A.4.3.

New 400 kV underground cable system project in Jutland (Denmark)

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The building of a 400-kV connection between Aalborg (North Jutland) and Århus (transformer station in Trige) will complete the ring of the main Jutland high-voltage grid.

Planning and government evaluation of the 140 km line have been going on for more than ten years. The Danish Energy Council approved the project in early March 2001. It is now intended that the high-voltage transmission line will enter operation in 2004.

The overall project for the establishment of this 400 kV high-voltage connection between Århus and Aalborg includes sections with underground cables. The three 400-kV cable sections will run across Mariager Fjord and the Gudenaa Valley, as well as through the Indkilde Valley, with an overall route length of 14 km.

Considered together, the three siphons are one of the world's largest cable projects. It is also the first time that 400-kV cables will be buried under agricultural land and nature reserves. For all three cable sections in connection with the Århus-Aalborg project, two 400-kV cable systems will be laid in parallel.

This paper gives the history of the project, describes the Environmental Impact Assessment process, from the public hearings to the political decision of undergrounding parts of the total route of the line.

After a short description of the three siphons (environment, cable route, etc) and the reasons why undergrounding has been decided, the technical issues regarding the integration of the three cable systems in siphons are addressed: cable dimensioning (thermal rating), overload capabilities, selected laying methods and techniques. The case of the crossing of the Mariager fjord is detailed.

Special attention is given to the transition compounds design: requirements and integrated functions, mitigation of the visual impact thanks to aesthetic design, use of composite insulators for improved safety.

Cables and accessories are described.

Type tests on complete cable system as well as tests on individual components are reported including type tests on aluminium laminated screen: mechanical tests, corrosion tests and water-tightness tests are carried out according to Cigre recommendations.

Installation methods of accessories (joints and terminations) are described and the assembly schedule of the three cable systems is given. After laying tests program is explained and commented.

Lessons learnt from the study of these large 400 kV Cable project are finally listed in conclusion of the paper.