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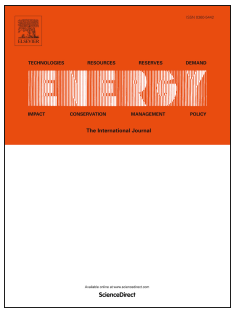

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A Novel Approach for Plug-in Electric Vehicle Planning and Electricity Load Management in Presence of a Clean Disruptive Technology

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Abstract

Plug-in electric vehicles within a decarbonized electricity sector offer a remedy for pollution mitigation in the transportation sector. In this paper, a decomposed planning model for optimal transition to electric vehicle in the deep decarbonization pathway project considering electricity grid constraints is developed. A bi-level charging/discharging control for plug-in electric vehicles is proposed to increase the penetration of electric vehicles in a planning horizon. Moreover, an integrated model of electricity and transportation sectors is developed to investigate the impact of autonomous electric vehicles as a clean disruptive technology for electric vehicles. The proposed planning model is able to determine whether the existing and future electricity grid infrastructure can meet the growing electrified transportation load in the near future or not. Hence, a Bayesian decision-based conjoint method for developing a heterogeneous transportation demand model is applied. The proposed planning model is carried out on Ontario's grid and a six-bus test system to corroborate the capability of the proposed planning model. According to the obtained results in Ontario's grid, penetration of plug-in electric vehicles is increased to 30% by 2025 while the total CO_2 emission is decreased by 28% compared to the case with no electric vehicle charging/discharging management and disruptive technology.

Keywords: Plug-in electric vehicles (PEVs), Autonomous electric vehicles

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