



**RAMBOLL**

## POWER TRANSMISSION - HV CABLES

**To survey and protect the HV cable installation is the most vital part of the installation.**

In any project, the installation of high-voltage cables requires knowhow and care. Special care must be taken regarding all aspects from the planning stages right to the installation and termination. Once installed and commissioned, HV cables are considered to be one of the most reliable means of transferring electrical energy to the main consumers.

Especially in urban areas, a safe and reliable distribution grid is needed. By supplying densely populated areas with electricity by a HV cable infrastructure, the communities are not as vulnerable to weather phenomena like flooding or trees being overturning in a storm, not to mention the esthetical value of having all installations below ground.

The recent development in renewable energy production pushes the limit for HV cable capacity all the way up to

transmission level. Our engineering team aids our clients in the specification and dimensioning of cables and cable joints for both onshore and subsea cables.

### **Environmental Impact Assessment**

At Ramboll we have many years of experience of undertaking EIAs on behalf of our clients. Our experience covers both onshore and offshore projects. We facilitate Environmental Impact Assessment for international, regional and local clients. We actively ensure a seamless contact between our client and the permitting authority.

### **Stakeholder coordination**

Routing of high-voltage cables is determined by a multitude of factors, all of which must be carefully assessed and evaluated. Depending on whether the project is onshore or offshore based, the stakeholder requirements vary a lot. Through our many years of experience in planning of routing,

especially in urban areas, Ramboll is highly experienced in performing a daily coordination with other utility owners.

When working with offshore projects, the stakeholder coordination changes into becoming more of an interface handling between different lots (or contracts) and a coordination of the installation and termination of the HV cables. Ramboll's extensive experience in designing offshore substations and wind turbine foundations enables us to provide detailed interface coordination between design and installation.

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## GROUND ENGINEERING BASED ON SOLID EXPERIENCE

The geotechnical and geophysical services are the foundation of any sub-surface project.

Ramboll has specialised experience and knowhow of HV cable installation and surveys, collected from onshore and offshore projects for more than 30 years.

Ramboll's geotechnical and geophysical survey departments have significant expertise in undertaking

both onshore and offshore surveys. Such investigations can identify the design requirements of the cable route and the need for cable burial or any other protective measures to ensure cable integrity and longevity.

The unique geotechnics service is world class, and at Ramboll that we are proud to share this for the benefit of our clients.

### Routing

Routing of onshore HV cables may be determined by local or even national planning by predefined corridors and/or areas where HV cables are prioritised. Ramboll has the breadth of expertise, knowledge and experience in identifying all factors influencing the routing. In an offshore wind park, the planning of the routes for the array or export cables is a very complex matter. After the park layout has been decided, an optimisation of the routes must be issued. At Ramboll we can support our client in the optimisation of installation cost as well as cable losses during operation.

### Services for onshore cables

On shore, cable projects often require quite a lot of stakeholder coordination to target cable corridors to existing installations in the ground. At Ramboll we map the existing cables and obstacles in the ground using our state-of-the-art

3D Geo radar. The vehicle-mounted equipment allows very high resolution cable mapping even at highway speeds.

Furthermore, we determine the sub-surface soil stratification using geophysical seismic surveys and geotechnical soil investigations. Our integrated geotechnics services include consultancy and engineering within:

- Soil stratification
- Sub-surface hazards
- Pre and post laid cable trace surveys
- Geotechnical design parameters
- Information on the organic contents of soils
- Heat transmission in soil
- Land fall investigations
- Cable crossings
- Direction drillings
- Excavations
- Construction pits
- Visualisation and GIS reporting

### Services for offshore cables

Offshore cables are exposed to

harsh conditions and the planning of the installations require the best pre-knowledge about existing conditions on and below the seabed. Great savings can be made using the appropriate approach to offshore works and at Ramboll you will find this experience and knowhow. We work with an integrated geotechnics approach uniting the services from:

- Geophysical investigations
- Multi-beam surveys, mapping the seabed surface
- Magnetometer surveys.
- Shallow and deep penetration seismic surveys mapping sub-surface soil strata
- Side-scan sonar mapping obstacles on the seabed
- Cable tracking of the cable burial status
- Seabed Cone Penetration Testing (CPT)
- In-situ sampling (Vibrocores)
- Geotechnical drilling, sampling and down-hole testing
- On and offshore laboratory testing



#### LEFT

Verifying as laid data for 132 kV export cable.

#### RIGHT

Vertical cable survey by 3D geo radar.