

Planing the Participation of Units Bound to Demand Response Programs with Regard to Ancillary Services in the PQ Power Market

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Abstract : The present research focuses on organizing the cooperation of units constrained by demand response (DR) programs, considering ancillary services in the P-Q power market. Moreover, it provides a comprehensive exploration of the effects of demand reduction and redistribution across several predefined scenarios (in three pre-designed demand response programs, for example, ranging from 5% to 20%) on system voltage and losses in a smart distribution system (in the studied network, distributed energy resources (DERs) such as synchronous distributed generators and wind turbines offer their active and reactive power for the proposed market). GAMS, a specialized software for high-powered modeling, is used for optimizing linear, nonlinear, and integer programming challenges. GAMS modeling is separate from its solution method, which is a notable feature. Thus, by providing changes in the solver, it is possible to solve the model using various methods (linear, nonlinear, integer, etc.). Finally, the combined active and reactive market challenge in smart distribution systems, considering renewable distributed sources and demand response programs in GAMS, will be evaluated. The active and reactive power trading by the distribution company is carried out in the wholesale market. What is demanded is active power. By using the buy-back/payment program, it is possible for responsive loads or aggregators to participate in the market. The objective function of the proposed market is to minimize the price of active and reactive power for DERs and distribution companies and the penalty cost for CO₂ emissions and the cost of the buy-back/payment program. In this research, the objective function is to minimize the cost of active and reactive power from distributed generation sources and distribution companies, the cost of carbon dioxide emissions, and the cost of the buy-back/payment program. The effectiveness of the proposed method has been evaluated in a case study.

Keywords : consumer behavior, demand response, pollution cost, combined active and reactive market

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