Aarhus

Lokesvej 15
8230 Aabyhoej
Denmark
+45 8744 2222

Hamburg

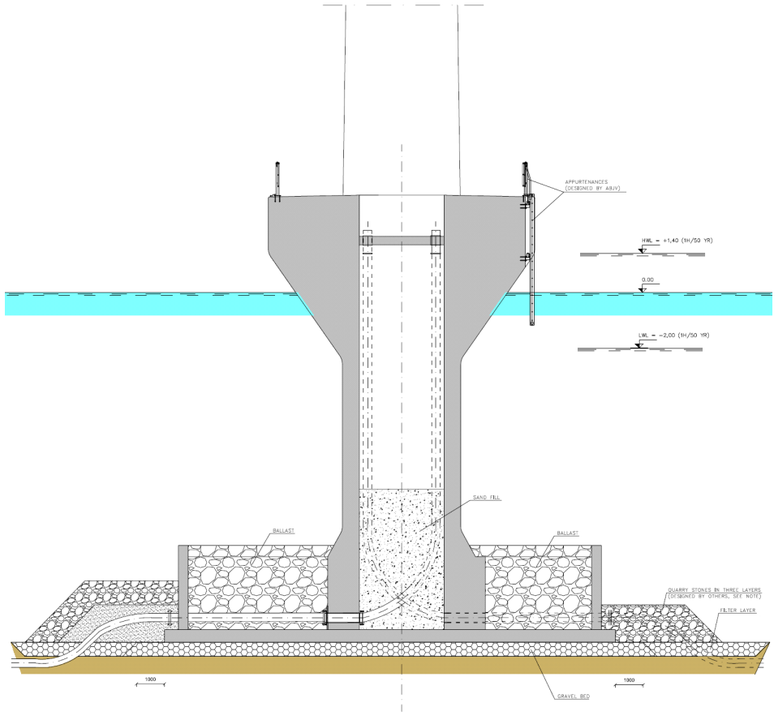
Kanalstr. 44
22085 Hamburg
Germany
+49 0 402 292 30

London

10 Grey Coat Place
London SW1P 1SB
United Kingdom
+44 0 207 960 6481

Aarsleff
Bilfinger
Berger
Joint
Venture
abjv.com

Aarsleff
Bilfinger
Berger
Joint
Venture
abjv.com



Project data

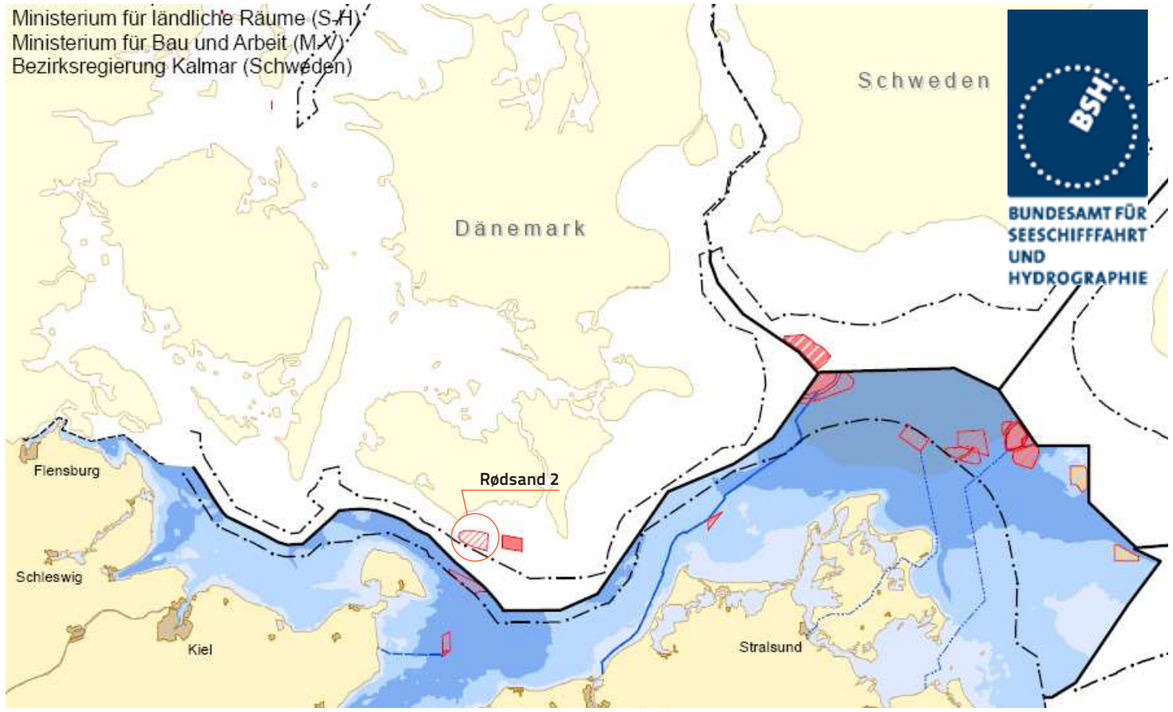
Gravity foundation
Height: 11 m - 16 m
Diameter/Top: 9.6 m
Outer diameter/shaft: 4.2 m
Diameter/bottom: 17.0 m
Weight excl. ballast: 1,200 t
Total volume Norit ballast: 35,820 m³
Total volume Norit sand: 8,184 m³
Total volume concrete: 44,143 m³

Excavation
Total volume excavation: 31,729 m³

Scour protection
Total scour protection: 11,300 m³ (Granite)

Installation time offshore
02/2009 - 04/2010

Offshore Wind Farm Rødsand 2



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

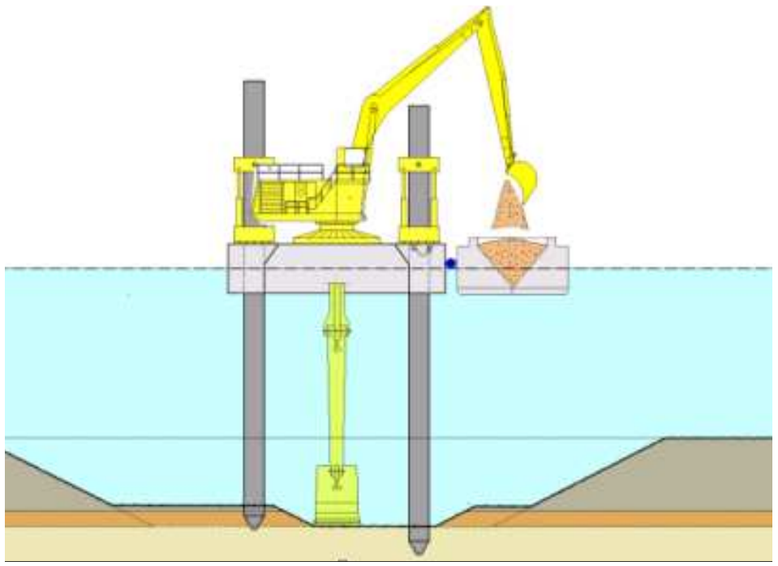
1. General information

Rødsand 2 was the second wind farm after Nysted Windfarm (Rødsand 1) to be constructed in Rødsand off the Danish coast. Rødsand 2 has a total installed capacity of 200 MW, consisting of 92 wind turbines as well as an offshore transformer platform. Therefore, it is one of the largest offshore wind farms in the world. Rødsand 2 is a continuation of Denmark's commitment to reach the renewable energy target of 20% by 2011, reaching already 15% as of the beginning of 2008.

abjv

2. Technical solution

The foundations are concrete gravity caisson foundations, like those used in the Nysted Windfarm. The structures are equipped with a concrete cone at the upper level of the shaft in order to reduce the ice loads. These foundations were produced on large pontoons with a footprint of 17 m × 17 m, a central shaft diameter of 5 m and an empty weight of 1,200 t. The foundations were secured in place after final positioning via the use of approx. 1,200 t of ballast stones in the bottom cells and approx. 300 t of Norit sand in the central shaft. In July 2008, a joint venture consisting of Bilfinger Berger Ingenieurbau GmbH and Per Aarsleff A/S, Aarsleff Bilfinger Berger Joint Venture (ABJV), was awarded the contract for the design, production and installation of the foundations. In the following, the foundation design and installation are outlined.



Spud-rigged pontoon with backhoe

Casting of foundation structures on barge

Soil preparation

3. Installation

The installation took place from February 2009 to April 2010. At first, the seabed at the installation site of each of the foundations was prepared in order to ensure that the soil conditions were able to support the loads resulting from the dead weight of the foundation and the attached wind turbine as well as the dynamic loads from waves, currents and wind. This involved excavating the seabed with a backhoe until soil with sufficient bearing capacity such as sand or chalk was reached.

The whole process was monitored by CPT tests. The final foundation levels were expected to vary between -7.5 m and -12.5 m.

Next, the concrete foundations on top of the pontoons were towed from their production location to their final location at sea. Upon arrival at the location, the transport pontoon connected to the installation vessel "EIDE Barge 5", which lifted and positioned the foundations onto the seabed with tug assistance.

Afterwards, the foundation elements were filled with ballast stones to hold the foundation in its required final position and to provide it with enough weight to effectively anchor the wind turbine to the seabed. This was done via the use of a large backhoe located on a spud-rigged pontoon and ballast stones which were sourced off site. Finally, the backhoe was used to place two layers of scour protection around the base of the foundation.

Placing of foundations