



SIEMENS



Siemens G4 platform – 3.6-MW and 4.0-MW geared wind turbines

The offshore workhorse - redefined

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.



SWT-3.6-120



SWT-4.0-120



SWT-4.0-130

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 G4 platform is comprised of offshore geared wind turbines with a power rating of 4.0-MW.

Evolution of the platform

The Siemens 3.6-MW and 4.0-MW wind turbines of the G4 platform represent the culmination of an evolutionary process of geared innovation and refinement to our wind turbines that dates back to 1980.

Determined to create the right machine for the right application, Siemens has progressively evolved the G4 platform to provide customers with a greater choice of technologies to meet their needs. The SWT-3.6-120 was an incremental advance on the proven technology of the SWT-3.6-107, which had become the most popular offshore wind turbine in the history of Siemens Wind Power.

With the release of a 4.0-MW wind turbine – featuring a 130-meter rotor and a more powerful generator – Siemens has produced a machine that can generate even more power without any compromise to investment robustness. Combined with advanced control features, it allows for further improvements in higher asset utilization.

The new SWT-4.0-130

The next step in reliable offshore energy

While the 4.0-MW turbine is based directly on the 3.6-MW turbine, it features improvements based on years of operational experience. Firstly, its structure has been strengthened, making it even more robust. Secondly, the optimized design features an improved layout, optimizing the ergonomics during maintenance.

Megawatt for megawatt, its simplified, yet robust, design makes it lighter than its predecessors. More importantly, its new, larger rotor, coupled with a more powerful generator, increases net annual power production by up to 15% at IEC I conditions. All of which allows Siemens to drive down the cost of offshore wind energy.

Enhanced design efficiency

A simplified tower design with fewer weldings has led to both lower weight and greater strength. In addition, a redesign of the nacelle layout has made the moving parts easier to access and service. Both the gearbox and generator have been updated to increase efficiency and resilience.

130-meter rotor for a higher AEP

The 4.0-MW is equipped with 63-meter long rotor blades, giving it a swept area of 13,300m², around two football fields. It is also 18% larger than that of its predecessor. Together with the added efficiency of the new geared drive train, the result is up to 15% more power output at IEC I conditions.



Aeroelastic blades for greater lifetime output

Thoroughly proven on onshore wind turbines, the benefits of Siemens' aeroelastic technology have been extended to the offshore environment. The B63 blade applied to the SWT-4.0-130 also features this blade technology.

A bigger rotor traditionally increases the loads on a wind turbine, which calls for larger and heavier structural components. Siemens' aeroelastically tailored blade changes that. The secret behind this technology is found in the intelligent controlled torsional twisting of the blade, with aerodynamic loading.

The result is optimized load characteristics at all wind speeds. In addition, the B63 blade benefits from Siemens' Quantum Blade Technology meaning that the new, larger rotor is barely heavier than its smaller predecessor whilst retaining excellent strength – as proven by extensive testing.

Optimized and robust design

The four key wind turbine modules – the blade, rotor hub, tower and power system – have been developed from the existing Siemens portfolio. By utilizing proven components and technologies to the widest extent possible, Siemens has eliminated many of the variables traditionally associated with the introduction of a new product.

The reinvention of the interior nacelle design has created a more ergonomic environment within the nacelle, where key components are readily accessible.



Proven technology, advanced performance

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 rotors of the G4 platform benefit from blades being 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 – are eliminated.

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.

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, e.g. at the passage of a gust front. The Siemens G4 platform works to enhance grid stability due to High Wind Ride Through. 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-4200 and the SWPS-4300 for 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. With the SWT-4.0-130, offshore maintenance has been rethought. Service technicians can enter the turbine via the helihoist platform or via conventional tower access, where a new gangway system enables safer access at rough sea conditions. The new, more spacious nacelle also provides technicians with optimized access to all key components.

In addition, the fail-to-safe capabilities within a turbine, combined with Siemens' superior lightning protection system, are designed to enhance overall safety.



SWT-3.6-120

IEC Class	IEC IA
Rotor diameter	120 m
Blade length	58.5 m
Swept area	11,300 m ²
Hub height	Site specific
Power regulation	Pitch regulated
Nacelle weight	140 tons
Rotor weight	100 tons

SWT-4.0-120

IEC Class	IEC IA
Rotor diameter	120 m
Blade length	58.5 m
Swept area	11,300 m ²
Hub height	Site specific
Power regulation	Pitch regulated
Nacelle weight	140 tons
Rotor weight	100 tons

SWT-4.0-130

IEC Class	IEC IB
Rotor diameter	130 m
Blade length	63.45 m
Swept area	13,300 m ²
Hub height	Site specific
Power regulation	Pitch regulated
Nacelle weight	140 tons
Rotor weight	100 tons

SWT-3.6-120

Setting the scene in modern offshore wind power

The design of this wind turbine is based on its long-term experience in offshore wind power. With a swept area 26% larger than its predecessor, it makes a giant leap forward in respect to energy yield. In comparison to the SWT-4.0-120, the slightly lower capacity makes the SWT-3.6-120 a competitive choice for sites with capacity constraints.

SWT-4.0-120

Further evolvement in offshore wind power

Based on the millions of operating hours and experience accumulated from the 3.6-MW class, the capacity upgrade to 4.0-MW is founded on confidence. The SWT-4.0-120 features the well-proven 120-meter rotor, which has obtained offshore experience since 2009. This makes the installation of a 4.0-MW turbine suitable for environments where maximum tip height restrictions apply.

SWT-4.0-130

The biggest and most advanced rotor in its class

By using advanced blade technologies, Siemens increased the 4.0-MW rotor diameter by another 10 meters – and the swept area by an astounding 18%. This allows for a significant increase in energy production, and due to the aero elastically tailored blade technology, this is possible without compromising structural loading.

The Siemens G4 platform – one of the four new product platforms – represents the culmination of an evolutionary process of innovation and refinement to our wind turbines for over 30 years. The proven technology of the 3.6-MW, combined with the upgraded 4.0-MW, means the G4 platform is a perfect choice for a reliable and profitable investment.

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