The Oslofjord Project - The world's first installed 420kV submarine cable connection combining SCFF cables and XLPE cables with flexible factory joints

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Statnett commissioned and put into service a new 420kV AC cable connection across the outer Oslofjord in 2014. The crossing south of Horten and Moss is 13 km long and has a water depth of maximum 220 meter. The cable system is based on a dual technology concept with six paper insulated self-contained fluid filled (SCFF) cables with state of the art pumping stations on both sides of the fjord and three cross-linked polyethylene (XLPE) cables. Each XLPE cable contains two factory joints fully qualified and type tested. To our knowledge this is the world's first installed 420kV XLPE submarine cable system with flexible joints.

Nexans Norway AS was awarded the turn key contract for the Oslofjord project 3rd May 2010. In this project Statnett decided to combine the well-known and proven SCFF technology with the emerging XLPE technology. The motivation for this choice was to start accumulating service experience with the XLPE technology for 420kV while keeping the risk level acceptable for this connection that is a vital part of the grid in the Oslo area. The SCFF technology has a long track record for submarine applications and has proven to be very reliable.

The XLPE cable with accessories was type tested and routine tested according to requirements given in IEC 62067 and Cigre recommendation Electra No. 171 and 189, while the SCFF cable with accessories was type tested and routine tested according to IEC 60141 and Electra No. 171. Mechanical tests were carried out for a design water depth of 400 meter. This ensured a robust margin with respect to the actual maximum laying depth of 220 meter.

A Distributed Temperature Sensing Systems (DTS) with fibre optical cables integrated in the power cables was installed to monitor the temperature of all nine cables from cable end to cable end. This ensures that the operational temperature on critical sections of the cables is within specified maximum allowable.

As part of the contract, Nexans delivered two complete pumping plants to supply oil and maintain pressure for the SCFF cables, one for each side of the fjord. Each pumping plant has the capability of supplying all six cables thus providing redundancy in case of service or repair on one side of the connection. In case of rupture of the SCFF cable, the pumping plant can maintain the oil pressure in the cables without ingress of water for a certain time until repair. All characteristics of the pumping plant and the cable system are monitored from the Statnett regional control center securing a short response time in case of irregularities.

The cables were installed using the cable laying vessel Nexans Skagerrak. The cable route was challenging with steep and rocky slopes down to the bottom of the fjord and narrow cable separation in the shallow areas, thus high precision positioning was required during the cable laying. The cables were as far as possible trenched to 1 meter depth in the subsequent trenching operation in order to protect against trawling activities in the area.