Multi-period routing and battery charge scheduling for electric vehicles

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Abstract

Recent innovations on battery technology have significantly improved electric vehicle's (EVs) driving ranges. As a result, companies exploiting EVs for urban and semi-urban operations do not longer need to plan for mid-route battery charging and can restrict all charging operations to take place overnight (or between shifts) at the depot. However, the trivial policy of fully charging all vehicles every night can lead to poor fleet management decisions. First, this policy may simply be infeasible because of charging infrastructure constraints (e.g., grid contraints, maximum number of available chargers). Second, this practice has a great and negative impact in the lifespan of the batteries (the most expensive and ecologically unfriendly component of an EV). To solve these issues, routing and charge scheduling decisions must be simultaneously made over a planning periods of (at least) few days. In this talk, we present a set mixed integer programming models to tackle this problem. Our models explicitly take into account the impact of routing and charging decisions on the lifespan of the batteries and try to minimize it. The models are not trivial and they provide insight into how to include battery concern and continous-time charge scheduling decisions into multi-period electric vehicle routing problems. We also present a matheuristic approach tailored to solve large instances of the problem.

Keywords: Multi, period, electric vehicle routing, Matheuristics, battery degradation

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