

## **The Utilization Possibility of Electric Vehicles for Regulation Resources and Impact on Power Flow of Distribution System**

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### **Abstract**

This report evaluates the utilization possibility of electric vehicle (EV) as regulation resources for demand response (DR). EV-OLIENTOR (EV-Optimizer for LaYout of Electric infrastructure Network by Traffic simulatOR) which have been developed by CRIEPI is applied to conduct traffic simulation of EV and calculate the charging pattern and state of charge (SOC) pattern of EV in Osaka prefecture. From the simulation results of EV-OLIENTOR, the possible amount of reduced charging power and available discharging power of EV for each time under the condition that all EVs will not experience shortage of electricity during their drive can be calculated. With the condition that the penetration rate of EV is 16% which is the governmental target in 2030 and the starting time of DR is 9:00~15:00 with the duration of 3 hours, simulation analysis shows that 500 MW can be produced from EV by reducing the charging power and discharging the power from EV (V2G) as possible regulation power which can be gained at residential house and work place respectively. The summation of possible amount of reduced charging power and available discharging power of EVs at residential house, where the starting time of DR is 18:00, is about 700MW which is the biggest potential of regulation power in all starting time of DR and charging point (home, work place, quick EV charger, and other). On the other side, the peak demand of charging power after finishing DR is increased to 700MW with the starting time of DR is 18:00 was found which exceeds peak charging demand of 300MW without DR. The new peak demand after finishing DR is created by the rapid increase of EVs' charging power after finishing DR operation, which can be regarded as the issues of transmission and distribution power systems causing frequency and voltage drop in the power grid.