Analyzing the Performance of Hybrid Electric Vehicles in Relation to Computer Network Implementation

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***Abstract*---** Concerns regarding environmental and economic sustainability have led to technological inventions and innovations. One of the areas that have received attention is the transport sector. Specifically, hybrid electric vehicles (HEVs) have been developed in a quest to reduce air pollution while saving natural resources. With HEVs documented to house dual powered engine systems, a reduced dependence on fossil fuels has been reported due to the compensation resulting from electric propulsion systems. Specific benefits accruing from the use of HEVs include environmental friendliness, financial benefits due to tax exemption and lower running costs, and the presence of regenerative braking systems that recharge batteries for use in later times. However, demerits include high purchasing costs, less power, and the need for expertise during repair as technological advancement remains inevitable. Therefore, the decision on whether to purchase HEVs or not should be determined by the intended purpose of an organization or an individual. In situations requiring emergency response or transportation of heavy loads by trucks, HEVs are unlikely to gain application. However, situations where city driving is preferred might witness HEVs gain significant application. Imperative to note is that the initial costs of purchasing and maintaining HEVs are offset by tax exemption and lower running costs, and that their adoption could pose a long-term benefit of fostering economic and environmental sustainability.

***Keywords*---** Network Implementation, Hybrid Electric Vehicles, Global Market Share, HEVs.

I. BACKGROUND

IN the current world, the necessity of striving towards the adoption of sustainable technology is seen as a response to environmental concerns, as well as economic demands that attract efforts towards cost-effectiveness. According to Clarke and Makram (2015), hybrid electric vehicles have been widely proposed as sustainable technologies that promise to replace cars that continue to rely on fossil fuel. As documented by German (2015), hybrid electric vehicles combine electric propulsion systems with those of the conventional internal combustion engine (ICE). Thus, these vehicles can be fueled like normal cars because they use internal combustion engines but have electric batteries or motors and can be wholly or partially powered by electricity. On the one hand, an efficient and well functioning transport sector is a requirement for social and economic development in which people are brought together to enable the exchange of ideas, goods, and other trade activities be achieved. On the other hand, the transport sector has been cited as being responsible for various negative environmental and social effects. For example, the sector has been attributable for significant contributions to air pollution and global greenhouse gas emissions (Hu, Moura, Murgovski, Egardt & Cao, 2016). As such, a global shift to a low-carbon and greener economy will necessitate significant improvements in the manner in which energy is used and produced. According to Jain and Tiwari (2015), the transport sector accounts for the use of over a quarter of the global energy and remains responsible for comparable shares of global carbon dioxide emission resulting from combustions of fossil fuel. As such, the trend prompts more specific and systematic technological solutions (Rodríguez & Paredes, 2015). Some of these solutions include the use of the best available energy and fuel efficient technologies, shifting incentives to less polluting and more efficient technologies and modes, and smart growth urban planning.

II. METHODOLOGY

Secondary sources will be utilized, with a content analysis technique aiding in discerning potential advantages and disadvantages that arise from the use of hybrid electric vehicles. Specifically, the paper will focus on journals that have been produced in recent scholarly contributions about the subject, as well as other peer reviewed sources whose outcomes are insightful.

III. LIMITATIONS

Exclusively, this paper analyzes trends in the emergence of hybrid electric vehicles, advantages of these vehicles, and some of the demerits that have been reported in recent scholarly contributions. As such, the paper excludes discussions about other vehicles with which the selected type shares basic technologies. These vehicles that are excluded include fuel cell vehicles, full electric vehicles, and plug-in hybrids. Overall, the paper focuses on the theme of environmental sustainability from the perspective of the evolution and use of hybrid electric vehicles.

IV. SCOPE

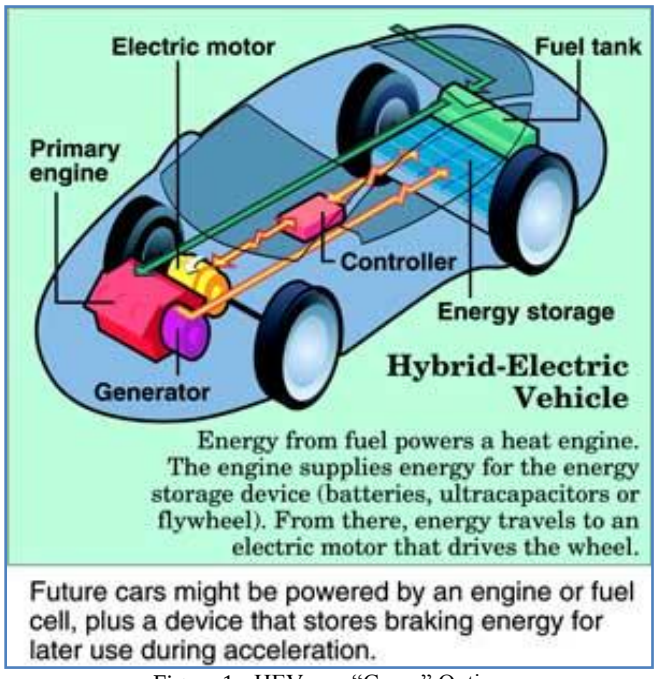

Figure 1 - HEV as a "Green" Option

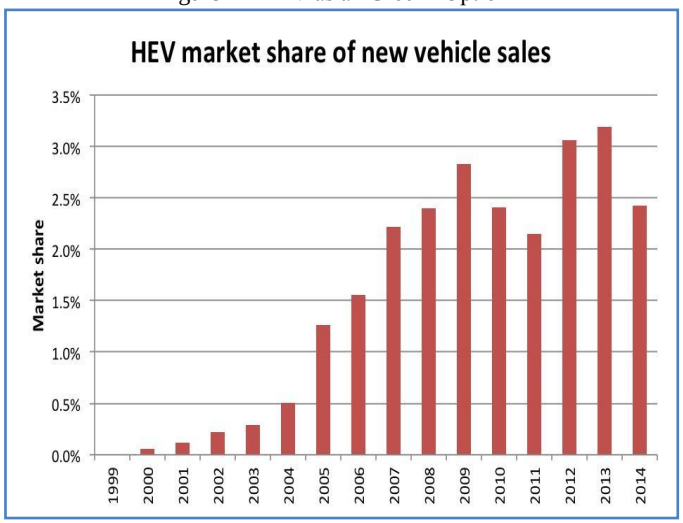

Figure 2 - HEVs' Global Market Share

The paper begins by providing a discussion of the current state of global energy use and pollution-related concerns while spearheading sustainability. Upon this discussion, the paper proceeds to describe the existing knowledge and goals of environmental sustainability while seeking to understand some of the solutions that hybrid electric vehicles have introduced in the energy, transportation, and environmental sectors. The paper culminates into an examination of the viability of the use of hybrid electric vehicles, a critical analysis that informs recommendations on whether these vehicles should be manufactured further an d be allowed to dominate the future of the transportation sector or not.

V. SECONDARY DATA OUTCOMES

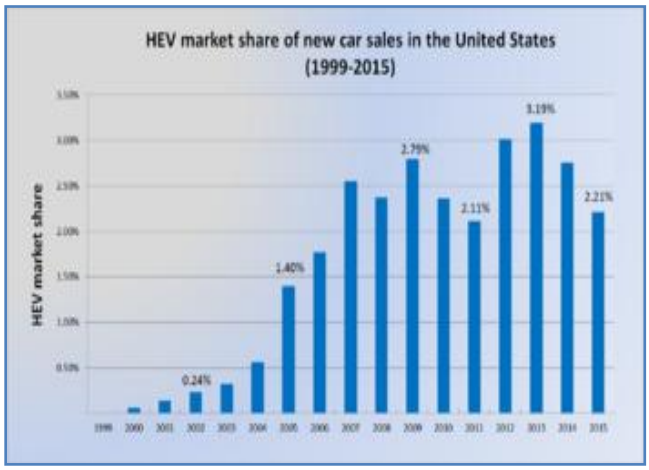

Figure 3 - Trends in HEVs' Market Share in the U.S

Powered with combinations of electric motors and combustion engines, HEVs are affirmed to be more energy efficient and potentially achieve about double the fuel-mileage reported when conventional vehicles are used. In addition, HEVs have been documented to yield substantial reductions in tailpipe emissions (Krupa, Rizzo and Eppstein et al., 2014). In relation to global production, the rate at which HEVS' numbers emerge has been relatively small. For example, the year 2007 witnessed the production of 541,000 HEVs. This number account for only 0.8 percent of vehicle assembly in the global light (Ilieva and Iliev, 2016). However, this number depicted a significant increase from the number produced in 2004, which accounted for only 0.25 percent (150,000 HEVs). By 2014, it was projected that the number of global HEVs would be as high as 1.7 million (Clarke and Makram, 2015). This projection indicates that interest in the use of HEVs is increasing dramatically and attracts an analysis of the benefits and disadvantageous that HEVs pose. Some of the brands belonging to the category of HEVs include Toyota Prius, Toyota Camry Hybrid, Honda Civic Hybrid, Toyota Highlander Hybrid, Lexus 400h, Nissan Altima Hybrid, and Saturn Vue Hybrid. Others include Honda Accord Hybrid, Saturn Aura Hybrid, Lexus 600h, and Chevy Malibu Hybrid (German, 2015). Appendix B and C illustrate summaries of the demand for HEVs in the U.S. and global contexts.

One of the benefits accruing from the use of HEVs lies in the attribute of environmental friendliness. Given that these vehicles run cleaner and have better gas mileages, environmental friendliness is evident. In addition, HEVs utilize twin powered engines that involve electric motors and gasoline engine, implying that fuel consumption is cut accordingly and while translating into energy conservation (Hu, Moura, Murgovski, Egardt & Cao, 2016). Another advantage lies in financial benefits. According to Jain and Tiwari (2015), many incentives and credits support HEVs and help to make the latter affordable. With exemption from congestion charges and lower annual tax bills arising from little or reduced expenditure on fuel, HEVs pose significant financial benefits to the users. It is also worth noting that HEVs exhibit a less dependence on fossil fuel. As asserted by Rodríguez and Paredes (2015), HEVs require less fuel to run and are much cleaner due to reduced emissions that result from lower amounts of fossil fuel used. The tertiary effect of this reduced dependence on fossil fuels is that HEVs lead to the conservation of natural resources, rather than deplete them through over-reliance on fossil fuels.

The presence of regenerative braking systems in HEVs adds to the merits of these vehicles. While driving, each type brakes are applied enables the vehicle to help the owner recharge the battery (Yanan, 2016). In turn, internal system kicks capture the energy released and utilize it for charging batteries that end up eliminating amounts of time required to stop and recharge periodically. HEVs are also advantageous in such a way that they are built from light materials. Due to this outcome, less energy is required while running the vehicles. Similarly, the engine of hybrid electric vehicles is lighter and smaller, implying that much or additional energy is saved (Wang, Sun, Zhou & Fan, 2015).). Another notable benefit associated with HEVs is that they pose higher resale values. Given that the price of gasoline continues to increase, a higher preference for hybrid electric vehicles is evident (as shown in Appendix B and C). The eventuality is that the "green" vehicles have begun to command a resale value that exceeds the average. Thus, an individual or organization that might express dissatisfaction with a given HEV could sell it at a premium price to potential buyers. With promises of reducing carbon imprint on the environment, these advantages place HEVs in better positions and project a future definition of the transport sector.

Despite the aforementioned merits, HEVs have been documented to pose various disadvantages. One of the demerits concerns the issue of less power. As noted earlier, HEVs are powered by two engines. The primary source of power is the gasoline engine and is much smaller than the engine that one would find ion single engine powered vehicles. This adversity is aggravated by the fact that low power characterizes the electric motor. Overall, the combined power of HEVs' two engines is likely to be lower than that of gas powered engines. Indeed, HEVs remain suitable for city driving, rather than for acceleration and speed (Soni, 2015). The second demerit is that HEVs can be very expensive. As asserted by Krupa, Rizzo and Eppstein et al. (2014), HEVs "can burn a hole in one's pocket." Compared to regular petrol vehicles, HEVs are so expensive that they can stretch to a range of $5,000 to $10,000 beyond the standard version. However, this extra amount spent on HEVs is compensated or offset by tax exemptions and lower running costs. Apart from cost and power-related issues, poorer handling has been associated with HEVs. The vehicles house packs of powerful batteries, lighter electric engines, and gasoline powered engines. The implication is that extra weight is added and ends up eating up the vehicles' extra space. Thus, HEVs pose the merit of fostering a "green" environment compared to other regular and single engine powered vehicles but the extra weight compromises fuel efficiency. Apart from the demerit of high purchase costs, HEVs are also associated with higher maintenance costs. With the presence of continuous technological improvements and a dual engine, higher costs of maintaining HEVs are inevitable and even new technologies aggravate the situation whereby mechanics experience significant challenges while repairing these vehicles (Ilieva and Iliev, 2016). Lastly, the presence of high voltage in the HEVs' batteries implies that an occurrence of an accident could prove lethal. Specifically, high voltages pose the risk of electrocution and hamper rescue efforts.

VI. CONCLUSION

In summary, the evolution of HEVs is seen as a response to changing technologies, as well as environmental concerns. Given the dual powered engine system in HEVs, these vehicles have been found to reduce the dependence on fossil fuels. One of the merits of this trend lies in the reduction in greenhouse gas and CO_2 emissions that could lead to air pollution while the other and related advantage lies in the manner in which HEVs save natural resources. Despite these merits, HEVs have been documented to be expensive in purchasing and maintaining, and that they are mostly limited to city driving (due to less power). Overall, the decision on whether to adopt HEVs or not should depend on the individual or organization's intended purpose. Imperative to note is that the initial high cost of HEVs is compensated or offset by tax exemptions and lower running costs and that the adoption could save the environment while striving towards a greener or sustainable economy.

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