

## Submarine Cable Link

# Electrifying the Croatian Archipelago



### Cable data

Voltage	35 kV AC	110 kV AC
Power	23 MVA	100 MVA
Length	100 km	100 km
Conductor	3 x 150 mm <sup>2</sup> Cu	1 x 300/400 mm <sup>2</sup> Cu
Insulation	XLPE	XLPE
Weight	21 kg/m	14 kg/m
Customer	Hrvatska Elektroprivreda, HEP	
Year	1995	1994/1995

### Project content

XLPE cable and accessories  
Fibre optic cables  
Cable system design  
Project management  
Installation (at sea, on land)

Electrifying the thousands of islands of the Croatian Archipelago not only needs a lot of planning and surveying but also a fast and reliable cable supplier. ABB High Voltage Cables was therefore selected as the turn-key contractor for the HEP 1994/1995 Inter and Cross-island submarine cable projects. In total, eleven circuits with almost 200,000 m of XLPE cables were installed, including a 110 kV connection to the important island of Brac, just off Split in Southern Croatia.

### Location

Situated on the western shores of the Adriatic Sea, Croatia has an impressive coastline dotted with some 3,000 islands, mainly built of limestone, the area also hosts beautiful coral reefs with abundant flora and fauna. The environmental precautions, which were required, placed high demands on the manoeuvring capabilities of the cable-laying vessel, as well as on the careful civil engineering work required at the cable landings. The aim was to minimise the environmental impact so as not to disturb the natural beauty of the archipelago.

### The Cables

Two XLPE cable types were supplied: a single-core 110 kV cable and a three-core 35 kV cable. The 35 kV cable has three 150 mm<sup>2</sup> copper conductors, each with 8 mm triple-extruded XLPE insulation, lead sheath and a PE jacket. Swelling powder in the conductor and swelling tapes below the lead sheath further protect the cable from water penetration. The three cores are twisted together in a trefoil configuration with a filling material, and the whole package has a continuous steel-wire armour with an outer protection of bitumen-bonded polypropylene yarn.



The 110 kV cables were supplied with 300 mm<sup>2</sup> and 400 mm<sup>2</sup> copper conductors respectively. Both cables have a triple-extruded 15.5 mm thick XLPE insulation and a lead sheath protected by a PE jacket. Again, swelling-powder in the conductor and swelling-tapes below the lead sheath further protect the cable from water penetration. The cables also have continuous aluminium-wire armour with an outer protection of bitumen-bonded polypropylene yarn.

### Production

The cables were manufactured in continuous lengths of approximately 100 km for the 35 kV cable, and 25 km for the 110 kV cable, in our Karlskrona factory. Modern triple-extrusion techniques and dry-curing were used to produce a high-quality cable. The quality assurance programme was extensive throughout the project, and one of the reasons ABB was selected as the main contractor was the efficiency of our quality assurance. The cables were completed in a record time of only 8 months.

### Cable Routes

The 35 kV cables were laid in ten circuits along the coast, from the island of Osinj in the north to Mljet in the south. The route lengths varied from 4 to 23 km, with a maximum depth of

water of about 90 m. The 110 kV cables were laid in five circuits, all of which were accompanied by a continuous fibre-optic cable also supplied by ABB. The route lengths of these circuits varied from 12 to 35 km.

### Installation

All the cables were loaded directly onto the laying vessel at our Karlskrona cable plant. The vessel then made its way into the Adriatic Sea and commenced laying. The ability of the ship to navigate with total precision was crucial in these shallow waters filled with coral and rocks. Dynamic positioning systems and satellite navigation systems were two important facilities required for accurate laying of the submarine cables. The cables were laid with not more than ten metres deviation from the pre-determined route. In the areas close to the shore, the cables were laid in pre-cast concrete troughs, under close supervision by divers.

All fifteen laying campaigns were successful and all the cable circuits were in place ahead of schedule. Rapid installation was essential in coping with the intricate issue of delivering cables to a country involved in an armed conflict.

### Commissioning

By June 1995, all the cable circuits had been successfully d.c.-tested, and they are now in commercial operation, distributing much-needed electricity to the islanders, providing an important foundation for rebuilding Croatian society and the Croatian economy.

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### BU Cables

ABB Power Technologies AB  
[www.abb.com/cables](http://www.abb.com/cables)

Telephone  
+46 455 556 00

Telefax  
+46 455 556 55

E-mail  
[sehvc@se.abb.com](mailto:sehvc@se.abb.com)

SEHVC M-035E