PROMOTioN
PROGRESS ON MESHED HVDC OFFSHORE TRANSMISSION NETWORKS

PRESS RELEASE

Technology maturity of HVDC circuit breakers proven by successful full-scale high-power demonstration

Arnhem/Berlin, 6 April 2020. A full-scale prototype of the ABB hybrid HVDC circuit breaker was successfully tested on the 27th of February 2020 in the independent KEMA Laboratories as part of the PROMOTioN HVDC technology demonstration programme. The EU funded PROMOTioN project aims to tackle technical, regulatory, financial and legal challenges to the implementation of meshed HVDC offshore transmission networks.

HVDC circuit breakers are key components to enable the smooth continuous operation of HVDC grids in case of grid faults. This enables the development of multi-terminal HVDC grids to reliably and efficiently export large-scale offshore wind energy to the North Sea countries and furthers European integration by facilitating a common energy market. Within the framework of the Green Deal planned by the European Commission, an offshore wind capacity up to 450 GW by 2050 is seen as necessary to achieve climate neutrality. To this end, such integrated and cross-border offshore HVDC grid connections must be created. Thus far, the application of HVDC circuit breakers has been limited, with only partial verification by testing and little operational experience.

The 350 kV rated prototype passed a carefully developed DC short-circuit current interruption test programme representing the full range of electrical DC short-circuit current interruption stresses which are encountered in real operation, paving the way to standardization of these test requirements. DC short-circuit currents from 340 A up to 20 kA were interrupted with a 3 ms breaker operation time and energy absorption up to 10 MJ. The current and energy test stresses were directly supplied by a test circuit based on AC short-circuit generators operated at low power frequency.

The tests were partly witnessed by an audience of TSOs and developers and are as such an important milestone in creating confidence in the technology maturity of HVDC circuit breakers. Alan Croes, Senior Manager Corporate Asset Owner TenneT TSO, says: "*Witnessing such an important step is providing further confidence in the availability of an HVDC circuit breaker. Given that TSO's are in principle designing*

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offshore grids without redundancy, limiting impact on our customers during a fault is crucial. This test has shown that we as TSO's now have more alternatives with this additional functionality for our offshore grid design."

The complete DC short-circuit current interruption functionality of a full-scale, fully-rated and fully-integrated system was successfully demonstrated in an industrially relevant environment, signifying a technology readiness increase to level 7-8 (with 9 being a fully developed competitively manufactured product in operation). In addition to the tests, it was also shown that a complex system like this can be assembled in the time span of a few days which is important for the maintainability and hence availability. The next step is the application to HVDC projects in which the performance and benefits of HVDC circuit breakers can be demonstrated in an operational environment.

About PROMOTioN

The demonstration was performed as part of work package 10 of the 'Progress on Offshore Meshed HVDC Transmission Networks' (PROMOTioN) project in which prototypes of three different HVDC circuit breaker technologies are demonstrated. The PROMOTioN project aims to tackle technical, regulatory, financial and legal challenges to the implementation of offshore meshed HVDC transmission networks. The consortium consists of 34 partners ranging from all major European HVDC equipment manufacturers, TSOs and academia to test labs and consultants. This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 691714. For more information please visit www.promotion-offshore.net.

Figure 1 – The witnesses in front of the test object in KEMA Laboratories' high power test bay