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 Vehicle-to-Grid systems and the transportation-water-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 Vehicle-to-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 Vehicle-to-Grid system in the transportation-water-energy nexus? To answer these questions: First, the life cycle environmental impacts of medium-duty trucks in commercial delivery fleets are analyzed. Second, the operation mechanism of Vehicle-to-Grid technologies in association with charging and discharging of electric vehicles is researched. Third, the feasible Vehicle-to-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 Vehicle-to-Grid system and the additional emissions caused by electric vehicle charging through marginal electricity is analyzed. Finally, the impact of the Vehicle-to-Grid system in the transportation-water-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, Vehicle-to-Grid systems, wind power integrations, and the transportation-water-energy nexus.

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The public is welcome to attend.