World Academy of Science, Engineering and Technology
International Journal of Energy and Power Engineering
Vol:8, No:06, 2014

Internal DC Short-Circuit Fault Analysis and Protection for VSI of Wind Power Generation Systems

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Abstract : Traditional HVDC systems are tough to DC short circuits as they are current regulated with a large reactance connected in series with cables. Multi-terminal DC wind farm topologies are attracting increasing research attempt. With AC/DC converters on the generator side, this topology can be developed into a multi-terminal DC network for wind power collection, which is especially suitable for large-scale offshore wind farms. For wind farms, the topology uses high-voltage direct-current transmission based on voltage-source converters (VSC-HVDC). Therefore, they do not suffer from over currents due to DC cable faults and there is no over current to react to. In this study, the multi-terminal DC wind farm topology is introduced. Then, possible internal DC faults are analyzed according to type and characteristic. Fault over current expressions are given in detail. Under this characteristic analysis, fault detection and detailed protection methods are proposed. Theoretical analysis and PSCAD/EMTDC simulations are provided.

Keywords : DC short circuits, multi-terminal DC wind farm topologies, HVDC transmission based on VSC, fault analysis
Conference Title : ICRESA 2014 : International Conference on Renewable Energy Systems and Applications
Conference Location : Paris, France
Conference Dates : June 26-27, 2014