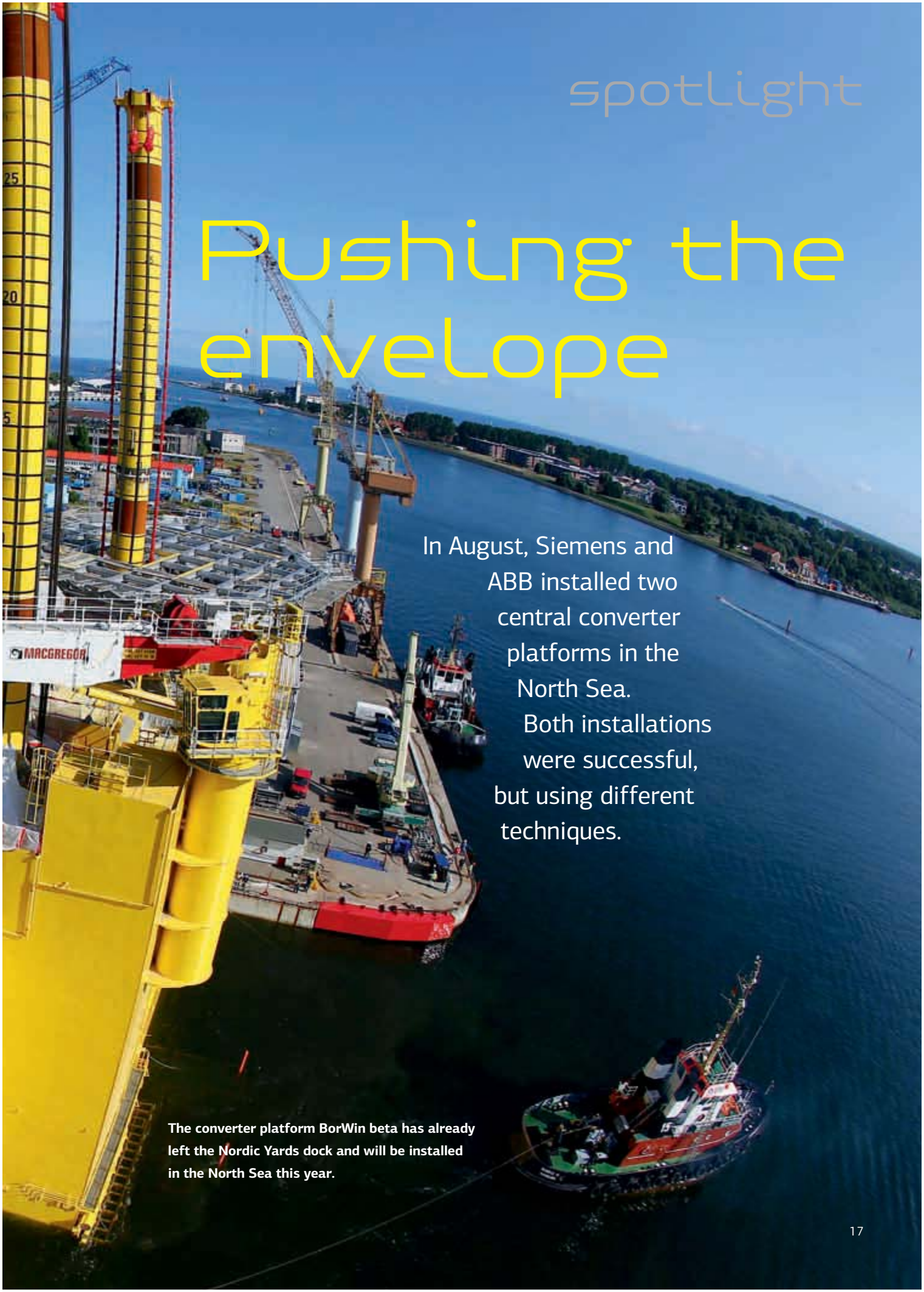
Photo: dpa

Pushing the envelope

In August, Siemens and ABB installed two central converter platforms in the North Sea. Both installations were successful, but using different techniques.



The converter platform BorWin beta has already left the Nordic Yards dock and will be installed in the North Sea this year.

Seven decks, a galley, 24 bunks, 12 cabins, common rooms and all kinds of sensitive electronics are encased in thousands of tons of steel. The converter platforms for German offshore wind farms no longer have anything in common with normal substations. They have the contours of a high-rise building and are reminiscent of a small town. The DolWin alpha (11,000 t) and HelWin alpha (12,000 t) platforms, which were built by ABB and Siemens, might as well be from another star when it comes to converter construction, and they are the heart of German electricity generation at sea.

Due to the high losses in power transmission via AC power lines over long distances, the converters play a central role. They convert the AC current from offshore wind turbines into DC current and relay it to land via high-voltage direct current (HVDC) lines. There it is converted back into AC current by an identical station.

It may sound simple, but it is actually a structural and logistical masterpiece that pushes technology to its limits and makes even the largest floating cranes in the world creak and groan under the strain. The challenges that these projects entail have already caused significant delivery delays for technology giants Siemens and ABB.

Successful float-over

The HelWin alpha station is 75 m long, 50 m wide and integrates seven decks into an overall height of 27 m. At the end of August, the weather conditions stayed favourable for long enough to allow it to finally be pulled out to sea by four tugboats and installed off the shore of Heligoland. The entire voyage took a total of one week and the installation process took four additional days.

The offshore wind farms Meerwind Süd/Ost and Nordsee Ost, both of which are already under construction, will later be connected to HelWin alpha. This was the first time a heavy platform had been installed in the North Sea using the float-over method without a floating crane, and the tension at Siemens was correspondingly high. Karlheinz Springer, CEO of the Power Transmission Division of Siemens, is clearly pleased: "The installation of our platform at sea marks the successful completion of the most critical phase of the project."

The transmission system operator TenneT has commissioned Siemens to build four converter stations, each of which will have two wind farms connected to it. The company decided against using a floating crane to install the first three converters, because there are only two ships worldwide that can deal with that kind of weight which also need suitable weather conditions. Instead, they chose a different option and designed a self-constructing platform.

To achieve this, a base frame was first anchored just under the sea for HelWin alpha, which has six holders for 100 m long steel pipes with a diameter of 3.2 m. The pipes themselves are located in powerful hydraulic towers on the deck of the platform. "Then, in late August, four tugboats positioned the HVDC platform at exactly the right spot, and the pipes could be threaded into the base frame. The topside was then connected to the substructure," Torsten Wolf, press spokesman at Siemens explains. Once that was finished, it was time for the hydraulics. It took the hydraulic system one day to push the steel construction up to 22 m above sea level, so that it would be protected from rogue waves.

A total of 100 workers will be involved in activities at the construction site for several weeks to come. The tasks that need to be performed include things like removing the ballast tanks that were attached for the voyage and opening doors that were welded shut using cutting torches. The interior of the station was also packed extremely carefully so that no damage would occur due to transport accelerations or swell. "The HVDC converter, which has a transmission capacity of 576 MW, will be completely ready for use in the second half of 2014 and will then be handed over to the client TenneT for further testing," Wolf said.

Ready and waiting

The completed BorWin beta platform will set itself up in exactly the same way. The installation is planned for this year, but Siemens may have already missed its window of opportunity as far as the weather goes. With a transmission capacity of 800 MW, the converter weighs a whopping 14,000 tons, and even that is not the end of

Photo: Siemens

The float-over method: four tugs precisely positioned the HelWin alpha converter platform over its base frame.

the line. The weight is set to increase a notch, "because the third station, SylWin alpha, will weigh 17,000 tons and is currently being built directly on a pontoon. It is 120 m long, 40 m wide and has a height of 8 m. The completed converter will be towed directly to the construction site and then lowered from the pontoon onto the base frame, using motors to control the process. The float-over process is widely used in Asian waters and is a proven method," Andreas Rosponi of Overdick Ingenieure GmbH explains.

The specialists for maritime construction problems played a key role in developing the concepts for Siemens. In principle, SylWin alpha could also be transported using tugboats. According to Rosponi, there is no reason why this wouldn't be feasible. To him, the biggest challenge would be the depth of the converter, which is greater than HelWin Alpha due to its design. "The base frame would also have to be much deeper below the surface. However, this would cause problems with the rigidity of the whole structure. In addition, the connections would have to be cemented with liquid concrete or welded," he says.

Siemens will rely on a floating crane again for its HVDC station HelWin beta, which will be the last one it builds for a while – even though the Federal Network Agency has mandated that HVDC stations have to have

The crane method: the topside of DolWin alpha was lifted onto the previously installed jacket by the crane vessel Thialf.

a transmission capacity of 900 MW, making them even heavier. To ensure that the available crane capacity is sufficient, Siemens intends to install HelWin beta in a trimmed-down form. Missing parts will be installed later at sea.

Slimming down

ABB has demonstrated that this is feasible. Its DolWin alpha platform is 62 m long, 42 m wide and 42 m high. At the end of August, tugboats attached their towing hooks to the steel colossus in Rotterdam and pulled it to the North Sea, accompanied by the Thialf. This floating crane can lift up to 14,200 tons with its two cranes, making it the world's most powerful crane vessel. Working conditions, however, have to be right for a machine as huge as this to operate, and that includes the water depth.

The Thialf is semi-submersible and has a weight-dependent draught of 12.5 to 31.2 m, which can be modified with ballast. However, since the water depth 45 km off the coast of Borkum is only 27 m and the complete topside of the offshore converter station weighs over 9,000 tons, ABB had to get rid of almost 2,000 tons. "We left out the transformer, the helicopter landing deck and the accommodation section for the personnel, among other things. These parts were installed later at sea, so that the Thialf had the correct weight during the first lifting operation and the topside could be lifted onto the jacket anchored to the seabed," Alexander Sonneck of ABB said.

In 2014, ABB will test its Gravity Based Structure (GSB), which is a fully floating construction; the second HVDC converter DolWin beta with a transmission capacity of 920 MW is also extremely heavy. With the new concept of the Norwegian offshore specialists Aibel, the fully-equipped topside is already on a floating foundation and will be towed by tugs to the construction site for installation.

This heavyweight steel foundation with six legs is currently being built by Drydocks World in Dubai. It is equipped with two hollow pontoons, which will be flooded at the construction site and then filled with mud and gravel. However, that will not happen for some time. The construction will first be carried piggyback by ship from Dubai to Haugesund, Norway, for final preparations. From there, it will then travel to the German North Sea.

Torsten Thomas

DC converter for the German North Sea

		Client	Yard	Capacity	Status
BorWin	**alpha**	ABB	Heerema	400 MW	in operation
	beta	Siemens	Nordic Yards	800 MW	ready for installation
DolWin	**alpha**	ABB	Heerema	800 MW	installed
	beta	ABB	Drydocks	924 MW	under construction
	gamma	Alstom	Nordic Yards	900 MW	commisioned
HelWin	**alpha**	Siemens	Nordic Yards	576 MW	installed
	beta	Siemens	Nordic Yards	690 MW	under construction
SylWin	**alpha**	Siemens	Nordic Yards	864 MW	under construction

www.offshorewindindustry.com/converter-stations

Photo: ABB