FOWPI (https://www.fowpi.in/)
FIRST OFFSHORE WIND PROJECT OF INDIA

Project Funded by
European Union (http://eeas.europa.eu/delegations/india/index_en.htm)

Substations

A substation integrates the power generated by various wind turbine generators in the farm and transforms the voltage from (for example) 33kV to 132 or 220 kV for evacuating the power into the main grid. The transmission of power could be in AC mode or DC mode depending on various parameters in grid studies.

There are generally two types of substations: offshore and onshore substations. The requirement may vary depending on the distance from the shore as well as the quantity of power being evacuated.

Offshore substations: are designed to withstand the offshore conditions placed optimally to interconnect with all individual wind generators through submarine cables.

Key component of an offshore wind farm substation includes:

- Interconnecting Transformers in order to step-up voltage from generation level to transmission level. These transformers are sized according to the capacity of wind generators with optimum operational philosophy and redundancy. These are well equipped with necessary safety measures.
- Switchgears and protective measures to isolate the array of wind generators or the export connections to the main grid.
- DC Converters in order to transmit the power through DC transmission system.
- Grid stabilizers (Reactors/Capacitors) to manage the reactive power of the offshore wind farm.
- Adequate earthing grid in order to provide safety to the equipment, structures and working personnel.
- Cable trays, tracks, clamps and supports for submarine cables
- Backup power supplier (diesel generators) in case of auxiliary power loss

Broadly, the best practices involved in "**Construction and Erection of offshore substations**" is presented below:

Execution planning of offshore erection	• Planning of different assembling stages • Determination of weather and sea behaviour for safe transport and installation during the period of assembly • Verification and release of installation procedures
Selection of pre- & post- pilling	• Exactly define the piling technology and the individual steps • Verification through external surveyors • Use of one pile driving template
Soil Investigation	• Geotechnical and geophysical investigations to understand the soil quality and sea bed • Scans to determine any stratification and to locate any objects in the installation area
Positioning, bubble curtain, mooring, DP and Jacking	• Use of bubble curtain systems to reduce the propagation of hammering sound • Dynamic positioning of crane ship / tugboat
Planning of vessels, barges, etc.	• Identification/calculation of the ship, tugboat, barge capacities required • Market analysis on the basis of the identified requirements, availability of marine spread
Setting down the base structure onto the seabed	• Positioning of base frame/ topside on the seabed • Horizontal and vertical alignment of the base frame • Piling to fix the base structure onto the seabed
Grouting the base structure piles	• Selection of grouting material • Use of grouting equipment • Check and release of grouted structure

Floating into position and alignment of topside	• Design anchor grid • Connection of anchor grid to mooring/positioning equipment • Floating in and positioning with mooring/positioning system • Observance of weather and sea behaviour
Jacking up the topside	• Check of trimming/ heeling level of jacking • Jacking down the legs • Guiding of the legs into the structure • Use Cameras, ROV, Shock absorber
Lifting the topside	• Fastening the spreader • Releasing of sea-fastening • Lifting procedure • Observance of weather and sea behaviour
Grouting the topside	• Selection of grouting material • Use of manipulation of grouting material • Use of grouting equipment • Examine and release grouted structure

An onshore substation is typically the interconnecting substation between the wind farm and the main grid. The power generated from the offshore wind generators are either directly connected to onshore substation or from offshore substation to onshore substation via HVAC or HVDC link.

For more information, refer the following informative links/material:

1. International guidelines on the risk management of offshore wind farms

2. General safety principles, requirements and guidance for platform installations associated with offshore wind sub-stations by DNV-GL published in Nov 2013. (http://rules.dnvgl.com/docs/pdf/DNV/codes/docs/2013-11/OS-J201.pdf)

3. Document- A Guide to an Offshore Wind Farm- Published on behalf of The Crown Estate. (http://www.thecrownestate.co.uk/media/5408/ei-a-guide-to-an-offshore-wind-farm.pdf)

4. Information about Offshore wind sub-stations and their designs, collected by ISC Consulting Engineers A/S. (http://www.isc.dk/wp-content/uploads/2016/09/offshore-substations-2014.pdf)

5. General description about Wind power offshore substations by Siemens AG, Germany. (http://www.energy.siemens.com/nl/pool/hq/power-transmission/grid-access-solutions/WIPOS/The%20Offshore%20Way_WIPOS.pdf)

Updated on: **March 2017**

Disclaimer:

The content on this website is provided for information purposes only. No legal liability or other responsibility is accepted by or on behalf of FOWPI team for any errors, omissions, or statements on this site, or any site to which these pages connect.

Have any Questions? Send a Message.

FOWPI FIRST OFFSHORE WIND PROJECT OF INDIA (https://www.fowpi.in/)

(https://www.facebook.com/FOWPI/) (https://twitter.com/FOWPI_India) (https://www.linkedin.com/company/first-offshore-wind-project-of-india-fowpi-/)

For more details on FOWPI project, please email:
info@fowpi.in (mailto:info@fowpi.in) or fowpi.india@gmail.com (mailto:fowpi.india@gmail.com)
Phone +91.124.4319500,
Telefax +91.124.4319501,
Direct +91.9687800983/8849012213

Nodal Ministry for Offshore Wind Energy

Ministry of New and Renewable Energy | MNRE (http://www.mnre.gov.in/)

Nodal Agency for Offshore Wind Energy

National Institute of Wind Energy | NIWE (http://niwe.res.in/)