Comparison of hybrid vehicles with other types of power units

Entertainment, Movie

1 Introduction

1. 1 Investigation Purpose

The times of low inflation have gone, especially in the resources centre and this is as a result of fossil fuels being capped with limit. Unfortunately, we can not reserve fossil fuels, such as coal and oil forever, though what we can do is introduce another power source for the likes of vehicles, whether this is a slowly but surely start, any positive impact on our fuel consumption as a whole and reduction ofglobal warming. There is a vital need of this information to be distributed to individuals around the world, as whether it is our generation which faces the issue of green house gas emissions or the future generation, one way or another we have to deal with it. The idea is to make the world realise that term ‘ hybrid’ is feasible and available to everyday consumers, of course at a price, but what isn’t

I will extract data from various research and development programs and compare it to the current hybrid’s which are available and observe the room for improvement. The contribution that will be put in has its limits, as I can not produce a new alternative or redevelop a current form, though it is my duty to identify and produce evidence of the type of hybrid and power units that can modernise today’s world effectively, safely and most importantly cleanly.

I will determine how the new generation of hybrid cars, which uses a combination of two or more distinctive power units to move a vehicle. This will include the comparison with conventional power units, such as petrol

and diesel engines. A thorough analysis will also be carried out, along with advantages and disadvantages, in relation to efficiency, resources, safety, performance emissions and other deriving factors.

Hybrid vehicles are deemed to be the future for vehicle transportation, as fossil fuels are diminishing, whilstpollutionis greater than ever. Technically, this is a resultant substitute for the conventional power source, though does this ultimately ridden the problemIf this is the case, would it a short or long term change?

1. 2 Methodology

I will extract information from various sources, including textbooks, internet and applying my common sense and literature towards it. I will firstly research in depth on the subject, and then followed by planning and structuring the report. I will use comparative arguments in order to review hybrid cars and other fuel types.

2 Hybrid Vehicle

2. 1 History

Since the early 1900’s, car designers have been experimenting with electric and hybrid power units. Hybrid vehicles were produced beginning as early as 1899 by Lohner-Porsche, who is best known for creating the first hybrid vehicle (gasoline-electric), the Volkswagen Beetle, the Mercedes-Benz SS/SSK, as well as the first of many Porsche cars. Early hybrids could be charged from an external source before operation; hence the term plug-in hybrid has come to mean a hybrid vehicle that can be charged from a

standard electrical wall socket. While employed at Lohner Coach Factory, Ferdinand Porsche developed the Mixte; a 4WD series-hybrid version of “ System Lohner-Porsche” electric carriage previously appeared in 1900 Paris World Fair. The Mixte included a pair of generators driven by 2. 5-hp Daimler IC engines to extend operating range and it could travel nearly 40 miles on battery alone and it was presented in the Paris Auto Show in 1901. The Mixte broke several Austrian speed records, and also won the Exelberg Rally in 1901 with Porsche himself driving. The Mixte used a gasoline engine powering a generator, which in turn powered electric hub motors, with a small battery pack for reliability. It had a top speed of 50 km/h and a power of 5. 22 kW for 20 minutes.

As a result of this, the internal combustion had reformed as the ‘ best’ at the given time and inheriting the power source for automobiles for over a century. Between this time, petrol and diesel powered vehicles took the opportunity to boost their technological advancements, which included fuel injection and computer controlled systems that aided the fuel efficiency, safety and power.

2. 2 How it functions

As we know, a conventional car has a fuel tank, along with an internal combustion engine and a transmission, which ultimately work simultaneously to turn the wheels of the car, thus making movement. In saying so, the fuel tank allocates fuel, such as petrol or diesel to the engine and therefore, the engine processes the fuel through the transmission, causing the wheels to turn.

Like all batteries, hybrid batteries have two electrodes (which collect or emit an electric charge) that sit in an ion-rich solution called the electrolyte. (An ion, by the way, is an atom or group of atoms with an electrical charge.)

The electrodes are typically very close, so a polymer film, called a separator, prevents them from touching, which would create a short circuit. An on-off switch in whatever device is powered by the battery—your phone or laptop—bridges the cell's electrodes to generate power. That's when the electrochemical reaction begins.

Keep in mind: What we commonly call " a battery" is actually a battery pack that houses many individual cells. Your mobile phone battery is just one single cell, but anything larger—even a laptop battery—uses multiple cells working together.

Ionized elements in one electrode are in a chemical state where they are easily attracted to combine with other molecules, emitting electrons (energy) in the process. Those elements are tugged through the electrolyte and the separator toward the opposing electrode. The ions of the negative electrode (anode) give up electrons; the positive ions coming toward the anode accept them. The electrons released during this process travel through the external circuit (e. g. your phone), producing a flow of charge in the opposite direction to the flow of ions. During recharge, current is forced into the cell, reversing the process.

As we take a tour of hybrid batteries, remember one thing: Total energy determines the vehicle’s electric range, whereas available power determines its acceleration. (http://www. hybridcars. com/hybrid-car-battery)

On the other hand, a hybrid vehicle consists of two parts, the internal combustion engine and the electric motor to form motion on the vehicle. Furthermore, the means of this is so that depending on theenvironmentthe vehicle is driving in, it will switch between the fuel engine and the electric motor, in order to maximise efficiency. Examples of this would be whether the vehicle was driving through urban or rural roads or even dependant on speed. This particular combination is called HEV (Hybrid Electric Vehicle) and is also important to note that is predominately used with diesel as the fuel

2. 3 Types of hybrids

There are many types of hybrids and whilst some are quite similar to each other, in terms of functionality, they are in fact two diverse designs. However, they are both built around improving fuel mileage and better the emissions to limit the harm to the environment.

The Mild hybrid focuses more on the traditional fuel engine, whilst integrating the three major components. It is conveyed around the assistance of the electric motor’s function for the fuel engine. In the case of conventional vehicles, motion of the force is what makes it a fuel engine.

In addition to this, the electric power only comes into the picture when further power is needed. Due to the fact that the vehicle is only using energy where essential, it is increasing fuel mileage. This design has enabled the

electric motor to do more than one task, which is either charge the vehicles battery or use vital electricity to help boost the performance of the vehicle. Unfortunately, the design has limited the possibility of doing both tasks simultaneously. Honda is a prime example of Mild hybrid systems, developed in models such as the Civic and Insight.

On the other hand, Full hybrid vehicles are designed differently, but the three key components are well and truly there. However, this is deemed to be more complex, in terms of benefiting the vehicle. The Full hybrid is able to utilise its electric motor independently under certain conditions of the fuel engine. The electric motor will take over, depending on certain models, which means if the vehicle is moving at a constant lower speed and will only have use of the fuel engine when acceleration is required.

Though, if the fuel engine permits it, they can both work simultaneously. Periods of high speed, like in the case of highway passing is an example of the two engines working together. Full hybrid cars are capable of both charging and using energy from the battery at the same time.

Ultimately, whether the vehicle is mid or full hybrid, they are both economically friendly, reducing emissions, whilst increasing whole life cost to include cost of manufacture.

2. 4 Technology

You can argue that, although the HEV is combined, the battery or electrical motor would still need to run on chargeable cells, thus being expensive. However, the defining feature the HEV has is its RESS (Rechargeable Energy

Storage System), which productively allows the system to be recharged, from the actual process of operating the vehicle and does not need any form of ‘ plugging in’. For example, the regenerative breaking converts the vehicles kinetic energy into energy, which is stored by the battery or capacitors.

Hydrogen Fuel Cells:

Hydrogen fuel cells consist of:

Anode

Membrane

Cathode

Electro engine

Power electronics

Batteries

Hydrogen tank

A fuel cell is a combination of electrodes sandwiched around an electrolyte. Oxygen passes over one electrode and hydrogen over the other, generating electricity, water and heat.

There are two main hurdles that stand in the way of mass production and widespread consumer adoption of hydrogen fuel cells. One is the high cost of producing fuel cells, which cost $1million to produce one vehicle and Toyota and Honda are currently leasing to Japan and California. It is important to note that, although it seems very expensive to produce a vehicle right now,

Toyota is hoping to reduce this cost to $50, 000 by 2015. I believethat the current cost would not make a make a difference to society, as the same with the current hybrid of electric vehicles. The reason for this is because everything is in production and to be quite honest, the world is not ready for a huge step, especially when the acceptance of hybrid vehicles as a whole is still in acceptance and surge of demand still waits.

The second issue, which of course is in relation to the first, typically consists of the lack of hydrogen refuelling stations. As we all know, it is safe to say that majority of vehicles on the road are under the influence of petrol or diesel applied engines. Therefore, oil companies may be reluctant to push the idea of hydrogen fuel, when they are perfectly indulging in their most profitable sector – petrol and diesel. And why not thoughIt is fairly logical to stand by your current business affairs when they are keeping yourself and shareholders happy. Though to be fair, Shell and BP have been promoting this idea and working with a dealership, which I will elaborate further down. There are many factors involved in which understandably fright oil companies, such as safety, cost and of course, lack of demand.

However, one company which has an extremely good reputation with hydrogen being their middle name and this is the ‘ California Fuel Cell Partnership’. They are a non-profit based company, who admire the concept of ending petroleum dependence and making a positive change to society. We can question whether this direction is possible or whether consumers will ultimately accept it, but without research and attempting to better the need for zero emissions as a whole, we will never know, rightAs of now, we do not

know any better, we isolate ourselves with the nature of life, believing that life today, will consist of the same resources in 50-100 years' time – or do we know the truth about commodities and turn a blind eye to limited resources and let the future generation deal with it – perhaps.

The California Fuel Cell Partnership is a public-private partnership to promote hydrogen vehicles (including cars and buses) in California. It is notable as one of the first initiatives for that purpose undertaken in the United States.

In January 1999, two state government agencies—California Air Resources Board and California Energy Commission joined with six private sector companies—Ballard Power Systems, DaimlerChrysler, Ford Motor Company, BP, Shell Hydrogen and ChevronTexaco—to form the California Fuel Cell Partnership. The goal was to demonstrate and promote the potential for fuel cell vehicles as a clean, safe, and practical alternative to vehicles powered by internal combustion engines. Within a very short time, other government agencies and private businesses became members.

In November 2000, the West Sacramento headquarters opened. The building includes a public gallery, offices, hydrogen fuelling station and indoor service bays for vehicle maintenance. At first, the automakers had just handful of cars all stationed in Sacramento. The goal was to see if these vehicles and fuel could be technically viable. If the answer was no, then CaFCP would close its doors in 2004.

Before the first phase was finished, CaFCP members knew that thetechnologycould succeed. The number of members grew to 33 and set a

new set ofgoalsfor the next phase of operation, from 2004-2007. During this period, CaFCP members worked on project to prove or disprove the commercially viability—would the vehicles, fuels and public policies meet consumer expectations?

In mid-2006, the members agreed that FCVs could be a commercial success. They agreed to a third phase through the end of 2012 to lay the foundations for a commercial market, which includes developing early retail stations, policies to enable the sale of retail hydrogen and necessary steps to building a supplier base for large-scale production in the future.

CaFCP completed its first phase of operation in December, 2003. The second phase will conclude in December, 2007. In mid-2006, the members agreed to enter a third phase to encourage fuel cell vehicle commercialization that will continue through 2012.

The California Fuel Cell Partnership is a unique collaborative of auto manufacturers, energy companies, fuel cell technology companies and government agencies. The members collaborate on activities that advance the technology, such as first responder training, community outreach and agreeing on protocols while standards are being developed.

Automotivemembers provide fuel cell passenger vehicles that are placed in demonstration programs, where they are tested in real-world driving conditions.

Energymembers work to build hydrogen stations within an infrastructure that is safe, convenient and fits into the community.

Fuel cell technologymembers provide fuel cells for passenger vehicles and transit buses.

Governmentmembers lay the groundwork for demonstration programs by facilitating steps to creating a hydrogen fuelling infrastructure.

What is the difference between a fuel cell and a battery?

Fuel cells and batteries are similar because they use a chemical reaction to provide electricity. A battery stores the chemical reactants, usually metal compounds like lithium, zinc or manganese. Once used up, you must recharge or throw away the battery. On the other hand, a fuel cell actually creates electricity through reactants (hydrogen and oxygen) stored externally. The fuel cell will produce electricity as long as it has a fuel supply. In short, a fuel cell vehicle is refuelled instead of recharged.

Why is it taking so long?

Well, this is a question everyone wants to know the answer to, I mean if there, why not release itThe problem is, technology, especially being new takes many years to come to the market. Before selling anything, it is important to create and enforce regulations and standards, to ensure that consumers get what the pay for. The California Fuel Cell Partnership is a prime example of their members working together on the barriers which

front us all and by doing so, they can streamline a process from years to months.

Is hydrogen a safe fuel?

The term ‘ fuel’ is not to be taken lightly and when dealing with any type of fuel, it is important to handle with care, just as hydrogen is done. For more than 50 years, hydrogen has been produced and used for commercial and industrial purposes with an exemplary safety record. Like all fuels, hydrogen has high energy content and must be handled with care. CaFCP’s members are building fuel cell vehicles and fuelling stations that meet or exceed safety standards. In addition, our members are defining new safety measures.

Like gasoline and other fuels, hydrogen is flammable. Unlike conventional fuels, it is very buoyant. With proper ventilation, hydrogen dissipates rapidly into the air, greatly reducing the chance of fire. Hydrogen is non-toxic, so if released it does not present ahealthhazard to humans and its effect on the environment is benign.

Petroleum Dependency and Fuel Cell Vehicle’s

Vehicles in the U. S. consume twice as much oil as the country produces. The number of vehicles on the road and the number of miles they drive increases every year, but U. S. oil production capacity remains about the same. In 2008, nation (U. S) consumed about 213, 810 gallons of gasoline daily—78 million barrels of oil in just one year. (A barrel is 42 U. S gallons.)

The National Research Council projects that by 2050 they will consume about 1. 5 billion gallons of gasoline a year, assuming that most of the vehicles on the road are highly efficient conventional, hybrid and flex fuel vehicles. If most of the vehicles are fuel cell and battery electric vehicles, gasoline consumption decreases by almost 70% to less than 50 million gallons a year—roughly half the current domestic oil production.

3 Current Issues with Conventional Vehicles

3. 1 Fuel Capacity

Fuel consumption and fossil fuels as a whole are again, diminishing is one of the reasons why hybrid vehicles and other power units are an opportunity cost. On top of this, the annual fuel cost is increasing for conventional cars, whether it is petrol or diesel. Due to the environment we live in, it is impossible to rely on the fossil fuel itself to increase Miles Per Gallon, instead the only option is to render the current technology of the vehicle.

Nevertheless, there are myths out there which try to better than conventional car with the likes of driving economically or using premium petrol, but how real are these mythsWell according to Susan Winlaw, co-author of the book, Car Advice for Women (and Smart Men says, “ Unless you have a job that requires regular sessions on a racetrack, there is no legitimate need to ever put premium fuel in your vehicle. Using regular gas could cost you a few horsepower when you’re driving at higher speeds, but chances are you won’t notice the difference, and it definitely won’t hurt your car. Your engine’s fuel-management system is perfectly prepared to handle

lower-octane fuel” says Winlaw. (Source: http://moneywatch. bnet. com/economic-news/article/6-myths-about-gas-mileage/317188/).

Well, this is down topersonal experienceand most importantly, trial and error, unless this is a fact, as the norm would be, most individuals would not want pay the higher price to observe savings, when fuel prices are costly in the first place.

So how do we be more economicalDo we drive with our air conditioning off or do we drive the road speed limitIn my experience, I was never fond of speed cameras being put left, right and centre and the daring part of being on the lookout for those cars with the flashing lights. Though I have to say, driving according to the road speed limit actually increased my MPG from A to B, which thoroughly surprised me to say that I do favour speed cameras and speed limits. In relation to this, it has been stated in reality ‘ fuel efficiency doesn’t really start to drop until you reach speeds higher than 60. And how smoothly you drive makes much more of a difference on petrol mileage than how fast.’

3. 2 Environmental Issues

Another major factor of changing our system is environmental factors. Global warming is amongst one of the major factors, for example just burning a gallon of petrol when combined with oxygen; it produces almost 20 pounds of Carbon Dioxide CO2. The idea from moving to a more ‘ green’ vehicle from a conventional can literally reduce the number of greenhouse gases emitted by SI units. There have also been ways for awareness, such as

energy rating for vehicles. The useful part we want is movement. We measure the weight of the vehicle and determine how much energy is being delivered to accelerate or maintain movement of the vehicle against external resistance. Then we could compare this to the amount of energy being put into the system. Useful power out over power input will give you the efficiency. As a result, the higher the CO2 emissions, the higher rate of road tax you will pay on the vehicle.

Below is a diagram illustrating the CO2 emissions chart:

Figure 1

At the end of the day, scientists and engineers are attempting to overcome obstacles, taking cars from the laboratory to the showroom, so that the first affordable and realistic car powered by hydrogen and pollution-free is driven by a child born today for their future.

The government has pledged $1. 7 billion in the U. S. for hydrogen research and development over the next five years, securing funding, however the objective is to overcome the obstacles involved in making hydrogen a viable energy source.

There is a high significance of environmental benefits of hydrogen, whether individuals believe it or not, as facts are facts, hydrogen can be pollution-free and infinitely renewable through wind, solar and hydropower sources. Either way, the importance is high, I mean, how long can we keep surviving on ‘ non-renewable’ sources for?

However, the phrase ‘ nothing is free in this world’ is true, in my opinion and you can not blame critics, who argue that the fuel source does have its environmental drawbacks; as they say, nothing is perfect. According to the National Hydrogen Energy Roadmap, it said that it requires up to 90 percent of all hydrogen has been refined from non-renewable sources, oil, natural gas and other fossil fuels. Does this mean we’re back to square one or is this just a stepping stone?

So we agree that the extraction of hydrogen from fossil fuels may not be environmentally friendly, though once the hydrogen is in a fuel cell car, only water vapour and heat will be expelled from the exhaust. But it is the burning of the fossil fuels, which are used obtain the hydrogen and this releases carbon dioxide, which is the primary cause of global warming. Even some scientists say that the hydrogen which has been extracted from fossil fuels creates an impact of the environment by releasing carbon dioxide in the air, which defeats the point of a clean-energy provider.

On the other hand, were bridges built with a perfect structureOr were car engines primarily built efficientlyI think not, so my point is that we need to use current fossil fuels to perform trial and error, hence the term ‘ hybrid’. But most importantly, this is all for the future and the main thing is that were making progressive now, whether it requires other sources of elements which contradict itself, though we just merely use it as a stepping stone.

President Bush’s 2004 budget asks for more than $22 million for hydrogen research and development to be devoted to coal, nuclear power and natural gas, and $17 million for renewable sources.

“ Cutting R&D for renewable sources and replacing them with fossil and nuclear doesn’t make for a sustainable approach,” said Jason Mark, director of the clean vehicles program for the Union of Concerned Scientists.

A recent study warns of the danger of releasing hydrogen itself into the atmosphere. Los Alamos researcher Thom Rahn led a team of scientists from California universities and the National Centre for Atmospheric Research in Boulder, Colo. Their study of the natural cycle of atmospheric hydrogen was recently published in the Britishsciencejournal Nature, and finds that substantially increased hydrogen production has the potential to damage the upper atmosphere.

Escaped hydrogen could build up, depleting the ozone layer near the North and South poles and triggering an increase in global warming. The study also warns that hydrogen may further contribute to global warming by aiding other chemicals in producing increased amounts of water vapour in the upper atmosphere.

“ It is impossible to manufacture, store and transport hydrogen without at least some fractional loss (to the atmosphere),” Rahn said.

Researchers from the California Institute of Technology estimate that leaked hydrogen in a hydrogen economy could cause as much as a 10 percent

decrease in the stratospheric zone. If hydrogen replaces fossil fuels as the world’s main energy source, the researchers believe that each year 60 trillion to 120 trillion grams of hydrogen could be released into the atmosphere. This is four to eight times the amount that is currently released.

The impact of increased hydrogen production depends on how well the earth adapts to the change. John Eiler, assistant professor of geochemistry at CalTech, said, “ This man-made hydrogen will either be absorbed in the soil — a process that is still poorly understood but likely free of environmental consequences — or will react with other compounds in the atmosphere. Determining which of these two processes dominates should be a solvable problem.”

Tracey Tromp, another CalTech researcher, contends that early recognition of problems will mitigate hydrogen fuel’s environmental flaws.

“ If hydrogen emissions present an environmental hazard, then recognizing that hazard now can help guide investments in technologies to favour designs that minimize leakage,” Tromp said.

The CalTech researchers, like other scientists looking at the environmental impact of increased hydrogen production, believe that the sooner such problems are identified, the easier it will be to find solutions to make a hydrogen economy truly feasible.

4. Hybrid – Environmentally Friendly

4. 1 Benefits of a hybrid compared to a conventional

The hybrid vehicle typically achieves greater fuel economy and lower emissions than conventional Internal Combustion Engine Vehicles (ICEV), resulting in fewer emissions being generated. These savings are primarily achieved by three elements of a typical hybrid design:

Relying on both the engine and the electric motors for peak power needs, resulting in a smaller engine sized more for average usage rather than peak power usage. A smaller engine can have less internal losses and lower weight.

Having significant battery storage capacity to store and reuse recaptured energy, especially in stop-and-go traffic, which is represented by the city driving cycle.

Recapturing significant amounts of energy, whilst braking that are normally wasted as heat. This regenerative braking reduces vehicle speed by converting some of its kinetic energy into electricity, depending upon the power rating of the motor/generator.

Other techniques that are not necessarily ‘ hybrid’ features, but that are frequently found on hybrid vehicles include:

shutting down the engine during traffic stops or while coasting or during other idle periods;

Improving aerodynamics; (part of the reason that SUVs get such bad fuel economy is the drag on the car. A box shaped car or truck has to exert more force to move through the air causing morestresson the engine making it

work harder). Improving the shape and aerodynamics of a car is a good way to help better the fuel economy and also improve handling at the same time.

Using low rolling resistance tyres were often made to give a quiet, smooth ride, high grip, etc., but efficiency was a lower priority). Tyres cause mechanical drag, once again making the engine work harder, consuming more fuel. Hybrid cars may use special tyres that are more inflated than regular tyres and stiffer or by choice of carcass structure and rubber compound have lower rolling resistance while retaining acceptable grip, and so improving fuel economy whatever the power source.
Powering the A/C, power steering, and other auxiliary pumps electrically as and when needed; this reduces mechanical losses when compared with driving them continuously with traditional engine belts.

These features make a hybrid vehicle particularly efficient for city traffic where there are frequent stops, coasting and idling periods. In addition noise emissions are reduced, particularly at idling and low operating speeds, in comparison to conventional engine vehicles. For continuous high speed highway use these features are much less useful in reducing emissions.

4. 2Vehicle Emissions

According to the EPA (Environmental Protection Agency), the recommended level for a typical passenger should equate to 5. 5 metric tons of CO2. However, the three most popular hybrid vehicles have set a new standard by consistently reducing their emissions and surpassing the recommended levels. The vehicles are the Honda Civic, which produces 4. 1 tons SI units,

the Honda Insight at 3. 5 tons SI units and last but not least, the Toyota Prius also being 3. 5 tons SI units of CO2 emissions.

4. 3 Buying a hybrid vehicle

A hybrid car gets a much higher mileage, up to ten percent in some cases, and emits 97% less toxins into the environment than the average car. They are lighter and have a gentler impact on roads and soft terrain. With the price of gasoline soaring, a car that can run on both gas and electricity, depending on the circumstance, is a big advantage. Most people who decide to buy a hybrid car, however, cite a " feel-good factor" as their main reason for buying the car. It is their small way to contribute to a greener world.

Despite all the benefits cited above, a hybrid car also has some downsides. For starters, they are expensive. A hybrid car tends to be more on average of ? 3000, which is sometimes more expensive than a traditional car. They cost more to register, and repair costs tend to be hefty, as the entire car systems are intrinsically connected, and only expert mechanics can handle repairs. Parts may not be readily available, which could mean being without a car for a longer period as you is waiting for it to be repaired.

5. Planning Schedule

Gantt chart:

Conclusion:

The information gathered can be elaborated excessively, though I will quantify the relevant information where necessary. This preliminary report

demonstrates how much of a positive impact hybrid vehicles have and how fuel efficiency in various sectors, such as fossil fuels and global warming can be significantly reduced. As for hybrid vehicles themselves, it illustrates their efficiency in major development, for years to come. They have proven to be more effective than conventional vehicles and although they may be more expensive now, the long term effects are more beneficial.

References:

http://www. ehow. com/how-does_4969688_hybrid-vehicles-function. html#ixzz17erGrIGx

http://en. wikipedia. org/wiki/Hybrid_electric_vehicle#Predecessors_of_current_technology

http://news. carjunky. com/alternative_fuel_vehicles/how-hybrid-cars-work-ab410. shtml

http://www. thegreencarwebsite. co. uk/blog/index. php/environmental-impact-information-tips-and-incentives-on-becoming-a-green-car-driver/ #impact

http://en. wikipedia. org/wiki/Hybrid_vehicle#Fuel_consumption_and_emissions_reductions

http://www. wisegeek. com/should-i-buy-a-hybrid-car. htm