

Free research paper on hybrid cars

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Abstract

This paper details the extensive review on modern concept of Hybrid Vehicles and their robust penetration in the automotive market. Hybrid vehicle which is actually a hybrid between a conventional engine and electric motor, utilizes both energy sources to start and gear up the vehicle via propulsion from the fuel tank. The use of on-board power units, reduced engine heating, rapid catalyst warm-up, reduced toxic emissions, plug-in hybrids, specific fuel stations, engine mapping, grid modifications and several other engine configurations have been taken into account to make the vehicles more fuel efficient, environment friendly, cost-effective and reliable. This technology is also bridging up the gaps between developed and under-developed countries by presenting more energy efficient vehicles with sustained power and acceleration requirements. Regardless of their expensive purchase amount and costly maintenance and overhauling, a huge amount of investors, consumers, industry groups and policy makers are interested in getting this technology because it logically satisfies the user with quite short payoff time and sustained vehicle life cycle. Clean Development Mechanism has quite positive future expectations from Hybrid Electric Vehicle technology. Though some intrinsic design improvements and substantial battery life enhancement techniques are still under dire consideration of the manufacturers to make it even more cost equivalent to the conventional gasoline vehicles.

Introduction

Main focus of this study is to examine the rapid intrusion of hybrid technology in our automobile society. A focused buyer group has been taken into consideration that have recently shifted from conventional vehicles to hybrid vehicles or buyers who are thinking of experiencing the highly talked and enticer hybrid technology. People search for something adequately economical, well-performing, safe and reliable. Studies have revealed that more energy is required to manufacture a hybrid car comparative to a conventional car and similarly high intensity of emissions is released by them because of highly advanced materials that are being used in their manufacturing process. Here, we will consider some of the main distinctions of a hybrid vehicle over conventional IC engine vehicles.

Supporting Greenhouse Effect

Hybrid Electric Vehicles can largely reduce the significant use of energy in terms of fuel and oil emissions and hence can enhance the greenhouse effect relative to the use of Conventional vehicles but costing quite high life cycle expenses. However, hybrid vehicles acquire an enticing ability to capture the psychology of thinking minds as it conceptually serves the best reasons to be purchased. It's capable of refueling part-time travel, with the help of fresh air coming from the radiator, which is quite helpful in saving the overall energy of vehicle. On the other hand, people has a different kind of perception regarding the use of advanced hybrid technology as type of material and electronic components used in the manufacture and processing of hybrid cars totally contradict the greenhouse effect being posed by them .

Hybrid cars seem quite neat and clean on the road but the statistics behind the picture are in conflict. Considering the initial energy consumption and outgoing emissions in minds, controversial thoughts have been shared, analyzed and still under-assessment amongst the main hybrid car producers around the globe. Finally, let's make a brief comparison of effect of both conventional gasoline cars and hybrid cars on the surroundings.

Cars running on petrol or diesel produce large amount of toxicants, chlorofluro-carbons and number of pollutants. While on other hand, hybrid cars which are also known as Green cars are quite environment friendly not only due to their cleaner and reduced emissions but also due to their another benefit to the surroundings that is almost non-existing noise pollution being created by them. Hybrid cars can easily accelerate up and down without producing any harsh or roaring sounds relative to the gasoline driven engines .

Reduced Engine excursions and Rapid Catalyst Warm-up

Apart from improved potential of hybrid cars to become energy efficient, main focus of hybrid configurations is to reduce the subsequent engine emissions which are not that environment friendly. Firstly, engine excursions are reduced into load regimes to reduce engine size with high intense emissions and then prior to engine cold start it heats the catalyst electrically and hence electrifying miles by using on-board power units. Another extraordinary feature of hybrid cars is rapid warm-up of the catalyst without emission surges and also despite of driving conditions.

Quick Payback time for HEVs

Mostly, Investments are done taking in consideration it's Payback time; the time period required to repay the overall amount being initially paid by the investor. According to the researchers, a new Hybrid Vehicle costs approximately 5000 USD more than price of conventional vehicle. So considering the savings per mileage of it and then calculating the payback time, it is not more than 4 years or so but it can differ according to the configuration and power of the engines. The thing is it can easily justify the investment done in quite a short period of time which plays an important role for a new product to capture the already competitive Conventional vehicle market. It can get a huge fan following, particularly, in the developed countries and supersede the orthodox conventional technology but talking on the behalf of under developing countries, this will not be a feasible idea .

Price of Expensive PM filters omitted

In order to obtain adequate level of emission reduction in conventional diesel or petrol engine, installation of quite expensive and rarely available emission reduction filters for NOx and PM is required which not only demands the alteration in the engine but can also reduce the overall efficiency of engine. According to conventional Vehicle Emission standards, PM filter technology has already been installed on various vehicles to make then environment friendly. But in future, this compulsory introduction of trapping and PM filtration system can higher the prices of diesel and petrol engines. Nowadays, some specific filtration technologies are available in the price range of 1000-1200 USD for Light Duty Vehicles and similarly 15000-20000 USD for Heavy Duty Vehicles. Keeping this in mind, buying a comparatively

more efficient and environment friendly Hybrid Car is not at all a bad option. Researchers predict that as the automotive will get more mature and Hybrid technology will further flourish, the gap between local vehicles and hybrids will soon close up. Emission regulation authorities will also play a vital role in future success of hybrid engines as then conventional diesel vehicles will become obsolete. Moreover, maintenance and troubleshooting costs of hybrid petrol vehicles is also comparatively less than that of conventional diesel engines but they can further be lowered with the passage of time, availability of relevant spare parts and skill of experience workers.

Assembling and manufacturing accounts for more than half of the final price of vehicle. This price can be further divided into indigenous component level in which the price of power electronics, motor controllers and battery pack is also included that are not installed by the Original Equipment manufacturer and hence costs almost 3-4 times of its actual cost. Similarly, the vehicle will also go through assembly and equipment testing phase prior to its first drive which also contributes in its overall additional cost.

Hybrid cars are Cost effective

Hybrid engines are more cost effective and affordable according to the level of technology and reliable mechanism they provide. They also supersede the conventional vehicles due to the distinguished hybrid duty cycles and their extrapolation from comparatively more powerful diesel engines. Internal design of hybrid engine is purpose-built and fuel-efficient, totally a different concept from that of a conventional engine. For example the introduction of RPM level restrictions and use of inexpensive components is a distinct initiative taken by the hybrid technology. It will require some time for Hybrid

Engines to penetrate in the market and gain self-sustainment with the experience in manufacturing process and introduction of subsequently innovative technologies. Today, a hybrid car costs 15-20% more than that of a conventional car but in return provides 25-30% enhanced fuel efficiency which is not a bad purchase. Introduction of regenerative braking system and lower rate of wear and tear, its payback time is consequently very short as compared to the conventional vehicles and enhances its reduced maintenance costs and fuel savings .

Engine Maps

Engine Map display is another explicit feature of hybrid cars that has gained them a large number of fan followings. Engine fuel consumptions and brake-specific fuel emissions are represented on engine maps where Brake Mean Effective Pressure is on y-axis and Engine rpm are on x-axis. Constant elevation lines are shown on the graph which assists in obtaining accurate maps far better than the simple. The functions like emission modeling, engine transient behavior, steady-state fuel consumption and adequate fuel economy plots are displayed in front of driver seat to ensure vehicle's good health all the time. This transmission modeling helps assist the driver to determine the engine operating point responsible for producing required load which is a combination of rpm and BMEP.

General Acceptance of Hybrid Cars

About 48% of US consumers which were asked said that they would be highly or extremely interested to buy a plug-in hybrid electric vehicle (PHEV).

PHEVs offer better fuel efficiency and mileage along with lowering the carbon emissions while relying lesser on oil and gas .

Another survey shows that only 35% of the surveyed owners of hybrid car are interested in buying another hybrid car again. This survey was based on the purchase behavior of consumers during the year 2008 and 2011. The same survey also revealed that the purchases of hybrid cars is quite lesser than as thought and mostly the customers who bought the hybrid cars did so due to their loyalty with the brand. .

Adequate Z60 mph Acceleration Time

Zero to 60 mph acceleration time is a vital factor in characterizing any vehicle's proficiency, reliability, accurate power-train sizing and performance. Since till date, there is no specific calibration tool is available to testify the zero to 60 mph acceleration of a vehicle but according to the conventional method used for obtaining exact zero to 60 mph readings, used vehicles are generally compared with the new identical vehicles to get the difference. According to pioneers of automotive technology, quite complex calculations and input analysis need to be done for understanding this theory. According to laboratory tests, a conventional car with manual transmission takes 10-12 seconds in obtaining Z60 mph but this time gets reduced to 6 seconds for high performance cars. As in hybrid cars, in first go only electric motor provides the power to wheel until it achieve an elevated rpm so the engine will not turn on at start which causes a slight delay in hitting full power.

Hybrid Design and the Impact of Cost Considerations

Automotive professionals are of the view that instead of containing complex and sophisticated design phases encountered in manufacture and cost requirements of a conventional vehicle; like shift feel, passing acceleration and start-up acceleration, hybrid cars are designed and manufactured in quite simple performance targets. Engine size is taken according to the grade ability required; motor and battery are sized according to the power required for additional acceleration and so on. In short, things are designed according to the requirement and need of the user so that to help vehicle perform superficially without using expensive and complex structures. Besides that, fuel economy factor and cost estimation for the redesigning of vehicle were not considered in the manufacturing phase of hybrid cars which can be called as a lame drawback but can be coped up with further market experience and adequate chronological development.

Fuel Economical

As hybrid cars lag a bit in their 0-60 mph acceleration time so it balances the contest with improved mpg. With decreasing acceleration time, hybrid systems are proved more fuel economical as compared to the conventional diesel or petrol engines which means the more heavily powered the vehicle is the more will be its capable to save fuel hybridization. This result should not consider in generalizing the concept and taking hybrid identical to the conventional vehicles. While climbing on steep grades hybrid vehicles cannot sustain long-duration grade ability as their batteries cannot bear overtime. The drive trains achieving 0-60 mph of 10-12 seconds have now been superseded by the advanced 8 seconds fleet with dominant market capture

because buyers with large investments are not interested in acceleration capability or fuel economical vehicle instead they will mostly concerned with the power capabilities of a vehicle which a hybrid does not acquire.

Enhanced Acceleration Performance requires more investment

Researchers reveal that it's a simple rule for all vehicles that you have to pay extra for enhanced acceleration performance but this rule implies very firm for hybrid in exclusive. Full Parallel Hybrid can be highly expensive regarding this fact in mind so another alteration is also available in the market that is mild hybrid vehicles in which you can easily boost up your acceleration performance by enhancing the battery and engine power in quite a less amount as compared to that of a full hybrid. Parallel hybrids are considered having the most cost effective life cycles amongst all full hybrid cars so far. In order to minimize the gap between cost prices of hybrid and conventional vehicles, the gasoline prices should increase otherwise the survival of hybrid cars will be on stake. But according to the recent trend as the hybrid component prices are considerably dropping a bit so likewise a considerable decrease has been seen in the prices of breakeven gasoline. Despite all these facts, if the hybrid car developers continue the improvement in battery life and minimize its cost, it can easily eliminate the difference between the costs of hybrid and conventional vehicles, which then will be a beginning of the era of Hybrid dominated Cars.

Regenerative braking system

Regenerative braking is another distinctive feature of modern hybrid vehicles, which makes it even more energy efficient; to capture some

amount of heat energy being lost to mechanical brakes and then effectively uses its generator motor to apply brakes to the vehicles.

Component Efficiency plays a vital role in Hybrid Vehicles

Talking about the Hybrid vehicle powertrains, in series hybrid configuration the engine is only responsible for generating the electricity to power up the electric battery while in case of parallel configuration the engine generates the power used for rotation of wheels. Actually, this electrified transmission of power to the wheels is less efficient as compared to the mechanical drive of gasoline engines but the regenerative braking system of hybrid cars take advantage. Idle fuel flow is omitted by the replacement of a smaller engine as compared to the substituted larger engine. Each component of hybrid train should give some comparatively high energy outputs in order to supersede a conventional gasoline engine .

Conclusion

The in-depth comparison between conventional vehicles and hybrid vehicles takes us to the conclusion that both are quite equivalent in pursuance and performance while contradicting in some aspects. Particularly, according to the design rules, hybrid cars will have inferior grade ability as compared to grade-climbing ability of a conventional vehicle while acceleration capability of parallel designed hybrid car is comparatively better than that of conventional vehicle. Despite of the uncertainty factor in performance prediction of a hybrid vehicle like dependency of zero to 60 mph attainment time on control strategies and dependency of engine turning-off on time delay between power signal and engine full power attainment. This analysis

also assist us get acquaintance with the future prospects of hybrid technology regardless of its fuel efficient propulsion method, cost effective design and good payback time. Besides these advantages, factors like expensive maintenance, low grade ability and use of not environment friendly materials in the manufacture of hybrid cars make them less attractive to people's investment. Still there is a long way to go in its energy efficient manufacturing techniques so that it may gain some clean image amongst its competitors. Unfortunately, owing to the less number of hybrids available on road and high manufacturing cost, the robust change from conventional to hybrid technology does not seem a feasible option. Apart from conventional vehicle's dominant significance in today's automotive market, Hybrid Electric Vehicle secure a great position to supersede it in coming future.

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