Optimal Charging Scheduling of Electric Vehicles based on Principal Component Analysis and Convex Optimization

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Abstract:
The widespread presence of plug-in Electric Vehicles (PEVs) in distribution power grids brings significant concerns regarding their energy demand and peak power requirements. In order to reduce the PEV load impact on power distribution networks, different strategies have been proposed based on the electricity price. This paper proposes a PEV charging approach that takes advantage of a disciplined convex optimization to reduce charging station costs. The proposed method can provide an optimal charging scheduling according to Time-of-Use (TOU) rates and maximum power penalty. Furthermore, Principal Component Analysis (PCA) is utilized to rank critical users in PEV charging stations based on their contribution to on-peak periods. Simulations are carried out for nine PEV during 24hour by using real-world data from a charging station, located on-campus. The results show the capabilities of the proposed approach to effectively reduce the electricity charging costs and identify the critical users.

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I. Introduction

Over the last decade, the global interest in overcoming transportation dependency on the