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Project data

Main quantities

Monopile: 240 t
Transition piece: 44 t
Platform deck: 80 t
Lattice mast: 57 t

Levels

Top lattice mast: C.D. +101.00 m
Platform deck: C.D. +10.00 m NN
Reference level: C.D. +0.00 m NN
Ocean soil: C.D. -24.50 m NN
Toe monopile C.D. -50.00 m NN

Main dimensions

Monopile

Length: 50.50 m
Diameter: 3.40/2.70 m
Wall thickness: 48 - 60 mm

Transition piece

Length: 15.0 m
Diameter: 3.00 m
Wall thickness: 40 mm
Platform deck:

12.20 × 12.20 m

Lattice mast

Length: 91.0 m
4.50 × 4.50 m

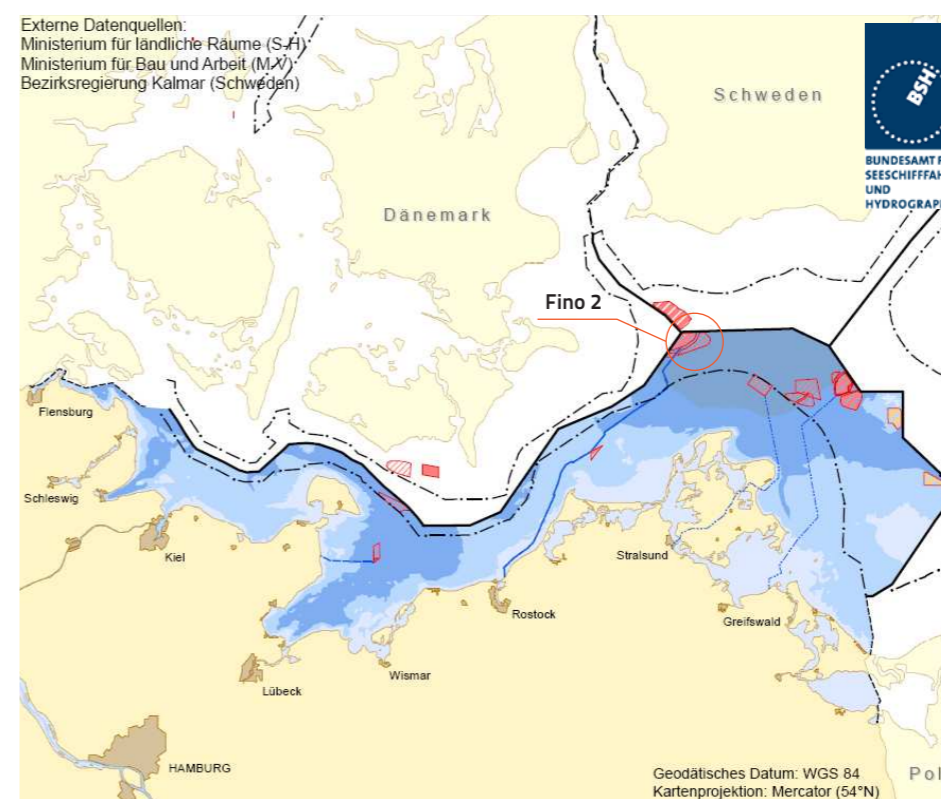
Location

"Kriegers Flak", 39 km north of the island Rügen,
water depth: 20 m
N 55° 00.42', E 13° 09.25'

Installation time offshore

03/2006 - 06/2007

Research Platform Fino 2



Planned and consented
wind farms in the Baltic
Sea; Source: BSH

1. Project background

Major progress in research and development for the generation of wind energy projects is currently being achieved by the construction and operation of research platforms in the North and Baltic Sea (FINO).

The research stations provide important findings for construction and operation processes of offshore wind

farms such as foundation structures, lightning intensity, wind load, possible power generation etc.

In 2003, the research platform FINO 1 was constructed and installed north of Borkum by F+Z Baugesellschaft mbH, a fully owned subsidiary of Bilfinger Berger SE. The construction and installation of FINO 2 was carried out in 2006/07, 40 km north of the German

island Rügen and is thus situated in the Exclusive Economic Zone (EEZ) of Germany, Denmark and Sweden and lies in the immediate vicinity of several planned offshore wind farms at the "Kriegers Flak" location.

2. Project participants

The research platform was financed by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) and the Ministry of Economics of Mecklenburg-Western Pomerania, both represented by the Jülich Research Centre GmbH (PTJ). As the client and operator, the Schiffahrt-sinstitut Warnemünde e.V., Institute at Wismar University, awarded Inros Lackner AG Rostock with the tendering, construction supervision and design of the project.

In the scope of a public tender in the spring of 2006, the joint venture F+Z Baugesellschaft mbH /Per Aarsleff A/S (JV F+Z/PAA), under the technical lead management of F+Z, was awarded the contract to construct and erect the research platform FINO 2 including all technical equipment.

3. Subsoil conditions

The subsoil conditions in the Baltic Sea with the coordinates 55°00'24.94" N and 13°09'15.08" E are initially characterised by a 2.6 m thick strata of medium-grained sand. Below this is a thicker layer of glacial till (semi-firm to firm consistency), which, at a depth of approx. 25 m below the seabed, is interrupted by an approx. 4.7 m strong

layer of basin clay (rigid to semi-firm). This is followed by a layer of detrital to firm chalkstone at 32.2 m below the seabed. This meant that the geological conditions and the water depth were suitable for monopile foundations, whereas the driving analysis indicated pile driving to be difficult.

4. Structural design

The tendered research platform consisted of the following main structures: monopile, transition piece with boat landing and platform deck as well as a wind measurement mast. The construction is certified by the classification company "Det Norske Veritas" (DNV).

4.1 Monopile

The 240-t-heavy and 50.5-m-long steel tube consists of cylindrical sections at the upper end (diameter $d=2.7$ m) and at the lower end ($d=3.4$ m) as well as a conical intermediate piece. Plate thickness varies between 48 mm and 64 mm. According to calculations, a penetration depth of the monopile into the sea bed of 25.5 m is required.

4.2 Transition piece

The transition piece consists of the central tube, the platform deck and the pier construction. The central tube

has a length of 15 m and a weight of approx. 44 t with a plate thickness of 40 mm.

4.3 Steel lattice mast

The four-stemmed lattice mast reaches from C.D. +10 m to C.D. +101 m. The structure is a welded tube construction and consists of four units. The mast narrows from 4.5 m × 4.5 m at the platform deck level to 0.9 m × 0.9 m at the top end. Devices for the measurement of environment data are distributed on seven measurement levels and installed on hinged arms. The mast has a total weight of 57 t.



Delivery of monopile from the floating crane "ENAK"

5. Offshore installation

5.1 Monopile installation

The jack-up platform "Annegret" of F+Z Baugesellschaft mbH is equipped with a crawler crane Liebherr HS 895, a hydraulic hammer IHC S-500, various grabs for removal of obstacles, a decompression chamber for the divers as well as accommodation facilities for up to 20 people. At the end of September 2006, the jack-up platform was hauled from the Port of Rostock, with satisfactory weather forecast, to the location for the installation of the monopile. With a maximum available leg length of 52 m, water depth including safety distance to be observed and air gap were unproblematic for the jack-up platform.

While the jack-up platform was positioned to the precise location by means of tugboats, winches and DGPS, the monopile was received in the Port of Mukran from the pontoon by the floating crane "ENAK" and put in a vertical transport position. Simultaneously to the hauling of the floating crane to the location, the foundation soil was surveyed at the jack-up platform "Annegret" by means of divers in order to localise and remove possible obstacles.

After the floating crane's arrival at the location, the monopile was placed into the hydraulically operated pile driving frame of "Annegret". Subsequently, the pile was driven into the ocean soil by means of a hydraulic hammer. Some of the anticipated difficulties arose, but nonetheless the pile driving operation was successfully completed due to the hammer's sufficient reserves.

5.2 Manufacturing, equipment and installation of platform and lattice mast

As of October 2006, the transition piece, platform deck, boat landing as well as four sections of the lattice mast were fabricated.



Pile driving with hydraulic hammer