

Chapter 12

Improving Renewable Energy Source in Automotive Applications: Evaluation, Analysis, and Design

Wei Liu

University of Sydney, Australia

Hongbo Shi

Harbin Institute of Technology, China

Hailing Ma

Jinggangshan University, China

Sang-Bing Tsai

*University of Electronic Science and Technology of China (Zhongshan Institute), China & Civil
Aviation University of China, China*

ABSTRACT

With the rapid development of automobile industry, people have become more and more aware of the shortage of the traditional automobile energy and the irreversible pollution to the environment. Sustainable development will be the first place in the automobile industry, but there is no clear evidence to identify the most effective specific solution. This chapter is divided into two parts, the first part aims to analyze the evaluation of automotive sustainable development by synthesis. A new hybrid multiple criteria decision making (MCDM) model that combines DEMATEL technique and DANP method is proposed. By analysis and comparison, the result shows that renewable energy source is the main influencing criteria that affects the automobile sustainable development. Based on this, the second part of this chapter provides an effective solution. An advanced energy storage based on the super capacitor of self-generating wireless charging is designed to be used in automotive applications. It has advantages of short charging time, high power conversion efficiency and low power consumption.

DOI: 10.4018/978-1-5225-3537-9.ch012

INTRODUCTION

The automobile is one of the most important vehicles in the world, and its invention has greatly affected people's lives. Growing demand for automobiles has resulted in a large vehicle population. As of 2015, the total number of vehicles in use worldwide, including cars, trucks and buses, exceeded 1 billion. The number is expected to exceed 2 billion by 2030 (Gao, Hensley and Zielke 2014). The vigorous development of the automobile is providing an ever more convenient mode of transport that saves time, money and improves efficiency.

The automobile industry has become one of the pillar industries of the national economy, and accounts for a large proportion of the output value and sales revenue. As a comprehensive assembly industry, it produces in large quantities. In this way, huge numbers of jobs can be provided in order to help the government solve employment issues. Meanwhile, the technological development of the automotive industry has also been promoting the progress of human science and technology. For example, high-end technology developed for winning the Formula One competition has been successfully transferred to other modes of transportation such as passenger cars and high-speed railway. In addition, the development of the automotive industry has greatly improved the efficiency of human work by saving time. Therefore, the automobile industry provides the benefits from different perspectives and social and technological development is inseparable from the automotive industry.

However, the accelerated development of the global automotive industry has led to a significant increase in greenhouse gas emissions. Environmental pollution is increasing, accompanied by calls for more environmental protection. At the same time, the shortage of international energy supplies has led to the continuing rise of international crude oil prices. Energy saving and environmental protection are the pressing issues dominating the automobile industry around the world. Different countries have gradually paid attention to the field of new energy vehicles in their R & D and industrialization. As the world's largest developing country and also one of the most important countries regarding energy production and consumption, China's rapid economic development has led to increasing demand for energy and dependence on oil imports. Transportation energy consumption is gradually increasing. With the rapid growth of car ownership, this proportion will continue to rise. So in the long run, national energy security issues will be more serious. Energy consumption has brought serious environmental problems. In recent years, air pollution has become a serious problem. An increasing number of people are beginning to realize the impacts of air pollution and the automobile as the primary cause of air pollution in large cities. Therefore, energy security and environmental pollution have become the bottleneck restricting the sustainable development of one country's economy. Under such pressure, the government attaches great importance to renewable energy in the automotive industry and gradually introduced a variety of programs and policies to encourage and promote the development of a new energy automotive industry, and its market penetration.

The promotion of renewable energy vehicles is designed to reduce environmental pollution and energy shortages. Investment in renewable energy sources in automotive applications can avoid damage to the environment due to the use of renewable energy as a driving force to reduce pollutant emissions. However, a large external cost exists in investing in renewable energy. As for automobile manufacturers, the development of renewable energy technologies not only has technical risk and requires large-scale business restructuring, but also needs enormous investment. That is to say, the producers bear a greater cost, but the benefits (environmental protection and energy conservation) can be shared by the whole of society. So this system imbalance means that manufacturers will not take the initiative to invest. In the

26 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage:

www.igi-global.com/chapter/improving-renewable-energy-source-in-automotive-applications/192838

Related Content

Bounded Primal Simplex Algorithm for Bounded Linear Programming with Fuzzy Cost Coefficients

Ali Ebrahimnejad, Seyed Hadi Nasserian and Sayyed Mehdi Mansourzadeh (2011). *International Journal of Operations Research and Information Systems* (pp. 96-120).

www.irma-international.org/article/bounded-primal-simplex-algorithm-bounded/50563

A Hybrid Approach Based on LP Metric Method and Genetic Algorithm for the Vehicle-Routing Problem with Time Windows, Driver-Specific Times, and Vehicles-Specific Capacities

Ebrahim Asadi-Gangraj and Sina Nayeri (2018). *International Journal of Operations Research and Information Systems* (pp. 51-67).

www.irma-international.org/article/a-hybrid-approach-based-on-lp-metric-method-and-genetic-algorithm-for-the-vehicle-routing-problem-with-time-windows-driver-specific-times-and-vehicles-specific-capacities/212676

Perspectives on Sustainability

(2017). *Managerial Strategies and Green Solutions for Project Sustainability* (pp. 53-76).

www.irma-international.org/chapter/perspectives-on-sustainability/178346

Opportunities and Challenges for Sustainable Business Strategic Planning in Small and Medium Enterprises (SMEs)

Mauricio Quintero-Angel, Claudia C. Peña-Montoya, Carlos Hernán Fajardo-Toro and Andres Aguilera-Castillo (2018). *Green Production Strategies for Sustainability* (pp. 153-167).

www.irma-international.org/chapter/opportunities-and-challenges-for-sustainable-business-strategic-planning-in-small-and-medium-enterprises-smes/192834

Using a Knowledge-Based Approach to Foster the Use of Risk Management in Construction

Alfredo Federico Serpell, Ximena Ferrada and Larissa Rubio (2018). *Global Business Expansion: Concepts, Methodologies, Tools, and Applications* (pp. 308-329).

www.irma-international.org/chapter/using-a-knowledge-based-approach-to-foster-the-use-of-risk-management-in-construction/202225