Testing experiences on extruded cable systems up to 525 kV DC in the first third party worldwide laboratory

CESI Group - Testing & Certification Division - Mannheim (Germany) and Milano (Italy)
vercellotti@cesi.it - jahn@fgh-ma.com

ABSTRACT

The boom of renewable power stations (solar energy and wind mills mainly), the increased use of interconnectors and submarine cables, the construction of urban substations in big cities with intense population and the need to avoid the use the overhead lines (right of way, acceptance and so on), are the main factors leading to the increasing amount of installed kilometers of cables all around the world. In many cases the generation and the consumption of the energy occur at different locations and therefore significant distances need to be bridged by a transport system, i.e. a cable including the accessories.

Transmission System Operators (TSO) and Distribution System Operators (DSO) search for innovative solutions in developing the transmission and distribution grids, but TSO and DSO also need to know the quality of the installed components they choose in order to deliver the highest quality level of power supply.

Independent testing and certification provided by a third party is the answer for delivering the qualification process for a cable system so utilities and network operators can be confident to deliver a reliable electricity supply.

This paper highlights the experiences gained during the first Long Duration Tests (PQT) performed in both lab and outdoor situations on 525 kV DC cable systems, introducing the challenges that a laboratory has to fulfill in order to represent a real end user circuit situation, the measurements to be performed in sometime hostile environment, the experience learned from test management and so on. Furthermore, we want to describe points to be updated at standardization level for future standardization works.

KEYWORDS

Cable Interconnection; Extruded HVDC cable systems; Long duration tests.

I. INTRODUCTION

Population growth, development of the digital economy and electric cars - the demand for electricity is expected to explode in the near future, believes IEA, anticipating a growth of more than 25% in total energy demand by 2040, driven in particular by India and developing countries.

This will require a $ 2000 billion investment in energy supply and the world demand for electricity should jump by 60% and represent almost a quarter of total energy demand (against 19% today).

In a changing electrical market, driven by renewable energies, the target is to get wind or solar energy to the consumption centers, transporting energy over thousands of kilometers.

Typical designs for power distribution and transmission systems are overhead power lines and/or more and more insulated power cables with increasing length.

The intrinsic property of these mostly polymeric insulated cables is their much higher capacitance per kilometer compared to overhead lines (of about factor 300-500).

Nowadays, especially for long distances and minimized losses, DC is preferred over AC technology, helping and in some cases replacing the old network in HVAC.

Between now and 2020 at least € 60 billion investment in HVDC will be required to keep pace with new developments of renewables globally e.g. only in the last 3 years the length of the connections made in the previous 50 years doubled.

Meanwhile in the next decade the market for HV submarine cables is estimated at $ 25 billion with about 3/4 of the projects located in Europe, where they are building different connections while others are in the planning or feasibility study phase (see Figure1).

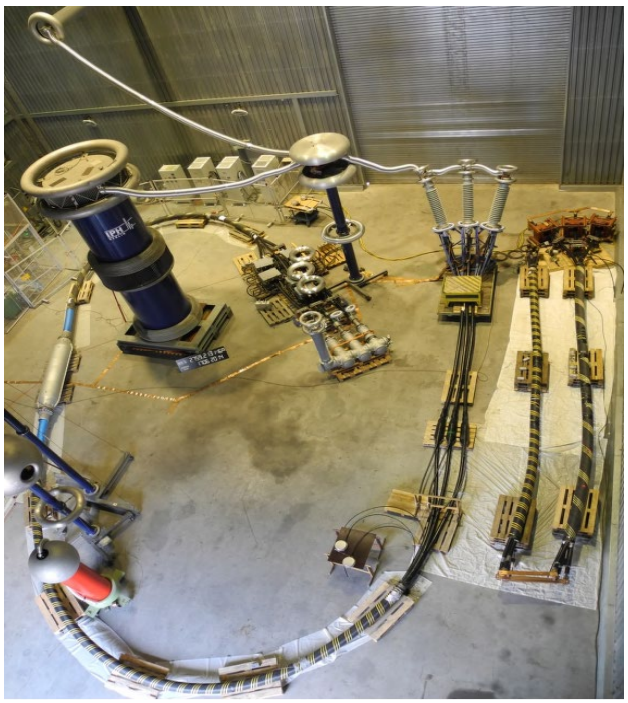

Fig. 1. Example of 3 phase AC submarine cable testing.

In Northern Europe these investments may primarily concern links to offshore wind farms, while in the Mediterranean Sea area interconnection links are prevailing to promote the integration and management of intermittent renewable sources but also the security of supply and the integration of electricity markets.