

Master's Dissertation

2015

Portfolio Optimization for Clean Energy Vehicle in UK
considering Introduction of Renewable Energy Sources

Hiroshi Nakamura

(Student ID Number : 81433353)

Supervisor Prof. Masaru Nakano

March 2016

Graduate School of System Design and Management,
Keio University
Major in System Design and Management

SUMMARY OF MASTER'S DISSERTATION

Student Identification Number	81433353	Name	Hiroshi Nakamura
Title: Portfolio Optimization for Clean Energy Vehicle in UK Considering Introduction of Renewable Energy Sources			
Abstract <p>Greenhouse effect is a big concern worldwide and it is needed to reduce Greenhouse gases, CO₂. Transport sector counts for 25% and Electricity generation sector counts for 33% in UK. Focusing on transport sector a penetration of CEVs is required to promote a low carbonized society, however, there are barriers which prevent CEV diffusion such as lack of charging stations. Indicating specific number for each CEVs helps the UK government and industries to determine preparation for charging station. In addition it is necessary to consider Renewable Energy Source (RES) policy. There is no CO₂ emission with a Battery Electric Vehicle is run, however, there is a CO₂ pollution by generating electricity. We show scenarios in this study which is considered electric diversity policy included RES policy in UK and predict CO₂ amount in generating electricity. This research presents an optimum portfolio for CEVs in each scenarios considering LCCO₂ of electricity generation.</p> <p>By using Optimizing CEV portfolio model, we can obtain a portfolio of each type of vehicles. Before calculating optimized portfolio we need to decide an objective function and constraints. In this study an objective function is defined as system cost which includes a fuel cost, a vehicle purchase cost and a providing infrastructures cost. An infrastructure means electricity charging station for electric vehicles and hydrogen charging station for fuel cell electric vehicle. Constraints are determined as CO₂ reduction target and an introduction rate of renewable energy sources in electricity generation sector. This model calculate optimized portfolio with satisfying these conditions.</p> <p>From the obtained result we can imply following contents. By pushing to penetrate renewable energy sources, it contributes to reduce CO₂ emission when driving electric vehicles. That means we can achieve CO₂ target with less EV unit than without renewable energy. Moreover, we can expect no large difference of CEV portfolio and it implies that there is no strong effect by introducing renewable energy sources over particular level.</p> <p><i>Key Words</i> : Clean Energy Vehicle, Renewable Energy Sources, Optimization</p>			