Optimal Offering Strategy of an EV Aggregator in the Frequency-Controlled Normal Operation Reserve Market

Electric vehicles (EVs) are to play an important role in electricity markets, since their energy storage capability can be beneficial to power systems operation. Electric vehicle aggregators will consequently develop adequate offering strategies to participate in energy and reserve markets, accounting for the market rules and operational capabilities of EVs aggregators (e.g., fleet of EVs). In this paper, we propose an offering strategy model for an EV aggregator to participate in the frequency-controlled normal operation reserve service (FCR-N) in Eastern Denmark. The aim is to maximize the expected revenue of the aggregator, accounting for potential penalties for missing the provision of both upward and downward reserves. The methodology has been modeled and tested under the scope of the PARKER project, which considers a case study based on real data from a small fleet of electric vehicles. An important conclusion relates to the availability patterns of the EVs that significantly changes the strategical participation of the EV aggregator in the service.