

First VSC-HVDC Demonstration Project in China – Nanhui Wind Farm

Grid Integration

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Abstract

With growing development in wind power and other renewable energy, the proportion of wind power and other intermittent power sources has increased substantially, posing enormous challenges to safe and reliable operation of power grid. VSC-HVDC transmission is widely recognized as the supreme technical scheme for wind farm's grid integration all over the world. It is applicable to any form of wind farms. The use of VSC-HVDC transmission system has significant competitive edge, especially for large-scale onshore and offshore wind farms. Development and application of VSC-HVDC transmission technology will provide economical, highly-efficient, environment-friendly and reliable technical means for the integration of large-scale intermittent power resource into smart grid.

CEPRI took charge of technology development, equipment supply and engineering implement for the first VSC-HVDC transmission of China - Shanghai Nanhui wind farm integration demonstration project. Through 5 years of scientific research, CEPRI has possessed of the key technologies of intellectual property rights on system design, core equipment manufacture, equipment testing methods, engineering applications, and the EPC capability on VSC-HVDC project. The demonstration project is composed of two 20MVA/ ± 30 kV converter stations, which transmit wind power to AC network via 8km DC land cables. The VSC valves use high voltage Insulated gate Bipolar Transistors (IGBT) capable of turning off currents and the microseconds pulse valve base electronic controller. And modularized structure with bottom supporting is adopted in the VSC valves. The project will parallel with existing AC line, thus enabling three different operation modes: the DC mode via the DC cable only, the AC/DC mode via the DC and the AC cable in parallel or STATCOM mode only. The control and protection strategies under all kinds of operation modes were verified by EMTDC digital and dynamic physical platform simulation.

The demonstration project was commissioned in May 2011 and passed a series of system tests including transient/stable operation performance, STATCOM mode and full load operation etc. successfully. This reconstruction of the grid connection not only enable the VSC Transmission system to control the wind farm power flexibility, but also provide dynamic compensation for the sending or receiving system reactive power demands, thereby increasing the system stability and improving the wind farm fault ride through (FRT) capability. The project provides a test platform and demonstration project for the development of this technology in China. And it also provides effective technical support to development and utilization of large-scale wind power.