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Risk averse scheduling by a PEV aggregator under uncertainty

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Abstract— Research on electric power systems has considered the impact of foreseeable plug-in electric vehicle (PEV) penetration on its regulation, planning, and operation. Indeed, detailed treatment of PEV charging is necessary for efficient allocation of resources. It is envisaged that a coordinator of charging schedules, i.e., a PEV aggregator, could exercise some form of load control according to electricity market prices and network charges. In this context, it is important to consider the effects of uncertainty of key input parameters to optimization algorithms for PEV charging schedules. However, the modeling of the PEV aggregator's exposure to profit volatility has received less attention in detail. Hence, this paper develops a methodology to maximize PEV aggregator profits taking decisions in day-ahead and balancing markets while considering risk aversion. Under uncertain market prices and fleet mobility, the proposed two-stage linear stochastic program finds optimal PEV charging schedules at the vehicle level. A case study highlights the effects of including the conditional value-at-risk (CVaR) term in the objective function and calculates two metrics referred to as the expected value of aggregation and flexibility.

Index Terms— Conditional value-at-risk (CVaR); optimal PEV charging schedule; plug-in electric vehicle (PEV) aggregator; risk aversion; stochastic linear programming

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