



Contribution ID: 988

Type: Poster Presentation of 1h45m

## Capacity Allocation of a Superconducting Flywheel Storage System (SFES) in Hybrid Energy Storage System for Wind Generation

*Monday 28 August 2017 13:15 (1h 45m)*

Due to the significant penetration of wind generation, the fast capacity resources are needed to handle the fluctuations caused by the wind generation. Battery Energy Storage Systems (BESSs) could be the solution as resources to back up the unpredictable fluctuation caused by the wind generation. However, the life cycle of batteries deployed in balancing operations could be a lot shorter compared to other capacity resources, caused by frequent charging and discharging operations. The alternative could be a superconducting flywheel storage system (SFES) with virtually unlimited cycle life and a high ramping rate, being able to come up with the fluctuations caused by the wind generation. The capacity of the SFES is relatively limited whereas BESS does not have such problems. The SFES can be synergistically used in combination with BESS to deal with the fluctuations caused by the wind generation. In this paper, a mixed integer linear programming (MILP)-based SFES capacity allocation method for fluctuation compensation in wind farm is proposed. The fluctuation of wind generator is divided into high and low frequency component by lowpass filter to be allocated to SFES and BESS.

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**Session Classification:** Mon-Af-P01.05

**Track Classification:** E4 - Levitation and Magnetic Bearings