

EXECUTIVE SUMMARY

The design of each component of the HTS cable system is depending on the global architecture. From an electrical point of view, the design is similar for offshore and onshore HTS cable systems. The cable core design depends only on the voltage, transported power, fault conditions, and the level of redundancy required by the final customer. The onshore system can be independent or in continuation of an offshore cable up to the grid connection station located 20 km or more from the shore.

The onshore configuration proposed in SCARLET allows for a modular HTS cable system based on periodic cooling stations along the cable length. The module is composed of one or several cable circuit units connected by joint bays and having their own cooling stations. Such modules of onshore cables can be repeated over long lengths, with the only limitation posed by supply utilities to each cooling unit (power, chillers or cold water). Hence, modular onshore HTS cables are proven ideal for connecting networks together, bringing renewables to the grid, or linking an offshore cable to the onshore substation.

For an onshore cable connecting an offshore cable to the grid, several choices are available depending on the landfall constraint. If there is space for a cooling station at landfall, then it is preferable to separate the cooling of the offshore and onshore sections of the HTS cable system. In this case, it is possible to deeply optimize the cable cryostat and the cooling system of the onshore part. If the only place for the first cooling system of the subsea part is the grid connection station, then the liquid nitrogen mass flow of the offshore part has to go through the cryostat of the onshore section and the downsizing of the cryostat of the onshore cable is limited.

This report presents the design of the onshore HTS cable components taking into account the system constraints. It covers the cable core design and modeling, the cable cryostat design, the termination, joint and thermal compensation designs as well as the hypothesis made for the cooling and the installation in the joint bays.