

EXECUTIVE SUMMARY

The main challenge of subsea cables is to reduce offshore operations throughout the lifetime of the cable system. The presence or absence of intermediate cooling stations has a huge impact on the system complexity all along the life cycle of the export system, from permitting to maintenance.

The first part of this report presents the estimation of the maximum thermohydraulic length, meaning the longest length that can be cooled down without an intermediate cooling system offshore. The study integrates and anticipates the harshest conditions in terms of losses, circulation of cryogen under pressure inside the system, and static sea water pressure from outside. The maximum thermohydraulic length can reach up to 38 km in the most favorable case.

As an export system requires in any case an offshore platform next to the windmills to collect their power and an onshore substation to connect to the grid, the presence of cooling systems on the collection platform and at the onshore substation has a limited impact. This leads to the possibility to have in the most favorable case 76 km of subsea cable without intermediate offshore substations, by cooling 38 km from each end. This upper limit gives the maximum length that is reasonable to manufacture. Typically, two scenarios can be envisaged and are presented in the report for the production: continuous production steps for all the cable “layers” up to the armoring, or the production of unit lengths of 1 to 3 km that need to be connected in the factory before or during the loading of the installation vessel.

The overestimation of losses can be very costly for a long-length cable, as it can impact the overall thermohydraulic design as well as the cooling system size and operational expenses. The development of a reliable and accurate method to assess the thermal losses of the cable cryostat is therefore of major importance. Based on the improvement of existing methods, a new test bench was built, with the measurement results reported in the following. Thanks to the precision of the method developed in SCARLET, improvement of the cable cryostat performance was already measured and documented. The effect of the various parameters was studied, and an optimized version of the cable cryostat was proposed. Moreover, a working group dedicated to this topic was created within the framework of IEC TC90.

In conclusion, the report shows that the building bricks used for conventional manufacturing of long lengths of export cable can also be used for HTS cable production. To reach higher TRLs, work still needs to be conducted on the thermal insulation for long lengths and thermal shrinkage management.