Optimal Sizes of Energy Storage for Economic Operation Management

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Abstract : Batteries for storage of electricity from solar and wind generation farms are a key element in the success of sustainability. In recent years, due to large integration of Renewable Energy Sources (RESs) like wind turbine and photovoltaic unit into the Micro-Grid (MG), the necessity of Battery Energy Storage (BES) has increased dramatically. The BES has several benefits and advantages in the MG-based applications such as short term power supply, power quality improvement, facilitating integration of RES, ancillary service and arbitrage. This paper presents the cost-based formulation to determine the optimal size of the BES in the operation management of MG. Also, some restrictions, i.e. power capacity of Distributed Generators (DGs), power and energy capacity of BES, charge/discharge efficiency of BES, operating reserve and load demand satisfaction should be considered as well. In this paper, a methodology is proposed for the optimal allocation and economic analysis of ESS in MGs on the basis of net present value (NPV). As the optimal operation of an MG strongly depends on the arrangement and allocation of its ESS, economic operation strategies and optimal allocation methods of the ESS devices are required for the MG.

Keywords : microgrid, energy storage system, optimal sizing, net present value

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