Offshore wind and Fugro’s vertical boring machine

James Amos, business development manager, Fugro, tells GDI how demand from the company’s clients to deliver faster cycle times for the installation of offshore wind farm foundations and a resultant reduction in overall project schedules is driving new technological developments.

The history of wind power development has been focused on the engineering of taller and larger turbines. Bigger turbines capture more wind, therefore producing more energy. In offshore wind, in particular, it is crucial to maximise the uptime of wind turbines in order to generate as much energy as possible, meaning that regular inspection and maintenance of these turbines is essential for maximising energy output.

More wind energy per turbine means that fewer turbines are needed to generate a desired capacity across a wind plant—ultimately leading to lower costs. The average turbine rating 10 years ago was 4MW, but this has come on significantly. In 2019 the average turbine rating was 7MW and is currently 9.5MW for projects that are now under construction. Incredibly we are expecting 15MW turbines to be the standard by 2030, a huge improvement.

With wind power providing an abundant energy source and decreasing costs many countries plan on using wind to accelerate their net zero strategies or low carbon energy transitions. It is anticipated that global offshore wind capacity will surge to over 250GW by 2030. Conservatively, an additional 176GW is planned. Assuming an average turbine size of 12MW, this is over 14,500 new turbines.

As governments outline ambitious targets to reduce carbon emissions, it has become increasingly important for the renewables industry to find new, innovative ways to build capacity and reduce cycle times to best take advantage of their assets. In order to improve both efficiency and sustainability, the industry is starting to turn more towards innovative solutions, powered by technology.

CHALLENGING ENVIRONMENTS

With the continued expansion of offshore wind, the number of sites that have the favourable combination of metocean and low strength geological (i.e. driven foundations) conditions are declining, and we are observing a shift to develop-
ing sites with more challenging foundation installation environments (i.e. drilled foundations). Drilling means a longer time in the field, which calls for longer vessel days and in turn means increased costs. The shift in the environment also signifies a shift in specific needs for drilling and construction.

Historically, and on a smaller scale, this need has been addressed by pile top reverse circulation drilling (RCD), a robust and well-established drilling technique, but one that yields a low rate of penetration (RoP). Our clients have tolerated inefficiencies with airlift and slow RoP delivered by RCD but this is now no longer the case. There is compelling demand from our clients to deliver faster cycle times and reduce overall project schedules.

TECHNOLOGICAL INNOVATION

Continuous technological innovation remains at the forefront for our organisation. When we talk about innovation, we are often talking about topics like new artificial intelligence (AI), software, data collection and autonomous vehicles. A huge piece of the industry that is often overlooked in this technological era is the construction equipment itself. Innovations that deliver increased efficiencies, improve performance and reduce installation costs are essential to remain competitive in the renewables sector.

We unlock these by developing new, ground-breaking installation methodologies for the offshore market. One such innovation is our vertical boring machine (VBM 3000), the first in a series of subsea vertical boring machines, designed to maximise the efficiency of foundation drilling operations for pre-piled jacket projects, thus greatly reducing cost and overall programme time, and mitigating health and safety risks.

Some of the key benefits of this technology include:

- Safer working environment – drilling operations take place remotely, reducing exposure to HSE risks
- Increased drill speed – the drive system’s proximity to the drill face allows for an increased revolutions per minute (rpm) of the drill bit achieving a drilling rate up to three times faster than RCD methods
- Improved spoil removal – the use of an integrated dredge pump increases spoil removal efficiency, enabling enhanced RoP (when compared to airlift)
- One pass installation – simultaneous installation of casing and drilling overburden reduces the construction programme

Globally, the construction industry is responsible for 11 per cent of energy-related carbon emissions. It is not unreasonable to think that countries will require zero emissions on heavy construction equipment, the same as they are doing now with road vehicles. Much like the auto industry has been making a bigger push to transition to electric vehicles, our future goal is to go all-electric. Benefits of the all-electric VBM include being environmentally friendly (less high-volume oil components), reduced noise, zero emissions and reduced service times.

LOOKING TO THE FUTURE

Wind farms of 2030 and beyond are only expected to be bigger, located in deeper waters, and become even more complex structures. They will have larger single rotor turbines or even multiple rotor turbines, be further from shore with stronger wind conditions and use state-of-the-art technologies for operation and maintenance. Sites like these may require new thinking in terms of construction, operation and maintenance. We have considered a few challenges and opportunities as we push the boundaries of technological innovation. One of these sectors is the floating wind market.

The floating projects of today have parallels with the fixed-bottom market in its early days of development. The number of available sites is increasing rapidly, expectations and competition are high. The floating wind market is still relatively nascent with about 40 different platform designs and no projects exceeding 100MW in the water. Currently, there is no clear winner for a universal anchor solution.

How the story of offshore wind will unfold will be dependent on the industry’s willingness to embrace technology like the VBM to facilitate the installation of marine foundations. Our technology will evolve to accommodate the foundation and varying environment types that are presented by our clients.

We are committed to meeting the aggressive number of projects to be commissioned and technology such as the VBM will help us achieve that. The VBM equipment is smaller, compact and more efficient as it does not require the deck space or large cranes normally associated with installing monopiles. This eliminates the need for specialist one-off installation vessels and means we can use the fleet of existing offshore vessels reducing the overall duration of drilled projects and ultimately, the cost per MW installed. In a highly competitive market, this increases the industry’s capacity to deliver on multiple large-scale projects in parallel.

James Amos is the Marine Infrastructure Services (MIS) business development manager at Fugro. He is responsible for the business development and sales growth of foundation drilling and installation services for construction activities in marine and over-water environments. Most recently developing opportunities with energy clients for Fugro’s innovative VBM 3000.