Germany continues to invest in green energy. By early 2019 approximately 460,000 additional households will be provided with sustainable wind-generated electricity by the Borkum Riffgrund 2 Offshore Wind Farm. Borkum Riffgrund 2 counts 56 Vestas turbines of 8MW each, resulting in a total capacity of 450 MW. Twenty turbines were installed on 50-metre-high jackets with 10-metre-high suction buckets. Thirty-six other turbines were placed on top of monopile foundations.

In the summer of 2016, the owner and developer Ørsted Wind Power A/S awarded the contract for the installation of the monopile foundations to the Jan De Nul Group. The scope comprised the temporary storage, transport and installation of 36 monopile foundations (MPs), 36 Transition Pieces (TP) bolted on top of the MPs, and the anode cages. The Jan De Nul Group was also responsible for the supply, transport and installation of scour protection around the 36 MPs and around the 20 Suction Bucket Jackets foundations. Jan De Nul Group also carried out the cable installation, which connects the Borkum Riffgrund 2 Offshore Wind Farm to the onshore grid. This project was successfully completed in mid-June 2018, for TenneT, the power supplier.

Borkum Riffgrund 2 is being developed off the coast in the German Exclusive Economic Zone (EEZ), 17km east of the Dutch border, 34km north of the island of Borkum and 54km north-west of the German mainland. The windfarm is one of several located within a cluster of projects, in an area especially designated for offshore wind energy production (Vorranggebiet Windenergie). It is surrounded by the operational Borkum Riffgrund 1 and Trianel Windpark Borkum offshore wind farms, all three are connected through the DolWin...
alpha and gamma substations to the German onshore TenneT grid.

‘Think before you act’

Each offshore wind project is different and has its own challenges. It is imperative to think before putting anything into action. Jan De Nul Group started designing and manufacturing one year before the actual installation. This solid preparation resulted in a flawless collaboration, with the client and subcontractors, and thus, in a safe installation process.

Each monopile foundation consists of a monopile (MP), a transition piece (TP) and an anode cage. Jan De Nul Group improved the client’s assembly design, based on its in-house expertise in offshore wind installations. For the first time, Ørsted agreed to have a bolted connection between the MPs and the TPs, instead of the grouted connections, which they use on their other wind farms.

Jan De Nul Group proved the strength of the bolted technology by using a full-scale mock-up test during the start-up phase. The results of this dummy test, enabled Jan De Nul to optimise the bolting procedure and efficiency, and to fine-tune the accuracy of the bolt tension monitoring system, which was a of paramount importance.

The Intellifast Ultrasonic System was eventually chosen as the best bolt tension monitoring system.

Crucial to plan and keep control

All three foundation components were fabricated by the German manufacturer Steelwind in Nordenham. Steelwind loaded the components onto barges for transport to Eemshaven, the marshalling harbour for the project.

After undergoing considerable alterations at the Nauta shipyard, in Poland Jan De Nul’s offshore installation vessel, Vole au vent, arrived at the port of Eemshaven in mid-February. The vessel was modified to create more deck space for the monopiles and transition pieces, with diameters varying between 6.5m and 8m, and also for the Noise Mitigation System, a hammer spread, lifting tools, an ROV for the sub-sea installation of cables and other project specific equipment.

A week after arrival of the Vole au vent in Eemshaven, the vessel launched the project by sailing out for the first installation trip. The installation of the first bolted wind turbine generator foundation for Ørsted took one day. Jan De Nul’s team installed on average one complete foundation per day consisting of MP, TP and anode cage.

Jan De Nul installed the 36 monopiles, transition pieces and anode cages in less than four months, delivering the project on 26 May 2018. Two weeks ahead of schedule.

There were strict project planning deadlines, which meant it was crucial to gear the transport arrangements to the offshore installation schedule.

Scouring around the foundations

The scope of the contract also entailed the installation of scour protection, around the foundations of all 56 wind turbine generators of Borkum Riffgrund 2. Jan De Nul Group’s fall pipe vessel, Simon Stevin, was mobilized for the rock installations around the monopile foundations, whereas

Koen Marchand, Project Manager Monopile Foundations Installation Project

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The multi-purpose vessel, Adhémar de Saint-Venant, was in charge of the suction bucket, jacket foundations’ scour protection. Additionally, the Simon Stevin installed the filter layer of rock, for the suction bucket jackets’ foundations. 92,500 tonnes of Norwegian, high-density rock were selected for the works executed by the Simon Stevin, to provide sufficient stability. High density rocks are more stable due to their higher, specific density, which results in a heavier stone layer compared to the standard rock gradings. By integrating this type of rock into the design, the scour protection layer thickness could be minimised.

Coasters loaded the rocks in the quarry and shipped them to the Simon Stevin in Eemshaven. The multi-purpose vessel, Adhémar de Saint-Venant, sailed to Norway to load 52,000 tonnes of high-density rock and shipped them to the site, where she installed the rocks around the foundations, using a large inclined fall pipe for the scour protection of the suction bucket jackets.

Noise mitigation measures taken
During the design and engineering phase, special attention was given to the environment and to the sustainability of the offshore construction methods. Offshore piling works in European waters are subject to stringent regulations for underwater noise and the impact on sea fauna and flora. The construction method used for the 36 monopile foundations needed to prevent or mitigate potential environmental impacts. Jan De Nul Group worked out a noise mitigation concept entailing the use of a bubble curtain and the Noise Mitigation System developed by IHC.

A bubble curtain is a well-known technique in the offshore industry using a subsea ring of perforated pipes letting out freely bubbles of air underwater, encircling the monopile. The curtain of bubbles creates a barrier which breaks the waves and prevents particles to spread.

The deployed Noise Mitigation System (NMS) designed and built by IHC Offshore Systems consists of an 800 tonnes double-walled casing, preventing the produced noise of the piling works to come out of the casing. The double walls are separated through an air-filled interspace. Additionally, the NMS creates its own bubble curtain inside, between the NMS wall and the monopile.

Connected to the onshore power grid
Jan De Nul’s multipurpose vessel Willem de Vlamingh installed the two cables with a total length of 15.5 km connecting the Borkum Riffgrund 2 Offshore Wind Farm substation to the DolWin Gamma convertor station. This DolWin platform converts the electricity generated by the windfarm into Direct Current (DC) before transporting it to TenneT’s onshore network.

The trenching support vessel Adhémar de Saint-Venant executed the cable protection works by means of post-lay jet trenching using Jan De Nul Group’s UTV1200 trencher.

The main goal was to build and complete another offshore windfarm supporting the mutual goal of establishing sustainable energy to feed thousands of families with green energy. Short lines of communication, clear and strict planning, and close cooperation between all parties involved, proved to be the key to success. This all resulted in finalising the offshore installation of the monopile foundations two weeks ahead of schedule.

‘The successful completion of this cable installation project will add onto our extensive track record for the installation of submarine power and umbilical cables for both the renewable and the oil & gas energy sectors.’

Wouter Vermeersch, Manager Offshore Cables at Jan De Nul Group

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