



Foundations for the future

Belfast based fabricators Harland and Wolff are to build the world's first commercial offshore "suction bucket" foundations. **Alistair Welch** reports

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 ABOVE: The
 Universal
 Foundation Met
 Mast

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 RIGHT: Robert
 Cooper, Chief
 Executive of
 Harland and Wolff



Industry experts estimate that foundations account for 30 percent of the overall cost of an offshore wind turbine - as a result, developers have been keenly searching for cost-saving options in this area. So-called "suction bucket" foundations is one technology that has been proposed and Forewind will deploy an innovative foundation design based on this technology when the consortium installs two meteorological (met) masts in its Dogger Bank zone - a Round 3

site which, at its furthest point, is 290km (180 miles) from the North Yorkshire coast - in 2012.

The met masts, which will monitor wave and wind conditions at Dogger Bank, will be fabricated by marine engineering specialists Harland and Wolff (H&W) as part of an overall project secured by Fred Olsen United. Further Fred Olsen companies, Universal Foundation, SeaRoc and Windcarrier will provide the foundation design, topsides and installation respectively.

The data gathered by the masts when deployed will be used in the design and development of what will become the largest offshore windfarm in the world.

The suction installed bucket foundation design was identified as part of the Carbon Trust's collaborative Offshore Wind Accelerator programme, an initiative which aims to reduce the cost of offshore wind energy by ten percent through research, development and demonstration. In 2009 The Carbon Trust opened a foundation design competition that attracted 104 entries from throughout the world and resulted in the selection of four finalists, including the suction bucket.

The foundation is aligned into verticality via an operator varying the pressures within hundreds of water jets integral to its base as a vacuum pump sucks it into the seabed. It uses less steel than conventional piled foundations and its design removes the need for pile driving, seabed preparations, scour protection and a transition piece.

"As the design involves an installation technique whereby the verticality of the foundation is controlled by a lip-mounted jetting system, there is no transition piece," explains David McVeigh, H&W Sales and Marketing Manager. "It is this installation process that is novel and intelligent and represents the major cost-saving element."

H&W engineers claim that in

typical Round 3 water depths (between 20-60m) the suction bucket, in comparison with tripod or jacket based designs, can cut costs by 50 percent.

To confirm the performance of the suction foundations, verify the design parameters and measure the loads and conditions they endure on Dogger Bank, one will be equipped with strain gauges, meters and data collection systems. This testing process is important to the commercial future of the technology: "Nobody will commit to having a field of 80 to 100 of these without having some form of long-term proof," says McVeigh.

Another reason why the suction bucket is more cost-effective is that it does not need to be installed from a heavy jack-up; it is designed to be installed from cheaper-to-hire DP vessels.

Nevertheless, the advantages of the foundation extend beyond pure cost. The design combines the main aspects of a monopile and a suction bucket into one product. Unless the seabed is heavily sloped, there is no need for seabed preparation. With no need for pile driving a number of environmental concerns are eliminated.

Dr Lee Clarke, Forewind's general manager, believes that the installation of the met masts will represent a significant milestone for the consortium, and for the offshore sector more broadly, if the new foundation process proves capable of delivering significant

cost reduction: "We have used our requirements for met masts to look beyond the standard foundation approaches and instead to demonstrate a new, exciting technology with possible benefits well beyond just the Dogger Bank development."

The technology has been developed over nearly a decade and after a number of successful prototype installations for both met masts and turbine foundations, is now entering full-scale production and supply to the commercial offshore wind market. "Our current provision is sufficient to manufacture in small numbers, but we are looking to increase volume significantly over the coming years," comments McVeigh.

Chief Executive of H&W Robert Cooper adds that Forewind's decision to deploy the foundation is significant in more ways than one: "Not only are we delighted to be part of the team awarded the contract to supply the two met masts, but this is also a significant development for H&W's ambitions toward volume manufacture of these revolutionary foundations," he says. "We continue to invest heavily in research and development, new equipment and training to drive down manufacturing costs."

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Read more about the development of the Dogger Bank zone in an article by Forewind's Gareth Lewis on p.46.