Siemens D3 platform – 3.0-MW and 3.2-MW direct drive wind turbines

Reduced complexity, increased profitability

Answers for energy.
Your trusted partner

Siemens has been a major driver of innovation in the wind power industry since 1980 when wind turbine technology was still in its infancy.

Technology has changed with the times, but Siemens’ commitment to providing its customers with proven wind turbine solutions remains the same.

The combination of robust and reliable turbines, highly efficient solutions for power transmission and distribution, and a deep understanding of the entire energy market ensures that Siemens will continue to take the wind power industry to new levels.

Long-lasting customer relationships – based on a track record of successful, reliable project deliveries – provide a sound, sustainable, and profitable investment.

Drawing on more than 30 years of experience in the wind power industry, a strong focus on renewables, and a global network of highly skilled and trained employees, Siemens has proven itself to be a trustworthy and reliable business partner and will continue to do so in the future.

With an increasing number of turbines being installed at inland, coastal, and offshore sites, reliability and best-in-class maintenance under challenging conditions are essential for optimizing the return on investment throughout a project’s lifecycle.

Over the past 30 years, Siemens has accumulated millions of hours of service experience. Drawing on this substantial knowledge, the company has established a flexible range of service solutions that are designed to optimize the output of wind turbines.
Intelligent ways to drive down the cost of electricity

Wind power is coming of age. It could soon be directly competitive with traditional energy sources. Driving down the levelized cost of wind energy is a key target for Siemens as we strive to make wind power independent of subsidies.

Innovation and industrialization are the main drivers of this. And our new platform strategy, founded on the knowledge and experience of more than 30 years in wind power, is a milestone along this path.

Standardization and modularization are fundamental to the new platform approach because they allow us to streamline the entire manufacturing and installation process. The organization of our product platforms into categories allows standardized modules, such as rotors, generators, towers, and hubs – to be used with different products. The total number of different components is thus kept to a minimum.

Each of our products is now a member of one of four platforms: the Siemens G2, Siemens D3, Siemens G4, and Siemens D6. “G” denotes geared turbines, “D” signifies direct drive technology, and the associated numbers represent the predominant power rating.

Therefore, the D3 platform comprises onshore direct drive wind turbines with a power rating of 3.0-MW and 3.2-MW.

Through continuous monitoring of our installed D3 fleet, Siemens engineers were able to boost the performance of the entire product platform. We increased the standard rating of 3.0-MW to 3.2-MW. This translates into 200,000 additional watts of product capacity for you, and 200,000 more reasons to choose Siemens.

**Outstanding performance with reduced complexity**

The Siemens 3.0-MW and 3.2-MW wind turbines of the D3 platform embody proven innovation in the field of direct drive generators, with hundreds of units already installed and operational.

As wind power plants develop capacities similar to conventional power plants, power-generation companies throughout the world are striving for greater efficiency and cost-effectiveness. Siemens’ solution: increase availability and profitability through innovative technology and reduced complexity.

Siemens direct drive turbines of the D3 and D6 platforms offer innovation through the consistent implementation of a common, highly efficient generator concept. With less than half the moving parts of a conventional geared turbine, the direct drive wind turbines improve performance, reliability, and maintainability. In addition, the compact design allows for cost-effective transportation and installation.
Performance and profitability go hand in hand

With its direct drive wind turbines, Siemens started with the ambitious goal of making a more cost-effective machine in order to become competitive with conventional power plants. Thanks to innovative engineering, that vision is becoming a reality.

In designing a wind turbine, a holistic view of the design and construction, materials, processes, manufacture, and installation is critical. The gearless 3.0-MW and 3.2-MW wind turbines carefully balance all these factors in a compact system. Service personnel have been involved in the development process to optimize working conditions and serviceability.

Reduced complexity
The Siemens D3 platform offers the simplest and most straightforward wind turbine design. Regardless of the reliable track record of gearboxes over the years, the gearbox is fundamentally the most complex component of a wind turbine. Eliminating the gearbox reduces complexity and can increase reliability.

Replacing the gearbox, the coupling, and the high-speed generator with a low-speed generator eliminates two-thirds of the conventional drivetrain arrangement. As a result, the number of rotating and wear-prone parts is vastly reduced compared to a geared machine.

Siemens has opted for a permanent magnet generator for improved efficiency. Unlike an electrically excited machine with a gearbox, a permanent magnet-excited machine does not expend any energy on the excitation itself. The D3 platform wind turbine generators also have an outer rotor, where the rotor spins on the outside of the stator. This design feature allows the rotor to operate within narrower tolerances, which helps to keep the dimensions of the nacelle compact.
Simplified design
Due to the removal of the gearbox and other design simplifications, Siemens has given service technicians more space within the nacelle. Here, key components are readily accessible and can be replaced without impacting others. The wind turbines of the D3 platform have a dual cooling system that provides even cooling of the generator via a top-mounted, passive cooling system for improved energy efficiency.

The key components of a wind turbine – the blade, rotor hub, tower, and controller – are all adopted from the existing Siemens geared-turbine portfolio. The utilization of proven components alongside rigorous testing on rigs and in the field enables Siemens to eliminate many of the variables traditionally associated with the introduction of such an innovative product.

Innovative tower solution
Higher towers significantly increase the energy yield of a wind turbine. At the same time, they pose considerable challenges in terms of transportability and cost. Siemens offers an innovative and economically viable tower concept to allow its wind turbines to reach heights above 100 meters. The bolted steel shell tower consists of multiple tower sections, which are mounted on top of each other and assembled together on-site. The modular concept of the bolted steel shell tower allows for very high hub heights (in excess of 140 meters) with very few requirements in terms of transport. The tower is erected in a short time and requires minimal maintenance. In fact, the HRC bolts require no retorquing during the tower’s lifetime.

Ease of transportation and construction
The D3 platform has a compact, lightweight design and has been engineered to meet even the most demanding of transportation routes. Key bridge and tunnel clearance specifications have been carefully considered when engineering the machine, and as a result, the 3.0-MW and 3.2-MW wind turbines can navigate many of the most demanding transport routes.
Proven technology, advanced performance

Grid performance with the Siemens NetConverter®
Siemens sets the standard in the field of grid compliance. Power conversion is implemented by Siemens’ NetConverter® system. This system is characterized by full conversion of the power generated, efficiently decoupling generator and turbine dynamics from the grid.

The NetConverter® system offers maximum flexibility in the turbine’s response to voltage and frequency control, fault ride-through, and output adjustment. As a result, Siemens wind turbines can be configured to comply with a variety of relevant grid codes in major markets and can be readily connected to the grid.

Siemens IntegralBlade® technology
The rotors of the D3 platform benefit from blades manufactured using patented IntegralBlade® technology.

The blades are made in one piece from fiberglass-reinforced epoxy resin during a single production step. As a result, all glue joints – the potential weak points that could expose the structure to cracking, water ingress, ice formation, and lightning damage – are eliminated.

Siemens WebWPS SCADA system
Via a standard Web browser, the Siemens WebWPS SCADA system provides a variety of status views of electrical, mechanical, meteorological, and grid station data as well as operation and fault status.

Wind turbine condition monitoring
Siemens’ wind turbine condition monitoring compares the vibration levels of the main nacelle components with a set of established reference spectra and instantly detects deviations from normal operating conditions.

This allows Siemens to proactively plan the service and maintenance of the wind turbines, as any unusual event can be categorized and prioritized based on severity.

Turbine Load Control (TLC)
The Turbine Load Control system continuously monitors the structural loading on the wind turbine. In case the loads exceed normal values, the turbine automatically regulates operation to bring loads back within the design envelope.

High Wind Ride-Through (HWRT)
Wind turbines are normally programmed to shut down if the 10-minute mean wind speed exceeds 25 m/s. This may lead to significant challenges for the grid system if the turbines in large wind farms are shut down more or less simultaneously.

The Siemens D3 platform works to enhance grid stability thanks to High Wind Ride-Through – an optional feature of the D3 platform. This replaces the fixed high-wind shutdown threshold with an intelligent load-based reduction in output power at some storm-level wind speeds.

Service
From the highly qualified local technician to the senior engineer at service headquarters, it is the Siemens service team’s track record and the vast amount of experience gained over time that makes the difference.

Siemens offers tailor-made service solutions for each of our turbine platforms, e.g. the SWPS-100B, the SWPS-200A, and the SWPS-300W service solutions for onshore wind turbines.

Further improvements in safety
Safety is at the heart of all Siemens operations. From production to installation, operation, and service, Siemens strives to set the standard for a zero-harm culture.
The toughest turbine for the roughest conditions

Extreme wind conditions place tremendous loads on a turbine. This turbine is built to deliver reliable performance under the world’s harshest operating conditions.

The turbine utilizes the same rotor as Siemens’ SWT-2.3-101 geared machine. Through the application of proven components, Siemens balances innovation with a secure investment.

The durable choice for strong wind conditions

When winds are strong, this turbine offers a superior combination of a large rotor and robust design.

The B53 quantum blade of the 108-meter rotor uses Siemens’ innovative aeroelastic blade design, which allows a larger rotor diameter and higher energy output without compromising structural loads. As a result, the turbine provides a lower cost of energy in heavy wind conditions.

Getting the most out of moderate conditions

Offering the largest rotor in the Siemens D3 platform, this turbine is designed to increase energy output at sites with moderate wind conditions.

Once again, the competitive edge of a Siemens turbine is based on innovative blade design. The B55 quantum blade benefits from an optimized root design that derives maximum power from the wind. Furthermore, the turbine has reduced noise emissions due to a lower rotor speed. With its combination of high energy output and low noise levels, this turbine is the ideal choice for most inland sites across the globe.

Offering three rotor sizes and a standard rating of 3.0-MW and 3.2-MW, the D3 platform is a perfect combination of performance and profitability for all wind conditions.