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Campus solar roads: Optimization of solar panel and electric charging station location for university bus route

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We explore the prospect of replacing conventional university campus buses powered by fossil fuels with ones using solar energy. The proposed research investigates the emerging technology of solar powered road panels within a stochastic framework in order to optimally determine the corresponding infrastructure requirements for a university circulator line. More specifically, an optimization model is developed in order to determine the optimal locations for solar-powered roadway segments and electric charging stations for the existing university campus bus route. Since the availability of solar energy is linked to sunshine levels, we explore the possibility of using hybrid buses, powered by electricity and storing the energy to batteries in order to allow operation in days with no sunshine. As an alternative we study the use of solar buses equipped with panels on the rooftop. In order to account for the uncertainty associated with the system inputs, the transportation demand for the campus route and the availability of solar energy over the campus area are simulated using stochastic methods. The capital cost and energy consumption of the selected buses, charging stations and solar panels are also investigated in a case study for the NTUA campus.