Siemens Completes Installation of Second HVDC Converter Platform for TenneT

• Major step forward for the offshore expansion of the German power grid
• North Sea platform can transmit wind power to supply more than 800,000 German households using efficient direct current technology

Siemens has installed the BorWin2 offshore platform in the North Sea northwest of the island of Borkum. This marks Siemens' achievement of the second crucial milestone in the German grid connection projects under contract with the German-Dutch network operator TenneT. Siemens had already erected its first converter platform for the HelWin1 connection off Heligoland in the North Sea in August 2013. The BorWin2 transmission capacity of 800 megawatts (MW) is enough to meet the power demand of some 800,000 German households. On the platforms, the alternating current generated by the wind turbines is transformed into low-loss direct current for transmission to the mainland by using Siemens technology. The BorWin2 onshore converter station, likewise supplied to TenneT by Siemens, is located in Diele. There the electric power from the connected wind farms is converted back into the alternating current required to feed into the power grid.

“Once more we have mastered the challenging offshore installation part. We are now in the final stretch to achieve commissioning in the first half of 2015, as promised. When the two platforms yet installed by us go on line, they will be able to supply more than 1.3 million households," states Karlheinz Springer, CEO of the Power Transmission Division within the Energy Sector of Siemens AG. “We are proud of having successfully tackled these highly complex tasks," says Lex Hartman, member of TenneT management. “We are set to make major progress in expanding our offshore capacity in the coming months," continues Hartman, "and that brings the German government's offshore expansion targets within reach.”
In mid-2010 the grid operator TenneT had placed the order for the BorWin2 offshore grid connection with a consortium comprising Siemens and the Italian cable specialist Prysmian. In all, Siemens is realizing five North Sea grid link-ups for TenneT: HelWin1 (576 MW) and HelWin2 (690 MW) off Heligoland, BorWin2 (800 MW) and BorWin3 (900MW) off Borkum, and SylWin1 (864 MW) off Sylt. The first four platforms HelWin1 and HelWin2, BorWin2 and SylWin1 are to commence commercial operation in rapid succession between the second half of 2014 and the first half of 2015. In April 2014, Siemens won the order for the fifth grid connection in the North Sea, BorWin3, in a consortium with Petrofac. It is scheduled to go on line in 2019. Once commissioned, the grid connections installed by Siemens will have a total transmission capacity of over 3.8 gigawatts (GW). Thanks to Siemens' efficient high-voltage direct current (HVDC) technology, transmission losses per link are less than three percent, not including cable losses.

The converter technology used by Siemens is called HVDC Plus, and is essentially a voltage-sourced converter of the modular multi-level converter type (VSC MMC). Siemens is a leading pioneer of VSC MMC technology in this field. By contrast with the conventional HVDC version, which can only be used in networks with sufficient short-circuit capacity, systems using HVDC Plus make it possible to start up island networks from scratch. This is an important prerequisite for operation of the offshore network. The modular VSC technology reduces complexity and thus the space required for the installations – an essential precondition precisely for use on offshore platforms. What is more, HVDC Plus ensures a nearly ideally sinusoidal AC voltage and a smooth voltage in the DC circuit. This eliminates the need for harmonic filters.

For the installation the platform was towed into position directly above the substructure, which Siemens had already installed in the North Sea, 39 meters deep at that point, in 2013. This substructure consists of six steel pilings of up 2.5 meters in diameter and with a wall thickness of eight centimeters, anchored around 50 meters deep in the seabed. With a length of up to 83.5 meters, these pilings are only ten meters shorter than the Statue of Liberty in New York, including its base. Once the platform is aligned immediately above the substructure, the two parts have to be meshed perfectly with each other. This is the most critical part of the whole installation sequence: it calls for a very calm sea and cannot be done in poor weather. Once this has been achieved, the platform is raised using a hydraulic device in an activity known as “jacking up”. To protect it against giant waves, the
platform is installed 20 meters above sea level. BorWin2 is designed for decades of operation in the rugged North Sea.

The platform is equipped with a helipad and was built under contract to Siemens by Nordic Yards at its shipyard in Warnemünde. The shipyard has been contracted by Siemens to fabricate three HVDC platforms in all. At 12,000 tons, the BorWin2 platform weighs more than 20 loaded and fully tanked Airbus A380 super airliners. With a length of 72 meters and a width of 54 meters, its surface area is more than half the size of a soccer field. The platform’s seven decks, spanning a total height of 25 meters, house not only all the technology and equipment required for high-voltage direct current (HVDC) transmission, but also living quarters.

Up to 100 employees at a time will be active on the platform for the next phase of the project in the North Sea. They will first re-open the doors and panels previously welded closed for transportation, and remove other transport safety fixtures and ballast weights. They will then commission the maritime systems such as the position lights and radio installations, and start up the air conditioning and water treatment systems. A self-propelled jack-up platform - a kind of mobile logistics and accommodation island - will provide on-site catering and living quarters for the crew.

The platforms are fully automated and, once commissioned, the systems can be monitored and controlled from land, with cameras and sensors providing a complete overview of the current operating status. The crews’ quarters on the platform can be used when maintenance work is required. Siemens has been contracted by TenneT for maintenance of the grid connection for an initial period of five years.

The special circumstances and challenges posed by such projects called for appropriate risk hedging. The insurance concepts for grid connection projects in the North Sea are individually tailored, with the Siemens Financial Services insurance unit (SFS Insurance) actively involved in the development of these concepts. These insurance solutions cover material damage to the platform and to the installations during construction and shipping, and within the warranty period.

HVDC solutions and the associated services are part of Siemens’ Environmental Portfolio. Green products and solutions account for about 43 percent of the Group's
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turnover. This makes Siemens one of the world's largest providers of environmentally compatible technology.

Offshore platform for BorWin2 North Sea grid connection successfully installed at sea

Siemens installed the offshore platform for the BorWin2 grid connection at sea in April 2014. BorWin2 is scheduled to go into operation in 2015. The platform is designed for decades of operation in the rugged North Sea and, once commissioned, will be remotely monitored and controlled from the mainland base.

German wind farms with HVDC grid connections

To reliably convey the power from offshore wind farms to the mainland over long distances, the German-Dutch grid operator TenneT counts on low-loss high-voltage direct current (HVDC) transmission. Siemens is implementing a total of five of the
nine HVDC offshore grid connections in the North Sea ordered to date, and thereby helping to make Germany’s energy transition a success.

HVDC grid connection links numerous wind farms to the mainland
High-voltage direct current (HVDC) technology enables the alternating current generated by the wind farms to be converted into low-loss direct current. First, a number of transformer platforms arranged around the wind farm transform the alternating current before it is converted into direct current on a HVDC platform. It is transported to land via a submarine cable and then converted back into alternating current for onward transmission. HVDC technology is usually used when transmission cable lengths reach 80 km and longer.

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Further information is available at: www.siemens.de/energy