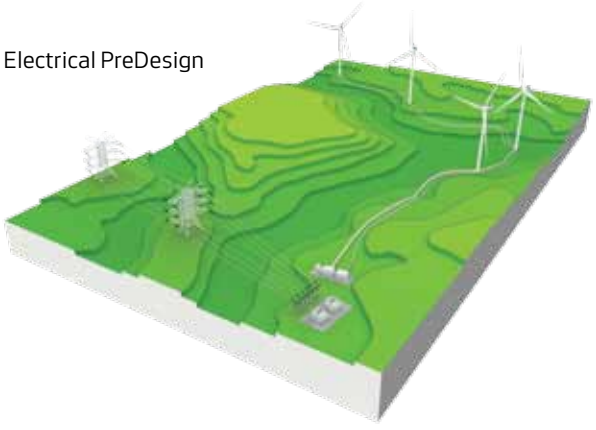


SiteDesign® – data-based decision-making

Optimise your wind power plant revenue right from day one. The service and maintenance costs of operating a wind farm are site and layout specific. SiteDesign® gives you a site-specific Cost of Energy map. The Cost of Energy map enables you to create the optimal site layout to suit your business plan, in terms of site conditions, turbine type and OPEX. SiteDesign® favours those who plan ahead.

By calculating the optimum turbine layout for a given site, SiteDesign® provides you with maximum value over the operational life cycle of your wind power plant. Cutting-edge modelling techniques allow us to identify turbine types and layout options for each project. Mesoscale data and on-site measurements form a long term cost model, balancing revenue against operating and maintenance costs. The result is a robust, factual analysis proposing a layout optimised for long term energy assessment and operational costs over the lifetime of the plant. The models are backed up by our unique global database, which covers millions of hours of operating data from real-time monitoring of more than 18,000 turbines in over 60 countries.

Electrical PreDesign

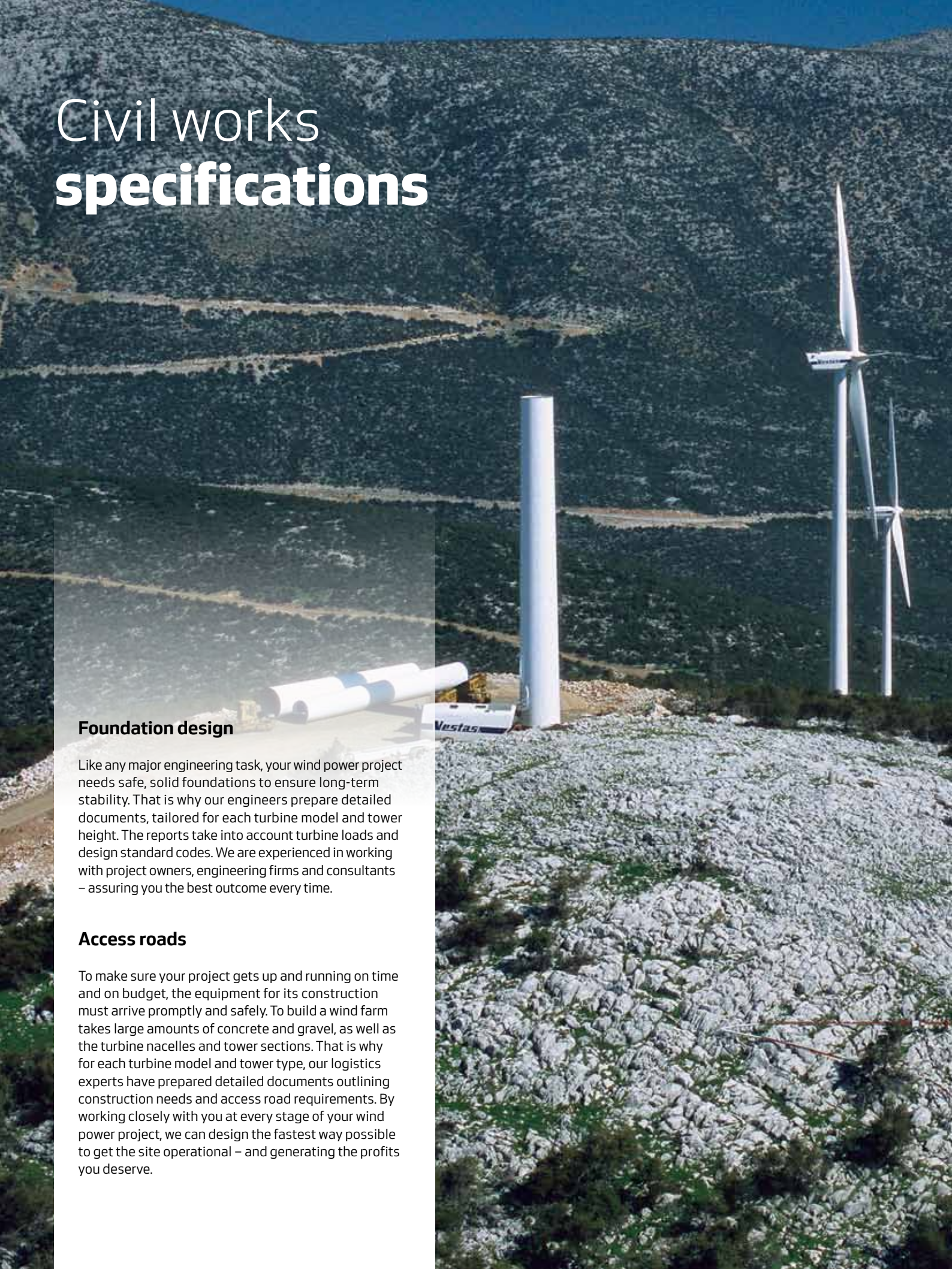


Electrical PreDesign – finding the right balance

The complexity and specific requirements of grid connections vary considerably across the globe, making optimal design of electrical components for your wind power plant essential for your business case. By precisely identifying the costs early in the process, you minimise the risk on your project significantly. Armed with our Electrical PreDesing report, customers are well placed for discussions with their own in-house power system experts, external power system consultants and transmission system operators. The report - reinforced with a presentation by our specialists and a detailed Q&A session - also describes optimal control strategies for use with the Power Plant Controller.

By identifying grid code issues early in the project phase and simulating extreme operating conditions, Vestas' Electrical PreDesign provides the surest way of building a productive and highly profitable wind power plant. By combining our experience of grid connections and turbine technology, along with our cutting-edge capabilities in turbine generator modelling, we can provide a highly accurate simulation of the wind power plant. This allows us to customise collector network cabling, substation protection and reactive power compensation, all of which boost the cost efficiency of your business.

Civil works **specifications**



Foundation design

Like any major engineering task, your wind power project needs safe, solid foundations to ensure long-term stability. That is why our engineers prepare detailed documents, tailored for each turbine model and tower height. The reports take into account turbine loads and design standard codes. We are experienced in working with project owners, engineering firms and consultants – assuring you the best outcome every time.

Access roads

To make sure your project gets up and running on time and on budget, the equipment for its construction must arrive promptly and safely. To build a wind farm takes large amounts of concrete and gravel, as well as the turbine nacelles and tower sections. That is why for each turbine model and tower type, our logistics experts have prepared detailed documents outlining construction needs and access road requirements. By working closely with you at every stage of your wind power project, we can design the fastest way possible to get the site operational – and generating the profits you deserve.

Procurement

Choosing the right **turbine**

+43,000 reasons to choose a Vestas wind turbine

Our product range is based on proven technology: we have installed more than 43,000 turbines around the world – more than any other supplier.

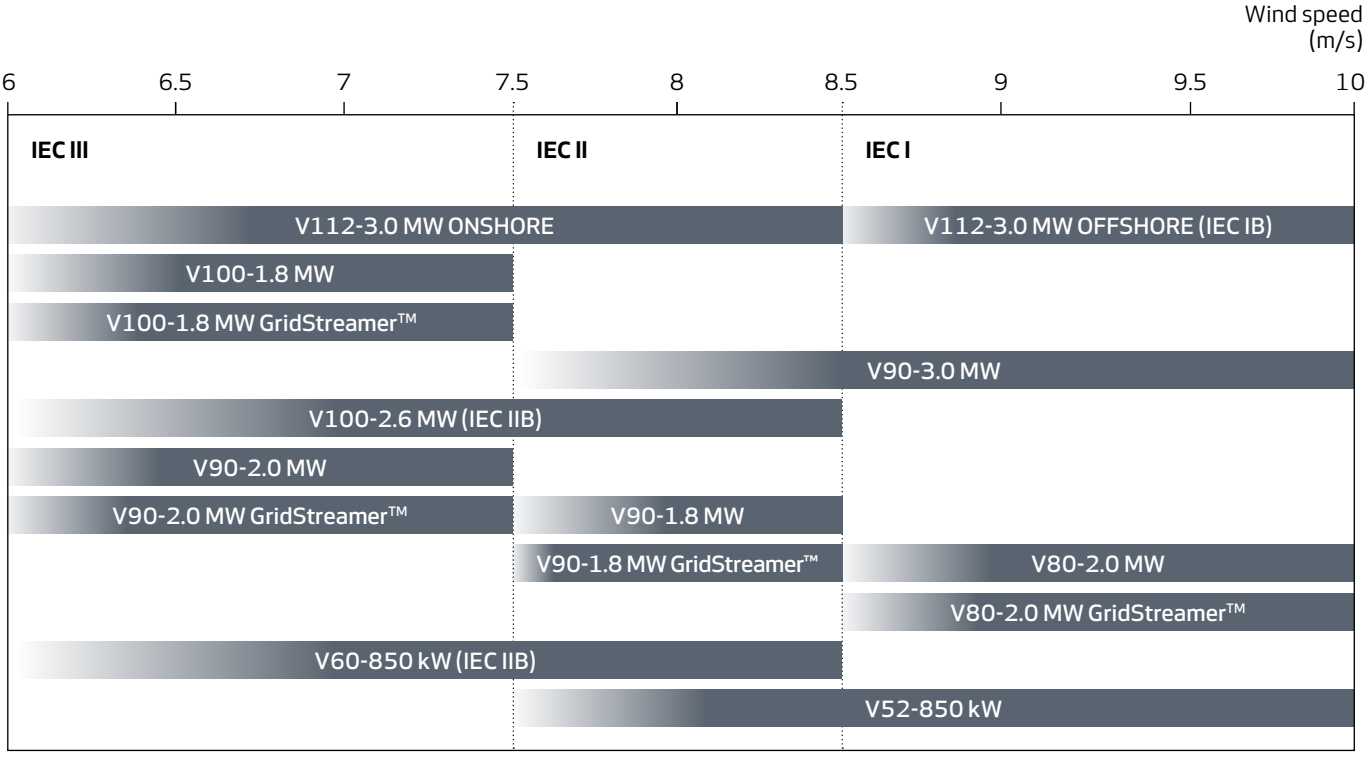
Unrivalled technical know-how

Choosing the right type of wind turbine is critical for the success of every wind energy project. With more than 30 years' experience in wind power and turbine development, we understand our clients and how to satisfy their technological and commercial demands. We can advise you on which of our turbines are most suitable for your site. Whatever your needs, we are likely to have the perfect match, onshore or offshore.

How do we ensure regular improvement of our products? By monitoring a large number of turbines in operation, analysing this valuable 'in the field' data, and using it to constantly refine our technology and find innovative ways of meeting our customers' expectations.

Introducing the largest wind turbine portfolio in the industry

- V112-3.0 MW onshore
- V112-3.0 MW offshore
- V90-3.0 MW
- V100-2.6MW
- V80-2.0 MW
- V90-1.8/2.0 MW
- V100-1.8 MW
- V80-2.0 MW GridStreamer™
- V90-1.8/2.0 MW GridStreamer™
- V100-1.8 MW GridStreamer™
- V60-850 kW
- V52-850 kW



Overview of Vestas wind turbines operating in the various wind classes.

80%

of Vestas' V112-3.0 MW can be usefully recycled

Technology beats turbulence

All our wind turbines are classified according to the IEC standard and our wind turbine programme covers the entire scale – from low, mid to high wind speeds and all turbulences – from low, mid to high turbulence. By choosing precisely the right turbines for a specific location and specific wind conditions, we assure you of the best return on your investment.

State-of-the-art expertise

Our highly-qualified and experienced research and development staff ensure Vestas' products remain at the forefront of the wind power industry, mixing cutting-edge technology with proven, reliable components. Throughout our range, customers benefit from state-of-the-art benefits across various areas, and among these are:

Research and innovation

We are dedicated to spearheading the wind power industry and ensuring it becomes a genuine alternative to oil and gas. Our R&D department is constantly devising new processes and techniques to lower the cost of turbine construction and energy generation, to present an ever-stronger business case to our customers. For example, we are currently developing a 'stealth' turbine designed to not interfere with radar systems, opening up more locations for potential use.

Smart controls

The control system is the 'brain' of the turbine, reducing wear and tear by adjusting movements such as pitch and yaw. This minimises the loads to which our turbines are subjected, allowing us to build lighter models with much smaller foundations – and since foundations form a significant proportion of the cost during construction, we considerably reduce the overall expense of the wind farm.

Blade technology

After more than 30 years of refining our equipment, our blade design is unique in the industry. We have designed them specifically for wind turbines, instead of being inspired by classic 'airplane wings', as is more often encountered in the industry. Carbon fibre construction makes our blades slimmer, stiffer and lighter, reducing loads on the turbines and allowing for efficient and economic construction – a win/win scenario based on our tradition for excellence.

Life cycle assessment

Vestas has set two ambitious targets for 2015 – to enable the highest possible MWh output per turbine weight and to use materials which have the lowest embedded greenhouse gas emissions, ensuring that our turbines are constructed from the most easily-accessible and renewable resources.

We have just undertaken an extended life cycle assessment of our newest product, the V112-3.0 MW, which provides a detailed profile of the turbine's environmental impacts. The study assessed 98.9% of the materials which comprise the turbine. By precisely tracking the carbon footprint across the entire life cycle – suppliers (92%), transport (1%) and Vestas (7%) – we can focus our attention and direct new environmental initiatives where they have the greatest impact.

For further details on life cycle assessment of our V112-3.0 MW, V80-2.0 MW, V82-1.65 MW and V90-3.0 MW turbines, see vestas.com.

+43,000

We have delivered more than 43,000 turbines worldwide.

A vision realised

The V112-3.0 MW is an industry game-changer. Never before has a turbine been tested so thoroughly before release to the market. It delivers early energy production, low balance of plant cost, and is easy and safe to service – fully tailored for both on and offshore sites.

Where innovation meets reliability

At Vestas, we know that investors need a strong, stable business case to invest in wind energy. That is why the V112-3.0 MW, our most technologically advanced turbine, builds on the proven technology of our previous ranges. Our components are reliable and durable, cutting downtime and maximising the return on your investment.

The V112-3.0 MW features a number of innovations, such as a permanent magnet generator delivering the widest possible operational range, and a full-scale converter for phenomenal grid support, reduced drive-train loads and optimum energy production.

Large rotors for maximum energy output

With its giant 54.65m blades, the V112-3.0 MW produces more energy from the same available wind. The long blades are part of creating the optimal rotor-to-generator ratio, producing a capacity and yield that allows profitable operation even from medium and low wind sites.

The blades are profiled for aerodynamic efficiency and structural strength. Their shape makes them less prone to airborne debris, ensuring prime performance at all times.

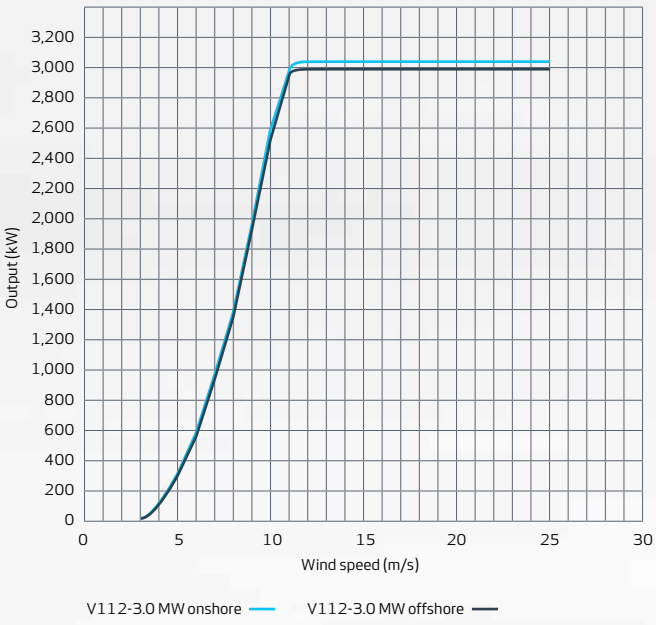
Onshore – high productivity, low noise

The V112-3.0 MW Onshore excels in the IEC III/II classes, its productivity making it profitable even at less viable sites with medium and low wind speeds. Various noise modes allow decibels to be reduced to comply with any sound restrictions imposed – all without significantly reducing productivity.

Offshore – taming a hostile environment

The V112-3.0 MW Offshore turbine is certified for IEC class IB with high wind speed and low turbulence. The high rotor-to-generator ratio ensures a high capacity factor to take full advantage of the available wind. A robust nacelle cover protects internal components from the environment outside, with shuttered air intake holes and service hatches. With a cut-in speed of 3 m/s and a steep power curve, the V112-3.0 MW Offshore offers a high output combined with industry-leading reliability. It is a low-risk, high-return option for safeguarding your investment.

Power curve for V112-3.0 MW



V112-3.0 MW

Making wind more profitable than ever – on and offshore

V90-3.0 MW

A better wind business by design

Efficient design drives down the cost of energy

Designed for on and offshore medium and high wind speed sites, the V90-3.0 MW boosts productivity by extracting more power from the available wind, thanks to its efficient build and innovative drive train and blade technology.

When we set out to design the V90-3.0 MW, we wanted to create a low-weight turbine combined with high performance. The result is a turbine which generates more power without any appreciable increase in size, weight and tower loads – driving down the cost of energy to keep your profits high.

Reliability, serviceability and yield

Why are we so confident in our product? We've installed more than 2,150 V90-3.0 MWs on and offshore – equivalent to more than 6,3 GW. The V90-3.0 MW builds on existing technology ensuring reliability, serviceability and yield – which all adds up to a safer way to run your wind business.

Drive train solution

The V90-3.0 MW minimises weight and loads through unique nacelle design and an integrated drive train, guaranteeing greater efficiency.

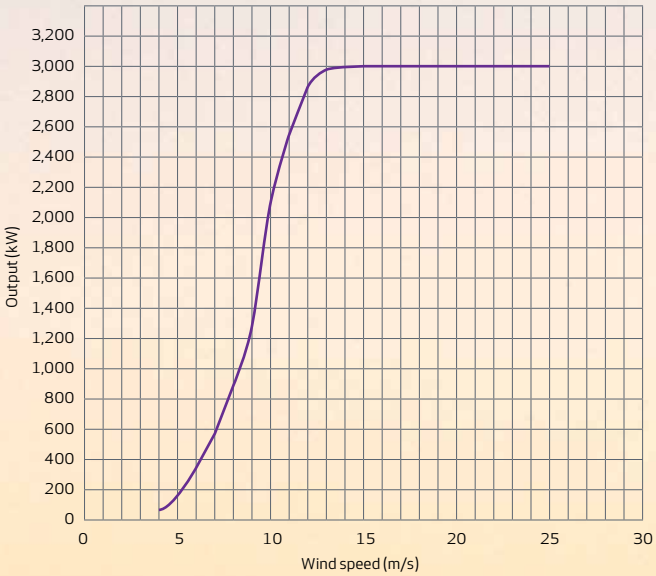
Strong blade design

We use glass fibre/carbon spars with glass fibre airfoil shells when engineering our blades – creating one of the lightest 44m blades on the market, making it possible to take full advantage of the wind while reducing the loads transferred to the nacelle.

Easy and economical to service

Most turbines operate on a six-month service schedule interval, but the V90-3.0 MW needs just one service a year, allowing you to arrange maintenance for the least windy months.

Power curve for V90-3.0 MW



Based on more that 2,150 installed turbines

To meet the growing demand for turbines for medium-to-low wind speed sites, Vestas has launched the V100-2.6 MW. The new turbine is based on the same robust technical platform as the tried and trusted V90-3.0 MW turbine, which has over 2,150 installations worldwide since 2002.

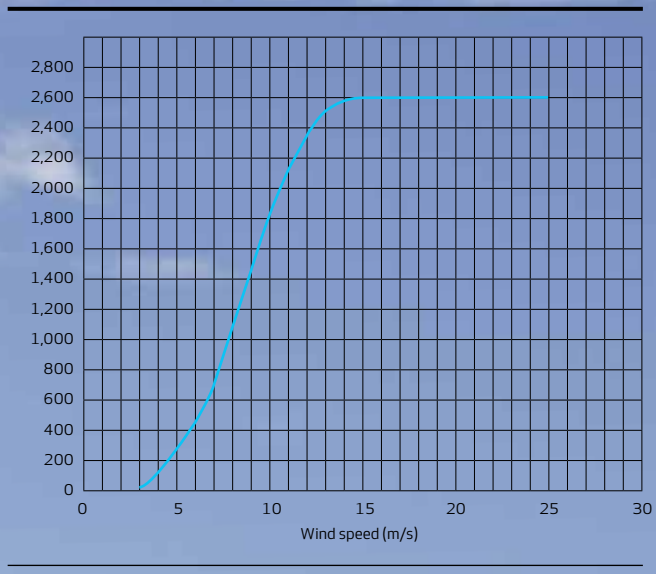
Using the same design strategy for minimising weight and loads through an integrated drive train and unique nacelle design, the V100-2.6 MW turbine is a powerful complement to the V90-3.0 MW. And since it is based on an existing turbine platform, almost all components for the V100-2.6 MW are already in use or production at Vestas today.

Its longer, 49m blades have a swept area of 7,854m^2, taking full advantage of the available wind at low and mid wind sites.

Maintaining the highest standards of safety

The V100-2.6 MW also replicates a number of key safety features that make it a safe workplace, from safety system in the nacelle, to fall arrest, service lift and access to the hub.

Power curve for V100-2.6 MW



V100-2.6 MW

Building on a strong technical platform

2 MW Platform

Maximum availability for the strongest business case

+97%

+97% availability drives down business risk. Our 2 MW class turbines are the most thoroughly tested on the market, with an overall proven availability of over 97% in 2009.

Your choice of three world-class turbines

Our reliable 2 MW range comprises the V80-2.0 MW, V90-1.8/2.0 MW and V100-1.8 MW turbines, all built on the same tried and tested technical platform. The V80-2.0 MW is designed for high wind sites, the V90-1.8/2.0 MW for low to mid-wind sites and the V100-1.8 MW for low wind sites.

Reliable technology for low-risk investment

Since 1999, we have installed more than 7,800 of our reliable 2 MW turbines around the world. Because these turbines are based on such a mature and well-established platform, they are a sound, low-risk choice. Using the best features from across the range, as well as some of the industry's most stringently tested components and systems, the reliable design minimises downtime – helping to give you the best possible return on your investment.

Improved yaw system

Our previous generations of 2 MW turbines included a four-gear yaw system. Our commitment to continuous improvement means our new versions feature a six-gear yaw system, as well as a 110 mm yaw rim subjected to induction hardening – meaning it is more robust and reliable than ever. Combined with the automatic lubrication system, this gives savings in maintenance costs and increases your uptime.

Affordable transportation and installation

Like all our turbines, the 2 MW turbines are easily transportable, by rail, truck or barge, to virtually any site around the world. All components are designed within international limits for standard transportation – so there'll be no unforeseen costs before revenue generation begins.

Remote control – 24/7

To reduce the cost of energy, our 2 MW turbines come equipped with VMP Global®, our latest turbine control and operation software. VMP automatically manages your turbines around-the-clock, not only ensuring maximum power output but also monitoring and troubleshooting, keeping maintenance costs to a minimum.

Strong technology for high challenging conditions

Extremely productive at high wind sites, the V80-2.0 MW has a proven and resilient design which keeps your cost of energy low.

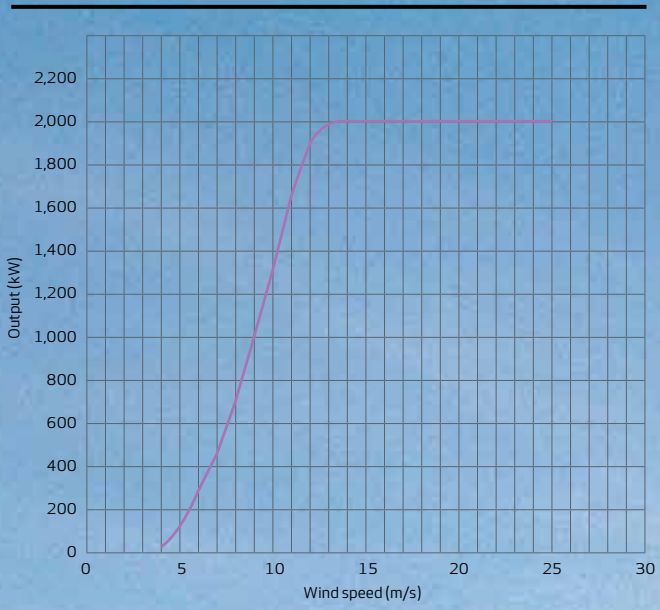
Built to perfection, built to last

The V80-2.0 MW is an incredibly stable turbine with high performance and output. For example the proven 39m blades are made from glass fibre in an epoxy resin, reducing the loads transferred to the nacelle resulting in extraordinary efficiency and reliability.

Setting new standards of success

With close to 4,000 V80-2.0 MWs currently producing power around the world, this turbine is our most tried and tested model. Benefitting from more than a decade of operational history, the V80-2.0 MW has the best track record in its range. Every component has been honed for performance and reliability to give our customers the confidence they need to invest.

Power curve for V80-2.0 MW



V80-2.0 MW

Making high-wind sites low-risk business

V90-1.8/2.0 MW

Providing a stable return on investment

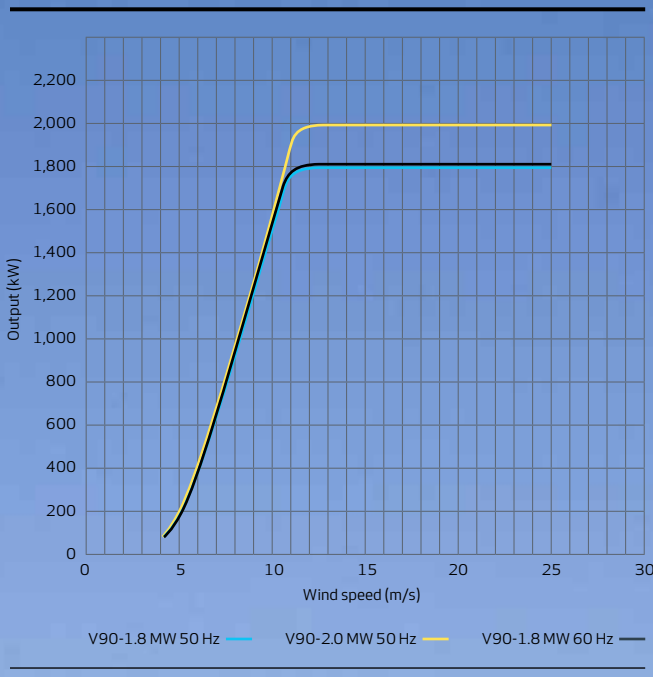
Productivity equals profits

With more than 3,800 turbines installed the V90-1.8/2.0 MW turbine is a highly proven turbine securing your investment. The V90-1.8/2.0 MW generates an enviable output in low to medium wind onshore sites compared to other turbines in the same wind class. Its 44m blades, made of glass and carbon fibre in an epoxy resin, feature lightning receptors and internal grounding cable, boosting safety.

Adjustable load and power modes

Keeping the turbines operating at capacity whatever the wind conditions is key for your business case. Therefore the V90-1.8/2.0 MW can be configured for fluctuations, based on site analysis for turbulence and wind speeds. For instance, during extreme turbulence they can run de-rated instead of being shut down, and during times of low wind they can be up-rated, exploiting the conditions for maximum output.

Power curve for V90-1.8/2.0 MW



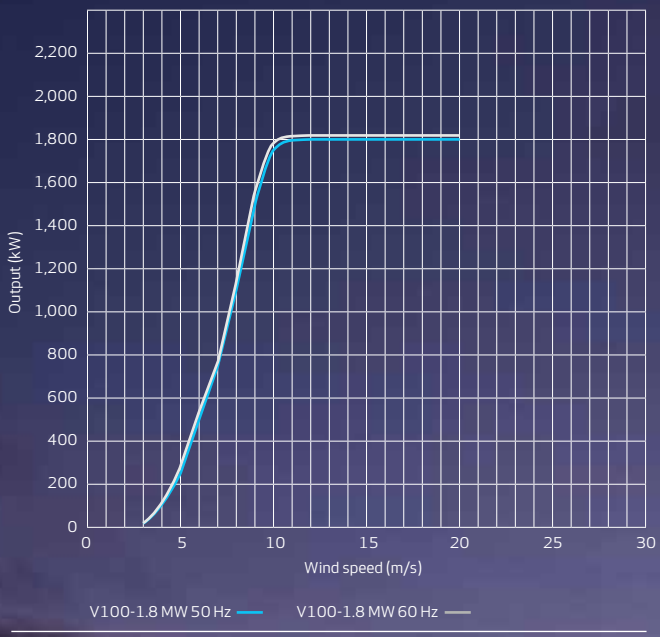
Opening up more locations than ever before

Until recently, many low-wind speed sites remained unsuitable for turbines. Using 3D tools and rigorous trials at the Vestas Test Centre, we were able to develop longer blades to make the most of limited wind while compromising neither safety or reliability.

At 49m, the V100-1.8 MW blades sweep an area of 7,850m^2, a 23 per cent increase compared to the V90. This maximises energy production at even the lowest wind speeds, generating a higher capacity and yield compared to other turbines in the 2 MW class.

All three standard 2 MW turbines use a converter system to deliver a consistent grid output, regulating the turbine's power provision as needed and quickly responding to grid disturbances. The system also reduces the load on the gearbox and other key components, reducing wear and tear.

Power curve for V100-1.8 MW

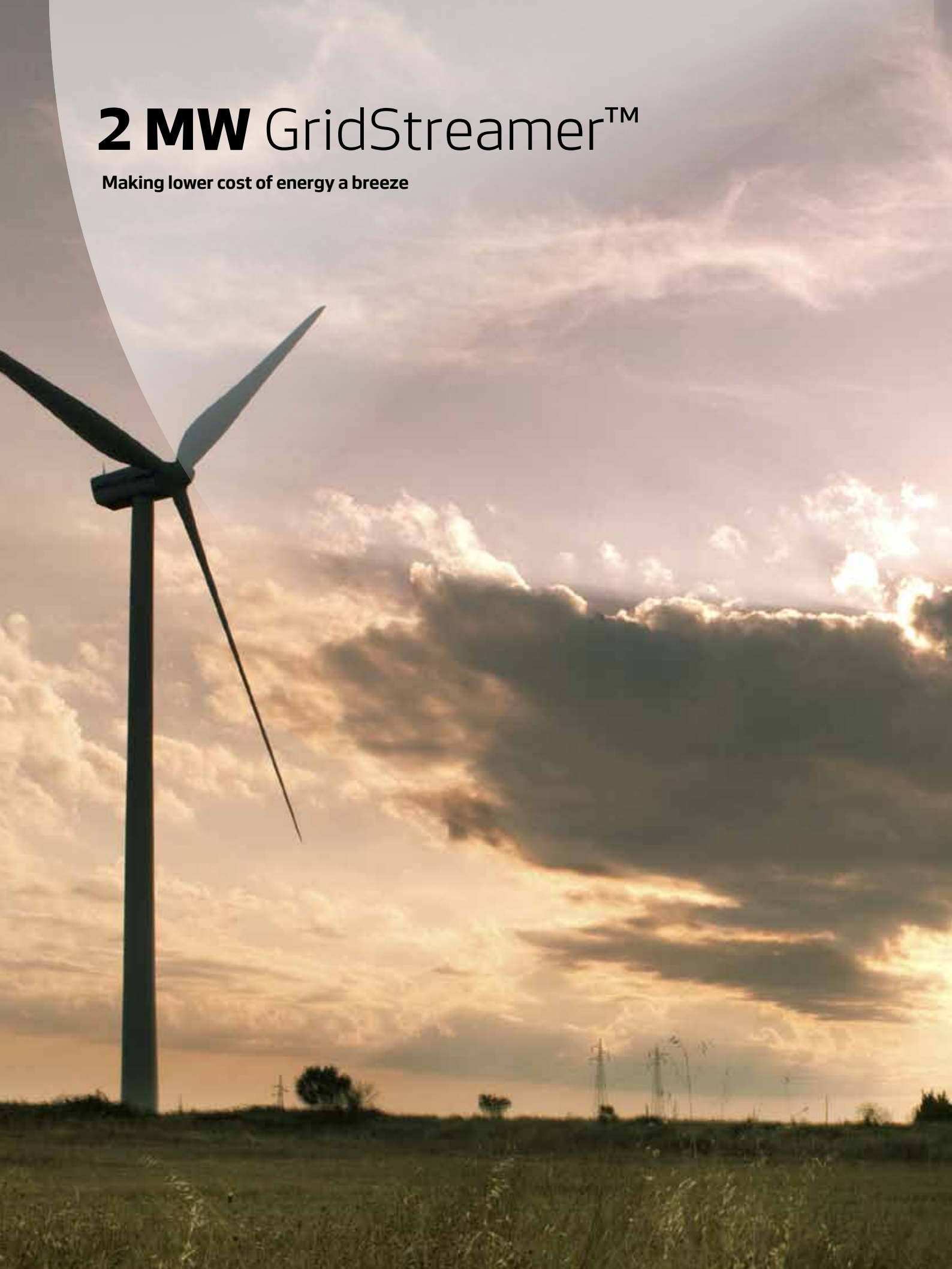


V100-1.8 MW

Opening up a new world of opportunities

2 MW GridStreamer™

Making lower cost of energy a breeze



Geared up for maximum compliance with new power system

As well as the tried and tested, state-of-the-art technology of our standard 2 MW turbines, the 2 MW GridStreamer™ models boast permanent magnet generators and full-scale converters to meet the most advanced compatibility requirements, offering comprehensive support across a variety of grid demands worldwide delivering the highest possible levels of reliability, maximising uptime and output. Furthermore, 2 MW GridStreamer™ turbines can continue operating even during a severe grid voltage drop, converting any excess power into heat and sparing the drive train components of any unnecessary loads. In fact, it can down-rate to 20 per cent of normal capacity without straining the equipment.

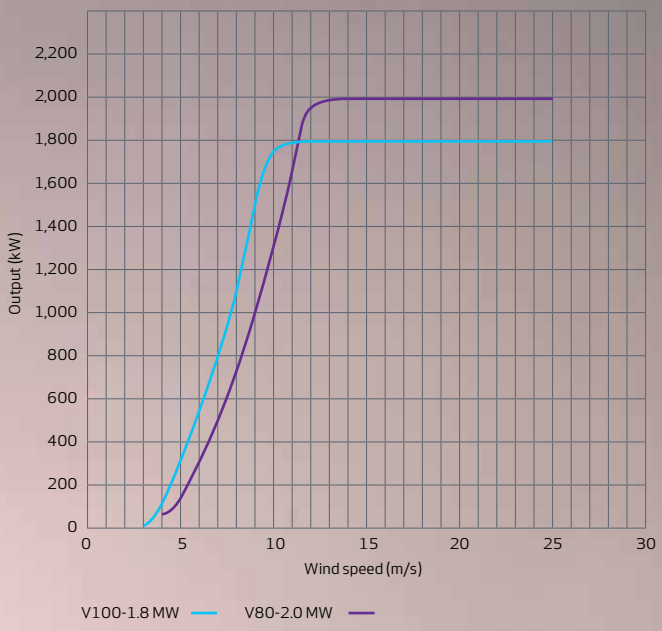
Scaling new heights

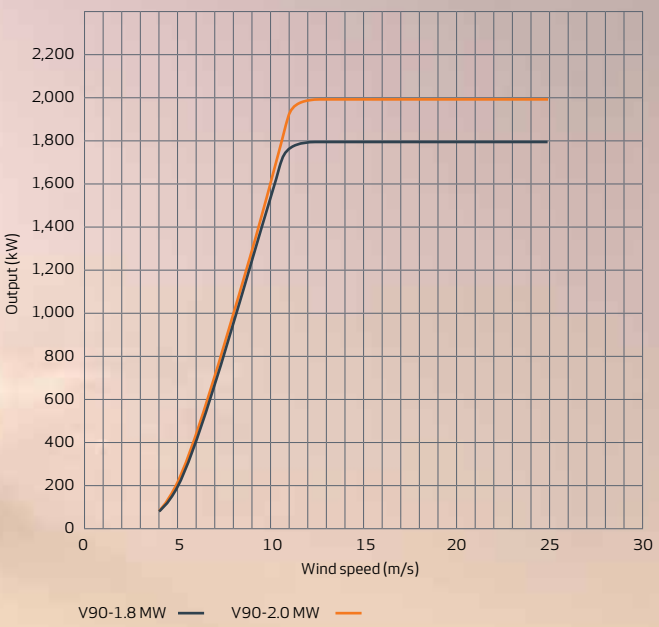
The groundbreaking technology which powers our 2 MW GridStreamer™ turbines are type certified to operate at altitudes up to 2,000 m above sea level, opening up some of the world's most wind-rich locations for commercial power generation. Efficiently designed and highly evolved, our turbines can promptly and affordably be transported to almost any site globally by rail, truck or barge.

Affordable to install and maintain

Apart from offering a high potential for profit, a wind turbine also represents a sizeable investment. That is why we do everything we can to safeguard your asset. Our state-of-the-art switchgear technology protects systems against current surges by isolating key components. In our permanent magnet generators we use no slip rings or brushes, both of which are susceptible to wear and tear. We employ anchor bolts in our turbine foundations for faster construction and tower realignment, and our nacelles are specifically designed for easy access, meaning quicker servicing and return to operational duty.

Power curves for 2 MW GridSteamer™ turbines





V60-850 kW

Tailor-made turbine for China

China's own world-class turbine

We have designed the V60-850 kW specifically to suit Chinese weather conditions, encompassing both medium and low wind speed sites. The design builds on the ever-reliable V52-850 kW model, bolstered by a raft of technological innovations to maximise productivity in this unique market.

Our customers requested a turbine which was easy to transport and install in challenging sites; one that was easy and less costly to maintain; with the V60-850 kW – produced in China with locally-sourced materials – we delivered a turbine as reliable and efficient as any in our range.

Tailored turbine, reliable technology

By using the V52-850 kW as the base model for the V60-850 kW, we have the benefit of drawing on the experience gained from installing more than 3,500 V52-850 kW turbines worldwide.

Cutting-edge blades

The V60-850 kW sports newly-designed 29m blades featuring a new structural design and an enhanced aerodynamic profile. Together, these deliver high lift and enable low cut-in and high cut-out wind speeds, maximising the operational range. Despite the bigger rotor and larger sweep area, the nacelle size remains unchanged from the V52-850 kW, but the V60-850 kW features all-new components including drive-train, bearing housing and gearbox.

Strength and simplicity

A new anchor-bolt design makes the V60-850 kW foundation lighter and easier to install than previous designs. By using less steel we cut construction times and costs. A new lightweight tower design offers similar benefits, its magnetic components weighing less than its forerunners in the V52-850 kW, slotting together quickly to save the customer time and money.

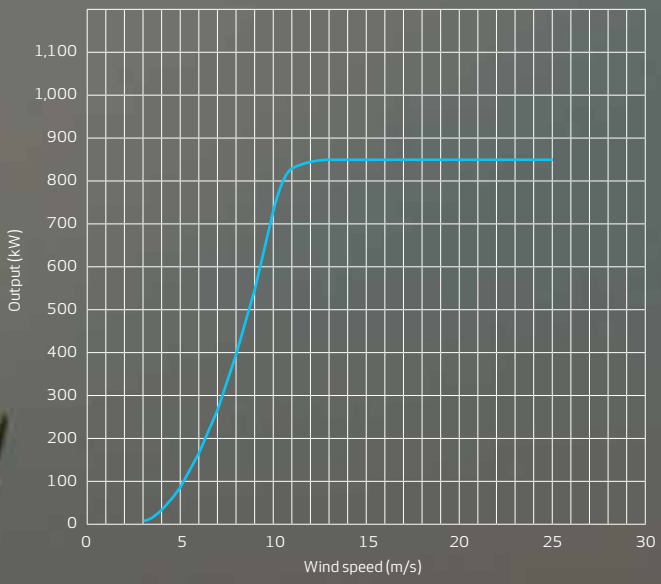
Cheaper transport and installation

We have designed a new style of blade mount enabling us to safely transport three blades at one time, using existing trucks and cranes. There is no need for customers to touch, lift or secure the blade directly, resulting in lower damage risk and lower cost.

Top quality power

OptiTip® and OptiSpeed® technology optimise power production, especially in modest winds. The turbine is easily adaptable to meet the needs of a range of grids, leading to better quality, reactive power.

Power curve V60-850 kW



Legendary all-round performance
The V52-850 kW is our most adaptable turbine, suited for all kinds of wind speed but particularly efficient in medium and high wind sites.

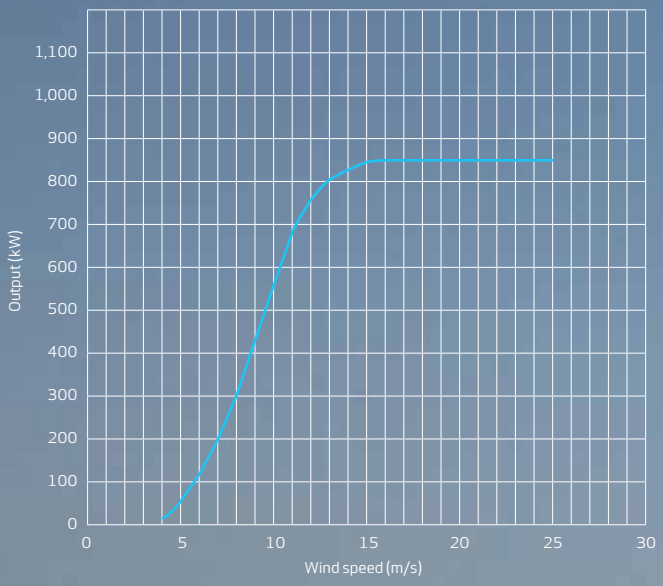
Most proven turbine
With more than 3,500 erected around the globe, the V52-850 kW is a reliable and popular turbine, recognised for its robust construction and track record.

OptiTip® blade adjustment
Our unique OptiTip® pitch regulation system features microprocessors which constantly adjust blade angles to suit the prevailing wind. It also keeps sound levels to within local regulations.

OptiSpeed® – for high efficiency
Our OptiSpeed® generator allows the turbine rotor speed to vary between 14 and 31 rpm to maximise output from the conditions at any given time. Put simply, it taps the higher efficiency from slow and variable rotations, storing excess energy in rotational form to exploit the full force of transient gusts. With lower peak loading, OptiSpeed® also reduces strain on the gearbox, blades and tower; and sound levels are kept to a minimum by lower rotation speeds.

Perfect for populated or remote sites
With five different tower heights and a remarkable sound profile, the V52-850 kW is equally suited to populated as remote sites. And its compact dimensions make overland transport simple and economical.

Power curve for V52-850 kW



V52-850 kW

The turbine that goes everywhere

Manufacturing

Scope of manufacturing

Reliable component delivery – on time, every time
At Vestas, when we commit to something, we stick to it. With more than 30 years' experience in the wind power industry, we know what it takes to ensure our business partners the best possible return on their investment – a reliable yet flexible global supply chain geared up to deliver the parts that we and our customers need, whenever and wherever they are required.

Technology – a proven supply chain
- Control systems and wind turbine assembly: 100% manufactured in-house
- Generators: 100% manufactured in-house
- Towers: 25% manufactured in-house
- Transformers and gearboxes: 100% externally supplied

Manufacturing quality

Quality assured – internally and externally
Whether we produce components in-house or through tried and trusted external suppliers, we have stringent policies in place to ensure they meet our high and exacting standards. All parts must be reproduced to validated design specifications. How do we achieve this? By identifying the critical processes for standardised production and carefully monitoring quality controls.

- We use Six Sigma performance targets to ensure each component precisely matches designs.
- We scrutinise each stage of the production process at component, platform, factory and process level.
- We monitor Critical To Quality (CTQ) charts to identify any unacceptable variations and make corrections before defects occur.

Responsible supplier management

When we monitor our supply chain, we also examine the sustainability standards of our suppliers. In doing so, we can exert a positive influence to improve levels of sustainability beyond our own operations.

Supply chain capabilities

Standardisation – control equals confidence
Our components operate to the highest performance standards for their entire 20-year design specification. How do we achieve this? Because we regulate and oversee all the processes during their manufacture. By closely monitoring the entire production chain we achieve two main objectives:

- We ensure each component lasts as long as it should and performs at its maximum potential.
- We increase the business case certainty for investors by avoiding unplanned failures and meeting performance expectations.

By maximising the number of critical processes under our control and minimising the variance between end products – in other words, producing components according to exact design specifications – we ensure high quality end products, time after time.

Supplier quality program

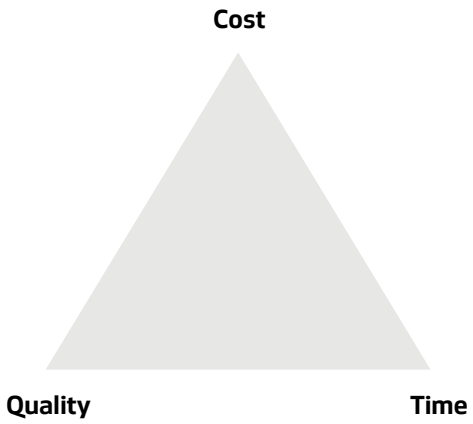
Not just maintaining standards – improving standards
Our quality control system demands the same stringent, consistent standards for both internal and external suppliers, and controls the criteria they are assessed against – driving up performance across all areas of the business.

We use quality control sheets throughout the entire manufacturing process. This ongoing monitoring of the supply chain has armed us with the knowledge about where and how we can get even better.

All elements of manufacturing fall under quality control – nacelle assembly, controls, blade and tower factories. This means we have complete faith in our products – which means you can have complete faith in us.

Construction

Transportation



What you need, when you need it

To get your investment off to a flying start, we at Vestas know that means delivering your products on time and at the expected high quality. With more than 30 years' experience in the wind power industry, we know what it takes to meet our customers' logistical needs:

- Long-term supply partnerships: we have experienced supply partners and good relationships with regulatory bodies.
- Customised transport equipment: our equipment has been developed with our supply partners to meet local planning constraints, and to ensure that products leaving the factory in perfect condition arrive on site in perfect condition.

Quality, promptness and value

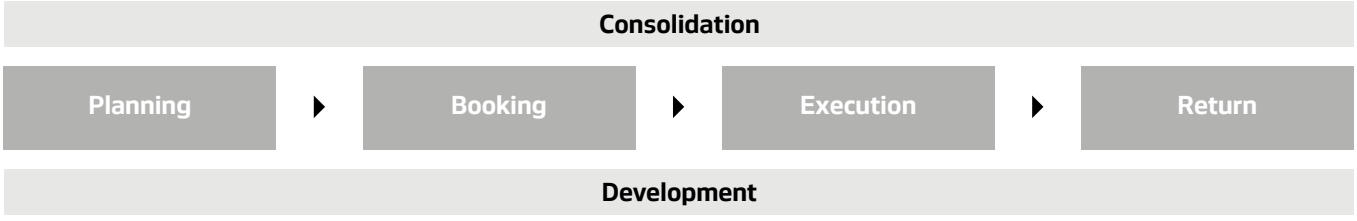
When choosing the right transportation options for your delivery, we aim to find the ideal balance between our three key considerations:

- **Quality** - your turbine and/or components will arrive in the perfect condition you expect from Vestas.
- **Time** - we will make sure you receive your products on time, every time.
- **Cost** - we will find the cheapest transport option for you which takes into account the above two factors.

Six steps to designing the ultimate transport solution

We have recently introduced a new Global Transport Process (GTP) to bring even more value to customers. Using our decades of experience in turbine transport, our specialist teams have devised an innovative new approach to ensuring every component of your turbine is where it needs to be at the time it needs to be.

- **Planning** - we collect accurate data from all areas of logistics – transport costs, return costs, VAT/Duty, lead time, carbon footprint and risk management.
- **Booking** - our Global Transport Booking (GTB) process is built on standard templates for reporting on quality, cost and delivery, securing the most efficient means of transport.
- **Execution** - this process sets a high quality for standardising the handling and reporting of important documents.
- **Returns** - this details how we handle and track transport equipment throughout the organisation. We track, trace, identify and tag all equipment at every stage of the journey.
- **Development** - we integrate new turbine/transportation equipment development with our technology R&D process. This includes transport manuals with focus on Critical To Qualities (CTQs) lifecycles, maintenance instructions and inspections involving all stakeholders.
- **Consolidation** - we take a global view on transport operations to find cost-savings for customers across all our business units.



630

In 2009 we shipped 3,320 turbines. End-to-end, they would span 630 miles.

High quality, **on-time products**

With more than three decades' experience in the wind power industry, we have standardised our global processes to deliver top quality products – on time, every time. It is a simple goal, but one we devote our working lives to accomplishing.

Our highly-trained technicians are certified to Germanischer Lloyd standards for excellence, safety and compliance. And we apply the same robust standards to our sub-suppliers as we do to our own people. It is company policy – our customers expect and deserve nothing less.

Detailed monitoring for provable results

Our customers have as much faith in our products as we do. People often ask how we maintain these standards. The answer is, by rigorously monitoring two key areas of performance:

- On-time commissioning
- No defects during construction

This means your project will be operational by the agreed date and will be free from problems. As an added precaution, our service team must sign off on the mechanical completion work – and since they will be the ones working with the end product, their own standards are meticulous.

Putting the customer in control

We understand the process which transforms a plan for a wind farm into a fully-operational, revenue-generating reality. A huge number of tasks are involved in realising this goal. We follow a policy of collaborating with the customer at every step of the way.

The ultimate aim of the construction phase is to build the wind power plant and deliver it to the customer on time, according to specification and on budget. With our experience, we ensure this process happens speedily, economically, and to a standard which lives up to the Vestas name.

Customers decide for themselves how much input they have during construction. We can provide everything from an EPC/ turnkey package, in which we provide, install and calibrate the plant, to a more streamlined package in which we simply supply and commission the turbines. The decision is yours, and you can always count on both our advice and practical support.

Logistical expertise, managed risk

Effectively managing your project's scope of supply is an important factor in minimising the risk. We have designed a number of flexible solutions for optimising scope of supply to meet every customer requirement.

Essentially, the scope of supply defines how the project deliverables are allocated between you, the customer, and Vestas during the design, manufacture, transport, construction, installation and commissioning of your wind power plant. The optimum allocation will depend on the specific characteristics of your project.

By choosing Vestas as your partner, you benefit from our vast knowledge and experience of different wind environments all over the world, together with our unrivalled project management skills, from design integration of every piece of the wind power plant, to high quality manufacturing and transport and construction expertise.

We generally offer the following scopes of supply:

- **Supply and supervision**: As well as supplying the turbines, we supervise their installation and commissioning on site.
- **Supply and commission**: We provide manpower to help get the turbines up and running. We may also provide transport if you need it.
- **Supply and installation**: In addition to the above, we procure and supervise the cranes for installing your wind turbines, provide the manpower to install and commission the turbines, and, if required, we can also transport them from the factory to the site.
- **EPC/Turnkey agreements**: We are responsible for the engineering, procurement and construction of the project. An EPC project may include everything from the design specification, procurement and manufacture, to the complete installation and commissioning of the wind turbines and balance of the plant, such as road construction, crane hard standings, HV transformer and substation protection equipment, and advanced SCADA system.

Power Plant Optimisation

Monitoring and **operations**

VestasOnline® Business SCADA System

Hit your production targets

To reach your commercial goals, you need to maximise production and minimise downtime. VestasOnline® Business, our unique Supervisory Control And Data Acquisition (SCADA) tool developed by electrical system engineers and wind turbine specialists, will help you achieve just that.

All the data you need

In the wind energy business, knowledge is power. The VestasOnline® Business system monitors not only wind turbines, but also meteorological stations and grid stations, compiling the data to produce critical reports including:

- Production charts
- Event and alarm notifications
- Performance and power curve reports
- Point of common coupling measurements

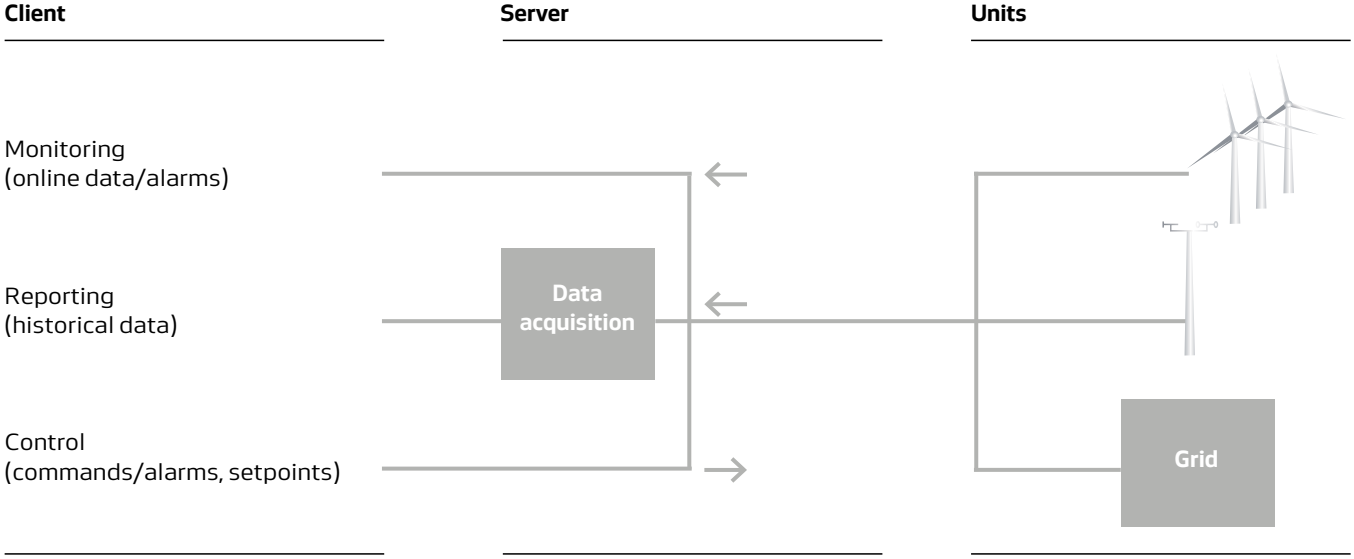
Sharpen your business performance

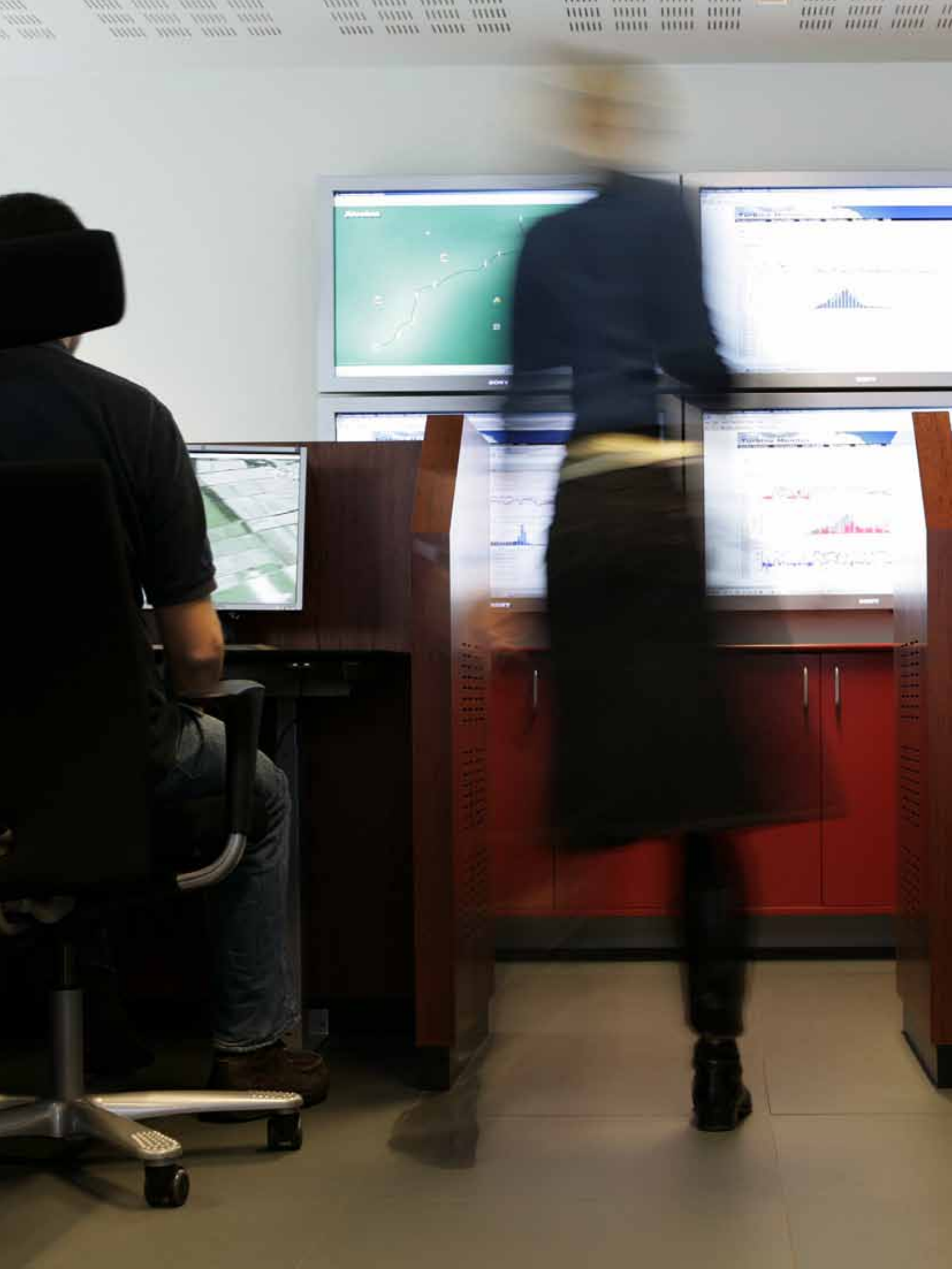
VestasOnline® Business allows you to communicate with third party service providers to support your power forecasting and trading. What's more, the monitoring and control technology can be easily integrated into your second-level system. VestasOnline® Business offers up to 500 1Hz online signals from each turbine.

Rapid reporting

As all investors know, time is money. In the event of a component failure you will receive an instant alarm in time to take action to minimise downtime and save on maintenance costs.

Basic layout of a SCADA system





Monitoring and **operations (cont)**

Intelligent control

VestasOnline® Business measures and records output at the point of common coupling, ensuring output is constantly optimised. For flexibility and compliance with local requirements, our technology also features advanced ramp rates and scheduling functions, keeping you one step ahead of the game at all times.

A scalable and modular solution

VestasOnline® Business integrates seamlessly with VestasOnline® Power Plant Controller. It is fully customised for the needs of individual sites and projects, and features the following components:

- VestasOnline® wind power plant server application, including a remote communication interface.
- VestasOnline® client application with choice of operator interfaces.
- Communication network of fibre-optic cables and switches connecting the server to the turbines.

Systems you can depend on

As a valued investor, we will provide you with technology you can trust. At the heart of the VestasOnline® SCADA system is a highly-reliable server, along with back-up disk storage and UPS power supplies. Tape stations are used for scheduled back-ups, while Ethernet technology secures fault-tolerant communication. Why are these safeguards in place? To ensure that VestasOnline® Business delivers total reliability, even if the power plant is compromised.

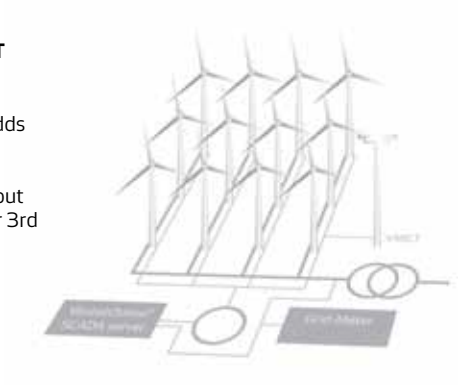
VestasOnline® Compact II

A lighter solution for smaller plants, VestasOnline® Compact II features:

- Industrial PCs installed at the bottom of turbine towers.
- An overview of power production, turbine status and statistics for the entire plant – with the ability to stop and start all turbines with a single command.
- Basic reporting and data export features.
- Transfer of alarms and status messages into emails.

WIND POWER PLANT (with SCADA)

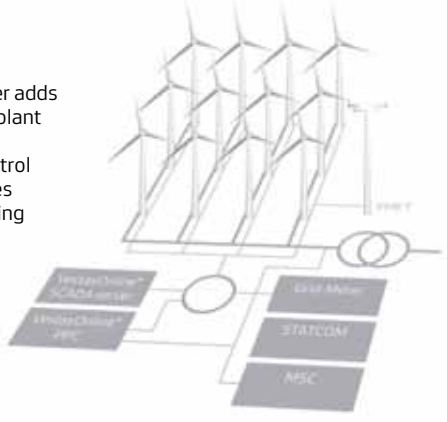
The SCADA system adds
- Monitoring
- Detailed reporting
- Optimisation of output
- Full business and/or 3rd party integration
- Active and reactive power control
- Scheduled ramp rates



For highly demanding grid codes the PPC can control additional substation equipment such as STATCOMs and MSCs

WIND POWER PLANT (with SCADA & PPC)

The power plant controller adds
- Fast and deterministic plant controls
- Redundant point of control
- Improved response rates
- Compliance to demanding grid codes



VestasOnline® Power Plant Controller

Worldwide grid code compliance

The VestasOnline® Power Plant Controller is the first controller on the market fully dedicated to wind power plants. This state-of-the-art technology secures worldwide grid compliance at the Point of Common Coupling for all known grid codes.

Fast, reliable real-time control with multiple control functionalities

VestasOnline® Power Plant Controller (PPC) controls the output of the wind power plant at the point of common coupling. Working independently of the SCADA system, VestasOnline® PPC accurately monitors and controls each wind turbine.

Transient Fault Recording

VestasOnline® PPC provides a grid measurement system that continuously logs all parameters, such as RMS, harmonics, waveforms flicker, and frequency. Through grid measurement, VestasOnline® PPC provides Transient Fault Recording for performance and post-fault analysis, including web server and remote monitoring capabilities.

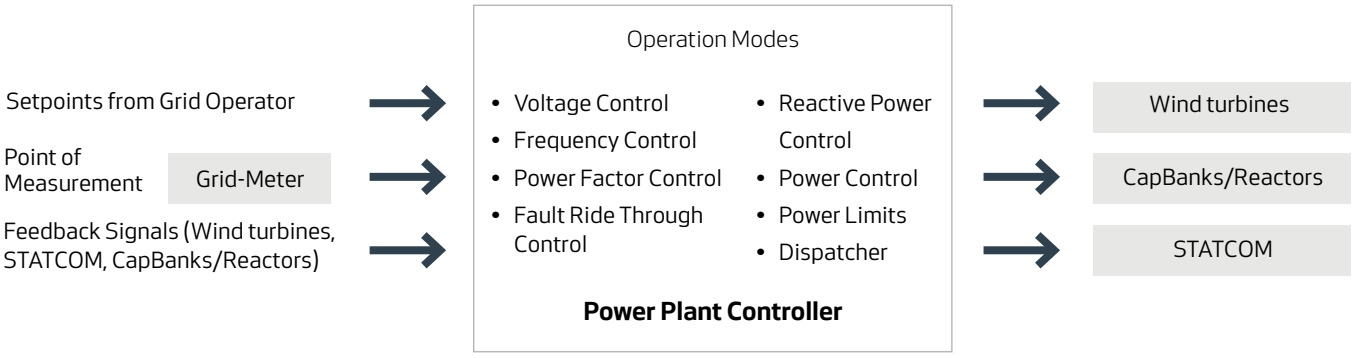
A scalable, modular solution

The VestasOnline® PPC is a fully integrated solution, supporting data acquisition and control of all wind power plant components. This includes interfaces to third-party equipment via various industry protocols.

Every power plant has different specifications and output requirements. VestasOnline® PPC is customisable to meet the specific needs of your site and project.

A single VestasOnline® PPC can control up to 160 Vestas wind turbines. For larger plants, two or three controllers can be combined to control up to 480 turbines.

The VestasOnline® Power Plant Controller is fully scalable, and features customisable configuration, allowing you to implement any control concept needed to meet local grid requirements.



Vestas service **concepts**

Our Active Output Management® (AOM) service programme ensures the highest possible output at all times, safeguarding your return on investment.

We provide a number of tailored AOM packages, so whatever the needs of the specific project, there will be one to suit you.

AOM 1000

For customers seeking maximum flexibility

With no base fee, a number of Vestas services are offered on a pay-as-you-go basis.

AOM 2000

A low-cost way to reduce the risk of downtime

Turbine performance is sustained through regular maintenance, with the option of additional maintenance items.

AOM 3000

For customers willing to share the risk factor

A complete field service package including parts (apart from main components) and labor is accessible to customers with more risk tolerance. Turbine reliability is maximised through expert scheduled and unscheduled maintenance.

AOM 4000

A complete package to maximise uptime and performance

A complete package including everything necessary (main components and material) to maximise uptime and performance. The service contract covers periods up to 10 years, suitable for customers who want the traditional time-based availability guarantee – of up to 97%. These high expectations are formalised through liquidated damages and bonus clauses in the contract.

AOM 5000

A complete package to ensure minimised lost production

A complete package including everything necessary to maximise output but with further aligned incentives. An energy based availability guarantee is offered that aligns service and maintenance execution with low wind periods. We strive to minimise lost production. The service contract covers periods up to 10 years, and energy based guarantees up to 97% (subject to site evaluation). These high expectations are formalised through liquidated damages and bonus clauses in the contract.

Service **capabilities**

Vestas Active Output Management® (AOM)

Maximising turbine production
No one knows wind like we do. We recognise that making the most of your wind farm asset is about more than engineering and logistics – it is about capturing wind when it is available to ensure the maximum energy output. That is why we offer customers a unique Active Output Management® (AOM) package, based on three decades of industry experience.

To realise the best possible return on your investment, an effective service infrastructure and O&M strategy is just as important as reliable turbines. With Vestas AOM, you are supported by a proven service partner, helping reduce your risks and deliver optimum turbine performance according to your needs.

How do we offer superior service and support? By choosing the right approach, in six key dimensions:
- The right people
- The right intelligence
- The right operations and maintenance plan
- The right infrastructure
- A strong partnership
- Backed by performance guarantees

The right people

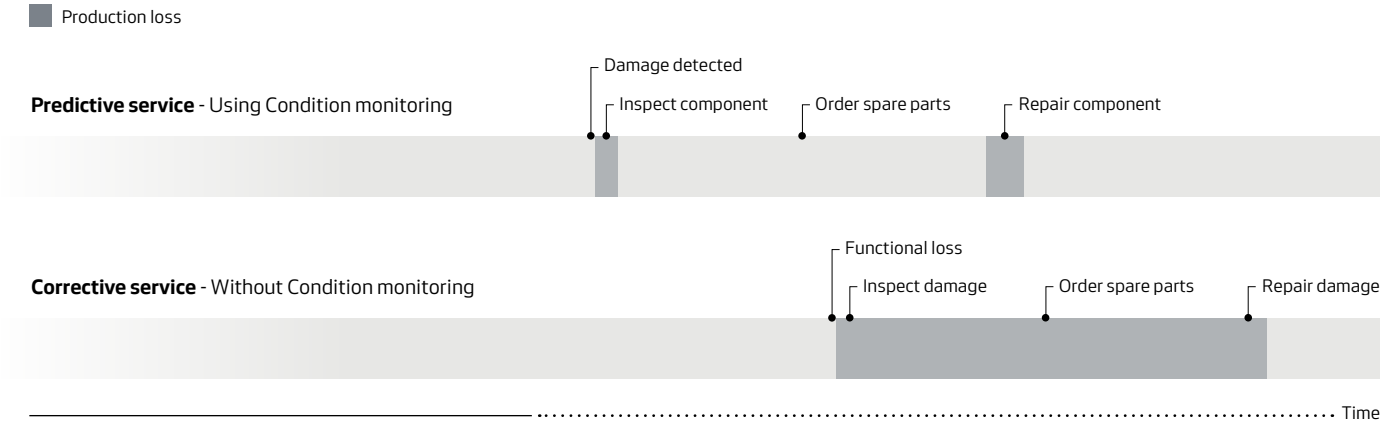
To operate a reliable, profitable power plant, you need a team of well-trained technicians – people who know not only the best way to torque a bolt or lubricate a bearing, but also understand how maintenance processes link to the long-term performance of your wind turbines. At Vestas, these are precisely the people we provide.

Our service and maintenance training is not limited to technicians. We also ensure site and regional service managers have the skills they need to deliver results across the fleet. This means tracking production, identifying problems and making improvements.

Certified training programme
With more than 3,500 service personnel worldwide, we have learned how to train technicians to the highest standards. Our instructors have hands on knowledge from the field and know best practice from own experience as well as global knowledge sharing. The training programme is certified by Germanischer Lloyd and every Vestas technician is re-assessed every two years.

Training facilities
We have state-of-the-art training facilities around the world. We use sophisticated turbine simulators for a hands-on approach to learning the practical skills needed to become a high performing technician. We complement technicians' training with periods of on-site work, where new skills are practised in readiness for the next stage in their development.

Corrective service vs Predictive service - Production loss



The right intelligence

Siting

Vestas Site Check is a tool that optimises turbine placement vs. component loads and production. Our siting teams draw on three decades of experience and industry-leading project siting models to ensure that the wind turbines perform to specification in the field. We have the largest and highest-quality database of wind data in the world. We integrate this unequalled knowledge about actual performance of the site into production forecasts. In addition to using the industry standards in modelling and analysis, we use Computational Fluid Dynamics (CFD) when evaluating how to improve predictable performance on complex sites such as ridge tops or forest areas.

Performance and diagnostics

Installation is only the beginning of our care promise. We offer wind farm output optimisation over the whole lifetime of the project. As such, we have set up a network of performance and diagnostics centers all over the world – each one staffed with world class engineers. The Vestas Performance and Diagnostics Centre (VPDC) monitors up to 130 data points per turbine from more than 18,000 turbines worldwide to identify potential component failures. By predicting problems before they occur, we can minimise production loss; and the data we gather is used to develop ever-more reliable and efficient turbines as well as enhanced O&M plans. To achieve this, we use condition monitoring systems and the Vestas developed Turbine Monitors which involves measuring signals including temperature, vibration, lubrication and debris wear.

Our site managers are committed to maximising production and reducing costs by:

- Optimising resource allocation – to drive better efficiency from site teams
- Solving root causes of problems – instead of retrospectively managing symptoms
- Reducing time spent on reporting – maximise time spent on maintenance
- Supervision to ensure quality of maintenance – ensuring continuous improvements

To verify the design life specifications, we have the unique ability to test complete nacelles in the world's largest wind turbine test facilities. We check for robustness, reliability and performance. Four Vestas Test Centres use advanced predictive modeling to replicate real-life conditions – which you benefit from in the service and maintenance plans.

Hardware and software upgrades

Our hardware and software upgrades improve reliability, increase power production and provide grid integration and power plant management.

The right operations and maintenance plan

Running large wind power plants requires efficient service and maintenance strategies for uninterrupted power production and cost control. This requires best practice systems enabling field experience to be fed into maintenance plans and turbine design.

The Vestas maintenance strategy can further be split into three approaches:

1. Preventive maintenance based on failure statistics and design criteria
2. Predictive maintenance based on condition monitoring and turbine monitors
3. Corrective maintenance based on effective and proven troubleshooting strategies

Vestas tools and planning processes enable control and transparency of wind farm operation. A key focus area is bundling of service and maintenance tasks to minimise downtime. The Preventative maintenance plan sets out prescribed intervals for scheduled maintenance and component replacement according to lifetime.

Predictive maintenance is a key enabler of supervision of critical components to get early warnings of potential wear out. Corrective maintenance is not only about efficient replacement of parts but also about effective troubleshooting strategies – a place where our experienced technicians play a vital role. A continuously updated FAQ system is a key enabler for effective and efficient troubleshooting. The FAQ system is a key part of the best practice systems in Vestas.

Vestas Site Manager gives the ability to address underperformers and detect contributors as well as engage design engineers and suppliers to improve turbine reliability. All sites globally have access to performance data and maintenance reports through the Vestas Site Manager tool to share and improve service processes.

The right infrastructure

Having the right infrastructure – supply chain, technical support and remote surveillance - in place is vital for maximising wind farm production.

Supply chain

Our global supply chain ensures on time component delivery. The supply chain includes a repair loop of repairing and overhauling main and minor components. The global integrated supply chain regions utilise both global and local sources for parts to optimise cost and delivery. To ensure components are available when needed warehouses have strategically been set up around the globe – the stock is continuously replenished and optimised through Kan Bans and forecasting.

Technical support and remote surveillance

Onsite technicians can get expert advice from our local technical support departments. These are placed in the regional service headquarters and serve as the escalating link to technology R&D. 24/7 remote surveillance is also handled by technical support, who remotely can reset any stopped turbines.

A strong partnership

In Vestas, we believe in forming close working relationships enabling you to achieve your business goals. Since each site is unique our first priority is to minimise cost of energy and increase business case certainty. We are dedicated to developing open and effective partnerships through ongoing communication. Our starting point is always the same: your business needs.

We design bespoke combinations of reporting, surveillance and analyses, giving you all the benefits of a managed performance centre. We hold business reviews on a regular basis to discuss performance and address potential performance issues.

You benefit from global access to information through a dedicated online portal containing tailored content such as documentation, news alerts and progress reports.

Safety

Safer ways to work
We are proud of our safety record at Vestas, but we're always striving to reduce accidents even further by developing safer ways to work. One way we achieve this is through a Safety First approach to any actions or decisions that undermine safety – no matter how small.

A shared responsibility
Working with wind turbines is not without risks. Heavy components in production, dizzying heights and unpredictable weather conditions during construction and service, all add up to a challenging work environment. But we refuse to accept that accidents are inevitable. Safety is paramount at Vestas, starting at the top with senior management. Individual employees also shoulder responsibility for their own well-being and the well-being of others. At a minimum we operate to the safety standards of OHSAS 18001 certification.

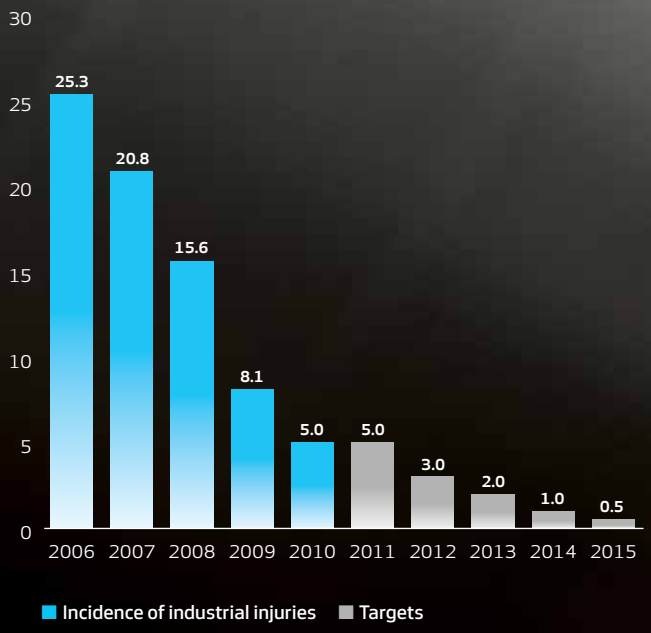
Failure is not an option
Our long-term goal is to avoid industrial injuries altogether. We are well on our way. In 2010, the incidence of industrial injuries causing lost time at Vestas was 5 per 1 million working hours. By 2012, we will lower it to a maximum of 3 per 1 million working hours.

Learning lessons, safeguarding staff
We monitor safety across the organisation. If an accident, near miss or hazard observation occurs, we have a detailed reporting process in place. This means we investigate what caused the incident and put measures in place to ensure it cannot happen again. We thoroughly safety-check new technologies and working practices before we introduce them, to make sure we identify any potential dangers early on. By helping to keep projects on time and on budget, safety in the workplace benefits both Vestas and our customers.

Walking the walk
Our managers and supervisors regularly conduct Safety Walks. This is a tour around a department, a site, or any work area to have an active dialogue with the employees about safety awareness with three main purposes:

- To reinforce safe behaviour and stop unsafe practises among staff, through dialogue
- To demonstrate we put safety first, through our presence on-site and commitment to resolving safety concerns with staff
- To raise safety awareness among employees and to ensure their concerns are addressed

Incidence of industrial injuries (per 1 mio. working hours)



In 2010, 1,222 managers and vice presidents completed their Safety Walk training – and performed almost 20,000 walks across the company.

Safety first – our ongoing quest

We will not rest until Vestas is among the safest companies in the world to work for. Current initiatives include:

Vestas Standards – Developing new global safety standards within electrical safety, control of hazardous energy and many more.

Safety Awareness – Behaving safer, making safe decisions and being positive role models for each other.

Incident Management – Enhancing the Incident Management process to ensure thorough root cause analysis; effective corrective, preventive actions are implemented to eliminate future injuries.

Global Wind Organisation – Participating in the association of international wind turbine owners and manufacturers. The group aims to promote basic safety training for everyone involved in the construction and operation of onshore and offshore wind farms. It focuses on medical certificates, manual handling and first aid, working at heights/rescuing from heights, and fire awareness for offshore sea survival.

Offshore

Energising your investment

Offshore pioneers reaching ever greater heights

At Vestas, we pioneered the offshore wind industry, so we know the technology inside-out. Since 1990 we have installed 580 wind turbines offshore, providing a total power capacity of more than 1,400 MW.

Spearheading the offshore wind revolution, we know how best to harness the raw power of offshore wind and transform it into clean, reliable energy which hits production forecasts time after time. Achieving revenue targets is an important priority across the company. We offer our customers accurate revenue plans to give them the business case certainty they rightly demand.

Nobody knows offshore wind like we do

Offshore is an important and integrated part of the products offerings from Vestas Wind Systems. With our offices across Europe, Scandinavia, and North America we are equipped to continue our expansion plans for the offshore market.

Our vast wealth of offshore experience contributes to superior turbine technology, convenient and cost-effective transport, fast and safe installation and a comprehensive programme of servicing and maintenance.

Stronger winds to boost your revenue

Why offshore? Offshore environments experience far stronger winds and less turbulence than sites on land, leading to higher levels of energy production and greater scope for profitability.

The offshore market has experienced double-digit growth in recent years and this is expected to continue in the future, with Vestas at the cutting edge of the latest technologies and techniques. As the industry matures, offshore wind will continue to increase its share of the global wind market. We can truly say that wind resources offshore are inexhaustible.

Experience counts in challenging environments

Successfully managing harsh offshore elements and sometimes extreme weather requires dedication and expertise. Fortunately, Vestas has more than 20 years of experience in all aspects of offshore project management, from supply-only contracts to full-scale engineering, procurement and construction (EPC) arrangements.

By employing the sort of careful planning in which we specialise, we can mitigate the risks associated with offshore energy production. We are well versed in handling all situations and complications which can arise during set-up of such complex projects, even when multiple suppliers and adverse natural conditions come into play. Our experience makes a big difference with major projects. For example, during 2010, we installed 100 turbines in less than 100 days at the Thanet offshore project – one month ahead of schedule and with one very happy customer. And on the Bligh Bank project off the Belgium coast, we successfully energised 55 turbines in 7.5 working days, paving the way for prompt energy production and lowering the overall cost of energy.

Skilled professionals help maximise your income

Offshore wind farm projects are ambitious, highly-specialised projects which unfold on a grand scale. As an investor, you need to be confident you are working with a partner with the capacity to support and enhance your plans to reap the ultimate rewards. At Vestas, we employ a diverse group of experienced and dedicated people across all skill sectors in the entire supply chain, from planners to designers, from engineers to managers.

Merely meeting expectations is never our goal – we aim to exceed our partner's vision every time. Our research and development branch is constantly working towards new innovations in installation and servicing, in the process cutting your costs, increasing turbine uptime and improving your profit margins. We take our industry leadership very seriously; operating at the forefront of the wind business is a source of pride to us and also an ongoing challenge which we strive to meet head-on.

Safety helps us deliver results

Working with 100-metre high turbines in strong offshore winds can be challenging and dangerous. At the heart of our business is an uncompromising approach to health and safety, summed up in our 'People before megawatts' policy. We carry out regular risk assessments and ensure all our staff and subcontractors undergo detailed safety training. Safety is something we aim to constantly develop at Vestas, with the ultimate aim of zero injuries. Our accident statistics reflect this firm stance and our safety principles are acknowledged as world-class within the wind industry.

Customised servicing tailored for you

We understand the complexity of offshore wind energy projects, which is why we design individual servicing agreements for each customer. Our service packages range from flexible, reactive arrangements to full-scope availability guarantees.

Our highly-skilled offshore technicians, supported by back-office engineers, work on-site every day weather permitting to ensure maximum uptime and business case certainty. The ultimate endorsement is that our customers regularly renew their service contracts with us.

We build a service hub on site with a dedicated team focused 100 per cent on the smooth and profitable operation of your turbines. Through our sophisticated logistics network, we ensure the right tools and spares are delivered on time, every time. For your ease of communication, you will be allocated a dedicated customer manager, giving you a single point of contact. You will also have access to detailed surveillance and performance data via an online customer portal, putting you firmly in the picture regarding your project's performance and allowing you to watch your investment grow.

Facts and figures

Wind energy - the numbers add up

At Vestas, wind is what we do, it is all we do and all we have ever done.
Our track record speaks for itself. Over the last 30 years we have installed more than 43,000 turbines in 65 countries across five continents. We were one of the first companies to identify the rich potential of wind and we remain the only major energy company in the world dedicated exclusively to harnessing its power.

Along the way we have gathered expertise, refined our processes and developed new products and techniques with the dual purpose of making the world a greener place and boosting the bottom line of our partners. A winning formula.

Our quest for innovation is ongoing. Our commitment to bringing the optimum return on investment for our customers and other stakeholders is total.

At Vestas, we know that achieving the best results means working in harmony with our partners. Whether it is collaborating on long-term planning or pooling research on essential tasks, our approach to cooperation translates into real and tangible benefits. By engaging with stakeholders we deliver greater certainty around key areas such as due diligence, environmental studies and permit regulations, as well as technological, engineering and logistical issues. On behalf of customers, we leverage our relationships with local authorities, green groups, suppliers, financial stakeholders and government relations units. Together, we can make a difference.

In an industry such as ours, experience matters. For more than three decades we have poured our passion and expertise into realising the full commercial potential of wind power. Now, through our relentless commitment to business case certainty, low cost of energy and partnership working, we can deliver the predictable and competitive cash flows that you, our customers, seek.

Track record by turbine type*

Turbine type	Quantity	Total MW
Other	26,511	13,909.00
V52-850 kW	3,764	3,199.40
V60-850 kW	15	12.75
V80-1.8 MW	1,016	1,828.80
V80-2.0 MW	2,981	5,962.00
V82-1.5 MW	213	319.50
V82-1.65 MW	2,883	4,756.95
V90-1.8 MW	572	1,029.60
V90-2.0 MW	3,286	6,544.20
V90-3.0 MW	2,170	6,510.00
V100-1.8 MW	20	36.00
V112-3.0 MW	2	6.00
Total	**43,433**	**44,114.20**

* Delivered Vestas wind turbines as of 31 December 2010.

Offshore track record by country*

Country	Quantity	Total MW
Belgium	55	165.00
Denmark	102	197.00
Japan	2	1.32
Netherlands	128	246.80
Sweden	11	12.97
United Kingdom	282	784.00
Total	**580**	**1,407.09**

* Delivered Vestas offshore wind turbines as of 31 December 2010..

Update

Vestas track record is updated every six months, and the latest version can always be found at vestas.com

Track record by country*

Country	Quantity	Total MW
Argentina	19	11.80
Aruba	10	30.00
Australia	554	1060.75
Austria	224	386.56
Azerbaijan	2	1.70
Belgium	120	274.67
Brazil	125	204.43
Bulgaria	110	292.20
Canada	1,021	1,683.10
Cape Verde	9	2.55
Caribbean Islands	2	0.20
Chile	64	116.68
China	2,615	2,964.05
Costa Rica	71	50.55
Croatia	21	47.95
Cuba	4	3.80
Cyprus	41	82.00
Czech Republic	44	64.47
Denmark	4,934	2,564.56
Egypt	124	79.08
Finland	38	18.45
France	586	1,104.95
Germany	5,879	7,405.13
Greece	698	944.32
Hungary	49	105.45
India	4,231	2,434.59
Iran	37	16.38
Israel	3	0.46
Italy	2,235	2,485.37
Jamaica	33	38.93
Japan	379	509.98
Jordan	5	1.13
Kenya	6	5.10
Latvia	1	0.85
Lithuania	6	18.00
Luxemburg	13	9.40

Country	Quantity	Total MW
Malaysia	1	0.15
Mauritius	1	0.10
Mexico	56	103.13
Morocco	84	50.40
Netherlands	1,280	1,506.35
New Caledonia	20	4.50
New Zealand	219	309.96
North Korea	2	0.18
Norway	27	15.88
Peru	1	0.25
Philippines	20	33.00
Poland	204	422.63
Portugal	347	628.90
Republic of Ireland	546	555.90
Romania	98	271.66
Russia	3	1.10
Slovakia	4	2.64
South Africa	3	4.21
South Korea	104	166.49
Spain	2,696	3,587.86
Sri Lanka	5	3.00
Sweden	1,012	1,117.63
Switzerland	17	24.56
Taiwan	50	86.10
Thailand	1	0.15
Turkey	139	375.91
USA	11,026	8,116.31
United Arab Emirates	1	0.85
United Kingdom	1,137	1,674.92
Uruguay	15	30.00
Total	**43,433**	**44,114.20**

* Delivered Vestas wind turbines as of 31 December 2010.

Turbines for all site conditions

Our broad product portfolio means that we have the ideal turbines for all sites and conditions.

No matter whether our smallest turbine the V52-850 kW or our largest turbine the V112-3.0 MW is the best choice for your specific project, you can rest assured that you will benefit from our long track record and in-depth knowledge of wind power technology.

To give you insight into the specifics of our turbines we have gathered some of the important technical data in this overview.

As you will see, we have a turbine for every condition and every requirement.

Go explore...

Turbine type	V80-2.0 MW	V80-2.0 MW GridStreamer™
Power regulation	pitch regulated with variable speed	pitch regulated with variable speed
Operating data		
Rated power	2,000 kW	2,000 kW
Cut-in wind speed	4 m/s	4 m/s
Rated wind speed	14 m/s	14.5 m/s
Cut-out wind speed	25 m/s	25 m/s
Re-cut-in wind speed	20 m/s	20 m/s
Wind class - IEC	IA and IIA	IA and IIA
Operating temperature range		
Standard temperature turbine	-20°C to +40°C	-20°C to +40°C
Low temperature turbine	-30°C to +40°C	-30°C to +40°C
Sound power**		
3 m/s		
4 m/s	94.0 dB(A)	94.0 dB(A)
5 m/s	99.3 dB(A)	99.3 dB(A)
6 m/s	103.0 dB(A)	103.0 dB(A)
7 m/s	104.5 dB(A)	104.5 dB(A)
8 m/s	105.2 dB(A)	105.2 dB(A)
9 m/s	105.2 dB(A)	105.2 dB(A)
10 m/s	105.2 dB(A)	105.2 dB(A)
Rotor		
Rotor diameter	80 m	80 m
Swept area	5,027 m^2	5,027 m^2
Nominal revolutions	16.7 rpm	16.7 rpm
Operational interval	10.8 - 19.1 rpm	
Air brake	full blade feathering with 3 pitch cylinders	full blade feathering with 3 pitch cylinders
Electrical		
Frequency	50 Hz/60 Hz	50 Hz/60 Hz
Generator type	4-pole doubly fed generator, slip rings	permanent magnet generator
Converter	Vestas Converter System (VCS) Vestas Converter Unity System® (VCUS®) Vestas Converter Scalar System™ (VCSS™)	full scale converter
Gearbox		
Type	two planetary stages and one helical stage	one planetary and two helical stages
Tower		
Type	tubular steel tower	tubular steel tower
Hub heights	60 m, 67 m and 78 m (IEC IA) 60 m, 67 m, 80 m and 100 m (IEC IIA)	65 m and 80 m
Blade dimensions		
Length	39 m	39 m
Max. chord	3.5 m	3.5 m
Nacelle dimensions		
Height for transport	4 m	4 m
Height installed	5.4 m (incl. CoolerTop®)	5.4 m (incl. CoolerTop®)
Length	10.4 m	10.4 m
Width	3.4 m	3.4 m
Hub dimensions		
Diameter	3.3 m	3.3 m
Width	4 m	4 m
Length	4.2 m	4.2 m
Max. weight per unit for transportation	70 metric tonnes	70 metric tonnes

** Noise reduced power modes are available

V90-1.8 MW	V90-1.8/2.0 MW GridStreamer™	V90-2.0 MW	V100-1.8 MW
pitch regulated with variable speed	pitch regulated with variable speed	pitch regulated with variable speed	pitch regulated with variable speed
1,800 kW (50 Hz) - 1,815 kW (60 Hz)	1,800 kW / 2,000 kW	2,000 kW	1,800 kW (50 Hz) - 1,815 kW (60 Hz)
4 m/s	4 m/s	4 m/s	3 m/s
13 m/s	13 m/s	12 m/s	12 m/s
25 m/s	25 m/s	25 m/s	20 m/s
20 m/s	23 m/s	20 m/s	18 m/s
IIA	IIA / IIIA	IIIA	S
-20°C to +40°C	-20°C to +40°C	-20°C to +40°C	-20°C to +40°C
-30°C to +40°C	-30°C to +40°C	-30°C to +40°C	-30°C to +40°C
			94.0 dB(A)
95.6 dB(A) (50 Hz) - 94.4 dB(A) (60 Hz)	95.6 dB(A)	95.6 dB(A)	96.2 dB(A)
99.8 dB(A) (50 Hz) - 99.4 dB(A) (60 Hz)	99.8 dB(A)	99.8 dB(A)	100.1 dB(A)
102.8 dB(A) (50 Hz) - 102.3 dB(A) (60 Hz)	103.0 dB(A)	102.8 dB(A)	103.9 dB(A)
103.7 dB(A) (50 Hz) - 103.5 dB(A) (60 Hz)	104.0 dB(A)	103.7 dB(A)	105.0 dB(A)
104.0 dB(A) (50 Hz) - 103.5 dB(A) (60 Hz)	104.0 dB(A)	104.0 dB(A)	105.0 dB(A)
104.0 dB(A) (50 Hz) - 103.5 dB(A) (60 Hz)	104.0 dB(A)	104.0 dB(A)	
104.0 dB(A) (50 Hz) - 103.5 dB(A) (60 Hz)	104.0 dB(A)	104.0 dB(A)	
90 m	90 m	90 m	100 m
6,362 m^2	6,362 m^2	6,362 m^2	7,850 m^2
14.9 rpm	15.2 rpm / 14.9 rpm	14.5 rpm	14.5 rpm
9.6 - 17.0 rpm	5.8 - 20.5 rpm	9.3 - 16.6 rpm	9.3 - 16.6 rpm
full blade feathering with 3 pitch cylinders	full blade feathering with 3 pitch cylinders	full blade feathering with 3 pitch cylinders	full blade feathering with 3 pitch cylinders
50 Hz/60 Hz	50 Hz/60 Hz	50 Hz	50 Hz/60 Hz
4-pole (50 Hz)/6-pole (60 Hz) doubly fed generator, slip rings	permanent magnet generator	4-pole doubly fed generator, slip rings	4-pole (50 Hz)/6-pole (60 Hz) doubly fed generator, slip rings
Vestas Converter System (VCS) Vestas Converter Unity System® (VCUS®) Vestas Converter Scalar System™ (VCSS™)	full scale converter	Vestas Converter System (VCS)	Vestas Converter System (VCS) Vestas Converter Unity System® (VCUS®) Vestas Converter Scalar System™ (VCSS™)
two planetary stages and one helical stage	one planetary and two helical stages	two planetary stages and one helical stage	one planetary stage and two helical stages
tubular steel tower	tubular steel tower	tubular steel tower	tubular steel tower
80 m, 95 m and 105 m (50 Hz) 80 m and 95 m (60 Hz)	80 m, 95 m and 105 m / 80 m, 95 m, 105 m and 125 m	80 m, 95 m, 105 m and 125 m	80 m and 95 m
44 m	44 m	44 m	49 m
3.5 m	3.5 m	3.5 m	3.9 m
4 m	4 m	4 m	4 m
5.4 m (incl. CoolerTop®)	5.4 m (incl. CoolerTop®)	5.4 m (incl. CoolerTop®)	5.4. m (incl. CoolerTop®)
10.4 m	10.4 m	10.4 m	10.4 m
3.4 m	3.4 m	3.4 m	3.4 m
3.3 m	3.3 m	3.3 m	3.3 m
4 m	4 m	4 m	4 m
4.2 m	4.2 m	4.2 m	4.2 m
70 metric tonnes	70 metric tonnes	70 metric tonnes	70 metric tonnes

Turbine type	V100-1.8 MW GridStreamer™	V90-3.0 MW	V100-2.6 MW
Power regulation	pitch regulated with variable speed	pitch regulated with variable speed	pitch regulated with variable speed
Operating data			
Rated power	1,800 kW	3,000 kW	2,600 kW
Cut-in wind speed	3 m/s	3.5 m/s	3.0 m/s
Rated wind speed	12 m/s	15 m/s	18 m/s
Cut-out wind speed	20 m/s	25 m/s	23 m/s
Re-cut-in wind speed	18 m/s	20 m/s	20 m/s
Wind class - IEC	S	IA and IIA	IEC IIB
Operating temperature range			
Standard temperature turbine	-20°C to +40°C	-20°C to +40°C	-20°C to +40°C
Low temperature turbine	-30°C to +40°C	-30°C to +40°C	-30°C to +40°C
Sound power**			
3 m/s	94 dB(A)		96.7 dB (A)
4 m/s	95.9 dB(A)	97.9 dB(A)	98.1 dB (A)
5 m/s	100.1 dB(A)	100.9 dB(A)	101.2 dB (A)
6 m/s	103.8 dB(A)	104.2 dB(A)	104.3 dB (A)
7 m/s	106.0 dB(A)	106.1 dB(A)	104.4 dB (A)
8 m/s	106.0 dB(A)	107.0 dB(A)	104.2 dB (A)
9 m/s	106.0 dB(A)	106.9 dB(A)	104.1 dB (A)
10 m/s	106.0 dB(A)		
Rotor			
Rotor diameter	100 m	90 m	100 m
Swept area	7,850 m^2	6,362 m^2	7,854 m^2
Nominal revolutions	14.9 rpm	16.1 rpm	13.37 rpm
Operational interval		8.6 - 18.4 rpm	6.72 - 13.37 rpm
Air brake	full blade feathering with 3 pitch cylinders	full blade feathering with 3 pitch cylinders	full blade feathering with 3 pitch cylinders
Electrical			
Frequency	50 Hz/60 Hz	50 Hz/60 Hz	50 Hz
Generator type	permanent magnet generator	4-pole doubly fed generator	4-pole doubly fed generator
Converter	full scale converter	Vestas Converter System (VCS) Vestas Converter Resistor System VCRS)	Vestas Converter System (VCS)
Gearbox			
Type	one planetary stage and two helical stages	two planetary stages and one helical stage	two planetary stages and one helical stage
Tower			
Type	tubular steel tower	tubular steel tower	Type tubular steel tower
Hub heights	80 m, 95 m and 125 m	65 m, 75 m, 80 m and 90 m (IEC IA) 65 m, 80 m and 105 m (IEC IIA)	
Blade dimensions			
Length	49 m	44 m	49 m
Max. chord	3.9 m	3.5 m	3.9 m
Nacelle dimensions			
Height for transport	4 m	4 m	4 m
Height installed	5.4. m (incl. CoolerTop®)	4 m	4 m
Length	10.4 m	9.65 m	9.65 m
Width	3.4 m	3.65 m (3.85 m installed)	3.65 m (3.85 m installed)
Hub dimensions			
Diameter	3.3 m	3.6 m	3.6 m
Width	4 m	4.2 m	4.2 m
Length	4.2 m	4.4 m	4.4 m
Max. weight per unit for transportation	70 metric tonnes	70 metric tonnes	70 metric tonnes

** Noise reduced power modes are available

V112-3.0 MW ONSHORE	V112-3.0 MW OFFSHORE	V52-850 kW	V60-850 kW*
pitch regulated with variable speed	pitch regulated with variable speed	pitch regulated with variable speed	pitch regulated with variable speed
3,075 kW	3,000 kW	850 kW	850 kW
3 m/s	3 m/s	4 m/s	3 m/s
13 m/s	12.5 m/s	17 m/s	13 m/s
25 m/s	25 m/s	25 m/s	18 m/s
23 m/s	23 m/s	20 m/s	
IIA and IIIA	IB	IA and IIA	IIB
-20°C to +40°C	-20°C to +35°C	-20°C to +40°C	-30°C to +35°C
-30°C to +40°C		-30°C to +40°C	
94.7 db(A)	96.0 dB(A)		
97.3 dB(A)	97.5 dB(A)		
100.9 dB(A)	100.9 dB(A)		
104.3 dB(A)	104.4 dB(A)		
106.0 dB(A)	107.5 dB(A)		
106.5 dB(A)	107.5 dB(A)		
106.5 dB(A)	107.5 dB(A)		
112 m	112 m	52 m	60 m
9,852 m^2	9,852 m^2	2,124 m^2	2,827 m^2
12.8 rpm	13.8 rpm	26 rpm	26.19 rpm
6.2 - 17.7 rpm	8.1 - 19.0 rpm	14.0 - 31.4 rpm	14.5 - 29.7 rpm
full blade feathering with 3 pitch cylinders	full blade feathering with 3 pitch cylinders	full blade feathering with 3 pitch cylinders	full blade feathering with 3 pitch cylinders
50 Hz/60 Hz	50 Hz	50 Hz/60 Hz	50 Hz
permanent magnet generator	permanent magnet generator	4-pole doubly fed generator, slip rings	4-pole doubly fed generator, slip rings
full scale converter	full scale converter	Vestas Converter System (VCS)	Vestas Converter System (VCS)
4-stage planetary/helical	4-stage planetary/helical	one planetary and two helical stages	one planetary and two helical stages
tubular steel tower	tubular steel tower	tubular steel tower	tubular steel tower
84 m and 94 m (IEC IIA) 119 m (IEC IIIA)	site specific	44 m, 49 m, 55 m, 65 m (IEC IA) 55 m and 74 m (IEC IIA)	60 m
54.65 m	54.65 m	25.3 m	29 m
4 m	4 m	2.3 m	2.3 m
3.4 m	3.4 m	3.1 m	3.1 m
6.8 m (incl. CoolerTop®)	6.8 m (incl. CoolerTop®)	2.9 m	2.9 m
12.8 m	12.8 m		
4.0 m	4.0 m		
3.74 m	3.74 m	2.4 m	2.4 m
3.75 m	3.75 m	2.8 m	2.8 m
5.42 m	5.42 m		
70 metric tonnes	70 metric tonnes	70 metric tonnes	70 metric tonnes

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