Abstract:

Employing electric vehicles as short-term energy storage could improve power system stability and at the same time create a new income source for vehicle owners. In this paper, the economic viability of this concept referred to as Vehicle-to-Grid is investigated. For this purpose, a price-responsive charging and dispatching strategy built upon temporally resolved electricity market data is presented. This concept allows vehicle owners to maximize returns by restricting market participation to profitable time periods. As a case study, this strategy is then applied using the example of Singapore. It is shown that an annual loss of $1000 resulting from a non-price-responsive strategy as employed in previous works can be turned into a $130 profit by applying the price-responsive approach. In addition to this scenario, realistic mobility patterns which restrict the temporal availability of vehicles are considered. In this case, profits in the range of $21 - $121 are achievable. Returns in this order of magnitude are not expected to make Vehicle-to-Grid a viable business case, sensitivity analyses, however, show that improved technical parameters could increase profitability. It is further assumed that employing the price-responsive strategy to other national markets may yield significantly greater returns.