Impact of Evs Charging on Power System Voltage Stability by Transportation-Electricity Coupled Simulation

Hideaki Uchida*, Hideki Fujii and Shinobu Yoshimura

The University of Tokyo, 7-3-1 Hongo, Bunkyo, Tokyo 113-8656, Japan.
*Corresponding Author: Hideaki Uchida. Email: uchida@save.sys.t.u-tokyo.ac.jp.

Abstract: In recent years, EVs (Electric Vehicles) with high environmental performance has been popularized. To realize a low-carbon and sustainable society, EVs are expected to play major roles, and it is essential to use renewable energy for their charging effectively. Interactions between the transportation network and the electric power system have not been considered so far. However, the interactions are supposed to occur via EVs, which will popularize in the near future. Most of the previous studies about EVs' popularization focused on either the transportation or the electric power system, and no sufficient simulation model has been studied. In this research, we proposed a coupled simulation model that can represent interaction phenomenon. Since the charging event is coupled to the electric power system mechanism, the spread of EVs will affect not only the transportation network but also the electric power system. For simulating the electric power system mechanism, we implemented the power flow calculation method for low voltage distribution systems and it coupled to the microscopic traffic simulation. Numerical experiments are executed in a certain area in the real world in Japan. Assuming high-output charging by quick charger at a charging station during long-distance trip and low-output charging by normal charger at home or workplace, we evaluated the time series change of the load flow in the urban power system by the EVs' charging events. As a result of the simulation, it was implied that the concentration of low-output charge after returning home might cause a voltage drop in the distribution system.

DOI:10.32604/icces.2019.05902 www.techscience.com/icces