V90-1.8/2.0 MW

Maximum output at medium-wind and low-wind sites

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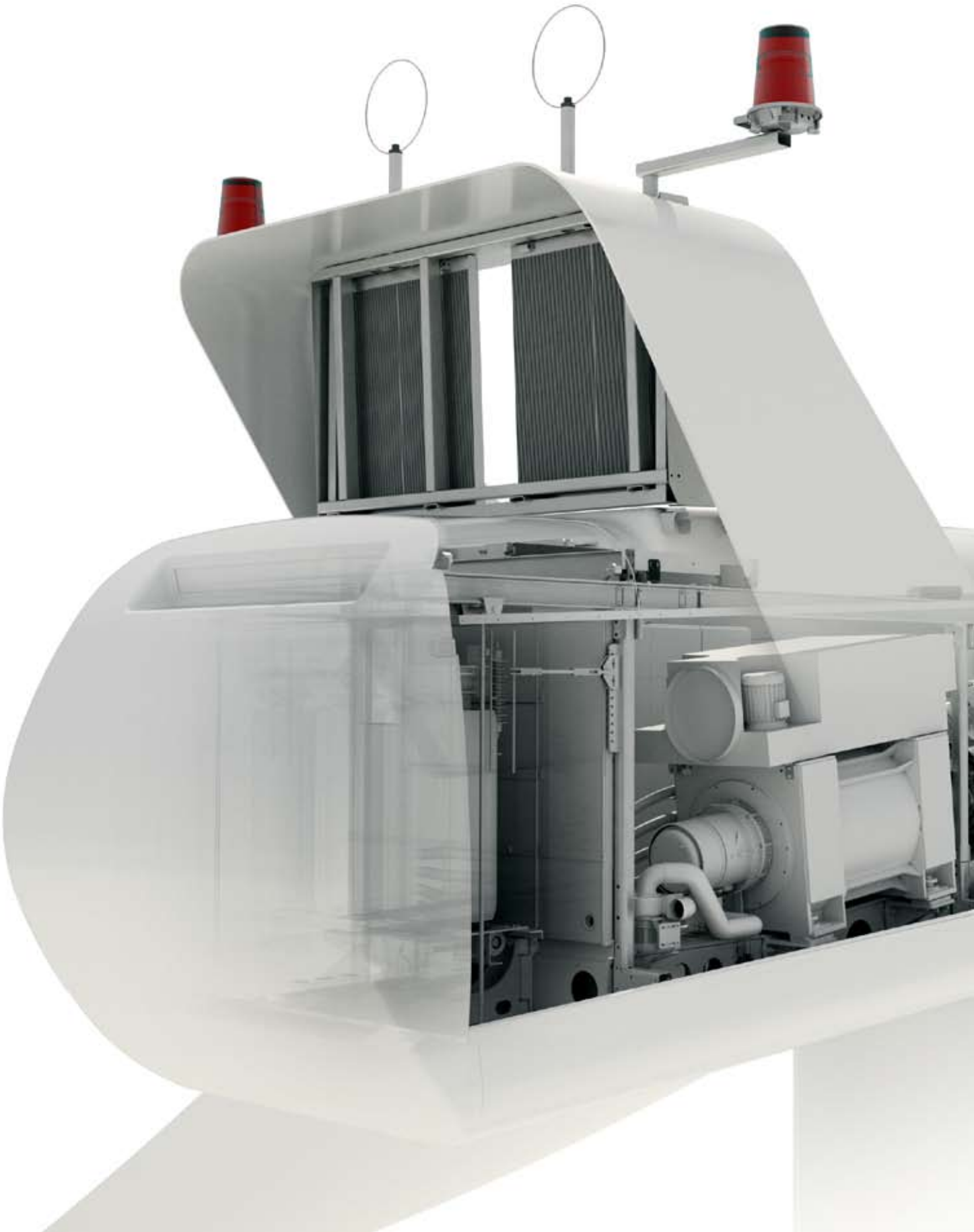
Vestas

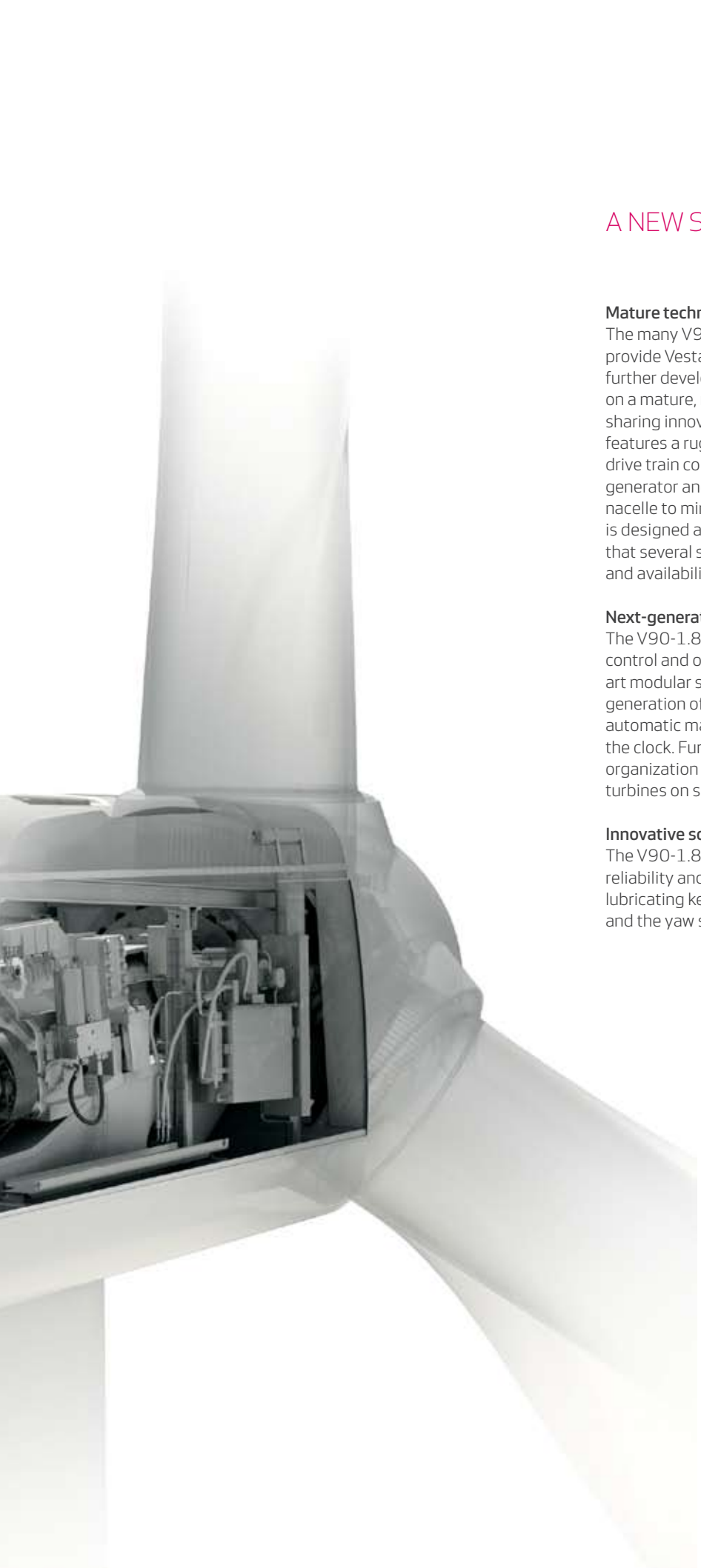

WE DELIVER
ON THE PROMISE
OF WIND POWER

SUPERIOR YIELD AT MEDIUM-WIND AND LOW-WIND SITES

Built on experience
The V90-1.8/2.0 MW turbine is designed to deliver optimal yield in its 1.8 MW configuration at medium-wind sites (IEC IIA) and in its 2.0 MW configuration at low-wind sites (IEC IIIA) and builds on decades of experience with existing Vestas turbines. We started with the nacelle from the V80-2.0 MW workhorse. Then we added the revolutionary blades used on the V90-3.0 MW high-wind turbine. Finally, all components were tuned to operate in harmony and take advantage of the special characteristics of medium-wind and low-wind sites.

Documented high availability and production
Vestas has installed more than 1,500 V90-1.8/2.0 MW turbines, since the first one was launched in 2004. If you count the entire 2 MW class, that number climbs to 5,000. All these turbines offer documented high availability and production. The V90-1.8/2.0 MW delivers low cost of energy, thanks to documented reliability and the highest yield in its class.



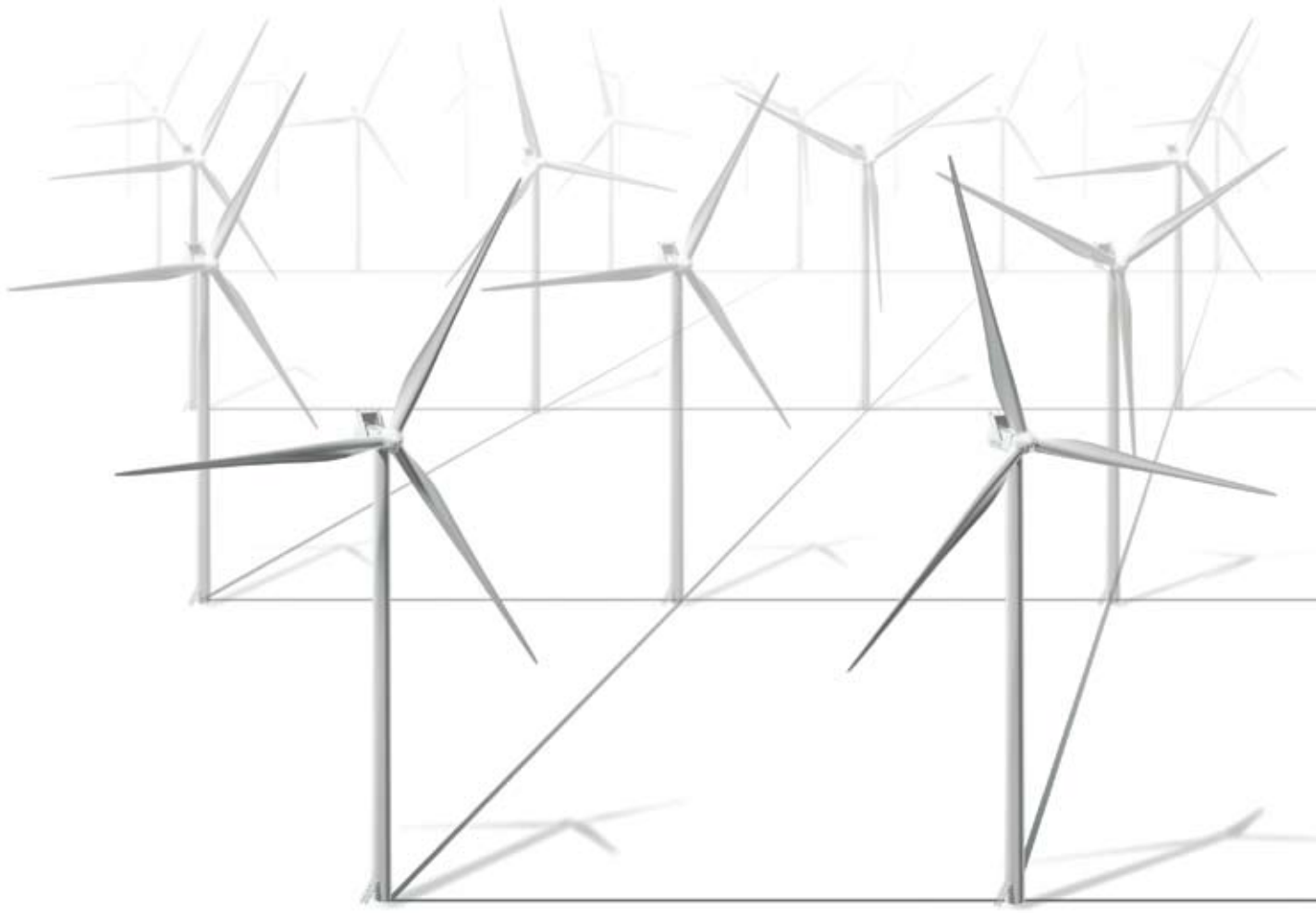


A NEW STANDARD FOR RELIABILITY

Mature technology ensures stable revenue
The many V90-1.8/2.0 MW turbines already in operation provide Vestas with invaluable knowledge on which to base further development. This means the V90-1.8/2.0 MW is built on a mature, reliable design platform, with several turbines sharing innovative, high-performance technology. The turbine features a rugged 6-gear yaw system, a proven, conventional drive train concept, a 50 Hz 4-pole generator or a 60 Hz 6-pole generator and a transformer, which is integrated with the nacelle to minimize power losses. Finally, the V90-1.8/2.0 MW is designed around a large number of standard components that several suppliers can provide, improving overall reliability and availability of the turbine.

Next-generation control system
The V90-1.8/2.0 MW is equipped with the latest turbine control and operation software VMP Global™, a state-of-the-art modular software platform developed to run the next generation of Vestas turbines. This software ensures reliable, automatic management of the V90-1.8/2.0 MW around the clock. Furthermore the software supports the service organization in monitoring and troubleshooting the wind turbines on site and remotely.

Innovative solutions for lubrication
The V90-1.8/2.0 MW offers a number of features that boost reliability and serviceability, including innovative solutions for lubricating key components such as the blade-bearing system and the yaw system.

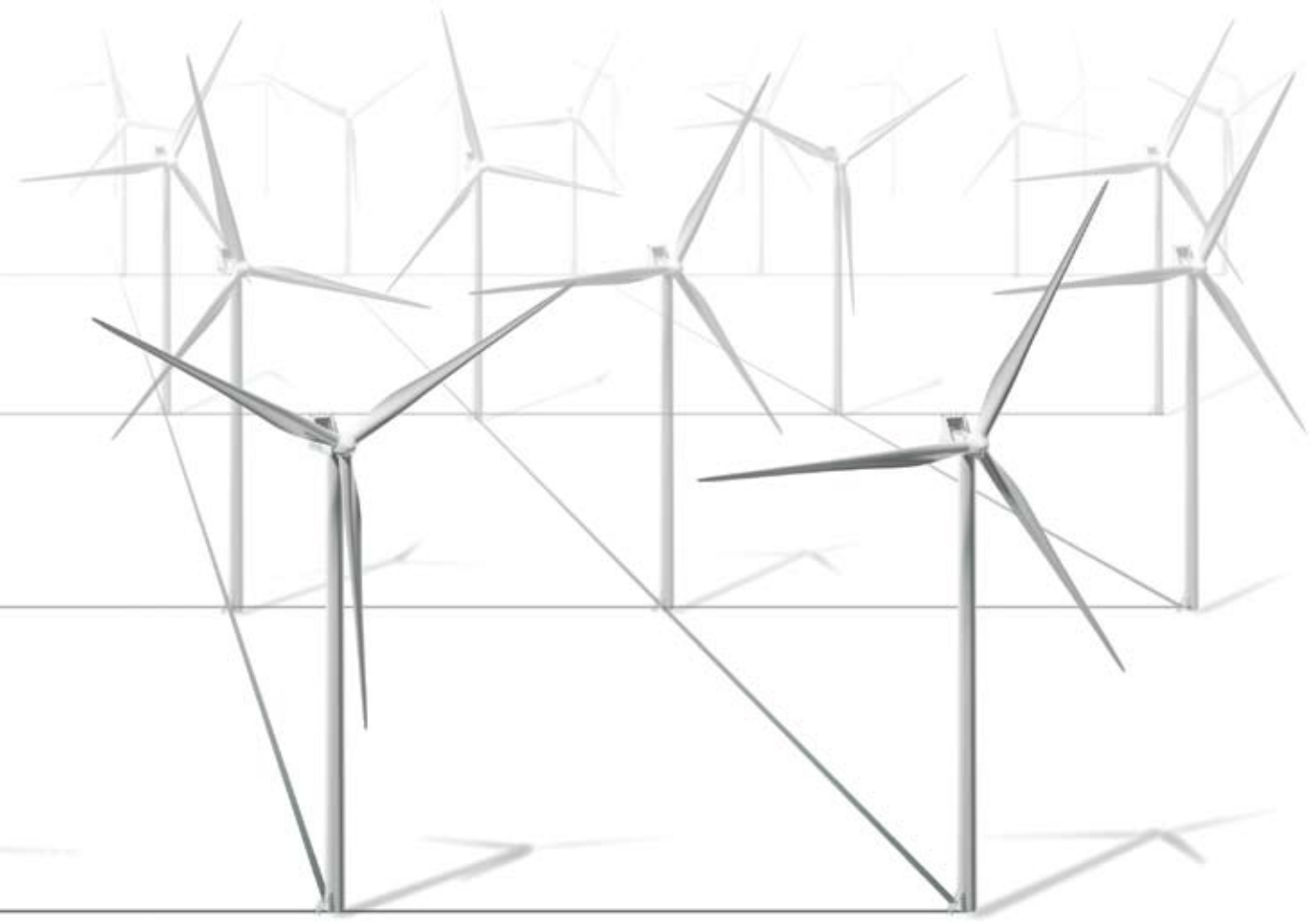


GROUNDBREAKING DESIGN AND EASY MAINTENANCE

Advanced grid operation and stable output
The V90-1.8/2.0 MW is equipped with VCS™ (Vestas Converter System), which ensures a constant and consistent output to the grid. Along with the turbine's pitch control, VCS™ also ensures energy optimization, low-noise operation and reduced load on the gearbox and other key components. The turbine's advanced grid compliance system provides fast and powerful active and reactive power regulation to maintain grid stability as well as excellent fault ride-through capabilities in the event of a grid disturbance.

Safety first and easy maintenance
Like all Vestas turbines, the V90-1.8/2.0 MW is designed for safe, convenient maintenance. Rotating parts are shielded, and all components are positioned to minimize service time and manpower.

3x44 metres of cutting edge
The revolutionary blades are made from carbon fibre and other lightweight materials. Even though V90s sweep a 27% greater area than V80s, the blade weight is almost the same. What's more, the shape of the blades has been refined to deliver the greatest possible output while minimizing the load on the turbine. The shape also makes these blades less sensitive to dirt, providing better performance at sites affected by salt, insects or other particles in the air.



Can be installed almost anywhere
The V90-1.8/2.0 MW is designed for fast, easy transport by truck, barge and rail to virtually any site in the world. The weight, height and width of all parts and main components are designed in consideration of local and international limits for standard transport. Installation, service and maintenance can be carried out using standard tools and equipment.

Special options
The V90-1.8/2.0 MW is available with a number of special options that can be provided at the customer's request. These options include:

- Condition monitoring system
- VestasOnline®, Compact or Business
- Switchgear
- Aviation markings on the blades
- Aviation lights
- Company logo
- Ice detection system
- Low temperature package allowing operation in temperatures as low as -30°C.

INNOVATIVE TECHNOLOGY FOR QUIET AND COOL OPERATION

CoolerTop™ saves energy and reduces sound levels
The environmentally friendly CoolerTop™ cools the water used in the turbine's cooling system by channeling wind into the heat exchanger. This boosts reliability, not least by reducing the number of moving parts and electrical components in the cooling system. CoolerTop™ also reduces the turbine's own energy consumption and it keeps sound levels low.

Low sound levels, high productivity
The V90-1.8/2.0 MW is a quiet turbine throughout its power curve, but it is even quieter during low-noise operation. The turbine can be operated in configurable modes that keep noise within defined sound levels, without having a significant effect on production. This makes the V90-1.8/2.0 MW ideally suited for sites where sound levels are a concern.


Vestas®

VESTAS TAKES CARE OF YOUR INVESTMENT ROUND THE CLOCK

Verified component lifetime
At the Vestas Testing Centre and Technology R&D, engineering experts and technicians use state-of-the-art testing methods to ensure that the turbine meets our standards for safety, performance and reliability throughout the 20-year service life. These tests push the components beyond their specifications. One method is known as Highly Accelerated Life Testing, which is performed in a HALT chamber. Extreme fluctuations in temperatures combined with heavy vibrations are just some of the stress tests the components are subjected to here. This enables Vestas to address design flaws before a turbine is introduced to the market.

Surveillance 24/7/365
Our surveillance services are manned 24/7 all year round to provide real-time surveillance, remote troubleshooting and other services. These services can also detect potential errors and disruptions before they occur, as data from your turbines is gathered and analyzed. This enables us to prepare a plan for preventative maintenance, in an effort to minimize unexpected production stops and costly downtime.

Service and maintenance
Vestas has service centres around the globe and we are able to cover your every need, from simple cleaning and planned maintenance to emergency call-outs and on-site inventories customized for your turbines.

Asset management and operation risk mitigation
Your wind turbines have to be maintained with great care to avoid exposing your investment to unnecessary risks. And that is exactly what Active Output Management is designed to ensure – that you get the greatest possible return on your investment in a Vestas wind turbine. AOM provides a number of advantages, such as detailed plans for service and maintenance, online monitoring, optimization and troubleshooting, and a competitive insurance scheme. We even offer a full availability guarantee, where Vestas pays compensation if the turbine fails to meet the agreed availability targets.

Project management for effective plants
The better your turbines fit your wind site, the more profitable your plant will be. That's why Vestas offers to take on project management from the initial wind measurements to complete installation of the wind power plant. More than 30 years of international experience and local expertise enable us to complete:

- Wind and site studies
- Designing the wind power project
- Selecting wind turbine types
- Installing the wind farm
- Servicing and maintenance throughout the turbine's service life
- Monitoring and remote troubleshooting.

TECHNICAL DATA FOR V90-1.8/2.0 MW

Power regulation	pitch regulated with variable speed

Operating data	**IEC IIA**	**IEC IIIA**
Rated power	1,800 kW	2,000 kW
Cut-in wind speed	4 m/s	
Rated wind speed	12 m/s	
Cut-out wind speed	25 m/s	
Frequency	50 Hz/60 Hz	
Operating temperature	standard range -20°C to 40°C	
	low temperature option -30°C to 40°C	

Sound power

(10 m above ground, hub height 80 m air density 1,225 kg/m^3)

4 m/s	94.4 dB(A)
5 m/s	99.4 dB(A)
6 m/s	102.5 dB(A)
7 m/s	103.6 dB(A)
> 8 m/s	104 dB(A)

Rotor

Rotor diameter	90 m
Swept area	6,362 m^2
Nominal revolutions	14.5 rpm
Operational interval	9.3 - 16.6 rpm
Air brake	full blade feathering with 3 pitch cylinders

Tower

Type	tubular steel tower
Hub heights	80 m, 95 m and 105 m (IEC IIA) 95 m, 105 m and 125 m (DIBt II)

Generator	**50 Hz**	**60Hz**
Type	4-pole asynchronous with variable speed	6-pole asynchronous with variable speed
Nominal output	1,800 kW/ 2,000 kW	1,800 kW

Gearbox

Type	3-stage planetary/helical

Main dimensions

Blade

Length	44 m
Max. chord	3.5 m
Weight	6,700 kg

Nacelle

Height for transport	4 m
Height installed (including CoolerTop™)	5.4 m
Length	10.4 m
Width	3.4 m
Weight	70 metric tonnes

Hub

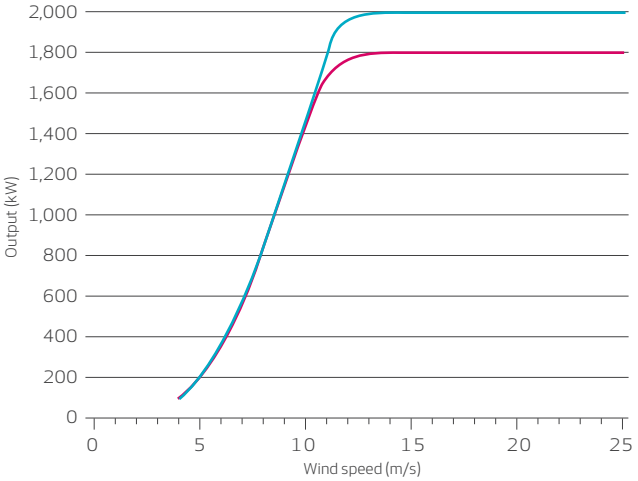
Max. diameter	3.3 m
Max. width	4 m
Length	4.2 m
Weight	18 metric tonnes

Tower

80 m	
Weight	148 metric tonnes
95 m	
Weight	206 metric tonnes
105 m	
Weight	245 metric tonnes
125 m	
Weight	335 metric tonnes

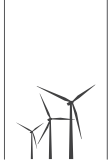
Power curve V90-1.8/2.0 MW

Noise reduced sound power modes are available.



No. 1 in Modern Energy

The world needs ever-greater supplies of clean, sustainable energy. Modern energy that promotes sustainable development and greater prosperity for all our planet's inhabitants. Vestas wind turbines are already generating more than 60 million MWh of electricity every year – enough to power all of Spain, for example – and we are ready to go even further. After more than 30 years in business, Vestas continues to pioneer the wind energy business, achieving breakthroughs that transform our entire industry.



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