The Viking Neptun is a 145 meter long cable laying vessel equipped with an advanced cable installation system

Achieving precise cable laying for offshore wind farms with a vessel mounted ADCP

Safely and precisely laying subsea power cables is crucial for transmitting power from offshore wind turbines to the onshore grid. Belgian company DEME depends on Nortek's vessel-mounted ADCP system to provide real-time, high quality current data across the entire water column, ensuring stable and secure subsea cable installations.

Subsea cables are required to connect offshore wind turbines to the power grid onshore. Precise and successful installation of these cables is challenging due to the dynamic and varied subsea environments they must be laid in.

Marine services company DEME uses a vessel-mounted Acoustic Doppler Current Profiler system, the VM Operations, to provide real-time information on current speed and direction throughout their cable laying operations. This data enables the team on the vessel to make adjustments during installation, ensuring precise cable routing and extending the lifespan of these crucial wind farm elements.

The global transition to renewable energy sources, such as wind power, is crucial to slowing the effects of climate change. Governments worldwide are pushing the growth of offshore wind, resulting in a large uptick of offshore wind farms in the last decade. This trend is predicted to continue for at least the next decade, according to the Global Wind Energy Council's 2023 Global Offshore Wind Report.

Developing an offshore wind farm, however, is no small feat. A site with suitable wind, ocean and seabed conditions must first be selected. Wind turbines are installed and connected to an offshore high voltage station, which collects the energy the turbines generate. In turn, this station is connected to shore via subsea power cables which deliver this renewable power to the grid onshore. The installation and maintenance of the turbines, cables and other wind farm elements require skilled and well-equipped crews.

Making offshore wind farms possible

Belgian company DEME specialises in dredging, marine infrastructure solutions for the offshore energy market, environmental works and concessions. Offshore wind plays a key role in its vision for a more sustainable future.

It works on several elements of the offshore wind installation process. According to Matthias Plasmans, Offshore Installation Manager at DEME, the business is involved with the installation of turbines, as well as laying the cables that connect the turbines to the high voltage station and from there to shore.

Plasmans works on DEME's Viking Neptun, a cable laying vessel recently equipped with Nortek's VM Operations: a vessel-mounted Acoustic Doppler Current Profiler (ADCP) system.

Precise installation of offshore wind power cables

Choosing a route for a cable between turbines or from the high voltage station to the shore requires knowledge of the subsea environment to avoid damage to the system. Precise knowledge of the location of the laid cable is crucial to the longevity and protection of the cable.

'The bathymetry of the seabed is very important for laying cables. We need to avoid obstacles like rocky outcrops that may damage the cables. We also need to avoid artifacts, shipwrecks or bombs,' says Plasmans. 'Once all that has been taken into account, a cable route will be drawn. It might be a straight line, or it may need to route around some artifacts or subsea features.'

Additionally, cables are often buried for extra protection. Buried cables are less likely to be damaged by fishing gear or anchors from other vessels. Proper cable laying facilitates burial, and knowing the exact location of the installation allows it to be added to maritime charts, helping fishing vessels and other seafarers avoid the area.

The process behind cable laying and connection

Turbines are typically connected to each other, and in turn connected to the high voltage station. When connecting a cable to a turbine, the cable is lowered off the ship, pulled into the turbine, and connected to the switchgear, the device that controls power output from the turbine.

'Then we start moving the vessel ahead, tracking the predefined route with dynamic positioning, and lay the cable until we come to the second turbine,' says Plasmans. 'There, we let the cable off the vessel in a controlled way, laying it down gently while it is being pulled into the turbine with a Dyneema rope.'

Using an ADCP to mitigate the challenges posed by dynamic currents and tides

'Everything we do is complicated by the fact that we are operating at sea,' explains Plasmans.

Currents and tides are one such complication. Water movement can affect the position of the cable as it travels from the vessel to the seabed. However, knowledge of the current conditions allows the operators to adjust their plans accordingly for a successful cable installation, and if this information is provided to vessel operators in real time, even constantly changing current conditions can be adapted to.

'The cables are quite flexible and take on a curved shape coming off the vessel towards the seabed,' clarifies Plasmans. 'So, if a cable goes into the sea and there is a current moving north, it might be two meters north of the planned design line by the time the cable hits the seabed. But if we know that the current is there, we can take it into account and move our vessel south, and then lay the cable down on the correct spot.'

Current data is essential not only for ensuring the cable is laid correctly on the route, but also for safe connection of the cable to the turbine as it is being lowered from the vessel.

'The last thing you want is the Dyneema rope or cable getting pushed towards the vessel or into the vessel's thrusters,' argues Plasmans. Such a scenario may be avoided with knowledge of current speed and direction.

DEME uses weather and tide forecasts to help plan its operations and has recently added the VM Operations system to its toolkit. The system provides the team with real-time current speed and direction over a 100 meter profile beneath the vessel, providing much more accurate information on the current conditions than weather and tide forecasts alone. The data are sent directly to the bridge so operators can continually adjust their maneuvers.

'With the VM Operations ADCP on the bottom of the vessel, we can look through the water column and know the current speed and direction at every depth at that very moment,' says Plasmans. 'This real-time data is important for us. We know what we're dealing with, and we can make adjustments accordingly.'

Before ADCPs 'the fish' was used for measuring currents

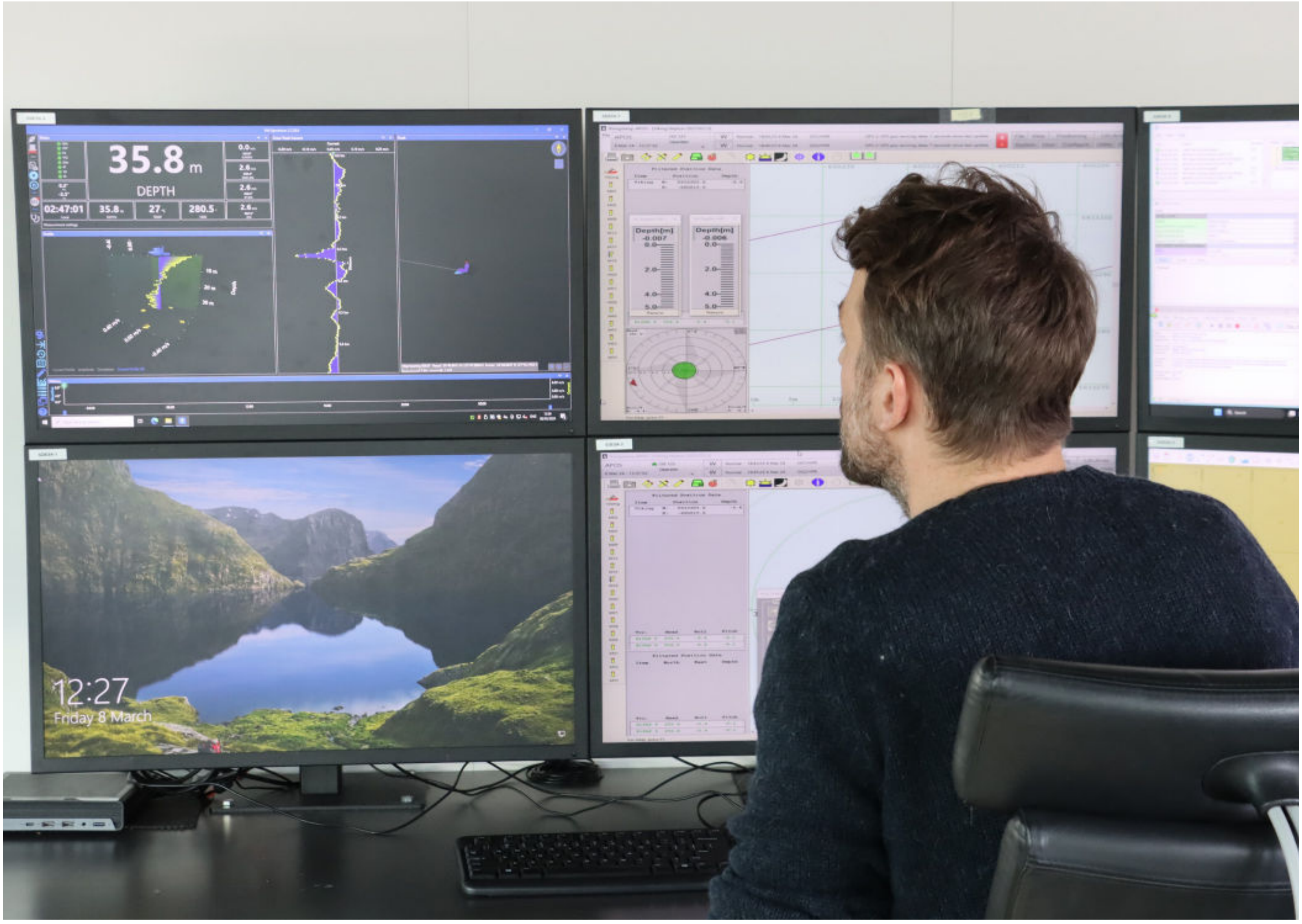
Prior to installing an ADCP on its vessel, DEME relied on less accurate current measurement methods for its cable-laying operations. 'We had what we called a 'fish',' recalls Plasmans. 'It was like a small torpedo with a small propeller and sensors on it. We'd lower it into the water and then measure how fast the propellor spun. The faster it spun, the stronger the current.'

Plasmans says the 'fish' was less than ideal. The measurements were not as accurate as an ADCP and were limited to a single depth near the surface. They also had to be careful that the rope attaching the 'fish' to the vessel did not become entangled in the thrusters. If weather conditions deteriorated while it was in the water, recovering the sensor became more difficult.

'It was better than nothing. Now, we have the ADCP, which stays on throughout the operation. It's much more user friendly and much more accurate,' he says.

Overall, DEME has found that equipping its vessel with the VM Operations has led to improved installation safety, quality and efficiency.

Loading a subsea cable onto the Viking Neptun in Amsterdam. This cable was used for installation at the Dogger Bank Wind Farm, UK



The VM Operations system delivers current data at multiple depths directly to the vessel operators so they can make real-time adjustments

The importance of current data at multiple depths

The Viking Neptun will be working on a new floating offshore wind project off the coast of Leucate and Le Barcarès in the south of France. The Les Éoliennes Flottantes du Golfe de Lion project will power 50,000 homes.

Floating offshore wind is a relatively young technology but holds much promise in the future of wind energy. Fixed bottom turbines attach directly to the seabed but are limited to waters up to 60 meters deep. Floating turbines, on the other hand, sit on the sea surface, held in place with a mooring system in waters up to 100 meters deep. With 80% of the world's offshore wind potential lying in waters deeper than 60 meters, floating wind opens up more options for offshore wind development.

According to Plasmans, for this project, the DEME team will be laying the export cable which delivers power from the turbines to the shore. The fact this project is for floating offshore wind presents its own unique set of challenges.

Since currents can change with depth, laying cables accurately can be more challenging for floating offshore wind farms in deep waters. The current velocity profile provided by the ADCP will be even more important to the team as they tackle cable-laying for this project.

'Having real-time, high-quality data throughout the water column helps us plan and adapt to the actual conditions,' says Plasmans. 'Even though we have weather and tide forecasts, we need good data. Not only predictions of what will happen, but what is happening in real time. The VM Operations gives us real life values, not calculated values, and that is very valuable.'

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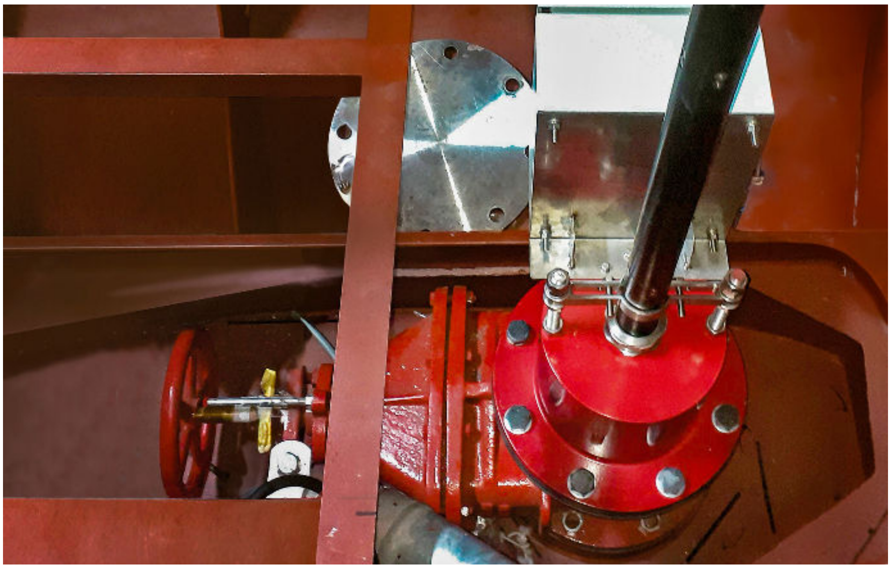

The VM Operations with a sea valve to maintain the ADCP, without the need for divers or docking the vessel