

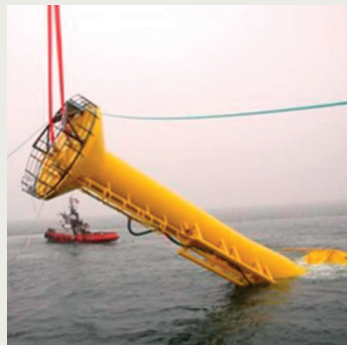
Installation: Horns Rev 2



The bucket foundation is lowered into the water



Bucket foundation being floated to site



Up-ending in progress



The bucket foundation during installation

The Project

In March 2009, Universal Foundation Norway (previously MBD Offshore Power) in cooperation with Dong Energy installed a mobile meteorological mast with a suction bucket foundation at the Horns Rev 2 site in the East North Sea. The foundation system was fabricated by Bladt Industries in Aalborg in 2008.

Design Brief

Following the Frederikshavn project, which was delivered in 2002 in a protected harbour environment, the Horns Rev 2 project saw the first true offshore deployment of the Universal Foundation. The aim of this project was to demonstrate the feasibility of a floating installation process and to deliver a movable met mast that could be used in several offshore wind farms.

The mobile structure was a prototype and utilised a monopod bucket foundation design as the support structure for a meteorological mast.

Technical Specification

The bucket foundation was designed to float out to site using two tug boats to guide it. To make this possible, 40 metres cubed of water was pumped into the head of the mobile met mast to ensure that it remained horizontal whilst afloat. Once it reached the installation site, it was then up-ended using a heave-compensated crane. It was necessary to pump air into and out of the bucket skirt during the up-ending process to stabilise and level the structure.

The bucket foundation was successfully installed to within 0.1 degree of true vertical and to within 0.6m of full seabed penetration (due to an unexpected sand wave). All

expected installation parameters were met or exceeded and the foundation remains in this exact position to this day.

Ongoing maintenance of the foundation system is kept to a minimum due to the inbuilt scour-prevention system that has been designed in to the lid section of the bucket. The reinforced structure not only acts as the main support for the tower section of the foundation but also serves to control and slow the flow of water and substrate over and around the interface point between the foundation and the seabed. The result is that the seabed around the foundation is significantly more stable and scour is dramatically reduced. To this end, no additional scour protection is required, a site investigation campaign was performed in 2013 in which the scour protection capability was confirmed. No additional remedial action is needed in order to guarantee the structure's long-term stability.

Quotes

Universal Foundation's Head of Business Development, Kristian Jacobsen said: "Horns Rev 2 proved the feasibility of the Universal Foundation in the intended working environment – offshore! The project furthermore proved that the foundation can rely on multiple installation methods, where a floating concept was used for delivery of this project, installation by a jack-up vessel was later seen at the Dogger Bank campaign in 2013. During operations it has been verified that the integrated scour protection system works and therefore helps reduce the O&M costs of the wind farm. Finally, the structure can be fully decommissioned and 100% removed leaving the site in a completely restored condition".