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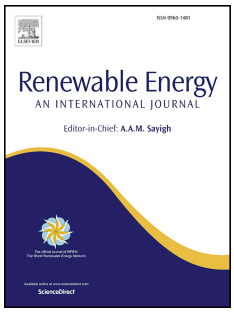

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Distributed Control Scheme for Residential Battery Energy Storage Units Coupled With PV Systems

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Abstract

A distributed control method for residential battery energy storage (BES) units coupled with photovoltaic (PV) systems is presented. The objective is to utilize customer owned BES units for solving the over-voltage issues caused by high PV penetration without significantly affecting the BES owners local objectives. 24 hour ahead active power set points of the BES unit are calculated by an optimization based scheduling algorithm. The objective function is locally decided and the optimization is performed at the local level. The BES units are charged from the excess energy from the PV systems mostly during the period the grid is under risk of over-voltage. If the set points that were calculated by the optimization, turn out not to be able to maintain the voltages within the statutory limits in real time operation, the active power set points are modified. Reactive power is also utilized when active power is not sufficient. The new set points are calculated by a central controller. The performance of the proposed method is validated in a simulation study. It is shown that the residential BES units can successfully be utilized for solving over-voltage issues without significantly affecting the primary needs of the BES owners.

Keywords: Battery energy storage, distributed control, optimization, PV systems, voltage regulation

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