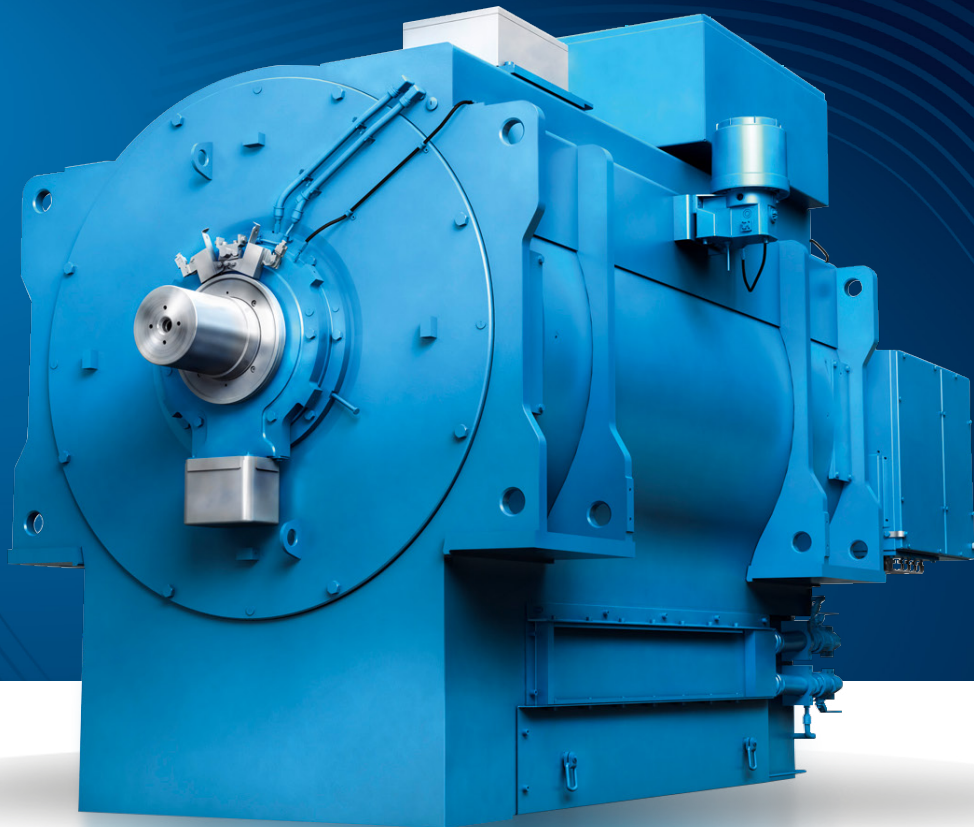




Winergy generator

Wind is our element



Outstanding quality – for maximum yield



In the wind sector, Winergy Wind Generators have been well known for some time now. They stand for outstanding quality, which ensures maximum energy yield and the highest system availability. That is why our wind turbine generators have enjoyed one of the top positions in the global market for decades now. Our portfolio extends up to 20 MW for onshore and offshore applications, and is always perfectly adapted to the particular wind turbine system concept.

The advantages of our wind turbine generators at a glance:

- **Proven quality:** over 50,000 times
- **Rugged and weatherproof:** smooth disturbance free operation in all climate zones – even under harsh conditions
- **Tailored:** solutions that precisely fit every wind turbine
- **High yield:** through maximum energy yield and high efficiency
- **Space-saving:** through compact designs
- **Competence in all of the usual generator concepts:**
 - Asynchronous squirrel cage generators
 - doubly-fed asynchronous generators
 - permanent magnet synchronous generators
- **Flexibility regarding the cooling options:** surface cooling, air/air or air/water cooling as well as water-jacket cooling
- **Can be globally used:** available as 50 Hz, 60 Hz, or combined 50/60 Hz version
- **Highest degree of reliability:** 100% quality check before being shipped
- **Low maintenance costs:** maintenance-friendly design and good spare parts availability
- **Used in onshore and offshore applications:** corrosion-resistant components
- **Comprehensive range of services:** around the clock and around the globe

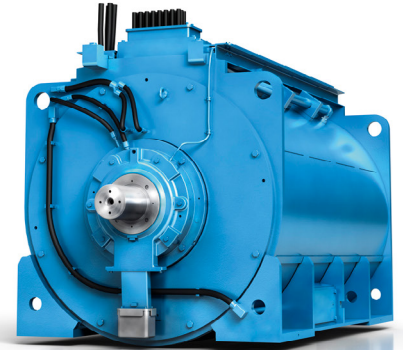
Generator	Generator concept	Cooling type	Shaft height	Power range
Winergy Wind Generator DFIG-A	Double fed	Modular air/air	500 – 800	up to 10 MW
Winergy Wind Generator DFIG-W	Double fed	Modular air/water or water jacket	500 – 800	up to 10 MW
Winergy Wind Generator DFIG-F	Double fed	Fin cooled	355 – 500	up to 1.25 MW
Winergy Wind Generator EESG-A	Electrically excited	Modular air/air	400 – 1000	up to 10 MW
Winergy Wind Generator EESG-W	Electrically excited	Modular air/water	400 – 1000	up to 10 MW
Winergy Wind Generator PM-A	Permanent magnet	Modular air/air	400 – 1000	up to 10 MW
Winergy Wind Generator PM-W	Permanent magnet	Modular air/water or water jacket	400 – >1000	up to 10 MW
Winergy Wind Generator IG-A	Squirrel-cage	Modular air/air	400 – >1000	up to 10 MW
Winergy Wind Generator IG-W	Squirrel-cage	Modular air/water or water jacket	400 – 800	up to 10 MW
Winergy Wind Generator IG-F	Pole changing	Fin cooled	355 – 500	up to 1.25 MW

This portfolio only represents the most common product range. There are no limits when it comes to shaft heights, power ratings and cooling concepts. The options that we have allow us to do a lot more – and we would like the opportunity to prove this to you.

Extensive range for the individual wind turbine system



Our extensive portfolio extends from permanent-magnet synchronous or electrically excited synchronous generators through squirrel-cage induction generators up to double-fed induction generators. The latter enjoy wide spread use in wind turbine systems. As we have this large portfolio to select from and we can precisely tailor the generator to the individual system type, we are able to provide the optimum generator to fit each and every wind turbine. Come and see for yourself.



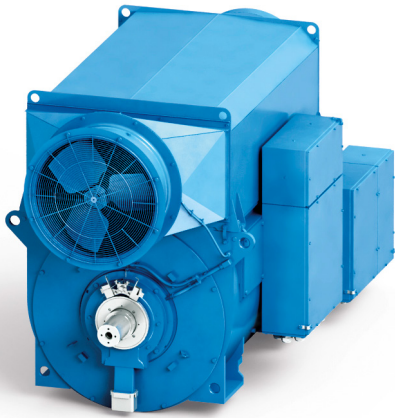
3.3 MW permanent magnet generator

Compact and rugged: Squirrel-cage induction generators

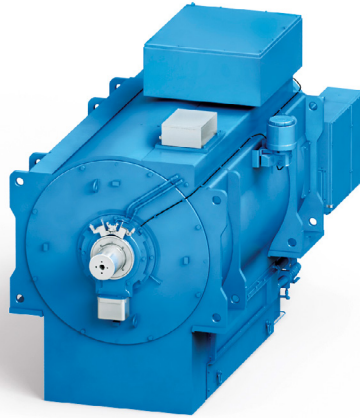
Our squirrel-cage induction generators have a long service life, are reliable and rugged, require little maintenance and also set themselves apart as a result of their low losses. For any particular power rating, they are extremely compact and light. As a result of their overall design, they have precisely the properties and features that are demanded in the wind turbine sector. One of the reasons for their low maintenance is the fact that they have no brushes and sliprings. They are connected to a full converter, which is dimensioned for 100% of the generator power. This type of connection to the grid has advantages: As a result of the wide speed control range, the generator can be operated completely decoupled from the grid. As a consequence, grid fluctuations have a significantly lower impact. Not only this, the turbine can be optimally adapted to the prevailing wind situation. This has a positive impact on the annual yield. Another positive feature is the 50 Hz/ 60 Hz compatibility, which allows a particular turbine type to be used globally.

Widely established: Double-fed induction generators

Double-fed induction generators are still the most widely established concept in the wind sector. They are characterized through their simple connection to the grid, a converter to optimize the power and fulfillment of the current grid codes. Another positive feature is their cost effectiveness, especially when it comes to the capital investment costs. This is because: For double-fed induction slipring generators, the stator is directly connected to the grid and the closed-loop control is realized through the rotor circuit. As a consequence, the converter only has to be rated for 30% of the rated generator power. Not only this, they are extremely reliable and have a high efficiency. They set themselves apart as the brush-slipring combination is monitored and has been optimized for a long service life. Our double-fed wind generators have proven themselves thousands of times worldwide – and in the meantime, also in large off-shore projects that generate several GW out on the open seas.



2,5 MW DFIG-Generator



5,3 MW DFIG-Generator



Electrically excited synchronous generators

Electrically excited synchronous generators are characterized by their tough design. The result: Generally a very low maintenance product that is extremely reliable and uses no magnets. Its controllability is another advantage. The power range of our electrically excited synchronous generators is being continually adapted to market requirements. As a consequence, we can immediately address every requirement.

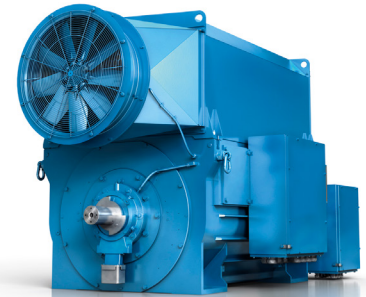
Permanent-magnet synchronous generators

Permanent-magnet synchronous generators represent an additional alternative. This full converter concept offers advantages, such as optimized yield as a result of the wide speed control range. This is complemented by the positive features of permanent magnet technology. These include low maintenance and reliability, as no electrical excitation equipment is required. As a consequence, they have a high efficiency and ultimately ensure a high total energy yield. Special emphasis was placed on a very rugged design. The magnets are completely protected against corrosion and are short-circuit proof. Further, they set themselves apart as a result of their modularity: They are available in water-cooled and air-cooled versions, for low voltage and medium voltage designs. The result: They can be optimally adapted to every turbine type.

We are driven by quality



Over 50,000 shipped Winergy Wind Generators speak for themselves. Customers around the globe are confident about the quality, first-class reliability and high efficiency. One of the reasons for this: They are optimized for operation over their complete service life. The maintenance friendliness of the high-quality Winergy Wind Generators plays a decisive role in reducing their costs to a very low level over a complete lifecycle.



2 MW DFIG-Generator

Focus on quality

The high quality of our generators is our first priority. Our complete generator production is aligned with this objective in mind. Quality checks and state-of-the-art test facilities secure this high level. Further, Winergy Wind Generators comply with all of the regulations of the relevant acceptance societies as well as international standards for wind turbine systems. Our generators also fully comply with grid codes.

Weatherproof and seaworthy

As a result of the humidity protection insulation and the vibration-proof windings, our wind generators reliably generate electric power in any climate and at each tower height. Versions with extended temperature ranges for cold climates as well as hot climates are standard practice for us. Special paint systems, developed for onshore and offshore applications ensure optimum protection against corrosion – even in salt-laden atmospheres.

Monitoring for an even higher availability

In order to further increase the availability, all of our generators are equipped with a comprehensive range of monitoring equipment: They are equipped as standard with temperature sensors and brush wear monitoring. Sensors for vibration, leakage or other measured variables are optionally available. These can be infinitely expanded – there are nearly no limits.

Maximum yield at each and every location

The wind turbine energy yield is increased using a yield-optimized efficiency characteristic with increased power factor. Our generators can be designed to address local wind profiles, therefore optimizing the energy yield at any location. Designs for higher voltage or frequency tolerances – also for 60 Hz – mean that Winergy Wind Generators can also be used at sites with weak grids.

Very quiet when required

Versions with lower sound levels are available for locations with more stringent requirements regarding noise emission. This is achieved using a noise-optimized electrical design, an innovative mechanical concept and specifically dimensioned external cooling systems.

The bearing concept: reliable and flexible

The bearings of Winergy Wind generators are designed for the entire turbine lifetime. In case of a change, this can be done flexibly inside the nacelle, which is particularly beneficial for offshore turbines. Reinforced bearings or sleeve bearings allow the wind turbine to be adapted to specific requirements. We consider the standard use of insulated bearings as a matter of course.

Optimized operational control

For optimized operational control of the wind turbines, the machines can be equipped with a second shaft end. This is then used to mount rugged speed switches, tachometers or pulse encoders. This provides the best possible accuracy.



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