Sizing and control of large PV system inverters connected to MV grid

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Abstract

New energy polices and the reduction in the prices of photovoltaic (PV) panels, storage batteries and power electronics inverters resulted in a dramatic increase in the penetration level of PV systems connected to the medium voltage (MV) network. Consequently, utility sets a restriction over the injected power fluctuations as well as the requirements from PV system to support static and dynamic stability of the grid. The German grid code for connecting generation units to MV network is one of the stringent grid codes regards the stability requirements. Those requirements are required to be fulfilled under techno-economical attentive considerations to maximize the profit of PV system owner. This paper introduces an optimal sizing for battery and its corresponding inverter to satisfy the grid requirements and to maximize the profit. The optimization is done using GAMS software. The system is implemented using a real time simulator PSCAD/EMTDC to study the dynamics of control loops under steady state and transient conditions. Moreover, the German grid-code is utilized for controlling the reactive power injected from system inverters to support the voltage stability. The simulation results reveal accurate, fast and improved dynamic response of the proposed system Index Terms-PV, power fluctuations, optimal sizing, reactive power management, voltage stability, coordinated control.

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