OFFSHORE SUBSTATION DESIGN
THERE IS NO SUBSTITUTE FOR EXPERIENCE
WWW.RAMBOLL.COM/SUBSTATION-DESIGN
Ramboll is the world leader in offshore foundation design for wind turbines. This covers minimum facilities with low manning frequency as well as larger facilities that are permanently manned with frequent access via sea or air.

**Offshore substations**

More and larger wind farms are being located offshore. The capacity of these wind farms spans from several hundreds of MW to 5-10 GW. To minimise the electrical transmission losses and the cable costs, the turbines in such wind farms are electrically connected to an offshore substation provided with a step-up transformer. The transmission to shore is then achieved by an HV AC connection (e.g. with reactive compensation) or an HVDC link.

With Ramboll as your partner, our extensive offshore experience will be implemented into the design of your substation with strong focus on safety, O&M and cost effective design. The development and design of the substation is highly dependent on the actual location and the operation and maintenance philosophy for the substation and for the wind farm.

**Multi-discipline services**

Ramboll provides multi-disciplinary engineering consultancy for all areas of the offshore substation:
- Definition of design standards and codes
- General layout development with consideration of safety, mechanical handling, operation and maintenance
- Implementation of electrical equipment such as step-up transformer, reactors, GIS switchgear, LV-switchgear, UPS system and control system
- Substructure design including j-tubes for cables, boat landings and foundation
- Specification of all auxiliary equipment such as cranes, emergency diesel systems and workshops
- Accommodation facilities and heli deck if required
- Installation engineering for topside and substructure as well as cable pull-in planning

**Substructure design**

The substructure design can be a simple steel mono pile, a larger jacket for deeper waters and higher topside loads or it can be a concrete gravity base structure. At Ramboll we have more than 30 years of experience within offshore substructure design. The structural design is carried out using Ramboll’s own state-of-the-art software programme ROSAP. All topsides and substructure design are performed within a fully integrated multi-discipline 3D system (e.g. PDS, PDMS, Tekla, Solidworks or SmartPlant 3D).

**Design codes**

The designs can be performed according to any acknowledged standard e.g. DNV-GL, IEC, NFPA, ISO or other international codes, as required to have the project certified by a Certifying Authority.

**Optimum solutions**

Ramboll is the ideal partner for carrying out studies to determine the kind of facility that is most advantageous at a given location. Our long track record of feasibility studies, front-end engineering design and detailed designs for clients’ operating facilities offshore will ensure that we will develop the optimum solution.

**Significant projects**

In 2016 Ramboll became the first non-Chinese company to design an offshore wind farm and substation in China. SPIC Binhai North Phase 2 in the Jiangsu province will be one of China’s largest offshore wind farms once completed. Other recent substation projects count Borssele I og II in the Netherlands, and Hornsea One and Westernmost Rough; both in the UK. The two UK projects are estimated to make a significant contribution to the UK government goal of installing 33GW of wind production by 2020. Finally, Ramboll also designed the substation for the Danish landmark project Anholt Offshore Wind Farm.
SELECTED OFFSHORE WIND FARM SUBSTATION PROJECTS

• Binhai 2 - Topside & Substructure – Concept & Detailed design (China)
• Borssele 1 and 2 – Topside & Substructure – Concept design (NL)
• Hornsea One – Topside & Substructure – Concept & Detailed design (UK)
• Burbo Bank extension – Topside & Substructure – Conceptual Design (UK)
• Westermost Rough – Topside & Substructure – Detailed design (UK)
• BARD Offshore I - Topside and Substructure – Concept and detailed design (D)
• Anholt substation – Topside & Substructure – Detailed design (DK)
• Horns Rev 2 substation – Topside & Substructure – FEED (DK)
• Robin Rigg substation – Topside & Substructure – Detailed design (UK)
• Sheringham Shoal – Substation Substructure – Detailed design (UK)
• London Array – Monopile foundation and cable deck (UK)
• Bligh Bank – Monopile foundation and cable deck – Detailed design (B)