

The Importance of New Technologies in Sustainable Public Transport: A Review of Cost-Benefit Analysis in Hybrid Electric Vehicle Use and Evaluation of Application Potential for Turkey

S. Erbas¹, H. Handan Demir², P. Atilla³, G. Demir²

¹ Istanbul metropolitan Municipality, Department of Rail System

² Bahcesehir University, Environmental Engineering Department, Çırağan Cd. Osmanpaşa Mektebi Sk. Beşiktaş 34353 İstanbul-Turkey

³ Istanbul Technical University, Institute of Energy, Ayazağa Kampüsü, Maslak 34469 İstanbul-Turkey
Presenting author e-mail: goksel.demir@bahcesehir.edu.tr

Abstract

International studies for effects of climate change recommend concrete limits to reduce greenhouse gas emission. Significant fuel consumption and air emissions are common in cities, which have heavy traffic because of starting and stopping in traffic jams. According to National Emission Inventory Report of Turkey road transportation contributed nearly 10% of CO₂ equivalent emissions. The purpose of this study is examining existing systems and to compare operating and capital costs of these systems with hybrid systems by making a cost-benefit analysis especially for the buses of urban public transportation. Diesel hybrid, diesel and CNG vehicles were compared in terms of life-cycle costs.

Buses as means of public transportation could considerably reduce the problems caused by traffic in the urban areas through the usage of innovative techniques and technologies of vehicle propulsion systems, among other things. Fuel costs comprise significant portion of transit budgets. Hybrid buses offer an attractive option and have the potential to reduce operating costs for agencies significantly. The hybrid technology that combines electrical and mechanical propulsion offers, which are environmentally efficient, has moved the technologies from demonstration stage to implementation stage. This paper reviews the advantages and disadvantages of hybrid bus operation for Turkey based on currently available best information. It reviews worldwide practices for types of hybrids, their performance, and cost of operation, and the situations if those vehicles are adapted to Turkey.

Diesel vehicles have slightly higher life-cycle cost in comparison with diesel hybrid vehicles. Also diesel hybrid vehicles have 30% better fuel economy than diesel vehicles. CNG vehicles have the lowest life-cycle cost because fuel cost in the CNG vehicles is less than almost half of the diesel fuel cost. Initial purchase cost of vehicles is expensive and there is almost no significant difference between CNG vehicles and diesel vehicles. Overall, diesel hybrid vehicles are compared with diesel and CNG vehicles in terms of life-cycle cost. This research showed that CNG vehicles are more economical than diesel and diesel hybrid vehicles in terms of life cycle cost and technology but they dependent on outside and diminishing fuel sources. Moreover, hybrid vehicles are gaining importance and their number is increasing because of their positive effect on fuel economy, air emissions and reducing our dependence on petroleum. These properties make hybrid vehicles better than conventional ones.

In addition, better fuel economy and less usage of fuels bring more economical solution (lower cost) for transportation industry. The optimization of hybrid vehicles based on the vehicles road, the knowledge of the average of speed, places and stop sequence on the road should be taken into consideration to maximize yield of hybrid cars.