Short term scheduling of a virtual power plant in a Day-Ahead market under uncertainties using point estimate method

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Abstract:

Enviromental concerns, improvements in renewable energy technologies, governmental incentives for the use of these resources, and increased T&D costs, are the main factors driving the energy sector into a new era, where considerable portions of electrical demand will be met through widespread installation of Distributed Energy Resources (DER_S). The Virtual Power Plant (VPP) is a decentralized energy management system tasked to aggregate of capacity some Distributed Generations (DG_S), storage facilities, and Dispachable Loads (DL_S) for the purpose of energy trading and/or providing system support services. Due of stochastic behavior of the prime sources of some DG_S, such of wind speed and temperature, the steady state analysis of the system with integration of such DG unit requires a probabilistic approach. in this thesis, a probabilistic Price Based Unit Commitment (PBUC) approach using Point Estimate Method (PEM) is employed to model the uncertainty in market price and generation sources, for optimal bidding of a VPP in a day-ahead electricity market. Also, the uncertainty of stochastic DG_S generation handled through increasing the amount of required reserve. The proposed model allows a VPP to decide on the unit commitment of its DER_S, and the optimal sale bids to the day-ahead market. The proposed optimization algorithm is applied to an 18-buses system And solved by GAMS.

Keywords: Virtual power plant; Price Based Unit Commitment; Point estimate method; Distributed enery resources; Interruptible load

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