

HVDC Light Submarine Cable Link

Estlink - connecting Estonia to the Nordic network



Cable data

Voltage	+/- 150 kV DC
Power	350 MW
Length	2 x 74 km submarine cable
	2 x 31 km land cable
Conductor	1000 mm ² Cu submarine cable
	2000 mm ² Al land cable
Insulation	Polymeric
Weight	26 kg/m submarine cable
	11 kg/m underground cable
Customer	AS Nordic Energy Link
Year	2006

Project content

The HVDC Light Cable System:
Project Management
Cable and accessories
Land- and offshore installation
Testing



ABB has designed, built and installed the world's longest HVDC Light submarine cable, the Estlink Cable. This link connects the power grids of Estonia and Finland and will enable power trading between the two countries as well as increasing the reliability of electricity supply. The Estlink project is the first European Union interconnection with one of its new member states since EU enlargement in mid-2004. The project was on the EU's agreed list of priority projects for the Trans-European Network. The power link is jointly owned by Finnish and Baltic power companies under the name AS Nordic Energy Link.

The ABB scope

ABB has delivered the 350-megawatt HVDC Light cable link as well as converter stations at both ends of the cable link. The Estlink consists of two parallel cables in its entire length. In total 210 km HVDC Light cable (oil-free) has been supplied from ABB's cable factory in Karlskrona, Sweden, a unit specially designed to cater for the production of long, powerful, submarine high voltage cables. Approximately 2x31 km of that length is underground cable and 2x74 km submarine cable.

The HVDC Light system

The technology chosen for this project, the HVDC (high-voltage direct current) Light technology, is a unique ABB technology. It is a mature, non-conventional technique which offers maximum security of supply and minimal environmental impact. The system is based on bipolar converters and extruded polymeric DC Cables. HVDC Light converters give very high-speed control of both active and reactive power in both networks. The HVDC Light technology allows power flows to be directly controlled in a manner not possible over a conventional, free flowing alternating current "AC" transmission line. The system will also help to integrate the electrical systems in the Baltic region, and stabilize grids on both sides of the interconnection.

The HVDC Light cables

The low losses of the HVDC Light Cables provide an excellent solution for transmitting power over long distances. This cable has a polymeric insulation specifically adapted for direct current. The conductor screen, insulation and insulation screen are extruded in a triple extrusion process. Radial water sealing is achieved by applying a corrosion resistant lead sheath. Longitudinal water sealing is achieved by applying a water swelling material under the lead sheath and by using compound in the conductor. The mechanical strength of the cable is provided by a steel wire armour. An outer serving of bitumen-bonded polypropylene yarn protects the armour. The strength and flexibility make the HVDC Light cables well suited for severe installation conditions both underground and at sea. The Estlink land cable has a diameter of about 10 centimetres and one meter of the land cable weighs about 11 kg. The Estlink submarine cable has a diameter of 10 centimetres and weighs 26 kg per meter.

Compared with traditional paper insulated cables and overhead lines, the polymeric cable has advantages because of its excellent mechanical flexibility and strength as for example:

- Land cables also in steep areas.
- Submarine cables for extreme depth.
- Aerial cables where land cable cannot be used.
- Storms, falling trees, snow and ice loads do not harm underground cables.
- Cables have no visual impact.
- The land can be used for other purposes.
- Overhead transmission lines require maintenance such as clearing of power lanes from growing trees, thermographic checks of conductor jointing sleeves and checks of insulators.

Cable route

The cable route begins with a land section of 2x9 km cable from Harku converter station in Estonia to the shore. A submarine cable of 2x74 km runs beneath the Gulf of Finland to the Finnish shore where a land cable of 2x22 km continues to the converter station at Espoo.

The cable installation

The Estonian land cable part was delivered on 24 cable drums and the weight of the shipment was about 200 tons. The Finnish land cable was delivered on 60 cable drums and that shipment weighed approximately 500 tons. The land cables were sent in 22 shipments across the Baltic sea to the installations sites.

The Estlink submarine cable was loaded directly from the factory onto the laying vessel. It was produced in long lengths, which minimized the need for jointing operations. The cable weighs some 3,850 metric tons and was laid in one section. The two HVDC Light power cables was bundled together to minimize magnetic field and to enable the cables to be buried by water jetting in one run. They were buried one metre into the sea floor to give protection against fishing gear and ships anchors.

HVDC Light cable experience

The HVDC Light polymeric cable system is now qualified up to 300 kV. The qualification tests have comprised Long Term Tests at higher stresses and Type Tests, all successfully performed. The amount of commercially delivered HVDC Light cables is now (October 2007) 1566 km.

Accessories for the cables

HVDC Light cable joints and cable terminations have been developed for all applications. For this project the following were utilized:

- Cable terminations matching the HVDC Light Converters
- Flexible factory joints on the sea cable, with properties like the cable itself
- Pre-fabricated land cable joints.
- Submarine cable repair joints (as contingency)
- Transition joints between submarine- and land cable.

Commissioning

The system was taken into commercial operation in the beginning of 2007.