

V90-3.0 MW
An efficient way to more power





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For more than 20 years, Vestas has been a leader in the development, manufacture, sale, marketing, service and maintenance of wind turbines. This has contributed to improving the competitiveness of wind power.

The wind power industry is growing rapidly. Therefore, it is particularly important to focus on the overall performance capacity of turbines with state-of-the-art technology. With the introduction of the V90-3.0 MW turbine, Vestas is once again expanding the boundaries of what is possible in wind power technology.

Based on new thoroughly tested technology combined with known and proven Vestas Technology, the V90-3.0 MW is a natural extension of Vestas' existing range of MW class turbines.

The ultimate goal for the development of the V90-3.0 MW turbine was clear from the very beginning:



The cost price per kilowatt hour generated, calculated over the design lifetime of the turbine – i.e. 20 years – was to be lower than ever before.

44 metres of innovative blade technology

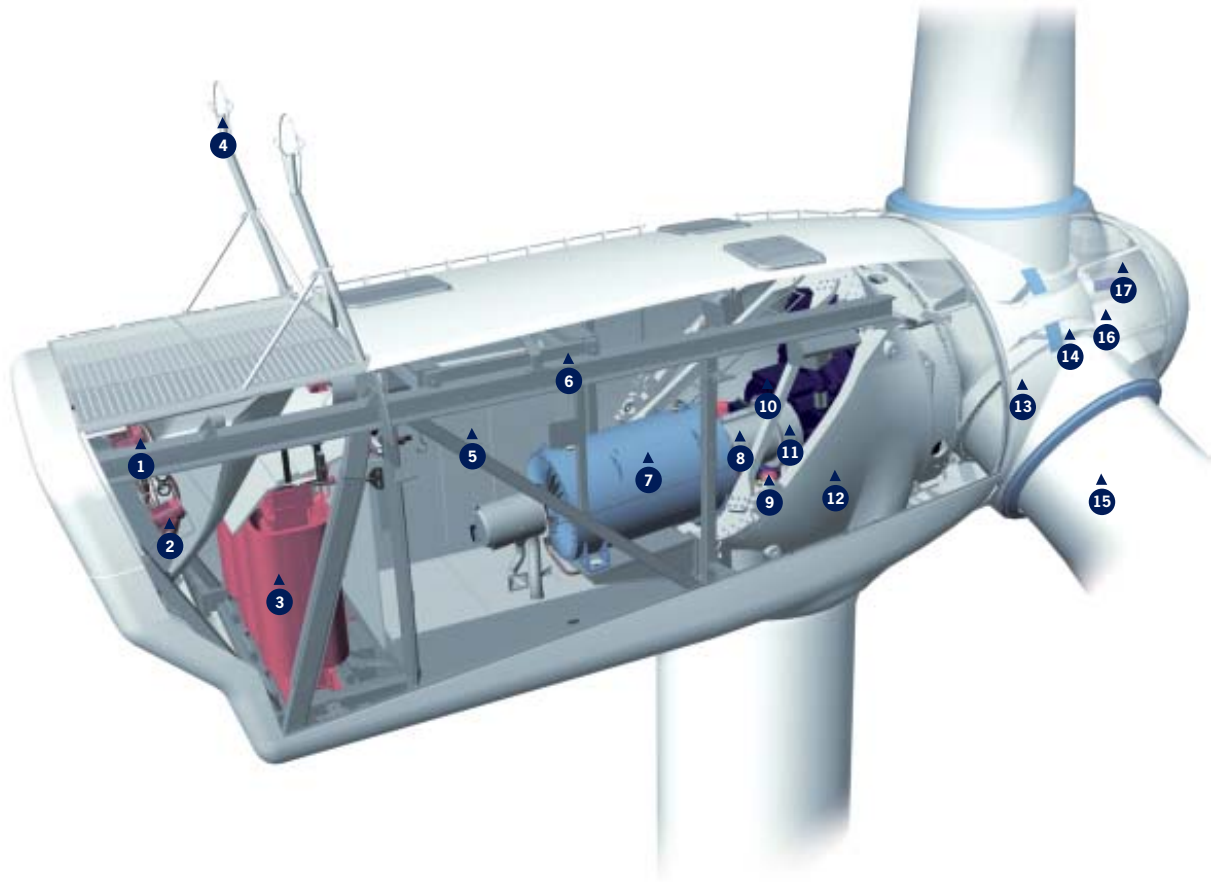
The conventional design approach states that the desire for greater output is inevitably linked with bigger, heavier turbines. This, however, would make it difficult to achieve the overall goal of producing energy at a lower cost price per kilowatt hour.

The new blade design for the V90-3.0 MW turbine features a number of new exciting developments.

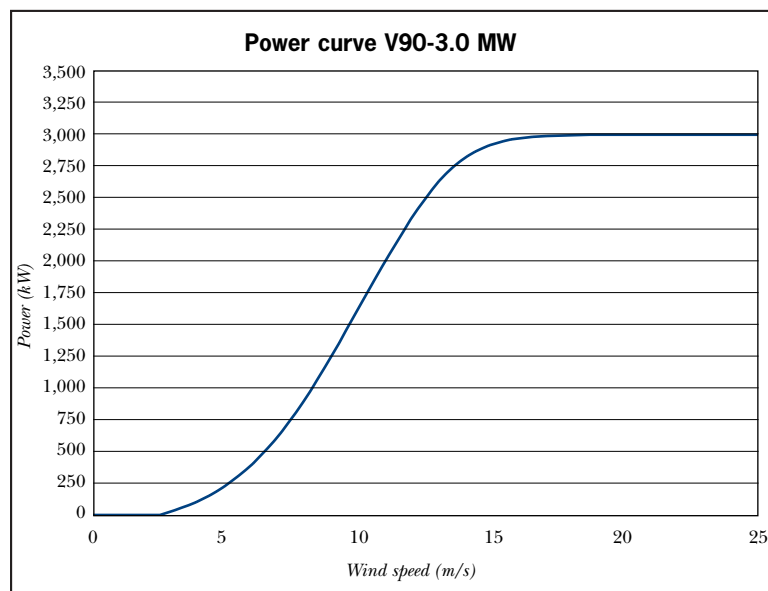
The new blade is extremely light, a breakthrough Vestas achieved by using a range of new materials. For example, carbon fibre – a strong, rigid yet very light material – has been used instead of fibreglass for the load carrying structure of the blade. Due to the strength of carbon fibre, it has been possible to reduce the amount of material used for the blades, thus cutting the overall weight even further and consequently reducing loads. In fact, the new 44-metre blades for the V90 rotor are lighter than the 39-metre blades for the V80 rotor.

Moreover, Vestas has made great improvements to the airfoil design of the new blades. These airfoils are the first in a new generation, improving energy production, reducing sensitivity to roughness on the leading edge of the blade, and maintaining a good geometrical relationship between one airfoil thickness and the next. The geometry of the new blades was defined by optimising the relationship between the overall impact of load on the turbine and its annual energy production. The airfoil was developed in collaboration with the Risø National Laboratory in Denmark.

The innovative Vestas blade design improves performance and increases output yet reduces the loads transferred to the machine.

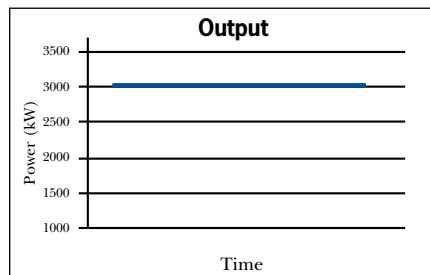
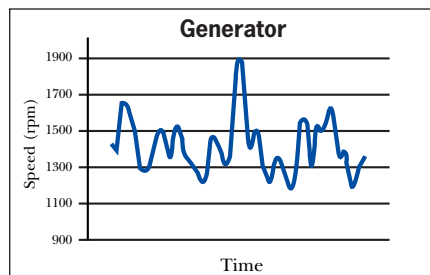
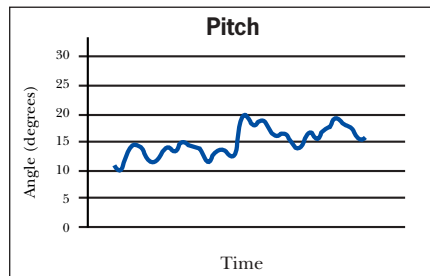
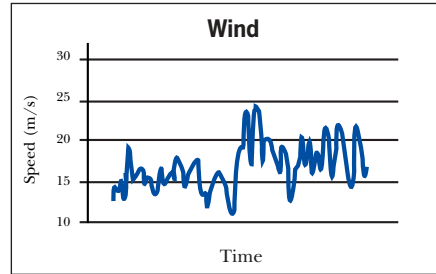


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|-------------------------------------|---------------------------|-----------------------|-------------------|
| 1 Oil cooler | 6 Service crane | 11 Parking brake | 16 Pitch cylinder |
| 2 Generator cooler | 7 OptiSpeed® generator | 12 Machine foundation | 17 Hub controller |
| 3 Transformer | 8 Composite disc coupling | 13 Blade bearing | |
| 4 Ultrasonic wind sensors | 9 Yaw gears | 14 Blade hub | |
| 5 VMP-Top controller with converter | 10 Gearbox | 15 Blade | |



Technical specifications

Rotor				
Diameter:	90 m			
Area swept:	6,362 m ²			
Nominal revolutions:	16.1 rpm			
Operational interval:	9-19 rpm			
Number of blades:	3			
Power regulation:	Pitch/OptiSpeed®			
Air brake:	Three separate pitch cylinders			
Tower				
Hub height:	65 m, 80 m, 90 m, 105 m			
Operational data				
Cut-in wind speed:	4 m/s			
Nominal wind speed (3,000 kW):	15 m/s			
Stop wind speed:	25 m/s			
Generator				
Type:	Asynchronous with OptiSpeed®			
Rated output:	3,000 kW			
Operational data:	50 Hz 1,000 V			
Gearbox				
Type:	Planetary/helical stages			
Control				
Type:	Microprocessor-based control of all the turbine functions with the option of remote monitoring. Output regulation and optimisation via OptiSpeed® and OptiTip® pitch regulation.			
Weight (IEC)				
Hub height:	65 m	80 m	90 m	105 m
Tower:	115 t	156 t	205 t	275 t
Nacelle:	66 t	66 t	66 t	66 t
Rotor:	38 t	38 t	38 t	38 t
Total:	219 t	260 t	309 t	379 t
<i>t = metric tons</i>				



OptiSpeed® allows the nominal speed of revolution of both the rotor and the generator to vary by approximately 60%. This minimises both unwanted fluctuations in the output to the grid supply and the loads on the vital parts of the construction.

All specifications subject to change without notice.

* Vestas OptiSpeed® is not available in the USA and Canada.



New ground-breaking nacelle design

Vestas chose to travel unconventional paths in developing a new, reliable and sturdy nacelle that can generate more energy – without increasing the overall size and weight of the nacelle itself or the loads applied on the tower and foundation.

Vestas excelled itself and can now launch a new, ground-breaking design. The innovative features of this design allow the forces acting on the machine to be absorbed by an optimised machine foundation. It also made it possible to fit the hub to a large bearing located on the outer periphery of the gearbox which, among other things, eliminates the need for a conventional main shaft. This results in an appreciably lighter construction. The new gearbox design has been reviewed by independent experts, and comprehensive testing has proven its efficiency. In addition, Vestas' research lab has performed full-scale tests on the gears.

The new design changed the physical demands on the construction and made it possible to reduce the length of the nacelle compared with its predecessor, the V80. This also minimises the yaw loads. The weight of the nacelle is almost the same as the V80-2.0 MW nacelle.

Transport and logistics are becoming a major consideration when constructing wind farms with the MW class wind turbines. Consequently, another innovation from Vestas is a nacelle that has become its own transport support system. Until now, the only option has been to load the nacelle onto a transport bed frame. In contrast, the new design is self-supporting, the transport equipment can be attached directly to the nacelle, thus eliminating the need for a transport bed frame.

Strong and light tower

By implementing a number of improvements in the design, Vestas introduces a new tower for the V90-3.0 MW turbine.

Intelligent design has resulted in a tower that is lighter. One of the breakthroughs increasing the fatigue strength of the tower was the innovative idea of using magnets to fasten the interior components to the tower wall rather than using welded brackets. Ultimate strength was achieved by using a stronger steel type than previously. The 80 metre tower for the V90-3.0 MW turbine weighs only approximately 156 tons, where a similar V80 tower model at the same height weighs around 200 tons.

Vestas has reduced total tower weight by approximately 44 tons, thus facilitating more cost effective transport.

Easier service and maintenance

Another significant improvement in the V90-3.0 MW turbine is that it requires only one preventive maintenance visit per year as opposed to the present industry standard of two. Access to the turbine has been simplified, with optimised placement of components inside the tower and nacelle. More room is provided to operate, making it easier to perform service and maintenance tasks.

Service requirements have been reduced due to a range of improved features such as automatic blade bearing lubrication and an oil-lubricated yaw system. These and a range of other improvements made it possible to design the Vestas V90-3.0 MW turbine to need only one service check a year.

All in all, the result is lower operational and maintenance costs per kilowatt hour.

With the introduction of the V90-3.0 MW turbine, Vestas has once again developed an outstanding turbine fitted for both onshore and offshore locations.

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