The new standard for offshore

Siemens D6 platform – 6.0-MW direct drive wind turbine

Answers for energy.
Siemens, the offshore leader

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.

In recent times, the world has seen an intense increase in the nature and capacity of offshore wind power plants. Given the logistical challenges of offshore projects where even the smallest issue can amplify costs, having technology that works and continues to work is paramount. This was the case when installing the first offshore wind power plant in 1991 and this remains the case today.

Siemens benefits from a track-record which makes it the world leader offshore. As the choice of the world’s largest offshore wind power plant – London Array – Siemens’ geared wind turbines are paving the way for green energy to become the cornerstone of the global energy mix.

Over the years, Siemens has accumulated vast service experience offshore. Drawing on this substantial knowledge, the company has established a flexible range of service solutions that are designed to optimize the output of offshore wind turbines.

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 be so in the future.
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 core levers to this. And our new platform strategy, founded on the knowledge and experience of more than 30 years in wind power, is a milestone on this path.

Standardization and modularization are fundamental to the new platform approach – allowing us to streamline the entire manufacturing and installation process. The categorization into product platforms allows standardized modules, such as rotors, generators, towers or hubs, to be used across different products. Thereby the total number of different components is kept to a minimum.

All of which means that we are helping our customers drive down the cost of electricity.

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 D6 platform is comprised of offshore direct drive wind turbines with a power rating of 6.0-MW.

Reduced complexity, outstanding performance

The Siemens 6.0-MW wind turbines of the D6 platform embody tried and tested innovation in the field of direct drive generators, with hundreds of units already installed and operational. The Siemens D6 platform redefines the wind industry standards for leanness, robustness and lifecycle profitability.

Based on Siemens’ direct drive technology, D6 wind turbines have 50 percent fewer moving parts than comparable geared machines and a towerhead mass of less than 360 tons. This unique combination of robustness and low weight significantly reduces infrastructure, installation and servicing costs, and boosts lifetime energy output.

The 154-meter rotor, designed specifically for the Siemens 6.0-MW wind turbine, has a swept rotor area of 18,600m². It therefore maximizes energy yield at offshore locations, from inland waters with moderate wind resources to the most exposed offshore sites.
Lean, robust and reliable technology

Lean

The Siemens 6.0-MW turbine of the D6 platform is based on proven Siemens direct drive technology: the simplest and most straightforward wind turbine design. Replacing the gearbox, the coupling and the high-speed generator with a low-speed generator eliminates two-thirds of the conventional drive train arrangement.

As a result, the number of rotating and wear-prone parts is vastly reduced with 50 percent fewer parts than a comparable geared machine. The associated reduction in maintenance requirements is crucial in offshore applications. Until now, the weight of large wind turbines has grown disproportionately to increases in power rating. The Siemens D6 platform has conclusively broken this trend. With a towerhead mass of less than 60 tons per MW the D6 wind turbine is genuinely lean. This new low-weight standard for offshore wind turbines offers significant cost benefits in terms of substructure requirements, shipping and installation. All of which are made possible due to Siemens’ tried and tested direct drive technology.
Robust

Benefiting from our unique offshore experience, the D6 platform is designed to exploit the broadest range of offshore environmental conditions. Designed to IEC 1 Standards, the D6 platform can be deployed in any known offshore location.

The structural capacity of all components is verified by full-scale testing. Highly Accelerated Lifetime Tests on all main components and the entire nacelle demonstrate their robustness. The entire turbine design is tailored to offshore application: all external surfaces and systems feature offshore-grade corrosion protection and the completely enclosed nacelle is fitted with internal climate control.

Reliable

The Siemens D6 platform is designed to both maintain and enhance the legendary reliability of Siemens wind turbines. Simple and robust, the direct drive technology offers the best possible basis for this. The rotor blades combine lightness and strength through single-cast Siemens IntegralBlade® production.

The nacelle, housing every part of the power system, forms a self-contained unit delivering medium voltage power to the wind farm grid. This allows turbines to be fully pre-commissioned onshore, leaving only final connection to be performed after installation.

Finally, the maintenance process has been reinvented too: with extra space within the nacelle, it has been repurposed as an on-site workshop, complete with crane and optional coffee machine.
Expertise in practice: fully developed technology, advanced design

Grid performance with NetConverter®

Siemens sets the standard in the field of grid compliance. Power conversion is implemented by the 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®

The 154-meter rotor uses blades manufactured with Siemens’ unique, 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 – are eliminated. The aerodynamic and structural design of the blade for the 154-meter rotor is based on Siemens’ Quantum Blade technology, incorporating unique airfoil profiles and redesigned tip and root sections. The root section uses Siemens “flatback” profiles to minimize root leakage and provide higher lift. The tip has also undergone a fine-tuning process to enhance lift. As a result, Quantum Blades offer superior performance in a wide range of wind speeds.

Siemens WebWPS SCADA system

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

Wind turbine condition monitoring

Siemens’ turbine condition monitoring system 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. In addition, the TLC system – an optional feature of the D6 platform – monitors the accumulated fatigue loading on the turbine, thereby providing key input for fact-based asset management.

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 offshore wind farms are shut down more or less simultaneously, e.g. at the passage of a gust front. The Siemens D6 platform enhances grid stability due to High Wind Ride Through – an optional feature of the D6 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 track record and the vast obtained experience of the Siemens service team that makes the difference. Siemens offers tailor-made service solutions for each of our turbine platforms, e.g. the SWPS-420O and the SWPS-430O service solutions for our offshore wind turbines.

Further improvements in safety

Safety is at the heart of all Siemens operations. From production, through installation, operation, and service, Siemens strives to set the standard. Onshore pre-commissioning and testing significantly reduce the amount of work that needs to be done in riskier offshore conditions. While the simplified direct drive concept in itself reduces service requirements, offshore maintenance has been completely rethought. Service technicians can enter the turbine via the helihoist platform or via conventional tower access, and here a new gangway system enables safer access at rough sea conditions. The spacious nacelle, housing far fewer parts than usual, provides technicians with an optimized access to all key components.
The 154-meter rotor, designed specifically for the Siemens D6 platform, uses the B75 blade. This is currently the world’s longest blade in operation, with a swept rotor area of 18,600m². It therefore maximizes energy yield at offshore locations, from inland waters with moderate wind resources to the most exposed offshore sites.

The Siemens D6 platform – one of the four new product platforms – embodies tried and tested innovation in the field of direct drive generators. Through optimized infrastructure, installation and service, the D6 platform is a perfect choice for a reliable and profitable investment helping to drive down the cost of offshore wind energy.