Title: A COMPREHENSIVE ASSESSMENT OF VEHICLE-TO-GRID SYSTEMS AND THEIR IMPACT TO THE SUSTAINABILITY OF CURRENT ENERGY AND WATER NEXUS

This dissertation aims to explore the feasibility of incorporating electric vehicles into the electric power grid and develop a comprehensive assessment framework to predict and evaluate the life cycle environmental, economic and social impact of the integration of Vehicleâ€”toâ€”Grid systems and the transportationâ€”waterâ€”energy nexus. Based on the fact that electric vehicles of different classes have been widely adopted by both fleet operators and individual car owners, the following questions are investigated: 1. Will the life cycle environmental impacts due to vehicle operation be reduced? 2. Will the implementation of Vehicleâ€”toâ€”Grid systems bring environmental and economic benefits? 3. Will there be any form of air emission impact if large amounts of electric vehicles are adopted in a short time? 4. What is the role of the Vehicleâ€”toâ€”Grid system in the transportationâ€”waterâ€”energy nexus? To answer these questions: First, the life cycle environmental impacts of mediumâ€”duty trucks in commercial delivery fleets are analyzed. Second, the operation mechanism of Vehicleâ€”toâ€”Grid technologies in association with charging and discharging of electric vehicles is researched. Third, the feasible Vehicleâ€”toâ€”Grid system is further studied taking into consideration the spatial and temporal variance as well as other uncertainties within the system. Then, a comparison of greenhouse gas emission mitigation of the Vehicleâ€”toâ€”Grid system and the additional emissions caused by electric vehicle charging through marginal electricity is analyzed. Finally, the impact of the Vehicleâ€”toâ€”Grid system in the transportationâ€”waterâ€”energy nexus, and the underlying environmental, economic and social relationships are simulated through system dynamic modeling. The results provide holistic evaluations and spatial and temporal projections of electric vehicles, Vehicleâ€”toâ€”Grid systems, wind power integrations, and the transportationâ€”waterâ€”energy nexus.

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The public is welcome to attend.