

A person is seen from behind, standing in a lush green field filled with wildflowers. They are holding a string to a large, colorful kite that is shaped like a rainbow and has long, flowing tails. The kite is flying high in a clear blue sky. In the background, a line of white wind turbines stretches across the horizon under the same blue sky.

SIEMENS

Creating the most from wind

The highest degree of availability and efficiency of wind turbine systems through the perfect interaction of reliable components

[siemens.com/wind-equipment](https://www.siemens.com/wind-equipment)

Answers for industry.



Intelligent standardization based on proven platforms

Within the scope of intelligent standardization, no complex special production is required to address wind and manufacturer-specific requirements.

We employ platform strategies, use components and harmonized systems that have proven themselves thousands of times over in harsh industrial environments and can be combined so that the particular specification is precisely complied with. It goes without saying that we consequently maintain industrial standards, the machinery directive and safety regulations that are becoming increasingly important in this sector.

The perfect interaction of standardized products and systems is secured through extensive hardware and software system tests at an early phase. This means that complex system tests for customers can be eliminated.

Standard engineering tools reduce programming and commissioning costs and minimize the risk of faults. The SIMATIC Wind Library is an example – a software library that has been specifically developed for the automation of wind turbine systems. 80 % of all wind turbine system functions are saved here.



Competitive advantages in series production

Increasing competition and cost pressure mean that the wind sector must sustainably optimize its development and production processes. We support the transition to optimized series production with our hardware and software, including standardized modular systems for your platform strategies, with reduced component variance and logistical and support processes in line with industrial requirements.

Product life cycle management software will support you in the future in production automation for wind turbines. For instance, it already optimizes turbine production layout in the planning phase. This addresses energy-saving potential at an early stage. Further, our software ensures transparency over the complete life cycle. Not only this, it is the sole data source for all product and process knowledge in turbine production. New wind turbines are developed and modified based on special design software. A wide range of simulation options help to correctly evaluate scenarios and replace wind turbine prototypes that are expensive and complex to produce. As result of the time saved, wind turbines can be more quickly launched into the market.



The partner that you can depend on for the future

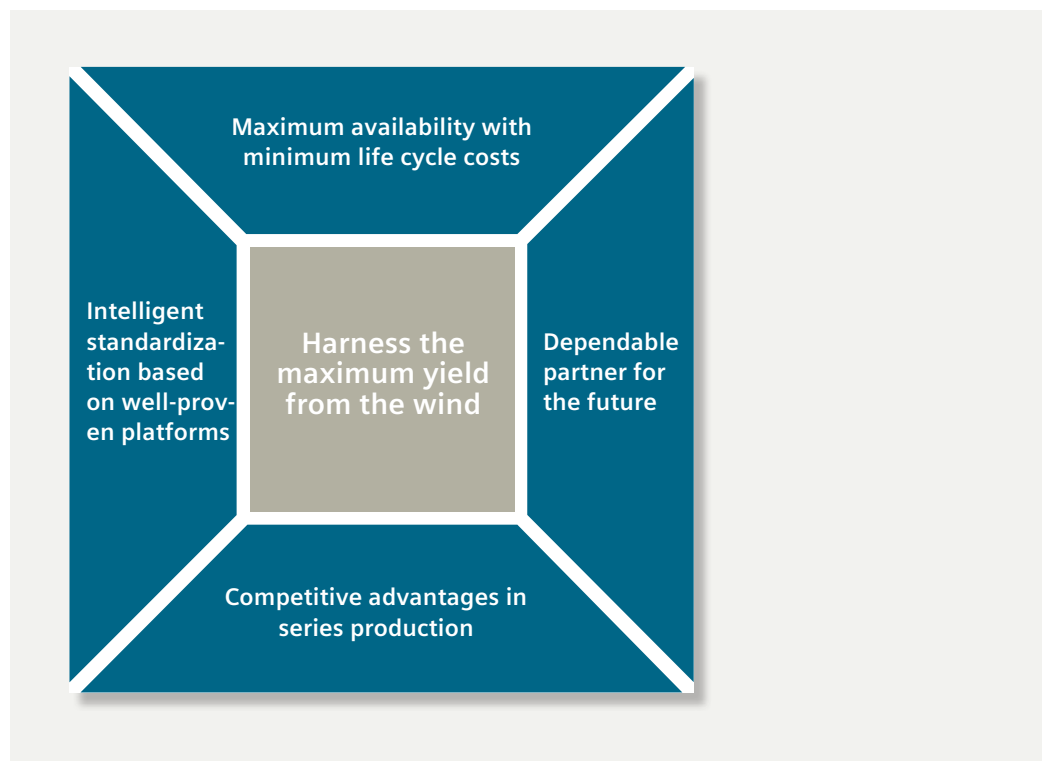
Siemens is an experienced and dependable partner for products, systems and solutions for the electric drive train as well as for the automation and power distribution in wind turbine systems.

Our decades of unique expertise make us one of the world's leading suppliers of industrial automation. This expertise and know-how is directly incorporated in our portfolio for the wind sector. This competence is reflected in the fact that more than 18,000 of our LOHER wind generators are operating reliably around the globe.

Optimally harnessing the force of nature

Within the scope of renewable energies, wind power is assuming a key role. Our products and systems operate perfectly with one another to optimally harness this force to create the most from the wind.

The result, maximum availability and efficiency, low production and maintenance costs, shorter engineering and commissioning times as well as a shorter time to market for new wind turbine concepts.



Maximum availability with minimum life cycle costs

Our products and systems have proven themselves many times over in the widest range of industries under the harshest of conditions. This is why they operate perfectly together to increase the overall availability.

All components, systems and assemblies seamlessly communicate with one another across all levels – from the individual terminal up to the higher-level control room. As a consequence, all of the system parts can be consistently monitored. This means that also in extreme situations, we can quickly and precisely respond to prevent a wind turbine system from being damaged.

Downtimes to carry out repairs can be minimized or even completely eliminated through preventive and predictive service and maintenance concepts.

In addition, our comprehensive range of services available 24/7 secures the maximum degree of availability. Through our global service network, we offer services precisely aligned to our customers' requirements around the world. The standard portfolio includes, among other things, remote maintenance, service, spare part logistics and online support.

An overview of the comprehensive range of products and systems for wind turbines

1. Automation and turbine control with SIMATIC

- Reliable operation from -40°C up to $+60^{\circ}\text{C}$
- Fail-safe software controllers without rotating parts and components such as fans and hard disks for maintenance-free operation and extreme ruggedness
- Hot swapping: In the case of a fault, modules, such as the distributed SIMATIC ET 200 I/O modules, can be withdrawn and inserted under voltage
- Prefabricated wiring: If a component has to be replaced, the individual wiring does not have to be disconnected
- High degrees of protection up to IP67
- High degree of ruggedness with respect to vibration
- Versions resistant to salt mist – especially suitable for offshore applications
- Powerful software library with all relevant standard functions of a wind energy plant
- Safety-Integrated on open, PC-based platform
- Easy integration of e.g. C-programs and MATLAB/Simulink algorithm

2. Communication and SCADA with SCALANCE

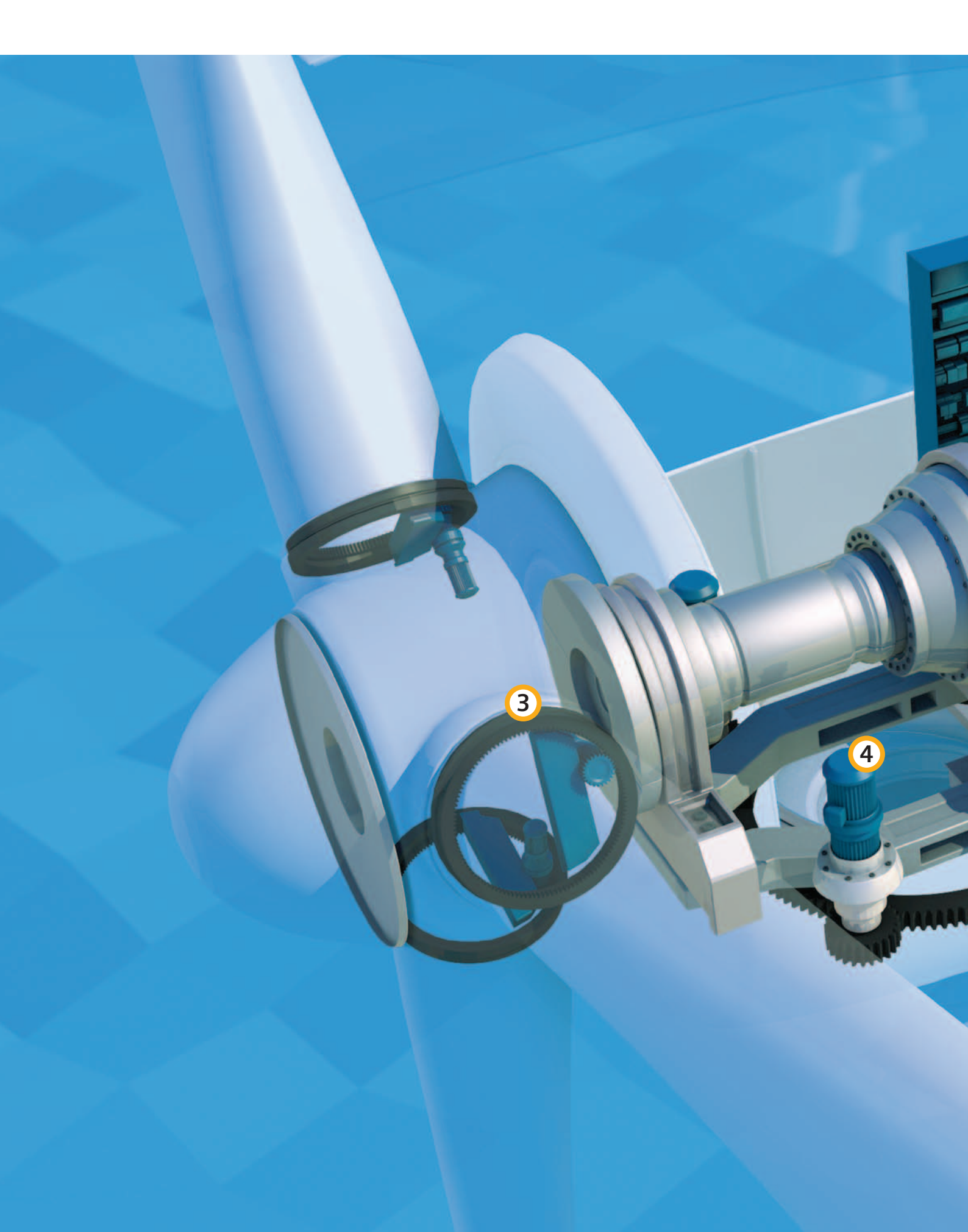
- Higher network availability based on redundancy mechanisms
- Integrated standard safety functions
- Seamless PROFINET-based communication and optimum diagnostics
- Communication to comply with real-time requirements with all of the associated diagnostic capabilities
- Wind farm and wind turbine communication, e.g.: DIN EN 61400-25 (standard for monitoring and control of wind turbines)
- Network components from the SCALANCE product family, suitable for harsh conditions and temperature ranges extending from -40°C up to $+70^{\circ}\text{C}$
- Highest degree of flexibility by using industrial wireless LAN with reliable PROFINET/PROFIsafe communication
- SIMATIC panels in degree of protection IP65, also for use in harsh offshore environments: design that is resistant to vibration, shock, salt water and temperature

3. Pitch systems based on SINAMICS, SIMATIC and SIRIUS components

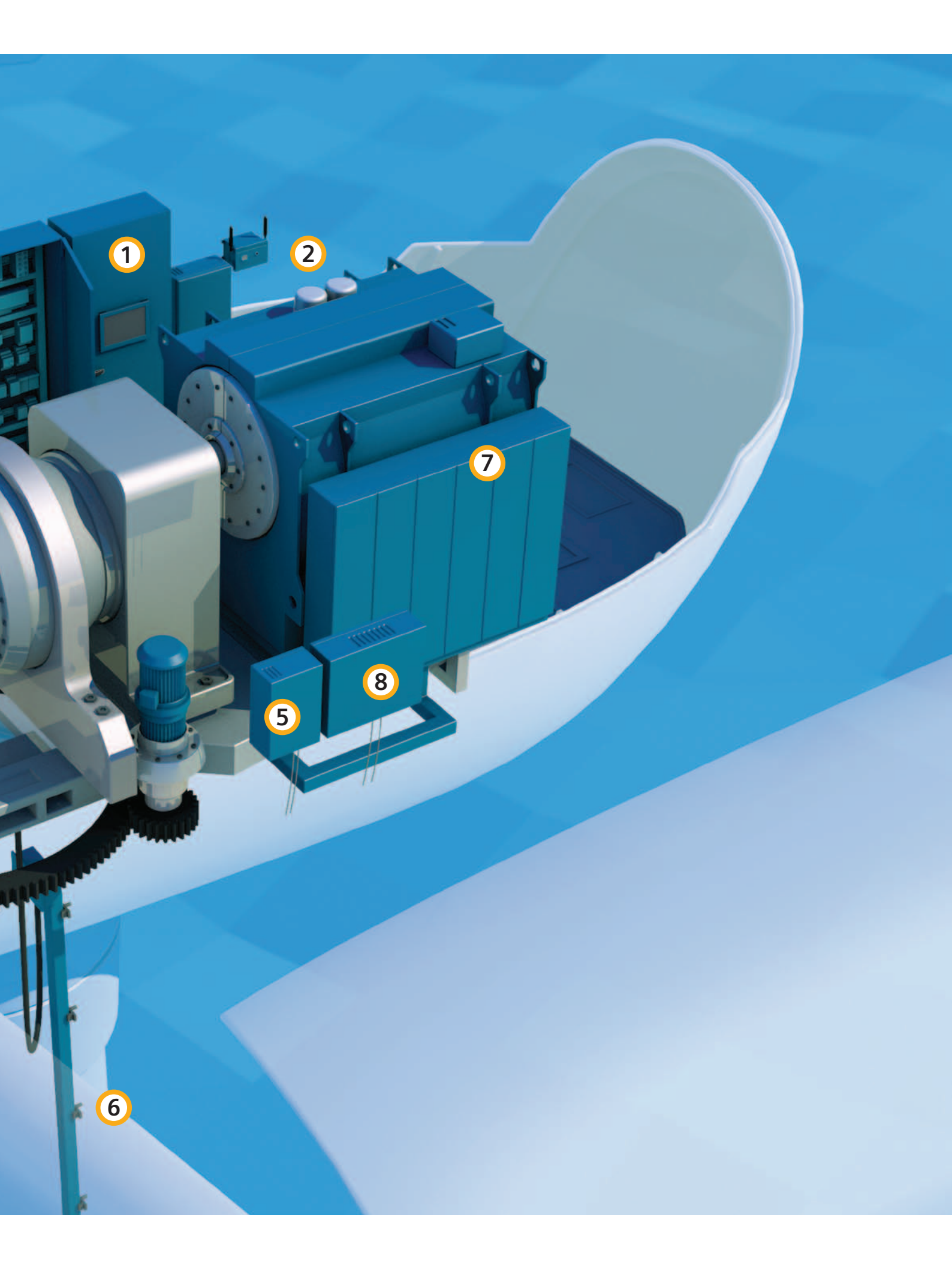
- Low mechanical stress on the pitch gearboxes and rotor blade bearings by using innovative control algorithms
- Turbine safety can be simply implemented using integrated safety concepts
- Lower energy usage of the pitch system by using efficient synchronous motors with a low moment of inertia in 4-quadrant operation as well as energy-efficient switchgear
- Reduced stress on the complete wind turbine system using individual rotor blade adjustment with a high degree of precision
- Lower mechanical stress as a result of the soft starting and braking provided by the control system
- Predictive maintenance using integrated condition diagnostics
- High-precision, reliable measurement results using rugged sensors – even under extreme environmental conditions
- GL certification: switchgear technology tested specifically for wind turbine systems ensures that in an emergency the rotor blades rotate into a stable, quiescent position
- Increased availability by using maintenance-free components with a long service life

4. Yaw systems with the SINAMICS and SIRIUS product families

- Reduced wear by using innovative control algorithms
- Structural stress is reduced by individually adapting single drive parameters
- Increased system availability by using maintenance-free components with a long service life
- Predictive maintenance using integrated condition diagnostics
- Integrated safety concepts for maximum protection of persons and the wind turbine
- Reduced loads on the gearboxes and bearings and lower mechanical vibration as result of the soft drive control
- Higher energy efficiency of the complete wind turbine system as a result of the energy recovery capability integrated in the SINAMICS drives
- Faster planning, commissioning and maintenance of the wind turbine as a result of the low number of components
- Optional use of standard induction motors in the IE3 Premium Efficiency class with an efficiency that is up to 10% higher than conventional motors



Components and systems for the complete electrics of the wind turbine system



5. Low-voltage power distribution with SENTRON, SIVACON and SITOR

- Reliable protection for personnel and systems using protection, switching, measuring and monitoring devices from the SENTRON portfolio, which are optimally harmonized with one another
- Higher short-circuit strength, reduced fire load, optimized EMC behavior using special SIVACON 8PS busbar distribution systems, which are protected against water (suitable for sprinkler systems)
- Sensitive converter power semiconductors are effectively protected using SITOR semiconductor fuses with extremely fast current interrupting characteristics
- Reliable power supply for the auxiliary circuits (e.g. pitch, yaw, hydraulics, fans) through optimum protection against short circuit and overload
- System failures and damage are avoided using a graduated system of lightning and surge arrestors
- Maximum system availability by being able to remotely control the circuit breaker as option
- High system transparency as a result of extensive measuring technology and communications-capable components

6. Medium voltage power distribution using NXPLUS

- Reliable connection between the wind turbine system and the grid – for example using gas-insulated NXPLUS wind medium-voltage switchgear
- Optimum transformer protection

7. LOHER wind generators and LOHER Dynavert XL wind converters

- High degree of reliability through strict quality assurance measures and state-of-the-art test facility
- Weather-proof generators from 250 kW up to 10 MW for onshore and offshore applications with vibration-proof windings that are protected against humidity and special paint finishes that are resistant to salt water
- Cold climate and hot climate versions are available
- Reliable and maintenance-friendly bearing design; bearings can also be changed in the gondola
- Disturbance-free operation – even when connected to weak grids
- Especially reliable gearless ring generators, which can be easily assembled from individual pre-assembled generator segments
- Redundant converter concepts by using power units that can be individually switched
- Disturbance-free operation as a result of generator and converter loads that are precisely coordinated with one another
- Generator and wind converter are optimally harmonized with one another – from development, through production, testing together in the test facility and certification up to service
- Comprehensive range of monitoring devices

8. Auxiliary systems with SIRIUS, SIMOCODE pro and SIPLUS

- Downtimes are avoided and the service life of wind turbine system is extended by permanently monitoring motors, gearboxes, bearings, fans up to tower vibration based on the SIPLUS condition monitoring systems
- Evaluation of analog and binary signals – where even high-speed events can be traced using sampling rates exceeding 40 kHz
- Independent realization of all of the protection, control and brake functions using the SIMOCODE pro motor management systems: The motor feeder remains fully functional and protected – even if the bus system or the turbine control fails
- High degree of operational reliability and safety using reliable plug-in systems instead of wiring for the SIRIUS switching devices
- SIRIUS monitoring relays sense motor currents and voltages, dissymmetry, creepage currents etc. and therefore provide valuable information regarding mechanical wear, blockages, component lifetime and much more
- Lower cooling costs in the control cabinet as a result of the lower intrinsic power losses of SIRIUS switching devices
- Comprehensive and integrated fire protection solutions based on reliable fire detection and efficient fire quenching technology

Additional information:
siemens.com/wind-equipment

In our Internet pages, under Support, you will find additional information brochures and technical descriptions.

Safety note:

When connecting an internal system to an external system, suitable protective measures must be taken in order to ensure secure operation of the system (these include IT security measures, e.g. network segmentation).

More information at:
siemens.com/industrialsecurity

Siemens AG
Industry Sector
P.O. Box 4848
90026 NUREMBERG
GERMANY

Subject to change without prior notice 08/12
Order no.: E20001-A90-P550-X-7600
Dispostelle 21503
WÜ/40140 GD.LD.SP.WIND.52.2.01 WS 09122.
Printed in Germany
© Siemens AG 2012

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