



RAMBOLL

POWER TRANSMISSION - OFFSHORE SUBSTATIONS

With a rising demand for offshore energy, the substations are key to an effective transmission of power onto land.

An offshore substation transforms and transmits the energy from e.g. wind turbines to the electrical grid on land and thus represents a vital part of the electrical infrastructure.

Ramboll has more than 25 years of experience in designing complete substations to wind farms and to oil & gas production covering the full range of engineering disciplines.

Ramboll is a leading consultancy in the field of structures, electrical and mechanical design and safety issues, and we cover all project phases from basic design through detailed design and tendering, to construction, commissioning and operations and maintenance.

Operating in harsh conditions

Weather conditions, water depth and soil conditions must be taken into consideration when planning and designing an offshore substation. Ramboll is experienced in working in harsh operating environments and adjusting

the detailed design based on these environments.

We utilise our experience to meet opposing requirements between the cost of size and considerations allowing easy installation and service conditions.

Electrical infrastructure

When designing the substation we focus on the process installations required to operate the offshore facility. We provide a professional consultancy service by implementing requirements from various stakeholders, i.e. the wind farm operator, the transmission system operator (TSO or DSO) etc. in the design for the HV layout as well as in the substation control system configuration.

During the erection phase Ramboll delivers engineering services for establishing communication infrastructure, vessel tracking monitoring systems, 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.

For further information please refer to www.ramboll.com/services/energy or contact us directly:

CONTACT

John Ammentorp
Head of Department
Automation and Electrical Systems
Tel +45 51616380
jona@ramboll.com

Electrical design

Taking an HV substation offshore is a challenge with increased design requirements for ruggedness and space management of the components and the electrical layout.

The main HV components influence on the design of the platform, and Ramboll executes the electrical design in close cooperation with the structural design engineers. Ramboll also has experience in Gas Insulated Switchgear (GIS) which is essential to save space and money on offshore installations.

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

- 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.

SCADA and control systems

Substation SCADA is a critical function since this system transmits vital data between the utility and the DSO/TSO, which is a part of the condition to operate the wind farm.

Ramboll provides a wide-ranging service independent of third party interests and based on our profound project management skills we ensure good coordination a clear communication between all stakeholders. We offer:

- Design and specification of substation SCADA and control systems
- 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 the logical interfaces.

Communication and site supervision

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

Typical focus areas are:

- 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.



ANHOLT OFFSHORE WIND FARM - SUBSTATION PLATFORM

CUSTOMER

Energinet.dk

LOCATION

Kattegat, Denmark

PERIOD

2010

SERVICE PROVIDED

Detailed design incl. substructure and complete topside design, consultancy.



ELECTRICAL DESIGN TRANSITION PIECES

CUSTOMER

Vattenfall

LOCATION

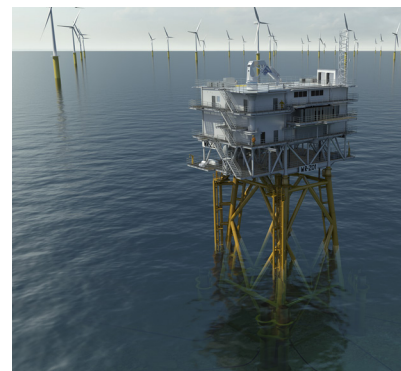
German North Sea

PERIOD

2013-2014

SERVICE PROVIDED

Detailed design of wind turbine low-voltage distribution.



WESTERMOST ROUGH OFFSHORE SUBSTATION

CUSTOMER

DONG Energy/Westermost Rough Ltd

LOCATION

North Sea, 8 km off the Yorkshire coast

PERIOD

2011-2012

SERVICE PROVIDED

Conceptual & detail design of the Westermost Offshore Substation.