

# V80-2.0 MW

Pitch regulated wind turbine with OptiTip® and OptiSpeed™



**Vestas**



## The ideal solution for inland placement

The Vestas V80-2.0 MW turbine is a pitch-regulated turbine with an 80 meter diameter three bladed rotor. The new turbine is a further development of the well-known technology from the V66-1.65 MW. The speed of

revolution of the rotor of the V80-2.0 MW turbine varies between 9 and 19 rpm, and this flexibility is one of the reasons why this turbine is ideal for installation in areas with modest wind speeds.

## Vestas OptiSpeed™\*

The V80-2.0 MW turbine is equipped with OptiSpeed™, a system that allows the turbine blades to rotate at varying speeds. OptiSpeed™ is a further development of the OptiSlip® system, which allowed the speed of revolution of both the rotor and the generator to vary by as much as 10%. With OptiSpeed™, the speed of revolution can now vary by up to approx. 60%.

OptiSpeed™ is an efficient solution because the converter only transforms the energy from the generator rotor, which is only a small part of the total energy generated by the system. The energy generated by the generator rotor is converted back into electricity suitable for the grid by the converter.

Thanks to the converter, the need to consume reactive power from the electricity grid is eliminated. However, it is possible to adjust the turbine to supply or consume reactive power, if required.

In short: OptiSpeed™ optimises energy production, especially in modest winds, making it easy to adapt the operation of the turbine to the parameters of the electricity grid.

## Lower sound level

Sound levels are of crucial importance when deciding on the placement of wind turbines in populated inland areas – often at locations where wind speeds are low. Thanks to the low speed of revolution of the V80-2.0 MW turbine in modest wind speeds Vestas has taken yet another important step towards fulfilling requirements for a wind power solution with a low sound level. The OptiSpeed™ feature also makes it possible to program the turbine sound levels before installation, so the operation of the turbine is tailor-made for the specific characteristics of the chosen location.

## Optimal pitch with OptiTip®

As with all other Vestas turbines, the V80-2.0 MW turbine is equipped with microprocessor-controlled OptiTip® pitch regulation, which ensures continuous and optimal adjustment of the angles of the blades in relation to the prevailing wind. The OptiTip® and OptiSpeed™ systems make it possible to optimise the solution to the often contradictory requirements for high output and low sound levels, depending on the location. On the V80-2.0 MW turbine, the pitch mechanism is fitted in the blade hub itself, and contains a separate hydraulic pitch cylinder for each blade. These separate pitch cylinders also ensure triple braking safety, because one feathered blade is sufficient to stop the turbine.

## Lightning protection

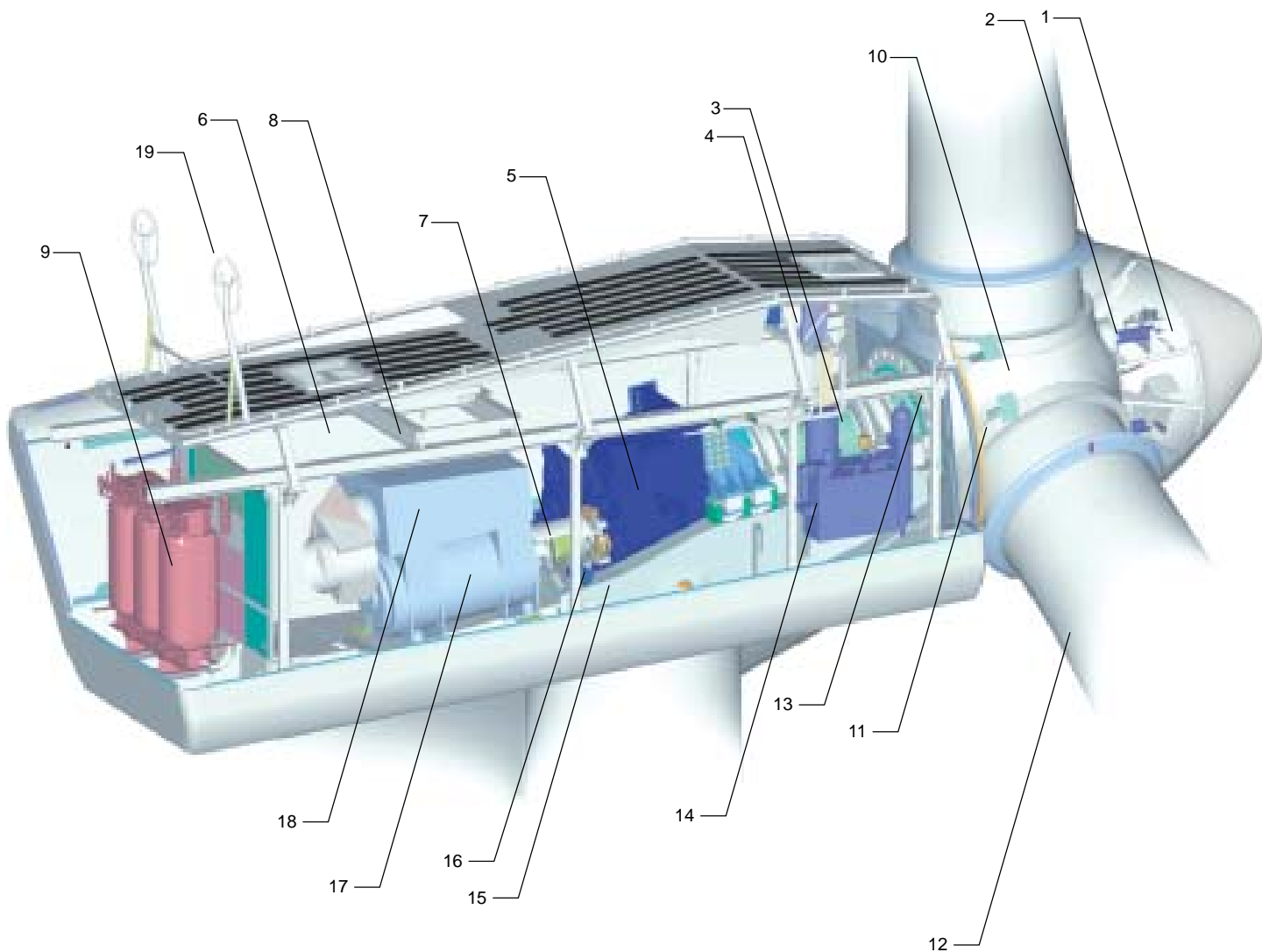
Naturally, the new turbines are equipped with Vestas Lightning Protection, which protects the entire turbine from the tips of the blades to the foundations. The system conducts almost all lightning strikes harmlessly past the sensitive parts of the nacelle and down into the earth. As an extra safety measure, the delicate control units and processors in the nacelle are also protected by an efficient shielding system. The lightning protection system is an improvement of the system used on earlier Vestas turbines. Naturally, it has been thoroughly tested and conforms to both the DEFU recommendation and the applicable IEC standards.

## Proven Performance

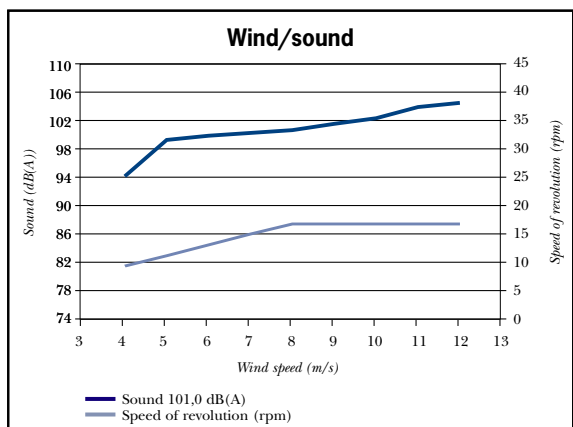
We spend many months testing and documenting the performance of the Vestas turbines. When we are finally satisfied, we run one last check by allowing an independent organisation to verify the results. This is standard practice at Vestas – a procedure we call Proven Performance. It is our guarantee that your Vestas turbines meet the very highest requirements for energy production, availability factor, power quality and sound levels.



\*) Vestas OptiSpeed™ is not available in the USA and Canada.



- |                                      |                          |
|--------------------------------------|--------------------------|
| 1. Hub controller                    | 10. Blade hub            |
| 2. Pitch cylinder                    | 11. Blade bearing        |
| 3. Main shaft                        | 12. Blade                |
| 4. Oil cooler                        | 13. Rotor lock system    |
| 5. Gearbox                           | 14. Hydraulic unit       |
| 6. VMP-Top controller with converter | 15. Machine foundation   |
| 7. Parking break                     | 16. Yaw gears            |
| 8. Service crane                     | 17. OptiSpeed™-generator |
| 9. Transformer                       | 18. Generator cooler     |
|                                      | 19. Ultra-sonic sensors  |



The figure illustrates the relationship between wind and sound levels as well as wind and speeds of revolution for turbines equipped with OptiSpeed™. It clearly shows the sound level advantages of lower speeds of revolution because the turbine's measured sound level at the lowest level is approx. 7 dB(A) lower at 4 m/s than at 8 m/s. For other sound levels, the advantage is up to 10 dB(A). It should also be noted that a decrease of 3 dB(A) is considered to decrease the sound level by half.

### Rotor

Diameter:	80 m
Area swept:	5,027 m <sup>2</sup>
Speed of revolution:	16.7 rpm
Operational interval:	9-19 rpm
Number of blades:	3
Power regulation:	Pitch/OptiSpeed™
Air brake:	Three separate pitch cylinders

### Tower

Hub height (approx.): 60 - 67 - 78 m

### Operational data

Cut-in wind speed:	4 m/s
Nominal wind speed (2000 kW):	15 m/s
Stop wind speed:	25 m/s

### Generator

Type:	Asynchronous with OptiSpeed™	Asynchronous with OptiSpeed™
Nominal output:	2,000 kW	2,000 kW
Operational data:	50 Hz 690 V	60 Hz 690 V

### Gearbox

Type: Planet/parallel axles

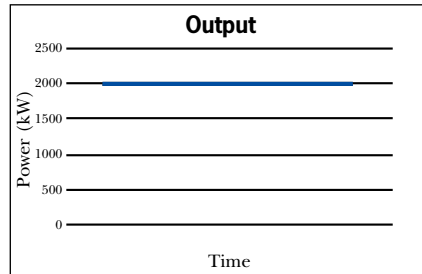
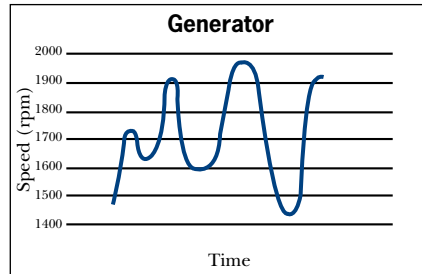
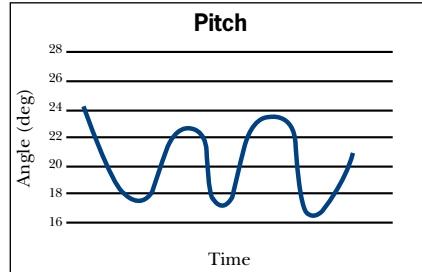
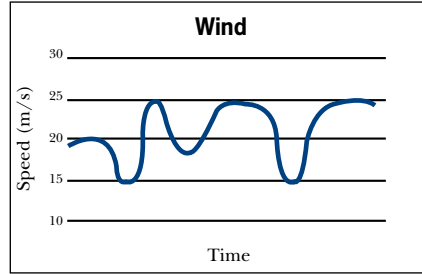
### Control

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 IA/IEC IIA)

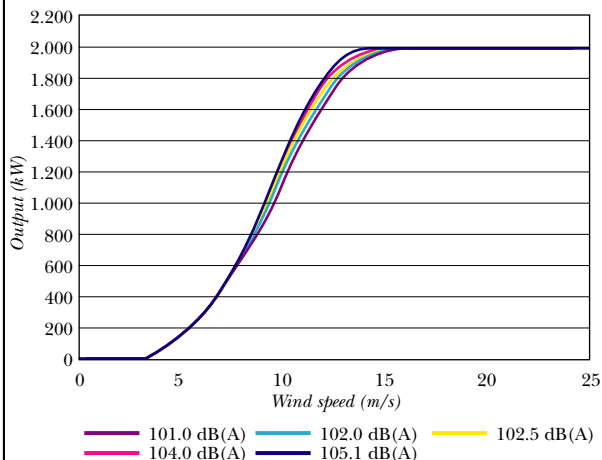
Hub height:	60 m	67 m	78 m
Tower:	140 t/125 t	158 t/143 t	203 t/199 t
Nacelle:	61 t	61 t	61 t
Rotor:	34 t	34 t	34 t
Total:	235 t/220 t	253 t/238 t	298 t/294 t

## Vestas V80-2.0 MW turbine with OptiSpeed™



OptiSpeed™ allows the revolution speeds of both the rotor and the generator to vary by approx. 60%. This minimises both unwanted fluctuations in the grid supply and the loads on the vital parts of the construction.

### V80-2.0 MW power curves



The sound output level can be adjusted by varying the revolution speed of the turbine as illustrated in the figure below. In practice, this means that the sound level recorded at a distance of 340 m (hub height 78 m), for example, can be reduced from 44.5 to 40.4 dB(A) – i.e. by more than half the recorded level.

# Efficient in modest winds



When establishing wind power plants, the first sites considered are usually coastal areas, deserted stretches of land and the sea. Quite naturally, as it is in these locations that wind conditions are most favourable. However, there is an art to generating energy where it is needed, and this often involves inland areas with modest wind conditions and short distances to built-up areas. That is why we are launching a new Vestas turbine, the V80-2.0 MW.

This new turbine can generate wind energy in areas with modest wind conditions, areas that were previously considered not economically viable or were not chosen due to concerns about sound levels. Not only is the new turbine extremely efficient in modest winds, but its sound level can also be adapted to match local requirements. All these advantages are due to the new Vestas OptiSpeed™ system, which allows the revolution speed to vary by up to approx. 60%.

The V80-2.0 MW is the largest Vestas turbine to date, irrespective of whether it is measured by production or size. It is a turbine that, in its own efficient and considerate way, generates environment-friendly energy where people need it.

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