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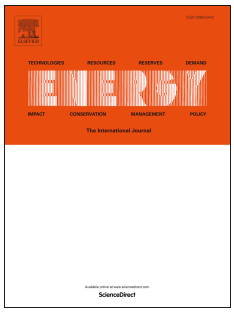

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Reliability Constrained Two-Stage Optimization of Multiple Renewable-Based Microgrids Incorporating Critical Energy Peak Pricing Demand Response Program Using Robust Optimization Approach

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Abstract: As the smart grid paradigm is capable to encourage the active consumers for efficacious participation in increasing system efficiency, demand response programs (DRPs) have attracted much interest in the worldwide recently, especially in optimization of smart microgrids (MGs). Under this context, this paper proposes an integrated method relies on cleverly cooperation of time rate-based DRP and heterogeneous distributed energy resources (DERs) deployment with aim to reliability-oriented planning of multiple MGs. To do this, a novel two-stage decision making model is exploited in which at the first stage the MGs construction is formed by optimal dynamic planning of hybrid DERs simultaneously with section switch allocation considering a reliability criterion for MGs as loss of load expectation (LOLE) constraint. Subsequently, at the next stage the critical energy peak pricing-based program accomplishes in order to flatten the load profile as well as diminishing the investment costs of MGs. Besides, owing to the unpredictable nature pertaining to renewable power production, the uncertainty modelling is inevitable where in this paper, a novel pragmatic robust optimization approach has been employed to deal with intense uncertainty of the problem. Numerical results obtained from an illustrative case study elucidate how the proposed MGs planning and utilized DRP pairing significantly increases the expected profit of system and ameliorates the reliability of end-users.

Keywords: MGs planning; demand response; robust optimization; renewable energy.

1. Introduction

1.1. *Concepts and Motivations*

In recent years, an enormous attention has been devoted to demand response programs (DRP) due to their impressive benefits like improving load profile specifications, enhancement the reliability level and increasing the proficiency of network as well as achieving cost savings [1-3]. On the other hand, microgrids (MG) with advanced metering infrastructures (AMI) are conceived of as an integrated comprehensive power grid that can purvey electricity and heat simultaneously, so that it is a smart way from points of generation to active consumers which can be cleverly managed both supply and demand sides [4]. Therefore, creating MGs in distribution systems will provide an opportunity for

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