Real-Time Central Demand Response for Primary Frequency Regulation in Microgrids

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Providing ancillary services for future smart microgrid can be a challenging task because of lack of conventional automatic generation control (AGC) and spinning reserves, and expensive storage devices. In addition, strong motivation to increase the penetration of renewable energy in power systems, particularly at the distribution level, introduces new challenges for frequency and voltage regulation. Thus, increased attention has been focused on demand response (DR), especially in the smart grid environment, where two-way communication and customer participation are part of. This paper presents a comprehensive central DR algorithm for frequency regulation, while minimizing the amount of manipulated load, in a smart microgrid. Simulation studies have been carried out on an IEEE 13-bus standard distribution system operating as a microgrid with and without variable wind generation. Simulation results show that the proposed comprehensive DR control strategy provides frequency (and consequently voltage) regulation as well as minimizing the amount of manipulated responsive loads in the absence/presence of wind power generation.