Mohseni, Soheil and Brent, Alan C., 2022, Risk-based dispatch optimization of microgrids considering the uncertainty in EV driving patterns, 17th International Conference on Probabilistic Methods Applied to Power Systems (PMAPS).

DOI10.1109/PMAPS53380.2022.9810595

Abstract The large-scale electrification of the transport sector will result in increasingly ’peaky’ loads, which necessitates the system integration of additional capital-intensive storage infrastructure in renewables-rich microgrids of the future. In this context, the vehicle-to -grid (V2G) technology can provide an effective platform to unlock the so-called ’storage on wheels’ potential of electric vehicles (EVs), thereby reducing the need for cost-prohibitive grid-scale storage. However, the dispatch optimization of electricity networks integrating a high share of V2G-enabled EVs is challenging given the uncertainties in forecasts of the associated timing of charging and discharging. In response, this paper introduces a novel mixed-integer linear programming-based model for the optimal operation of a grid-connected microgrid (MG) integrating solar photovoltaic and wind turbine generation systems, which are supported by a hydrogen-based energy storage system, whilst assuming a high level of EV penetration. To this end, the information gap decision theory (IGDT) is employed to evaluate the impact of risk-averse(RA) and risk-seeking (RS) strategies against the possible aggregated EV charging/discharging scenarios where limited information is available about relevant driving patterns. Importantly, the simulation results from a test-case community MG system indicate that the RA and RS strategies are associated with a representative daily MG operation profit deviation of 21% and +19% compared to the most-likely risk-neutral strategy, respectively.

Keywords Microgrids, Electric vehicles, Uncertainty, Risk, Vehicle-to-grid, Optimal operation, Vehicles.

\website\IGT\mohseni-etal2022abs.tex 20.10.2022