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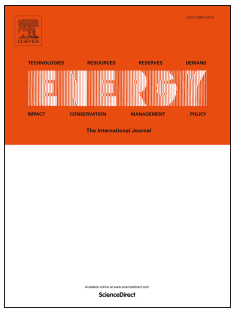

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A Novel Stochastic Energy Management of a Microgrid with Various Types of Distributed Energy Resources in Presence of Demand Response Programs

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Abstract

In this paper, the energy management of a microgrid including wind turbine, PhotoVoltaic (PV) modules, Combined Heat and Power (CHP) systems, fuel cells, power only units, heat only unit, Plug-in Electric Vehicles (PEVs), and thermal energy storage resources for supplying electrical and thermal loads is presented. For achieving a better management on demand side, both price-based and incentive-based Demand Response Programs (DRPs) have been used and their impacts on reducing the operational cost of microgrid in both grid-connected and island modes have been investigated. Also, the uncertainty of price, load, wind speed and solar radiation are taken into account in order to obtain more realistic results. By discretization of Probability Distribution Function (PDF) of each uncertain parameter, a set of scenarios is generated. Then, using a scenario reduction method based on mixed-integer linear optimization, the set of reduced scenarios is obtained. Two-stage stochastic programming approach is used to minimize the operational cost in microgrid energy management. The proposed method for microgrid energy management has been evaluated in three modes: grid-connected, grid-connected with DRPs, and island mode with DRPs.

Key words

Microgrid Energy Management; Distributed Energy Resource (DER); Demand Response Programs (DRPs); Uncertainty, Two-stage Stochastic Programming; Plug-in Electric Vehicles (PEVs)