Energy Management and Control Strategy of Photovoltaic/Battery Hybrid Distributed Power Generation Systems With an Integrated Three-Port Power Converter

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Abstract— Photovoltaic (PV)/battery hybrid power units have attracted vast research interests in recent years. For the conventional distributed power generation systems with PV/battery hybrid power units, two independent power converters, including a unidirectional dc-dc converter and a bidirectional converter, are normally required. This paper proposes an energy management and control strategy for the PV/battery hybrid distributed power generation systems with only one integrated three-port power converter. As the integrated bidirectional converter shares power switches with the full-bridge dc-dc converter, the power density and the reliability of the system is enhanced. The corresponding energy management and control strategy are proposed to realize the power balance among three ports in different operating scenarios, which comprehensively takes both the maximum power point tracking (MPPT) benefit and the battery charging/discharging management into consideration. The simulations are conducted using the Matlab/Simulink software to verify the operation performance of the proposed PV/battery hybrid distributed power generation system with the corresponding control algorithms, where the MPPT control loop, the battery charging/discharging management loop are enabled accordingly in different operating scenarios.

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