



SIEMENS



Siemens D6 platform – 6.0-MW direct drive wind turbine

The new standard
for offshore

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. Exactly the right task for us.

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.

In 1991, we installed the world's first offshore wind farm at Vindeby in Denmark. From these modest beginnings to today, Siemens benefits from a track record that makes it the world leader in offshore applications. 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.



Prototype of the SWT-6.0-154

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 D6 platform comprises 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, 6.0-MW wind turbines have 50 percent fewer moving parts than comparable geared machines and a tower head 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 drivetrain 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 tower head mass of less than 60 tons per megawatt, 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 this is made possible thanks to Siemens' proven 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 I 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 applications: 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 precommissioned onshore, leaving only final connection to be performed after installation.

Finally, the maintenance process has been reinvented too: complete with crane and extra space, the nacelle has been repurposed as an on-site workshop.

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 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® technology

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 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' 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.

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 D6 platform enhances grid stability thanks 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.

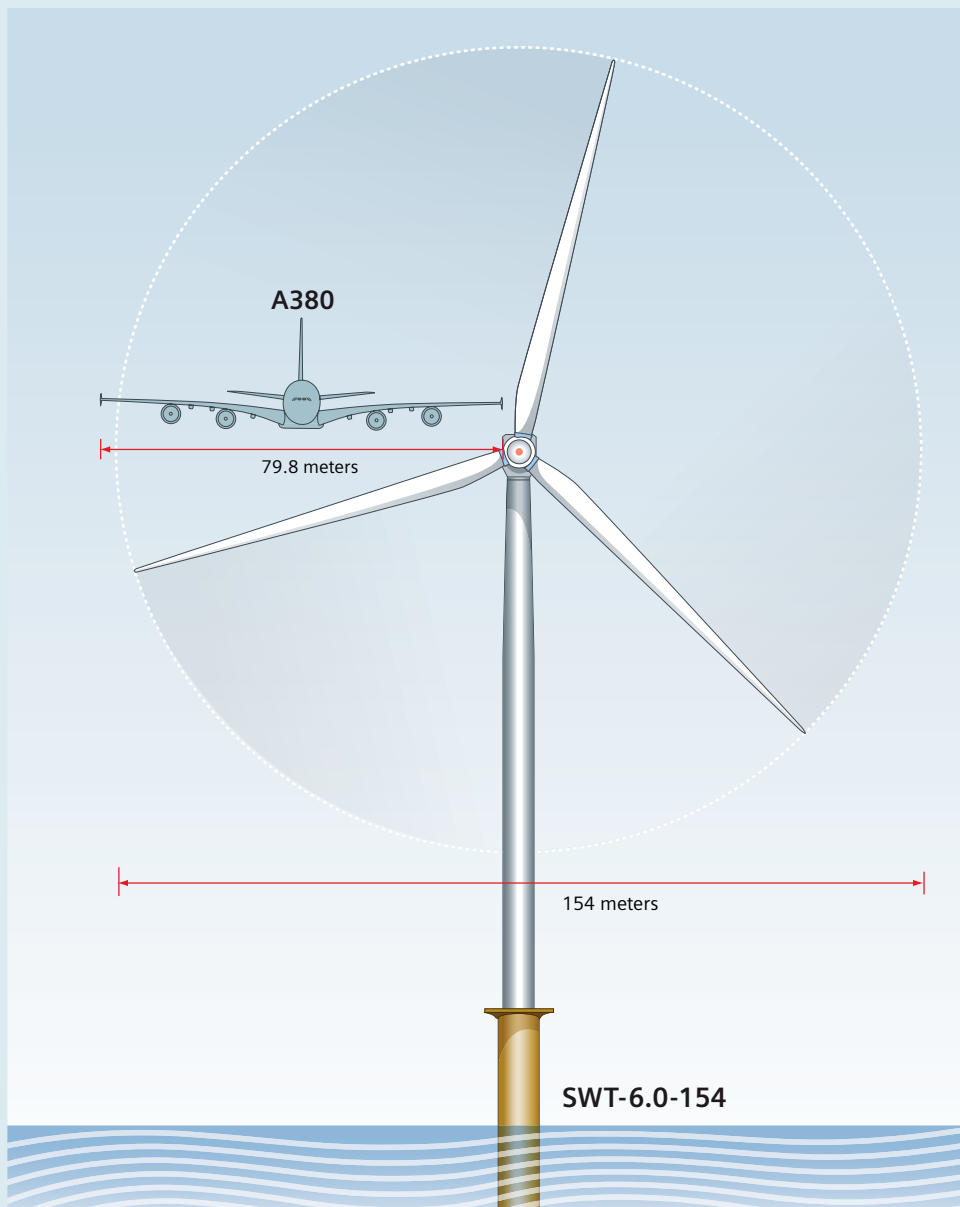
Service

From the highly qualified local technician to the senior engineer at service headquarters, it is the 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-4200 and the SWPS-4300 service solutions for our offshore 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. Onshore precommissioning 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 heli-hoist platform or via conventional tower access, and here a new gangway system enables safer access in rough sea conditions. The spacious nacelle, housing far fewer parts than usual, provides technicians with optimized access to all key components.



SWT-6.0-154

IEC Class	IA
Nominal power	6,000 kW
Rotor diameter	154 m
Blade length	75 m
Swept area	18,600 m ²
Hub height	Site specific
Power regulation	Pitch regulated, variable speed
Tower head mass	360 tons

For maximum output

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 18,600 square meters. It therefore maximizes energy yield at offshore locations: from inland waters with moderate wind resources to the most exposed offshore sites.

Through optimized infrastructure, installation, and service, the D6 platform is the perfect choice for a reliable and profitable investment that helps drive down the cost of offshore wind energy.

Published by and copyright © 2014:
Siemens AG
Energy Sector
Freyeslebenstrasse 1
91058 Erlangen, Germany

Siemens AG
Wind Power
Lindenplatz 2
20099 Hamburg, Germany
siemens.com/wind

For more information, please contact
our Customer Support Center.
Phone: +49 180 524 70 00
Fax: +49 180 524 24 71
(Charges depending on provider)
E-mail: support.energy@siemens.com

Wind Power
Order No. E50001-E310-A186-X-7600
RS 15_01_113

Printed on elementary chlorine-free bleached paper.

All rights reserved.

Trademarks mentioned in this document are the property
of Siemens AG, its affiliates, or their respective owners.

Subject to change without prior notice.

The information in this document contains general
descriptions of the technical options available, which
may not apply in all cases. The required technical options
should therefore be specified in the contract.