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Strategic decision-making of distribution network operator with multi-microgrids considering demand response program

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Abstract

In this paper, the operation scheduling of future distribution network is discussed under assumption of multi-microgrids. The economic operation scheduling of distribution network operator in the presence of autonomous microgrids is formulated as a game problem. Due to participation of multiple players with different objective functions, the multi follower bi-level programming is intended in the energy management scheme. From the distribution network operator's perspective, the decision-making strategy seeks to minimize the operation costs of distribution network operator. Network operator interconnecting upstream grid and interaction with microgrids schedules distributed energy resources and loads in economical matter to operate in optimal operation point. On the other hand, microgrid owners fed electrical loads interacting with the other microgrids and distribution network operator implementing demand response program during the scheduling horizon to acquire maximum profit. Therefore, the key focus of this approach is decision-making of distribution network operator which will be affected, not only by the reactions of microgrids, but also by the exchanging power between the microgrids. The paper discusses the theoretical background, architecture and algorithms of the proposed multi follower bi-level programming, and demonstrates the performance of distribution network operator and microgrids by means of simulation on the radial distribution test system.

Keywords: Decision-making, Distribution network operator, Multi-micro-grid, Multi follower bi-level programming, Demand response

Nomenclature

Abbreviations:

MG Microgrid.

MGO Microgrid owner.

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