Efficient Control of Active Transformers for Increasing the PV Hosting Capacity of LV Grids

The increased penetration of grid-connected photovoltaic (PV) systems in low voltage (LV) grids creates concerns about overvoltage in these grids. The proposed methods to prevent overvoltage, such as reactive power absorption by PV inverters and active power management of customers, focus on decreasing the voltage rise along LV feeders, and the potential of active medium voltage to low voltage (MV/LV) transformers for overvoltage prevention has not been thoroughly investigated. This paper presents the application of active MV/LV transformers for increasing the PV hosting capacity of LV grids. The potential interferences between the operation of active transformers and the reactive power absorption by PV inverters are investigated, and a voltage droop control approach is proposed for the efficient control of these transformers during high PV generation periods. The proposed method can potentially increase the PV hosting capacity of the grid, while eliminating the need for a complex and centralized controller. The voltages of specific locations or the grid state estimations provide adequate data for adjustments of the droop parameters. The simulations and field test results associated with the implementation of the proposed method to a newly developed active LV grid with high PV penetration in Felsberg, Germany, confirm the efficiency of the proposed method.

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