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# Designing A Vehicle-To-Building (V2B)-Based Smart Energy Management System for Nearly Zero-Energy Buildings

K.-Y. Lo[1], I.-Y.L. Hsieh[2]
*Department of Civil Engineering, National Taiwan University*
*106319, Taiwan*
*r10521604@ntu.edu.tw, iyhsieh@ntu.edu.tw*

**Abstract**

A growing number of governments are supporting electric vehicle (EV) deployment in response to the global trend toward net-zero emissions. EVs are believed to play a crucial role in ensuring greater coupling between different energy sectors through Vehicle-to-Everything (V2X) technology, where X could be anything, including Building (V2B). With an aim to achieve nearly-zero energy buildings (NZEB) goal, this study designs a smart energy management system (SEMS) with a novel V2B strategy embedded for peak shaving and grid dependence reduction. The proposed SEMS successfully manages the overall energy demand from buildings as well as EV charging by integrating renewable energy resources and battery storage devices with optimal charging and discharging scheduling for EVs. The charging and discharging prioritization are determined every hour, based on arrival/departure time, current/required state of charge, EV battery capacity, charging/discharging rate, and efficiency. Considering energy load demand only from buildings and ignoring EV charging demand are found to cause considerable bias in evaluating the environmental benefits of V2B technology. The simulation results reveal that the proposed energy management scheme could realize potential savings in building loads and carbon emissions; however, there is a trade-off between investment costs and carbon footprint reduction.

**Keywords:** Vehicle-to-Building Strategy; Energy Dispatch; Electric Vehicles; Carbon Emissions; Economic Analysis

[1] Graduate Student
[2] Assistant Professor, Corresponding Author