Charging Infrastructure Requirements of Plug-in Electric Vehicles

OVERVIEW
Plug-in electric vehicles (PEVs), have the potential to improve the energy and environmental landscape of personal transportation, but face a hurdle of access to charging infrastructure. Additionally, the types, locations, and quantities of electric vehicle supply equipment (EVSE) that will be required are not well established. This study investigates the charging infrastructure requirements from the perspective of PEV operating cost and BEV feasibility.

GOALS
Evaluate the impact of realistic charging infrastructure options on real travel behavior in order to delineate PEV operating cost, BEV feasibility, and optimal charging strategy designed to identify the quantity and location of chargers and charger types in a given area.

RESULTS
All the PHEV scenarios show significant operating cost reductions compared to the baseline. The results can be divided into six clusters based on charging time options. Charging time strategies reduce operating cost more significantly than charging locations. A higher charging power capability, combined with an acceptable charging time strategy offer only slight benefits for PHEVs, but charging power is an important factor in increasing BEV functionality and decreasing public charging requirements. The approximation of the electric vehicle supply equipment (EVSE) needed at different types of locations (e.g., home, workplace, shopping) is proposed based on an optimal charging strategy.

RESULTS (continued)
For Level 1 charging, feasibility increases with vehicle range from 45 miles to 80 miles, but becomes saturated beyond 80 mile vehicle range. Level 2 charging exhibits continuously increasing feasibility with longer range BEVs. These results demonstrate the importance of higher power charging for BEVs, in particular for BEVs with longer range capability.

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