Master's Dissertation 2016

Business Dynamics Evaluation of Battery Swapping in Electric Vehicle Systems

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SUMMARY OF MASTER'S DISSERTATION

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Title

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Abstract

Electric vehicles (EV) have been in the market for decades as agents of transition to sustainable transportation system. The commercialization of electric vehicle is slow due to its characteristics in terms of limited range, long charging time, and high initial cost compared to incumbent internal combustion engines vehicle but it has the advantages in operation cost, flexible energy sources, and grid integration. Based on the study of over 8 EV business models in Asia, US, and Europe, this paper identifies a system model and evaluates the dynamics of operational and financial interaction within electric vehicle systems using system dynamics methodology. Over time there is a need of battery swapping system to accommodate higher number of electric vehicles; and its business viability has to be evaluated to ensure its sustainability. This paper models the dynamics of passenger growth and business operation; then it simulates the financial performance of the business over the period of 100 business quarters in terms of cash flow, book value, and present value. The purpose of this research is to create a quantitative model to evaluate the viability of an EV business model with battery swapping system. A model is proposed for a battery swapping highway electric bus system in Malaysia. Battery stocks act as a buffer to accommodate the demand change to the system such as increase of vehicle stock and utilization rate. It reduces the need of charging infrastructure upgrade, as the batteries are pre-charged at a normal rate when the battery is in depot. The battery swapping system demonstrates the possible success scenario for EV business model by What-If analysis.

Key Words:

Business Dynamics Evaluation, Simulation Model, System Dynamics

Electric Vehicle, Battery Swap