Tco of hybrid vehicle designs essay sample

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The term hybrid electric vehicle is referred for vehicles that utilize energy from different resources including electric grid and having functionality to replace petroleum as a source of energy. PHEVs are also one of these hybrid vehicles having reduced energy consumption and emissions including carbon dioxide comparative to conventional vehicles. Battery size, weight, cost and its life cycle are important concerns in TCO. Payback period is also significant while making calculations for purchasing cost of hybrid vehicles. This is undeniable fact that hybrid vehicles have a higher manufacturing cost in comparison with conventional vehicles.

According to Al-Alawi & Bradley (2013), the different parameters and assumption were not implemented properly while evaluating the total cost of ownership (TCO) for PHEVs in past. They pointed out that numerous studies have investigated to evaluate PHEVs based on the fuel economy and initial costs of PHEVs in 2010 including Fisker Karma and Toyota Prius in 2011 and 2012 respectively. The results have inconsistency in the context of model and assumptions associated with benefits and cost calculation. The initial cost varies for PHEV between USD4600 and USD 9100. Moreover, maintenance and salvage value were not incorporated as a component of TCO (Al-Alawi & Bradley, 2013).

Figure 1 Flow chart for ideal TCO

Redelbach et al. (2014) formulated different models to calculate TCO by taking into account average electricity consumption and fuel for different driving distances. The discovered average power usage of about 15 kWh/100 km for the CD-mode and traction electricity was offered mostly by an ICE in CS-mode, so the typical power usage over the entire driving range reduced,

where the average energy intake was improving. The resulting energy usage of the EREV was taken as a function of electric battery size for a customer with a yearly travel of 15, 000 km. They anticipated the typical final electricity usage in MJ/100 km minimizes as the battery's driving array boosts because of the electric motor has a higher performance than the ICE. The raised battery weight for long driving that requires higher footing power has been taken into consideration in this analysis. The computed electricity intake was found 90 MJ/100 km for an electric battery driving array of 61 km, which represented the variety of Chevrolet Volt-EREV. For this situation, the share of intake for the power from grid and fuel were computed as 45 % and 55 % respectively. The outcomes for energy intake of the PHEV were dramatically higher compared with the EREV especially for greater electric battery sizes. The calculated energy intake was 135 MJ/100 km for a battery size of 5 kWh, which represented the configuration of Toyota Prius-PHEV. For this instance, the share of usage for electrical power from grid and fuel were determined as 15 % and 85 %, respectively. The incorporated electricity expense for electrical energy and fuel were computed based on the electricity intake and the assumed costs of the power service providers. The resulting prices from the TCO model were presented in Figure 2 as a feature of battery capacity. In addition, the analysis showed that the energy cost decrease with growing battery size due to the higher share of electric driving (Redelbach, Özdemirn & Friedrich, 2014).

Figure 2 Relation between battery size and energy consumption

Figure 3: Fuel economy of different Hybrid electric vehicles

Source adopted: Alexander, & Davis, 2013

Based on model developed by Al-Alawi & Bradley (2013), energy cost for hybrid car is 0. 68/Km

So, TCO based on fuel consumption for 100000 Km = $6826

Gasoline consumption of Toyota Corolla having same features = 10000liter (“ Gasoline and diesel fuel update”)

Gasoline price on the 30th June 2014= $1. 279/liter

Hence, total fuel cost for conventional vehicle for travel distance of 100000 Km = USD12790

Conclusively, it is evident from the above TCO calculations that the hybrid vehicles are more economical with half operating cost apart from environmental friendly (Vlieta et al. 2011). The user may be benefited by exemption of the carbon tax as well as avoid them from fluctuating fuel prices.

Reference

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