



POWER TRANSMISSION - OFFSHORE SUBSTATIONS

Only through innovation the demand for clean power generation can be met.

Within the last decade, the erection of offshore wind farms has gone from pioneering to becoming an industrialised process. This development is made possible through accumulated experiences in Ramboll and by managing the Engineering, Procurement and Contracting (EPC) process.

At Ramboll we have more than 25 years of experience in the offshore sector, designing substations to offshore wind farm substations as well as oil & gas production. Our success is based on a close cooperation with our clients, ensuring that the design meets all requirements.

Ramboll competences

An offshore substation represents the vital part of the infrastructure for an offshore wind farm.

At Ramboll we can provide multi-discipline services by embracing a coordinated effort within the

following business areas:

- Structural design
- Mechanical and electrical installations
- High-voltage distribution (distribution and transmission level)
- Low-voltage distribution (LVAC, LVDC, UPS)
- Substation automation and platform supervision
- Subsea cables
- Onshore substations

Electrical infrastructure

When designing the substation, we have our focus on the process installations, required to operate an offshore wind farm.

We provide a professional consultancy service to our client by implementing requirements from various stakeholders, i.e. the wind farm operator, the transmission system operator (TSO or OFTO) etc. in the design for the HV layout as well as in the substation

automation configuration.

During the erection phase Ramboll can deliver engineering competences for establishing communication infrastructure, vessel tracking monitoring systems as well as people registration and offshore people tracking.

During the construction phase of the platform itself, Ramboll can provide competent supervision and commissioning teams, to ensure that the platform is fully tested and operational before load out.

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TAKING A HV SUBSTATION OFFSHORE IS A DESIGN CHALLENGE

At Ramboll we utilize our experience to meet opposing requirements between the cost of size and considerations allowing easy installation and service conditions.

When designing an offshore substation, our focus is on the process requirements given from the wind farm as one producing unit. At Ramboll we utilize our many years of experience to keep this focus.

Designing a substation for our client is not only a substation project. For Ramboll it is to participate in the construction of a wind farm. We contribute proactively to contribute to a successful project execution.

An offshore substation represents an interface point of gravity. Ramboll offers a proactive interface handling supporting our client on a technical level as well as coordinating contractual splits.

Electrical design

Taking an HV substation offshore is a design challenge. The main HV components on a platform influence the design of the platform, as well as increasing the requirements for a ruggedness with regard to the components as well as the electrical layout.

Ramboll has expert knowledge in all aspects of electrical design and project execution within the following areas:

- Electrical layout (Single Line Diagram)
- Grid connection
- Transient stability and harmonic analyses
- HV distribution (GIS)
- Main and Aux. transformers
- Relay coordination
- LV systems (LVAC, LVDC, UPS)
- Earthing system

For simulation of the electrical design we use PowerFactory-DlgSILENT or Paladin Designbase

Substation automation

Substation automation is a critical function of an offshore substation, since this system transmits vital data between utility and the TSO, which is a part of the condition to operate the wind farm.

Ramboll provides consultancy services independent of third party interests. We offer a wide-ranging service covering:

- Design and specification of substation automation
- Logical and physical network design
- Electrical panel design
- Optical fibre layout
- Fire detection and extinction

The network and optical fibre design represent a complex interface between all deliveries and the client's internal network. In close cooperation with the client Ramboll can coordinate the physical as well as logical interfaces.

Communication and site supervision

Depending on the client requirements or national legislation, Ramboll can offer consultancy services on specification, procurement and installation of site supervision and communication.

The following scope of supply is normally considered:

- Radio communication (VHF, TETRA)
- Vessel Traffic Monitoring System (VTMS)
- Meteorological (MET)
- Line Of Sight (LOS)

Depending on the scope, integrated solutions can be provided covering:

- Radar coverage
- People tracking, including site access control
- Cameras



LEFT

Anholt substation being prepared for load out

RIGHT

132/34 kV Main transformer cable connections