The realization and commissioning of the ±500 kV 100 MW HVDC link Sardinia Island – Italian Peninsula (SAPEI)

ABSTRACT

The essential characteristics and the steps followed in the realization process of the new ±500 kV 1000 MW HVDC link Sardinia Island – Italian Peninsula (SAPEI), whose completion was achieved at the end of 2010, are presented in this paper.

Notwithstanding the growing application of HVDC links around the world and the acquired experience in the area of DC energy transmission, any new HVDC link requires substantial engineering efforts because of the peculiarities of the networks to be interconnected and the quick evolution of the technology, that involve a continuous updating of system design. In the case of SAPEI, the highest levels of availability and reliability of the link, together with the possibility to restart from emergency conditions so as to cope with the peculiar needs of the Sardinian network, were the drivers throughout any stage of the project, from the early localization of the plants to the final commissioning.

Converters, converter transformers, AC filters, smoothing reactors, AC and DC yard switching equipment as well as the control and protection system were designed, tested and realized with quality standards at the top of the state of art. At the same time, redundancies were adopted for all major functionalities, and a particular flexibility of the circuit configurations was realized so as to permit a quick passage from bipolar to monopolar operation, avoiding the interruption of the entire interconnection in case of failure of either one converter unit or one pole cable.

As far as the HVDC cables are concerned, the main challenges were the very high voltage, the length of the route, and above all the sea bottom depth, reaching the maximum of 1,620 m, an unprecedented record for submarine cables, that confirms the high technology needed to achieve this kind of works. Mass impregnated paper insulated cables together with different sizes and conductor material (Cu and Al), were the solution to cope with the different installation and ambient conditions along the route. The laying activities of submarine cables, that had been preceded by an extensive sea-trial campaign, were all performed by the Prysmian owned ship “Giulio Verne”.

Following the laying, the cables were protected by burial on the seabed at a depth of up to 600m. Finally, the commissioning tests were not only aimed at verifying the design performances, but were themselves a fundamental part of the project, as they also gave the opportunity to make the final tuning of the system performances and operations possibilities. To this end, even very rare conditions were reproduced so that operators be ready to tackle any events. But the challenges that the new realization went across were not of technical nature only.