Technical description

DolWin2
Largest offshore wind HVDC grid connection in the world

For the DolWin2 project, offshore wind farms will be connected to an HVDC converter station installed on an offshore platform in the North Sea. The generated power will be transmitted through a 45-km long DC submarine cable system and a 90-km long underground cable system to the HVDC onshore station at the grid connection point of Dörpen West. The transmission system will have a total capacity of 916 MW at ± 320 kV, which will make it the world's largest offshore wind HVDC grid connection.

This HVDC Light connection provides numerous environmental benefits, such as electrical losses of less than 1 percent per converter station, and neutral electromagnetic fields. Compact converter stations will help reduce carbon dioxide emissions by more than 3 million metric tons per year by replacing fossil fuel-based generation.

Offshore HVDC converter platforms

As trends move towards huge offshore power plants located in remote sites and in harsh, unforgiving environments, suppliers can expect increased demand for platforms which have the capacity not only to house large AC substations or HVDC converter stations, but also to act as hubs for operation and maintenance personnel. To meet these demands, a highly innovative, robust and scalable platform has been designed to address issues such as efficient production and easy installation, which requires only a minimum of offshore work, without need of a heavy lift vessel or jack-up operations. The design is flexible with respect to installation programs, as it is possible to set up year-round, in the North Sea and elsewhere.

DolWin beta platform main design and layout

The platform concept is a self-installing steel gravity base structure (GBS) which is floated to the site and installed by ballasting (Fig. 1). The construction resembles a traditional twin pontoon structure, consisting of two submerged pontoons, six columns supporting the deck structure and a bracing system connecting and stabilizing the platform parts.

The modular approach is shown in Fig. 2. The topside has two principal decks – the main deck (lowest deck) and intermediate deck. These decks are part of the platform's structural design and are split into different rooms. In addition, there is also a weather deck.

The main deck mostly contains ABB-supplied equipment, such as HV GIS, shunt reactors, main HV transformers with dedicated arrestors, converter reactors and other HVAC and HVDC components. The intermediate deck contains converter IGBT-valves in six rooms and a freefall lifeboat.

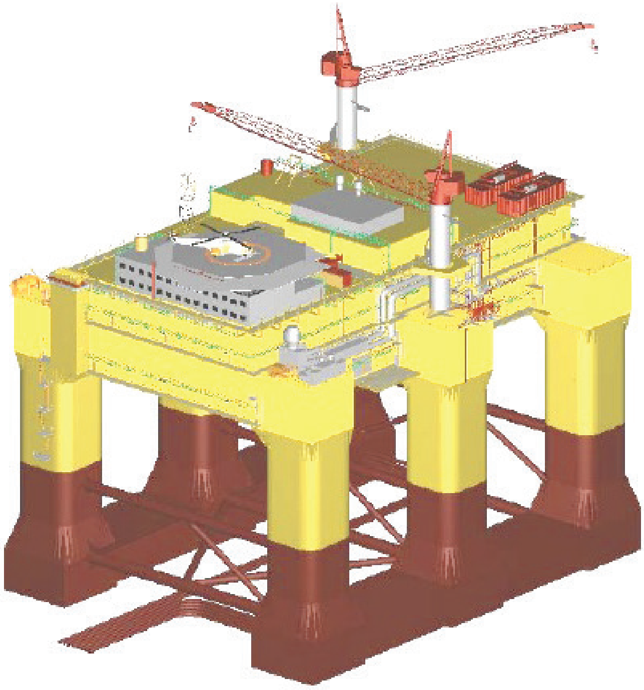

Fig. 1 A 3-D model of the GBS platform for Dolwin2.

The weather deck will typically contain MV and LV transformers and switchgear, batteries and distribution systems, HVDC and platform controls, central safety and telecom equipment, the converter IGBT valve cooling system, emergency generator, workshops, platform control room and emergency room. In addition, there are two cranes and HVAC systems for the weather deck rooms and inert gas housing. The modular design approach also allows for a permanent accommodation module to be installed on the weather deck.

The size of the module is customized and defined by client specifications and local and global regulations, standards and norms. The top of the columns (box top) are utilized for platform secondary and utility systems, including seawater systems (filters, coolers, submerged pumps), the cooling medium, coolers and pumps, main HVAC systems, the diesel system (tanks, pumps, etc), drainage systems, firewater pumps, fresh water tank and pumps, etc.

Power and fiber cables are guided from the sea floor to the cable splicing area in two of the column tops, via dedicated J-tubes.

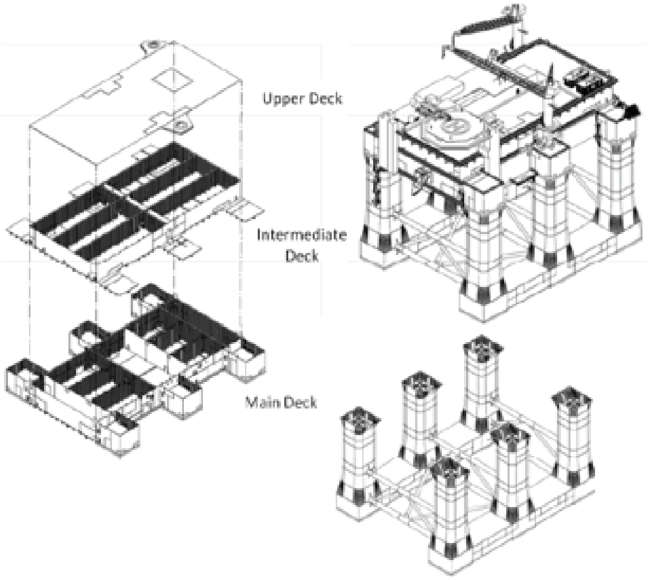

Fig. 2 Modularization of a gravity based structure platform. The topside structure is the same for all concepts, whereas the substructure is sized for water depth and power rating.

Transportation and installation of GBS platform

Prior to load out, all equipment on the platform will be installed and commissioned as far as possible at the yard.

Transportation to the installation site is done using tug boats. The design fulfils all relevant standards with respect to sea-worthiness, meaning that the installation procedure has low weather dependency. In practice this means the platform can remain at sea even in rough weather conditions, and wait for the weather to stabilize enough for the actual ballasting operation to begin.

Upon arrival at the site, the towing lines will be rearranged to suitable lengths and angles. One large or two smaller additional tugs will be mobilized locally and connected to the platform (Fig. 3). At this point, provided the weather for installation is appropriate, the positioning will commence.

The platform will be gradually ballasted down until the pontoons are just above the seabed. When an acceptable position is confirmed, the platform position will be secured by further ballasting down to achieve skirt penetration.

The installation operation is monitored by ROVs. For permanent ballasting, solid ballast (e.g. gravel) is poured into the lower part of all six columns. The installation method described above requires minimal hook-up work offshore, and no heavy lift vessels or noisy piling operations are needed. Offshore commissioning is limited to energization and the trial run following installation of the HV cable.

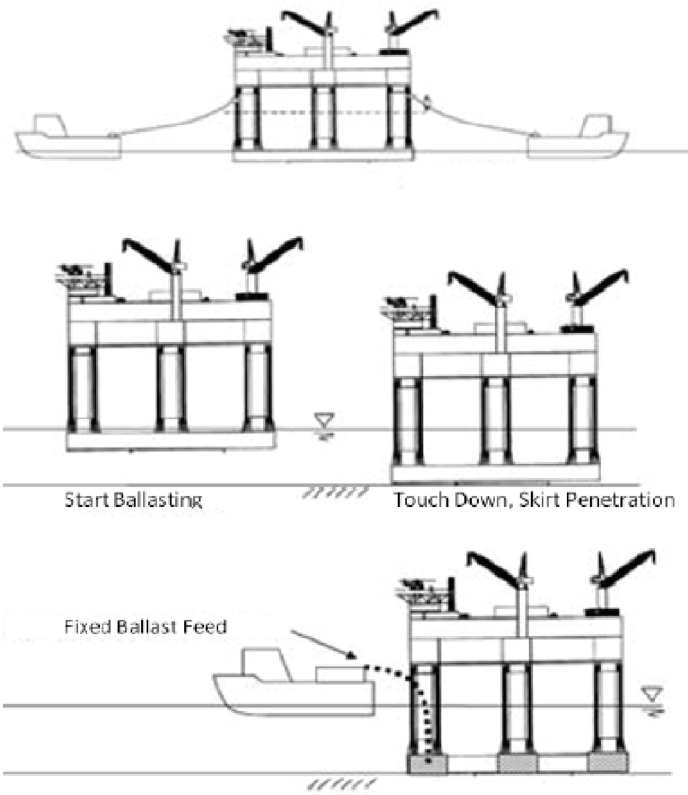

Fig. 3 Transportation, installation and positioning of gravity based structure.