A Review on Fleet Fuel Conservation

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ABSTRACT

In Day-to-day transportation, people are depending on the public transport vehicles. Physical performance is an important indicator of road transport industry. It affected financial performance. Current system suffers from a Low kilometer per ten liters (KPTL). The researchers improved the maximum efficiency with the help of different Fuel Conservation mechanism. Also, the Fuel Conservation will help to improve the vehicle efficiency, fuel economy, and the depot comfort. In this paper, an attempt has been made to study and review of various methods used for Fuel Conservation and fault detection for vehicle efficiency Also at different city's performance analysis of bus transit systems are reviewed and discussed and to find best suitable method.

Key Words: fuel economy, vehicle efficiency, KPTL.

1. INTRODUCTION

The transport sector plays an increasingly significant role in global energy requirements, accounting for 23 percent of all world energy consumption. A single energy source, petroleum, still accounts for the vast majority 95 percent of the energy used by the sector. As a result, the oil price volatility of recent years has created considerable pressures on transport systems, particularly in the developing world [1].Pressure, plus the explosion of urbanization and private vehicle ownership, has created strong incentives for city officials in developing countries to improve the efficiency and enhance the attractiveness of public transportation. Energy consumption for transport per individual is four times higher in cities such as Houston or Chicago, where the majority of trips are made by private car, compared to cities such as Warsaw or Hong Kong, where public transport, walking, and cycling is predominant. In most large cities in developing countries, buses continue to be the public transport option of choice, carrying a large share of urban travelers, often at the relatively low cost [2]. Nowadays, the increasing energy demand and the limited reserves of the conventional sources have raised the concerns of the researchers all around the globe to look for fuel conservation as well as alternative resources. The realization that fossil fuel resources required for the generation of energy are becoming scarce and that climate change is related to carbon emissions to the atmosphere has increased interest in energy saving and environmental protection. The strategy to reduce dependence on fossil resources is based on reducing energy consumption by applying energy savings programs focused on energy demand reduction and energy efficiency [3].

At the same time, many bus transit systems are plagued by inefficiency, overcrowded and undependable service, congested roadways that slow down buses, and chaotic operating environments. As a result, the share of travel represented by bus transit has declined [4]. In many cities, the operating cost per bus kilo-meter exceeds revenues, and bus fares are often kept low irrespective of the cost of providing service. For example, in India, most publicly owned bus systems in large cities generally cover about 70 to 90% of operating costs. In Jakarta, Indonesia, the provincial government has regulated public transportation fares, keeping them just high enough to prevent bus companies from operating at a loss [5].

Fuel makes up a relatively large fraction of total bus operating costs, especially when labor costs are low, as in many developing countries. Fuel costs can be reduced by improving the driving style of bus drivers, and through sound maintenance practices. A safe and economical driving style can reduce variable costs (fuels, repairs, maintenance, tires), decrease downtime due to repair work and maintenance, mitigate negative environmental impacts, and improve road safety. Similarly, well-maintained buses that are properly tuned and adjusted tend to be cleaner, safer and consume less fuel than poorly maintained vehicles [6].Guidance note provides detailed and practical recommendations on how city bus operations managers and their technical staff can plan and implement such enhancements to their fleets through O&M practices without significant capital investments. By implementing such

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recommendations, municipal officials and bus operators can increase the efficiency and fuel economy of their bus systems and reduce their cities' energy consumption, congestion and pollution. Work on this Guidance Note starts with a glob to assess state-of-the-art bus O&M practices in a number of countries, with a focus on enhancing fuel economy [2]

A lot of good research work is done and going on throughout the world in this area. Researchers have worked individually on the different type of transport sectors conservation technologies. An attempt has been made in this paper, to review the review of the various type of conservation technologies, the review of the paper is categorized the transport sectors technologies in the overall world. The paper seeks to identify factors which can be developed to influence conservation.

2. LITERATURE REVIEW

B.S. Raje (2016) studied fuel saving is a global responsibility and hence 'It is Call to All'. If consumption cannot be controlled, the 'Global Warming' will make the climate change adverse and rebound on humanity anytime. Fuel being energy can neither be created nor can it be destroyed. Hence, let us prolong the available resources to maximum extent at least by avoiding wastage. [7] Yanzhi Ann Xu et al. (2016) evaluated potential fuel and emissions savings from the implementation of eco-driving of local transit and GRTA (Georgia Regional Transportation Authority) express bus fleets. Eco-driving duty cycles developed through a speed and acceleration modification algorithm. The eco-driving algorithms reduce fuel consumption and emissions by limiting engine load, as indicated by STP (scaled tractive power) in the moves modeling scheme, while still conserving total distance and average speed. [8] Shakti sustainable energy foundation (2016) this report reflects the importance of preventive maintenance practices in improving fuel efficiency. A large contribution can be made to fuel efficiency performance through proper preventive maintenance practices. [9] Lu Li et al. (2016) have done the study of bus routing in the problem that also allows for multi-lines travel or interlining for each bus. Two routing methods were developed to solve the recharging problem. Mixed bus fleet management scheme is substantially more cost-efficient than the single bus type fleet management scheme. [10] Atiyeh, Andry and Narelle (2015) reviewed that fuel efficiency can be achieved as a result of positive interactions between in-vehicle systems and drivers. The first step in an on-going program of research to develop and design an innovative eco-safe in-vehicle feedback system to improve fuel efficiency and safety which can maximize driver acceptance and reduce driver distraction. Ensuring appropriate systems can enhance the potential of using these technologies to promote environmentally friendly driving, reducing emissions and save human life. [11] P.Immonen et al. (2014) studied about hybrid systems and show that when driving at steady speeds below 53 km/h, the series hybrid mode has the lowest fuel consumption and is thus the best choice. However, when driving at speeds above 53 km/h, the diesel mode provides the lowest fuel consumption, although the difference is not significant. The calculations on fuel consumption indicate that this hybrid bus should not be driven as a parallel hybrid at all unless the high power for acceleration is temporarily needed. [12] Laughlin and Burnham (2014) evaluated overall fuel economy for the propane vehicles is close to that of comparable diesel vehicles, on an energy-equivalent basis. In total, these fleet vehicles are annually displacing around 212,000 DGE (diesel gallon equivalent) of petroleum and around 770 tons of GHG emissions. In the case study, it was shown that propane school buses exhibited a smaller fuel efficiency penalty relative to diesel buses than typically expected. [13] Shauna L. Hallmark et al. (2013) analysed and developed a new solution methodology of hybrid buses and they had the highest fuel economy for all time periods combined. Hybrid buses had a fuel economy that was 11.8% higher than control bus overall and was 12.2% higher than buses with model years 2007and higher, 23.4% higher than model years 2004 to 2006. Fuel economy for the hybrid buses was highest in the spring at 2.04km/l and lowest in the summer at 1.9km/l (14.4% higher). [14] The "Driving Efficiency Module", which is used in the expert system that has also been briefly introduced. One of the main goals of an expert is to provide the driver with an online assistance system through the "Driving Efficiency Module", which generates fuel efficiency guidelines to improve fuel economy driving presented by Tianyi and Christian. (2012) [15] Bhandarkar (2011) developed a new solution methodology of the use of CNG in place of diesel fuel in KSRTC buses which reduced CO from 5978.4 kg/day to 996.4 kg/day, NOx can be reduced from 52311kg/day to 22169.9 kg/day and particulate matter can be reduced from 946.58kg/day to as minimum as 29.89 kg/day. The significant number of old vehicles of Pre-Emission era is still on road, they are polluting more due to poor and improper maintenance. They should be replaced. [16] ESMAP (Energy Sector Management Assistance Program) report (2011) recognized and developed minor malfunction in the air/fuel or spark management systems can increase fuel consumption and emissions significantly. A study conducted in Bangkok shows, with over 90% of all public transport handled by buses, that a periodic maintenance program for aging bus fleet resulted in a fuel

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economy gain of percent and a significant drop in exhaust emissions by at least 40% carbon monoxide,20% hydrocarbons, 55% particulate matter, 15 % black smoke, and 27% capacity. [2]

Sudhakararao, U.(2010) had studied Andhra Pradesh State Road Transport Corporation (APSRTC) in India reported fuel economy for identical bus types in Hyderabad to be 10 to 12% higher than the values reported by Mumbai and Delhi. Much of the fuel economy benefits are attribute-able to bus O&M practices in this place. Data over 29 years (1980-2009) shows that fuel economy has improved from 4.1 km per liter (km/L) in 1981 to 5.2 km/L in 2010-11. [17] Comparable buses in Delhi Transport Corporation (DTC) and Brihan Mumbai Electric Supply and Transport (BEST) report fuel efficiencies in the 4.2 to 4.5 km/L range. [18] UNEP (United Nations Energy Programme) report (2009) studied nine bus companies in Jakarta participated in a comprehensive bus inspection/maintenance (I/M) and driver training program. While a 5% decrease in fuel consumption was achieved through maintenance practices, improved driving methods resulted in another 10 percent decrease in fuel consumption. [6] Suzana Kahn Ribeiro et al. (2007) forecasted that the GHG emissions can be reduced by, reducing the loads (weight, rolling and air resistance and accessory loads) on the vehicle, thus reducing the work needed to operate it, increasing the efficiency of converting the fuel energy to work, by improving drivetrain efficiency and recapturing energy losses, changing to a less carbon-intensive fuel, and reducing emissions of non-CO2 GHG's from vehicle exhaust and climate controls. [1] Schiavone, J. (2005) developed a multi-objective optimization using the key elements of a well-developed maintenance plan includes the following steps: written maintenance plan that is updated regularly for all vehicles in the fleet. Preventive maintenance checklists that are, at the minimum, consistent with manufacturer requirements for buses under warranty. QA/QC checks on repairs conducted regularly by an internal team and periodically by an external team. Detailed and permanent record keeping system that can track the maintenance history of each bus. [19]

3. DISCUSSION

This study critically examines existing in-vehicle systems and their potential to improve fuel efficiency. The average kilometer's performed per liter of fuel is called fuel efficiency. In India the highest fuel efficiency of (State Transport Undertakings) STU is 5.63 Km/l liter it is observed from the study that fleet fuel economy a call to all. The fuel conservation techniques have different performance. These technologies used for different fleets, brought variation in their performance as observed. Performance of fleets mostly depends on the maintenance techniques and diver performance of fleet. If one of the parameters goes wrong then it will make a huge impact on the performance of the system.

Today different types of conservation technologies are available. Different types of technologies have different fuel conservation. To reducing energy consumption many countries have adopted eco-driving policies within the transport sector. Good driving skill may play an important role in reducing fuel consumption as compared to vehicle maintenance.

Positive effects on fuel consumption using eco-driving in-vehicle systems can improve fuel efficiency but proper eco-driving training is also an important factor in fuel conservation. Sometimes drivers do not support eco-driving is observed. We argued that there is the number of driving behavior parameters such as speed choice, deceleration, acceleration, idling, headway and lane deviation which all contribute to eco-driving. These parameters that influence fuel consumption as shown in table-1.

Table I. Driving Parameters

Driving Parameters	Fuel consumption
Cruising speed	Decrease fuel consumption
Highest gear possible	Decrease fuel consumption
Follow speed limit	May increase fuel consumption at low speeds
Speed~ 60-80 km/h	Decrease fuel consumption
Smooth deceleration	Decrease fuel consumption

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Driving Parameters	Fuel consumption
Smooth Acceleration	Decrease fuel consumption
Aggressive driving	Increase fuel consumption due to hard acceleration/deceleration

Eco-driving shows lesser performance at the different condition when compared to other conservation technologies. It is observed from the study that maintenance technique shows better performance the ideal condition.

The Indian government believes in effective improving employee motivation program, as result, Andhra Pradesh State Transport Corporation (APSTC) is on the 1st rank in bus fuel efficiency. APSRTC uses modern and updated technologies to provide cleaning in minimum possible time with the help of automatic washing units installed at major bus stations. Also, regular checks are carried out to maintain buses, to achieve zero breakdowns, minimizing costs, ensure low emission and fuel efficiency.

To increase the quality of maintenance activities should be assigned to different sets of technicians. Quality control measure should also be incorporated. Customized maintenance practice should be developed specifically and management and labor both should involve completing the process. For increasing efficiency involved in maintenance activities should be provided one specific maintenance schedule, pass/fail criteria and step by step suggestion developed specifically for each bus. Bus depot management uses old manual calculation method for keeping maintenance the record of buses.it takes a long time to keep the record of all the buses hence it in need of computer-based software to maintain record of buses. Defect classification system should also be employed to priorities repairs, and it should be ensured that defects identified ae fixed before the vehicle service. The better performing drives should be appropriately rewarded. Recent technology like vehicle health monitoring system is an effective the solution to check the current status of a vehicle so it can be useful solution for improving buses performance.

Many researchers have been said and done in improving the driver's contributions to fuel efficiency. But a large contribution can also be made to fuel efficiency performance through proper corrective maintenance practices. The main part in conservation techniques carried out is daily maintenance, decadal maintenance, engine oil change, by-monthly docking and running repairs. Also regular checking and replacements.

4. CONCLUSION

This paper shows a review of a current condition of the published literature on fuel conservation and potential of fuel conservation. In recent year's eco-driving, maintenance practice has been studied by researchers. It is concluded from the review that positive interactions between in-vehicle systems and drivers fuel efficiency are achieved. Sometimes bus drivers unable to support eco-driving due to environmental conditions such as hilly regions, Ghats, river banks. So a huge contribution of proper preventive maintenance practices can achieve fuel efficiency in any condition. Maintenance practice provides an impressive solution to all energy problems such as increasing fuel consumption, higher fuel costs, fuel supply and environmental concerns and among all the fuel conservation techniques. This review supports the concept of using maintenance to influence on fuel efficiency. Fleet Fuel Conservation is a long-standing program. Further there is a lot that the government can do at this juncture to popularize modelling approaches in an attempt to improve fuel efficiency.

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