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Hybrid Vehicles: The Need for Today's Environment

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Abstract: ***What is a hybrid? Anything that is made by combining two different elements can be called as Hybrid. So, a hybrid vehicle combines two methods for the propulsion of a vehicle. Possible combinations include gasoline/electric, diesel/flywheel, and fuel cell/battery. Typically, one energy source is the storage of electricity, and the other is the conversion of fuel to energy. Growing concerns over the limited supply of fossil-based fuels such as petrol and diesel are motivating intense activity in the search for alternative road transportation propulsion systems. In addition, regulatory pressures to reduce urban pollution, CO2 emissions, and city noise have made plug-in electric especially hybrid vehicles a very attractive choice as the alternative to the internal combustion engine. In this paper, hybrid vehicle technology and why 150 CC or fewer power engines should be converted to hybrid. Hybrid electric vehicles are admired because of their ability to achieve related performance to a standard automobile while prominently improving fuel efficiency and tailpipe emissions.***

Keywords: Hybrid Electric Vehicles (HEV), Electric Vehicles (EV), IC Engines, Motors, Gasoline

1. Introduction

The term cc refers to the unit "Cubic Centimeter" of volume. And in the case of engines, it is used to represent the volume of internal combustion engine cylinders.

The cc can also be represented in Liters, as shown below,

1000cc=1000cm^3 = 1 liter=1.0L

There are many types of engines used for myriad applications in today's world. The most common is the Automotive and combustion engine which operate on fossil fuels (mostly) i. e., fuel is burnt as an explosion for the engine to function. This controlled explosion happens in the **Engine Cylinder**. Depending upon the application number of cylinders may vary from 1 to as high as 12. Within these Engine Cylinders are **Engine Pistons** that move up and down to create and maintain the optimum pressure required in the cylinder for the engine to operate.

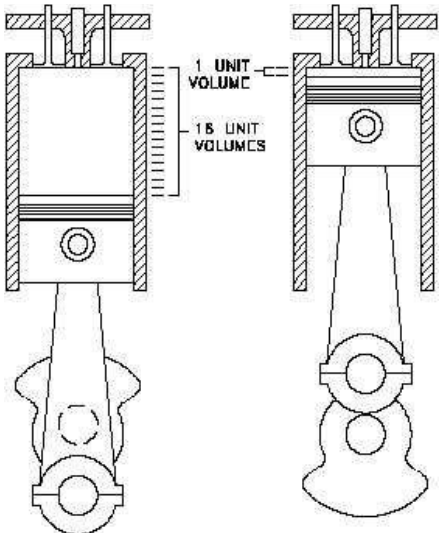

Figure 1: Piston Arrangements

An **Electric Vehicle** is a vehicle that uses one or more electric motors or traction motors for the propulsion of a vehicle. An electric vehicle can be powered through a collector system by electricity from off-vehicle sources or may be self-contained with a battery, solar panels, or an electric generator to convert fuel to electricity. Most Electric vehicles have Lithium-Ion Batteries (Li-ions or LIBs). Lithium-ion batteries have a higher energy density, longer life span, and higher power density than most practical batteries. The power of a vehicle's electric motor is measured in kilowatts (kW).100kW is roughly equal to 134horsepower.

Motors are the "workhorses" of Hybrid Electric Vehicle drive systems. The electric traction motor drives the wheels of the vehicle. An electric motor can provide full torque at a lower speed, unlike a traditional vehicle, where the engine must "ramp up" before full torque can be provided. The motor also has lower noise and higher efficiency. Other characteristics include excellent "off the line" acceleration, good drive control, good fault tolerance, and flexibility with voltage fluctuations.

2. 150 CC or Fewer Engine Vehicles and Motors

Usually, motorcycles are associated with 150 cc or fewer engines that is to provide high speed. Depending upon the number of strokes and cc of an engine it can deliver power and torque. While a 50 cc 2-stroke engine is suitable for short distances, a 4-stroke engine is what gives you maximum power. A 150-cc engine can reach a speed of 55 mph (Miles per Hour) to 70 mph depending on the condition of your engine, the weight of the vehicle, the weight of the passenger, and the modifications in the vehicle.150 cc 4-stroke engines run on a lower RPM (Revolutions per minute) so thus there is less wear and therefore lower maintenance. A 150cc 4-stroke engine is perfect for riding in cities as it is easy to maneuver in traffic and through lanes and side-roads, with constant braking. It also handles well at high speeds.4-strokes are better known for their fuel economy over 2-stroke engines since it provides complete combustion of the intake charge thus it saves fuel.2-stroke are more environmentally challenging,

due to their noise and emissions, they are being replaced with 4-stroke. Although 4-stroke engines are a major improvement from 2-stroke they still are not very environmentally friendly as they work by burning air and fossil fuels thus emitting harmful emissions to the environment.

3. Why Switch?

At present, for propulsion, all vehicles rely on the combustion of **hydrocarbon (HC) fuels** to derive the energy necessary. Combustion is a reaction between the fuel and the air that releases heat and combustion products. The heat is converted to mechanical power by an engine and the combustion products are released into the atmosphere. An HC is a chemical compound with molecules made up of hydrogen and carbon atoms. Ideally, the combustion of an HC yields only carbon dioxide and water, which do not harm the environment. Indeed, green plants convert carbon dioxide to oxygen by photosynthesis. Carbon dioxide is a necessary ingredient in vegetal life. Animals may not have any consequences from breathing carbon dioxide unless its concentration in the air is such that oxygen is almost absent.

The combustion of HC fuel in combustion engines is never ideal. Besides carbon dioxide and water, the combustion products contain a certain amount of nitrogen oxides (NO*x*), carbon monoxides (CO), and unburned HCs, all of which are toxic to human health.

Air pollution, global warming, and the rapid depletion of the Earth's petroleum resources are now problems, caused by emissions from petroleum vehicles, of paramount concern.

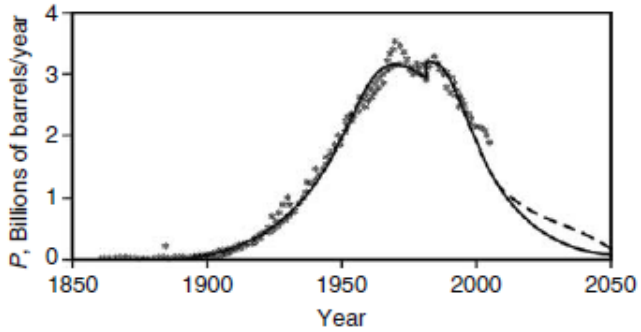

Figure 2: Annual Production of Petroleum in the USA from 1859 to 2050 (estimated)

In recent decades, the research and development activities related to transportation have emphasized the development of higher efficiency, cleaner, and safer mode of transportation. Electric vehicles (EVs), hybrid electric vehicles (HEVs), and fuel cell vehicles have been typically proposed to replace conventional vehicles shortly. The Department of Energy projected that if 10% of automobiles nationwide were zero-emission vehicles, regulated air pollutants would be cut by 1, 000, 000 tons per year, and 60, 000, 000 tons of green-house carbon dioxide gas could be eliminated.

4. Working Principle

The working principle of hybrid bike basically involves three processes, the first process involves when the vehicle is running through internal the combustion engine, the second process involves when the vehicle is running through an electric motor and the third process involves when the vehicle is running in both the modes according to the requirements. When the vehicle is driven at the outside of the city and need more power to drive, the vehicle is powered through internal combustion engine. The power from the engine is taken from pulley and then it rotates the wheel.

Gasoline Mode

In gasoline mode, the engine will be main source of power to the rear wheel. The rider can control the speed through an ordinary accelerator handle. In this mode, the motor will be in the ideal position at the front wheel, where its battery connections are cut off by another relay which is controlled by a microcontroller. This mode can be activated when we require high power outside the city limits. During this high-power operation, the engine will run on its rated RPM, so the fuel consumption is considerably low, also the pollutants coming out of the exhaust are reduced.

Electric Mode

Here we can use a hub motor which will be running with the help of battery. The motor is fixed on the wheel of the vehicle and is controlled through the controller unit. The hub motor is steadily emerging as a standard drive method just like e-bikes, scooters, solar cars, and many other light electric vehicles. With a hub motor conversion, there is no need for external mounting brackets and drive chains to support a motor and transmission. The direct-drive hub motor is about as simple as things get. The motor is exactly fixed as in the centre axis of the wheel hub. Now the vehicle rim starts to spin over the axis body for rotation of the wheel. The electric power supply is charged to the battery through a separate charger. Here some losses may be occurred due to mechanical friction. When the vehicle is driven inside the city, running in the plain and in need of low power the vehicle is powered through a motor. The power to run the motor is supplied from the battery. During this process, the speed of the vehicle will be minimum and there are no smog-forming pollutants produced during the vehicle runs. The mileage of the vehicle while running on the electric motor mainly depends upon the time of charging and also depends upon the capacity of the battery. During this process, the mileage of the vehicle is increased considerably.

Hybrid Mode

This is a special type of mode where the rider does not care about the current mode of operation. This is entirely controlled by the microcontroller. The microcontroller can be programmed as when the vehicle's speed reduces than a certain amount, the electric mode will be activated. If it is above that, then gasoline mode is to be operated. As city limits the vehicle operates in electric mode and in outer, it

will operate in gasoline mode. Therefore, we can reduce energy consumption, pollution, and cost per kilometre.

5. Why Hybrid over Electric?

Emissions Analytics claimed that at given supply issues with batteries, more effective use of production resources is small-battery hybrid vehicles (or mild hybrid). The numbers support that claim. A mild hybrid can save 73 grams per kilometer of CO2 per unit of battery size. Comparatively, a battery-powered vehicle saves 3.5grams/km per kWh and full hybrids save 50.5 grams of CO2 per kilometer, per unit of battery capacity.

Even hybrids with three different use cases stated (gasoline mode, electric mode, and hybrid mode) yielded better per-kWh CO2 savings. Mostly engine got a 5grams/km per kWh figure, compared with 50-50 and mostly battery, which managed 12 and 19.9 percent respectively. Still, at worst, 1.5grams per kWh of battery unit used is better than a representative EV.

That's assuming that CO2 emissions produced during the production of the electricity and car battery are equal in total to tailpipe emissions. According to Emissions Analytics, some studies suggest that EVs are less 'green' when CO2 is tallied up throughout the life of a car.

6. Comparison

Type Category	IC Engine	Electric	Hybrid
Vehicle Cost (in Rupees)	35000	33000	40000
Fuel cost 1 litre (in Rupees)	72	8	80
Mileage (1 litre)	45	50	95
Running Cost of the Vehicle per Kilometre (in Rupees)	1.6	0.16	0.84
Speed of the Vehicle (in Km/hr)	55	35	45

7. Drawbacks

Can be Expensive

The biggest drawback of a hybrid 2-wheeler is that it costs more than a gasoline vehicle, however, the extra amount put into buying it can be compensated by the fact that it offers lower running costs.

Higher Maintenance Costs

The presence of engine and motor makes it difficult for mechanics to repair and batteries for the motors have to be maintained which can be costly when the battery needs to be replaced.

Accidents from High Voltage in Batteries

In case of an unfortunate accident, the high voltage present in batteries can be lethal as there is a high chance of getting electrocuted in such cases.

Hydrogen Fuel Cell Issues

The source can for hydrogen be environment-friendly such as Solar or wind power or it can be harmful such as coal and natural gas (gasoline). If hydrogen is being sourced from coal or natural gas then the ecological motive of hybrid 2-wheeler is undermined.

8. Conclusion

In heavy traffic and inside the city there is no chance and need of moving fast. At that time, if the vehicle is run by an IC engine, more fuel is wasted due to variation of acceleration. If the vehicle is run an electric hub motor through the battery, the consumption of power is reduced. During less load operation, the vehicle can be easily run using a battery instead of by engine, when high torque is required it can be changed to IC engine mode.

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