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Development of Electricity Supply Infrastructures for Large-Scale Adoption of Electric Vehicles—Challenges and Opportunities

A massive introduction of plug-in electric vehicles into the road transportation provides a promising approach to relieving oil dependence and diversifying energy supplies, reducing greenhouse gas emissions and improving the air quality, and ultimately enhancing the society's economic and environmental sustainability. One of the major barriers that hamper a large-scale adoption of electric vehicles is the lack of sufficient electricity-charging infrastructures. While it is a long-term investment-intensive and technology-uncertain course that involves various societal and economic challenges, developing supply infrastructures for electric vehicles also offers new opportunities to improve the operational performance of transportation networks and electricity grids. This talk focuses on discussing some challenges and opportunities arising from two emerging research problems: 1) How to locate electricity charging or swapping stations on a regional level to maximally eliminate range anxiety within intercity travelers and freight carriers, so as to stimulate the penetration and usage of electric vehicles? 2) How to design a smart garage-based, urban transportation-electricity megasystem and its pricing and trading mechanism to optimally adjust individual electricity-exchanging and vehicle-parking behaviors, so as to help reduce the traffic congestion and electricity waste?