



## POWER TRANSMISSION - ONSHORE SUBSTATIONS

**A safe and reliable distribution of electrical energy is the basis of any modern society.**

For any onshore substation project, Ramboll provides services throughout the project lifecycle; from basic design, specifications, procurement, calculations, installation procedures and commissioning to maintenance planning.

When committing to a project, Ramboll offers not only engineering and procurement competences, but will also provide project management with reference to Ramboll's ISO 9001 certification.

### **Ramboll competences**

At Ramboll our competences are based on worldwide project experience for Engineering, Procurement and Contracting (owner's engineer) of substations, with voltage levels varying from transmission level to distribution level.

Our field of experience includes outdoor and indoor substations, as

well as internal high voltage distribution in power plants and larger industrial installations. Ramboll delivers a multi-discipline service covering electrical design, automation and civil works. We support our client in all interface handling upstream and downstream covering all disciplines from relay coordination to communication.

### **Onshore wind farm substations**

In addition to the deliveries normally considered for substations, Ramboll can supply a full range of consultancy services for onshore wind farm projects.

Our services include Interface management towards the wind turbine manufacturer as well as:

- Transient stability and harmonic analyses
- Engineering of array cables
- Optical fibre layout
- Network design
- Grid code compliance
- Wind turbine SCADA and park control

Furthermore, Ramboll is able to deliver the design basis of the wind turbine foundations.

### **Power generation**

Ramboll has extensive experience within internal power distribution in power plants and waste incineration facilities. Our experience covers HV distribution, fast bus transfer systems, generators and magnetization, transformers and relay protection. We have coherent experience with power plant automations systems.

### **CONTACT**

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## DESIGNING A SUBSTATION

- At Ramboll we strive to address the challenges of utilising continuously evolving technology, driven mainly by the development within data acquisition and substation automation.
- Ramboll will in cooperation with the client, proactively participate in interface management which is considered to be a vital key to mutual success.
- Delivering high quality as-built documentation, providing the client with optimal conditions for operation and maintenance.
- During construction, the main focus is on work place safety, closely coordinated with the clients facility management

### Electrical design

At Ramboll we believe in close cooperation with the client throughout all phases of a project. Only through open dialogue a satisfying solution can be achieved for the future O&M organisation.

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

- Electrical layout (Single Line Diagram)
- Grid connection
- Load flow calculations
- HV distribution
- Main and aux. transformers
- Relay coordination
- LV systems (LVAC, LVDC, UPS)
- Earthing system
- VAR compensation

We provide static og transient simulations of the elctrical design using PowerFactory - DlgSILENT or Paladin Designbase.

### Substation automation

Substation automation is a vital part of a substation project. All control and monitoring of HV equipment and auxiliaries are normally carried out from a centralised control room.

This increases requirements to the complete communication infrastructure and the control hardware implemented.

At Ramboll we offer a wide-ranging service covering:

- Design and specification of substation automation
- Logical and physical network design
- Line of Sight solutions
- Optical fibre layout

We have expert knowledge within implementation of station bus communication and signal exchange toward third parties and upstream SCADA systems.

### Civil works

Through many years of experiences, Ramboll is a competent partner in delivering solutions for infrastructure and structural design. Our experience range from arctic conditions, rock blasting or operating in urban areas.

Our services include:

- Roads
- Foundations, including oil sumps
- Buildings
- Cable ducts
- Fencing/access control
- Lightning protection

For larger indoor substations Ramboll offers architectural services, and detailed engineering of lighting and HVAC.

Ramboll handles all services including project management, design, authority approvals, supply, procurement, site supervision and construction management.



#### LEFT

Refurbishment of Koltrop 220/70 kV substation .

#### RIGHT

Refurbishment of 150 kV Studstrup Power Station