Optimal Pricing Strategies for CSs in the Frequency Containment Reserves Market for Vehicle-to-Grid Integration

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Résumé

Electric vehicles (EVs) and the infrastructure of electric vehicle charging stations (EVCS) are emerging as
essential components of sustainable energy systems. In this context, we introduce an innovative approach that utilizes
aggregated EVCS to participate in the auxiliary market, thereby providing grid-balancing services. Our model continuously
monitors changes in EV state-of-charge (SoC) across both time and space, taking into account various factors, including
driver behavior, current SoC levels, and the associated charging/discharging costs and benefits. This approach will
enable charging station operators (CSO), in collaboration with aggregators, actively engage in the frequency containment
reserves (FCR) market. We introduce an optimization framework in conjunction with this EV model. For establishing
pricing policies with the twin aims of maximizing profits for aggregators and charging station operators (CSOs), while
also minimizing energy charging expenses for EV users. Our findings underscore the effectiveness of this pricing strategy
in achieving these dual objectives, as demonstrated through realistic simulations integrating the EV mobility and the
Electricity FCR market.

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