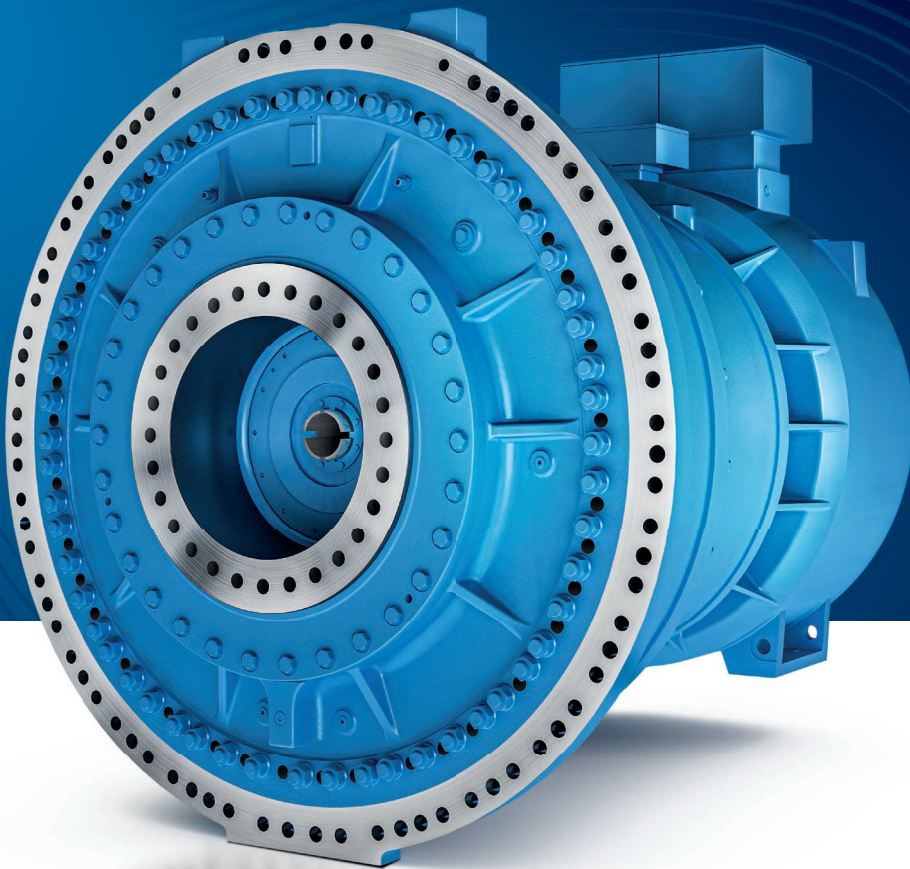




# ***Winergy HybridDrive***

The power pack for wind turbines



# Winergy

## HybridDrive

The Winergy HybridDrive is the answer to the challenge of further reducing the cost of power generation. The direct connection of a two- or three stage planetary gearbox with a permanent magnet synchronous generator creates a medium-speed drive concept that guarantees maximum efficiency. Both Winergy's mechanical and electrical engineering expertise are reflected in the HybridDrive. The new concept offers the following advantages:

### **The compact choice for wind turbines**

The HybridDrive is characterized above all by its very compact design. The functional integration of the gearbox with the generator allows a reduction of the drive train length by up to 50% and a weight saving of more than 15% compared to a disintegrated drive train. This also allows the nacelle size to be significantly reduced, resulting in weight savings of the entire turbine.

### **Modular drivetrain design**

The modular design of the HybridDrive reduced drivetrain development with low technical risk. At Winergy, mechanical and electrical components have been optimally developed and reliably manufactured for over 40 years. This ensures the optimal interface between generator and gearbox.

### **Significant weight saving**

The permanent magnet generator with oil cooling allows more than 10% weight savings compared to the DFI generator in a disintegrated drive train, despite multiple torque. In any case, the High Density<sup>X</sup> gearbox technology additionally promises higher power density. The functional integration with the gearbox as well as internal brake disks are two of many reasons for further weight savings of the entire drive train by more than 15% in total.

### **Flexible application for any nacelle configuration**

The HybridDrive can be flexibly integrated into any transformer configuration. The converter and transformers can be positioned modularly at the top or bottom of the tower. Flexible configuration options in drive train development.

### **Reduced service costs**

The HybridDrive concept promises high component durability and reliability. The functional integration offers the advantage of a common maintenance-friendly bearing for both components. Furthermore, no slip rings or brushes are required in the generator. This results in a total reduction in service costs of more than 5%.

### **Low dependence on raw materials**

Thanks to the integrated two- or three stage planetary gearbox, the HybridDrive requires a much smaller permanent magnet generator for its medium-speed generator than in comparable DirectDrives. As a result, the proportion of the raw material „rare earths“ is 80% lower than in DirectDrives. This results in a minimized dependence on the raw material „rare earths“ and offers stable and long-term cost calculations.

### **Low noise emission**

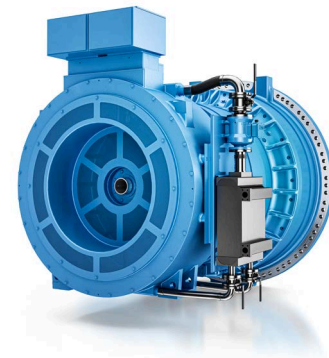
The new medium-speed drive technology significantly decreases the noise level along with the reduced output speed of the gearbox. In addition, we use an oil-cooled generator without an additional fan instead of the usual air-cooled generator.

### **Journal bearings installed as standard**

Winergy journal bearings are installed as standard in the HybridDrive. The journal bearings optimize the vibration behavior, as well as the noise emissions and the efficiency of the system at lower cost. This results in increased reliability of the system and reduced service costs.

### **LCoE reduction with the HybridDrive**

The efficiency and thus the achievable output energy are fully scalable. Winergy has developed the HybridDrive in order to realize improved LCoE for customers. Special advantages bring the mentioned modularity of the system, as well as the oil cooling of the generator and the high efficiency related to the whole system. Benefit from the increase of the AEP and the improved efficiency of more than 96.5%, related to the whole system.



Oil-cooled generator of the HybridDrive

HybridDrive specifications	
Power class	Up to 20 MW
Application	On- and Offshore
Total weight	45t ... 120t
Gearbox specification	
Rated torque	6.000 ... 20.000 kNm
Torque density	Depending on application > 200 Nm/kg
Gear ratio	i=35 ... 100
Efficiency	Up to 99%
Generator specification	
Voltage	LV, on request
Torque density	Up to 20 Nm/kg
Full load efficiency	96,5% ... 98%
Cooling options	oil/water, air/water, air

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