MT 26
International Conference
on Magnet Technology
Vancouver, Canada | 2019

Contribution ID: **1377** Type: **Poster Presentation**

Thu-Mo-Po4.11-05 [78]: Optimal Designing and Performance Evaluation of Inductive Superconducting Fault Current Limiter Combined with Low-Voltage Mechanical Circuit Breaker in DC Microgrid System

Thursday 26 September 2019 08:45 (2 hours)

To secure the reliable dissemination of the dc microgrid system, it is essential to establish efficient protection scheme. There are various protection methods of dc microgrid system : fuse, circuit breaker (Solid-state, Mechanical, Hybrid, etc.), superconducting fault current limiter (SFCL) and fault tolerant converter. Among the mentioned methods, the mechanical circuit breaker (MCB) has the advantages of high interrupting reliability and low steady-state loss close to zero, but it has a very slow interruption time (> 30 ms) that cause serious damage and large loss to electric power equipment during fault. In this paper, to improve protection of dc microgrid system and MCB's efficiency, we proposed the optimal designing of inductive SFCL (I-SFCL) combined with low-voltage MCB in DC microgrid system. The MCB was optimized according to the limited fault current level and improvement of the fault current interrupting performance of the MCB is verified. First, in order to select the optimal position, the one I-SFCL was located for each distributed power source and main grid in dc microgrid system. And the fault current limiting ratio and bus voltage sag were analyzed for each I-SFCL position under various fault conditions. Second, the dc CB was designed based on the voltage-current interruption curve of the actual low-voltage dc CB using the black-box arc model, and the simulation was performed each by dividing the case where the with I-SFCL or without I-SFCL. The voltage, current and loss values for each principal component in the transient area were calculated, and comparative study was performed. As a result, through the application of I-SFCL, the fault current and voltage sag in renewable sources can be effectively limited, and the interrupting performance of the MCB can be greatly improved to ensure the reliability of the dc microgrid.

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Session Classification: Thu-Mo-Po4.11 - Current Limiters & Breakers