

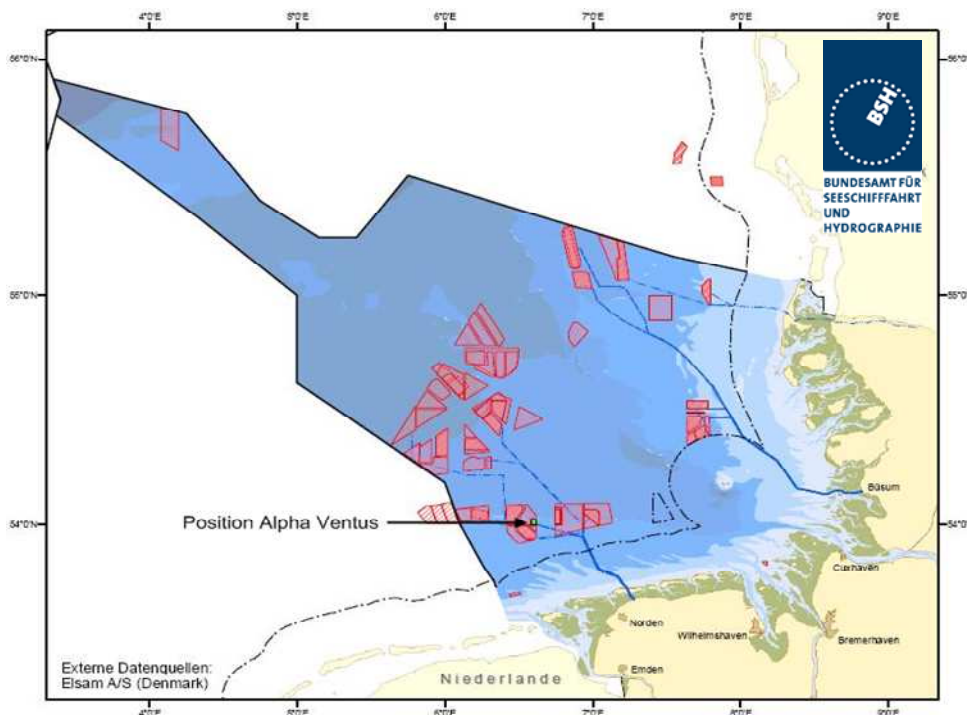
Transformer Station Alpha Ventus

1. General Information

Germany has a renewable energy target of 27 % by the year 2020, already reaching an impressive 14% in 2007. Nearly half of the 14 % is derived from wind energy. Wind turbines have a total installed capacity of over 22,000 MW. In an attempt to meet the 2020 target, Germany invests in its first offshore wind farm Alpha Ventus. It is located approximately 45 km north of Borkum Island in the North Sea and consists of 12 wind turbines and an off-shore transformer station. Construction takes place from 2008 to mid 2009.

and installation of the offshore transformer station, the focus of this article. This station serves 3 main functions in the operation of the wind farm.

Firstly, it transfers the electrical power produced by the wind turbines into the German electricity grid. Secondly, it provides operating power to the wind turbines and thirdly, it also acts as the logistical support centre for the wind farm. The design, construction and installation of the platform is outlined in the following sections.



Planned, consented and built
Wind Farms in the North Sea;
Source: BSH

2. Design and Construction

The offshore transformer platform consists of 3 main components: the above water structure (topside or platform deck), the underwater lattice tower structure (the jacket) and four foundation piles. Topside and jacket are produced at Wilhelmshaven quayside and then transported to their offshore location via a shear leg crane for installation.

In January 2008, the construction of the topside structure begins. The 24m x 18m platform deck is a 3 level structure consisting of a helipad at an elevation of +40 m Mean Sea Level (MSL), a main deck at +25 m MSL which houses the electrotechnical plant, and a cable deck at +21 m MSL, where the cables from the turbines arrive. The main structure is designed as a steel grillage stiffened by a corrugated metal sheet slab, while the deck corners have been braced with tubular cross beams to transfer the loads from the helicopter and plant decks to the substructure.

The total weight of the topside, including transformer, helideck, further electrical and operating equipment is 630 t.

The jacket is a 45.3 m high truss structure made of steel pipe, weighing approximately 500 t. The top half of the structure is a rectangular prism with dimensions of 9 m x 9 m. Beneath this, the platform legs splay out diagonally at 69° angles creating a trapezoidal prism with a seafloor footprint of 30.5 m x 30.5 m. At the base of each of these platform legs a pile sleeve is located, resulting in a total seafloor footprint of 34 m x 34 m.

The final foundation components for the structure are the four steel piles, with a diameter of 2,650 mm and a weight of 110 t each, which are used to anchor the jacket structure to the sea floor. This is achieved by the use of the pile sleeves located at the base of each platform leg of the jacket. Recesses located on the top of these sleeves facilitate the insertion of the 41.8 m long piles which were then driven 30 m into the sea floor.

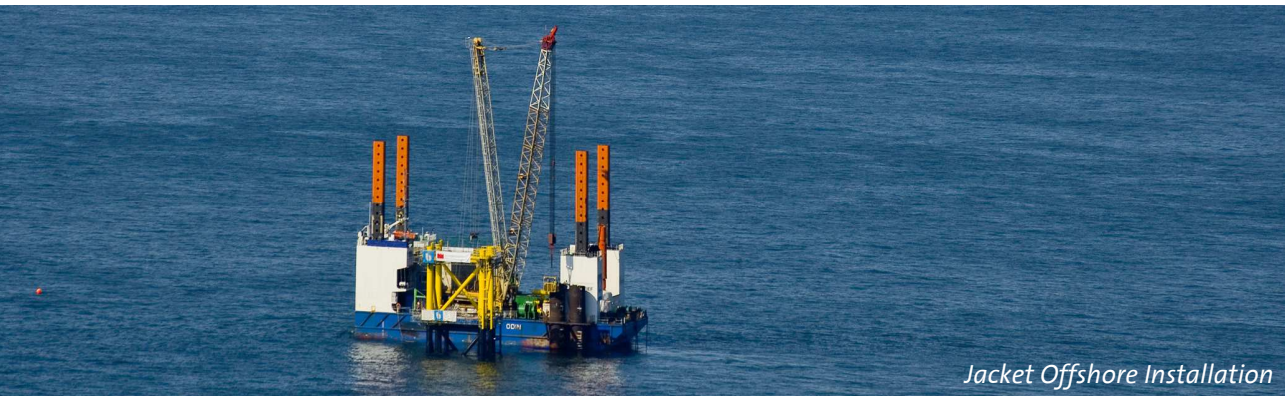
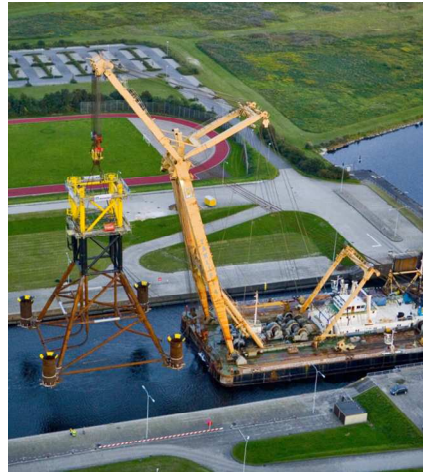
Topside (Platform)



Jacket construction at quayside



Taklift 4 with Jacket Structure



Jacket Offshore Installation

3. Installation

In September 2008, the offshore transformer station is installed and located in the south-eastern corner of the wind farm. The installation is a 3 step process. Firstly, the jacket is transported to its required location by the floating crane “Taklift 4” and then lowered to its required position on the sea-floor.

The next stage involves securing the jacket structure to the seafloor with four tubular steel piles. The piles are transported by means of “Taklift 4”, which is equipped just in time to the location. A jack-up is used for the installation of these piles a ringer crane, a hydraulic hammer (IHC 500), accommodation facilities for up to 34 persons, a decompression chamber for the divers and a mixing plant for the grout connections.

The pile is driven into the seabed under water until it reaches the final depth. Additional measurements to reach the required verticality are not necessary. The grouting material of the sleeves runs through inlets which are connected to the jacket with flexible tubes. Finally, the grouted sleeves are checked by divers and documented by video.

Next, the platform deck is installed on top of the jacket structure. This is achieved via a pile sleeve connection. After lifting and adjusting the topside structure into position, the annuli resulting from the gap between the sleeves and the legs of the topside structure is filled with a high strength grout. To ensure the effective transferral of forces between the two structures, circular shear keys are installed at the tubes.



