Optimization methods for energy management systems used in microgrids: A state-of-the-art review

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Abstract

Energy is one of the most important needs of human history, especially with the effect of chaos environments such as war and pandemic. There have always been tensions between countries on energy due to the increasing energy need since the Industrial Revolution that started at the end of the 18th century. Due to the finite and harmful nature of existing energy sources, new energy production techniques are being developed and the tendency towards renewable energy sources such as solar, wind, hydraulic and geothermal is increasing. Microgrids that assist in the distribution for electricity which is generated from small-scale renewable energy sources are grids with limited loads and production, which can be operated either grid-dependent or off-grid. Microgrid provides advantages such as reduced transmission and distribution costs, reducing energy losses, providing more energy efficiency, having lower capital costs, and providing a low-cost entry to a competitive market. Optimization methods can be applied for optimum use of renewable energy sources in microgrid systems. In this study, studies on optimization techniques used in microgrid systems in energy management in the current literature were examined. By researching the optimization methods used, a general framework has been presented regarding the formation of the objectives of planning the use of energy resources and minimizing costs within the optimization methods. In addition, a comprehensive analysis of the optimization methods frequently used in microgrid systems is presented.

Keywords: Microgrid, renewable energy sources, optimization techniques, energy management system