

Hierarchical Operation Strategies for Grid Connected Building Microgrid with Energy Storage and Photovoltaic Source

Authors : Seon-Ho Yoon, Jin-Young Choi, Dong-Jun Won

Abstract : This paper presents hierarchical operation strategies which are minimizing operation error between day ahead operation plan and real time operation. Operating power systems between centralized and decentralized approaches can be represented as hierarchical control scheme, featured as primary control, secondary control and tertiary control. Primary control is known as local control, featuring fast response. Secondary control is referred to as microgrid Energy Management System (EMS). Tertiary control is responsible of coordinating the operations of multi-microgrids. In this paper, we formulated 3 stage microgrid operation strategies which are similar to hierarchical control scheme. First stage is to set a day ahead scheduled output power of Battery Energy Storage System (BESS) which is only controllable source in microgrid and it is optimized to minimize cost of exchanged power with main grid using Particle Swarm Optimization (PSO) method. Second stage is to control the active and reactive power of BESS to be operated in day ahead scheduled plan in case that State of Charge (SOC) error occurs between real time and scheduled plan. The third is rescheduling the system when the predicted error is over the limited value. The first stage can be compared with the secondary control in that it adjusts the active power. The second stage is comparable to the primary control in that it controls the error in local manner. The third stage is compared with the secondary control in that it manages power balancing. The proposed strategies will be applied to one of the buildings in Electronics and Telecommunication Research Institute (ETRI). The building microgrid is composed of Photovoltaic (PV) generation, BESS and load and it will be interconnected with the main grid. Main purpose of that is minimizing operation cost and to be operated in scheduled plan. Simulation results support validation of proposed strategies.

Keywords : Battery Energy Storage System (BESS), Energy Management System (EMS), Microgrid (MG), Particle Swarm Optimization (PSO)

Conference Title : ICESPS 2017 : International Conference on Energy Sources and Power Systems

Conference Location : Zurich, Switzerland

Conference Dates : January 13-14, 2017