



Energy management strategies in hybrid renewable energy systems: A review

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ABSTRACT

Variability and intermittency are some of the main features that characterize renewable energy sources. Intermittency usually includes both predictable and unpredictable variations. The many drawbacks of intermittency of renewable sources can be overcome by considering some special design considerations. Integrating more than one renewable energy source and including backup sources and storage systems are among the few measures to overcome these drawbacks. These additional design considerations usually increase the overall cost of the renewable system. Furthermore, the presence of more than one energy supply/storage system requires the control of energy flow among the various sources. Therefore, optimizing the size of the components and adopting an energy management strategy (EMS) are essential to decreasing the cost of the system and limiting its negative effects. The energy management strategy is commonly integrated with optimization to ensure the continuity of load supply and to decrease the cost of energy production. Therefore, energy management is a term that collects all the systematic procedures to control and minimize the quantity and the cost of energy used to provide a certain application with its requirements. The energy management strategy usually depends on the type of energy system and its components. Various approaches and techniques have been used to develop a successful energy management strategy. In this paper, a comprehensive review of the approaches proposed and used by authors of many papers is conducted. These approaches include both the standalone hybrid renewable energy systems and the grid-connected hybrid renewable systems. More attention is focused on popularly used techniques to address the features of each system. The selected papers in this review cover the various configurations of the hybrid renewable energy systems for electric power generation only.

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