

ELECTRICAL VEHICLE TECHNOLOGIES

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ABSTRACT

The concept of Electrical Vehicle is based on use of sustainable energy which is replaced by non-renewable source of energy into renewable source of energy. We all know that Electrical Vehicle is suitable option for transportation purpose as it can reduce import of crude oil and strengthen our economy. The EV as simple way to reduce the greenhouse effect. The technology used for EV has less complicated design and it reduce the risk of corrosive chemical, toxic fumes, fires and electric shock in the event of crash. The paper introduces some features of electrical vehicle, including studies on government policies, charging methods, key techniques, effect of charging and solution to the related issues. Based on current development status and problems, discuss the trend of EV

Keywords- Electrical Vehicle, Energy Sources, Components Types of Electrical Vehicle

INTRODUCTION

Now days, electric vehicles (EV) are gaining popularity, and the reasons behind this are many. The one of the most is contribution in reducing greenhouse gas (GHG) emissions. In 2009, the transportation sector produces 25% of the GHGs produced by energy related sectors. As a vehicle, an EV is quiet, simple to operate, and does not have the fuel costs associated with conventional vehicles. As an city transport mode, it is highly useful. It does not use any stored energy or cause any production while idling, is capable of frequent start-stop driving, provides the total torque from the startup, and does not require trips to the gas station. It does Not produces either to any of the smog making the city air highly polluted. The instant torque makes it Highly preferable for motor sports. The quietness and low infrared signature make it useful in military use as well. The power sector is going through a changing phase where renewable sources are gaining momentum. EVs are being considered major provider to this new power system comprised of renewable generating facilities and advanced grid systems. All these have led to a renewed interest and development in this mode of transport The first known electric locomotive was built in 1837, in Scotland by chemist Robert Davidson of Aberdeen



Fig1:-Electric Car Built by Thomas Parker, photo from 1895

Mahindra electric mobility limited, formerly known as the Revai Electric Car Company is an Indian company based in Bangalore involved in designing and manufacturing of compact electrical Vehicle. The companies first electric Vehicle was Revai electric car, available in 16 countries with more than 4000 of its different versions and sold worldwide by mid 2011. Electrical vehicle (EV) based on electric propulsion system. No internal combustion engine is used. As the energy source electric

power is used. The main advantage is the high efficiency in power conversion through its electric motor. Recently there has been large research and development work reported in both academic and industry. Commercial vehicle is also available. Many countries have provided incentive to user through lower tax or tax exemption, free parking and free charging facilities. On the other hand, the hybrid electric vehicle (HEV) is an alternative. It has been used extensive in the last few years. Almost all the car manufacturers have at least one model in hybrid electric vehicle. The questions are: Which vehicle will dominate the market and which one suitable for future? this paper is to examine the development of electric vehicle and suggest the future development in the area.

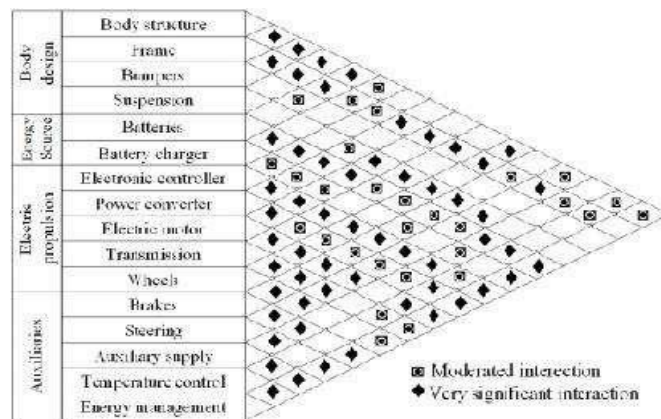


Figure 1. Major EV subsystems and their interactions. Some of the subsystems are very closely related while some others have moderated interactions. Data from [4]

COMPONENTS OF ELECTRIC VEHICLE

- Motor
- Controller
- Charger
- Dc/Dc converter
- Contactor
- Batteries

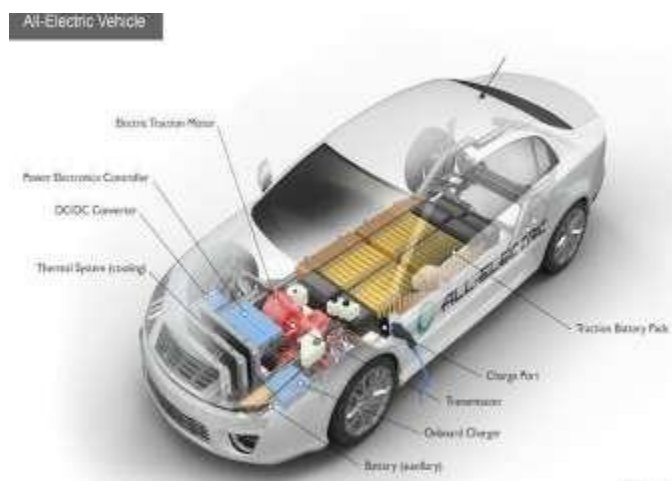


Fig3:-Components of EV

- Generally the BLDC motor is used.

- Simpler to maintain, more durable, smaller.
- 85%-90% more efficient.
- Able to self start.
- Control the BLDC motor.
- Increase efficiency, Reliability and extend.

CONTROLLER-

- Control the BLDC motor.
- Increase efficiency, Reliability and extend.
- Battery life time.



CHARGER-

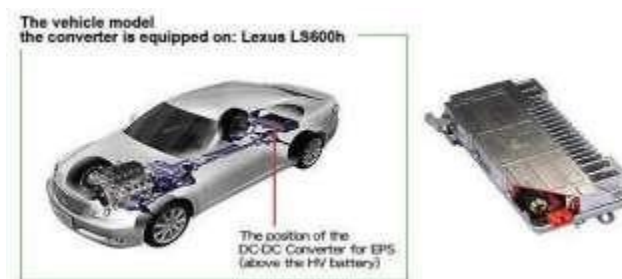
- It contains plug that connects EV batteries to an electric source, providing the batteries with Electric Energy.

DC / DC CONVERTER-



Fig:-EV charger

- Recharges the battery through DC converter

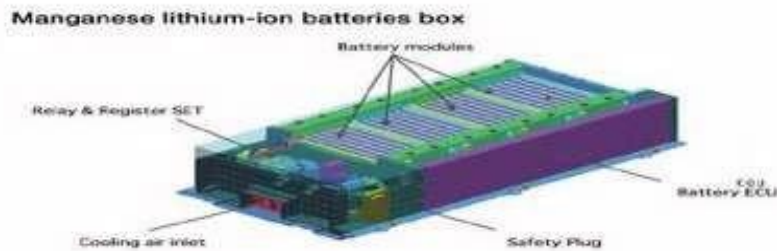


CONTACTORS-

- This is like a big ON switch, powering of drive circuit when we turn the key.

BATTERIES-

- The batteries that are used for electric cars are rechargeable.

**ENERGY SOURCES:-**

The energy storage system in electric cars comes in the form of a battery. Battery type can vary depending on if the vehicle is allelectric (AEV) or plugin hybrid electric (PHEV). Current battery technology is designed for extended life (typically about 8 years or 100,000 miles). Some batteries and can last for 12 to 15 years in moderate climates, or eight to 12 years in extreme climates. There are four main kinds of batteries used in electric cars: lithium-ion, nickel-metal hydride, lead-acid, and Ultra capacitors.

TYPES OF ELECTRIC VEHICLE BATTERIES:-**LITHIUM-ION BATTERIES**

The most common type of battery used in electric cars is the lithium-ion battery. This kind of battery may sound familiar – these batteries are also used in most portable electronics, including cell phones and computers. Lithium-ion batteries have a high power-to-weight ratio, high energy efficiency and good high-temperature performance. In practice, this means that the batteries hold a lot of energy for their weight, which is vital for electric cars – less weight means the car can travel further on a single charge. Lithium-ion batteries also have a low “self-discharge” rate, which means that they are better than other batteries at maintaining the ability to hold a full charge over time. Additionally, most lithium-ion battery parts are recyclable making these batteries a good choice for the environmentally conscious. This battery is used in both AEVs and PHEVs, though the exact chemistry of these batteries varies from those found in consumer electronics.

NICKEL-METAL HYDRIDE BATTERIES

Nickel-metal hydride batteries are more widely used in hybrid-electric vehicles, but are also used successfully in some all-electric vehicles. Hybrid-electric vehicles do not derive power from an external plug-in source and instead rely on fuel to recharge the battery which excludes them from the definition of an electric car. Nickel-metal hydride batteries have a longer life-cycle than lithium-ion or lead-acid batteries. They are also safe and tolerant to abuse. The biggest issues with nickel-metal hydride batteries are their high cost, high self-discharge rate, and the fact that they generate significant heat at high temperatures. These issues make these batteries less effective for rechargeable electric vehicles, which is why they are primarily used in hybrid electric vehicles.

LEAD-ACID BATTERIES

Lead-acid batteries are only currently being used in electric vehicles to supplement other battery loads. These batteries are high-powered, inexpensive, safe, and reliable, but their short calendar life and poor cold-temperature performance make them difficult to use in electric vehicles. There are high-power lead-acid batteries in development, but the batteries now are only used in commercial vehicles as secondary storage.

ULTRA CAPACITORS

Ultra capacitors are not batteries in the traditional sense. Instead, they store polarized liquid between an electrode and an electrolyte. As the liquid's surface area increases, the capacity for energy storage also increases. Ultra capacitors, like lead- acid batteries, are primarily useful as secondary storage devices in electric vehicles because ultra capacitors help electrochemical batteries level their load. In addition, ultra capacitors can provide electric vehicles with extra power during acceleration and regenerative braking.

How do electric car batteries work?

All-electric vehicles have an electric traction motor in place of the internal combustion engine used in gasoline-powered cars. AEVs use a traction battery pack (usually a lithium-ion battery) to store the electricity used by the motor to drive the vehicle's wheels. The traction battery pack is the part of the car that must be plugged in and recharged, and its efficiency helps determine the overall range of the vehicle. In plug-in hybrid electric vehicles, the electric traction motor is powered by a traction battery pack much like an AEV. The primary difference is that the battery also has a combustion engine. PHEVs run on electric power until the battery is depleted and then switch over to fuel which powers an internal combustion engine. The battery, usually lithium-ion, can be recharged by being plugged in, through regenerative braking, or by using the internal combustion engine. The combination of battery and fuel gives PHEVs a longer range than their all-electric counterparts. Charging your vehicle with electricity presents you with the opportunity to cut your greenhouse gas emissions by fueling your vehicle with a renewable resource like solar power. On average 80 percent of electric car charging is done at home, and solar panels can both offset the costs of charging a vehicle regularly and reduce the use of nonrenewable fuels in the recharging process. Additionally, many public chargers use solar panels as a way to reduce the use of nonrenewable energy throughout the process. If you're interested in a solar panel installation plus installing a EV charging station at home, simply.

EV TYPES

EVs can run on ICE working alongside it. Having only batteries as energy source constitutes the basic kind of EV, but there are kinds that can employ other energy source modes. These can be called hybrid EVs (HEVs). The International Electro technical Commission's Technical Committee 69 (Electric Road Vehicles) proposed that vehicles using two or more types of energy source, storage or converters can be called as an HEV as long as at least one of those provide electrical energy. This definition makes a lot of combinations possible for HEVs like ICE and battery, battery and flywheel, battery and capacitor, battery and fuel cell, etc. The EVs can be categorized as follows:

- (1) Battery Electric Vehicle (BEV)
- (2) Hybrid Electric Vehicle (HEV)
- (3) Plug-in Hybrid Electric Vehicle (PHEV)
- (4) Fuel Cell Electric Vehicle (FCEV)

Battery Electric Vehicle (BEV)

EVs with only batteries to provide power to the drive train are known as BEVs. BEVs have to rely solely on the energy stored in their battery packs; therefore the range of such vehicles depends directly on the battery capacity. Typically they can cover 100 km–250 km on one charge, whereas the top-tier models can go a lot further, from 300 km to 500 km . These ranges depend on driving condition and style, vehicle configurations,

road conditions, climate, battery type and age. Once depleted, charging the battery pack takes quite a lot of time compared to refueling a conventional ICE vehicle. It can take as long as 36 h completely replenish the batteries, there are far less time consuming ones as well, but none is comparable to the little time required to refill a fuel tank. Energies 2017, 10, 1217 4 of 82 Charging time depends on the charger configuration, its infrastructure and operating power level. Advantages of BEVs are their simple construction, operation and convenience. These do not produce any greenhouse gas (GHG), do not create any noise and therefore beneficial to the environment. Electric propulsion provides instant and high torques, even at low speeds. These advantages, coupled with their limitation of range, makes them the perfect vehicle to use in urban areas; as depicted in Figure 2, urban driving requires running at slow or medium speeds, and these ranges demand a lot of torque. Nissan Leaf and Teslas are some high-selling BEVs these days, along with some Chinese vehicles. the wheels are driven by electric motor(s) which is run by batteries through a power converter circuit.

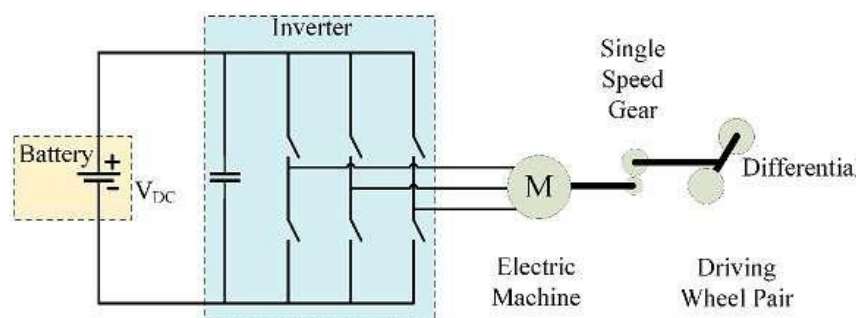


Figure 3. BEV configuration. The battery's DC power is converted to AC by the inverter to run the

Hybrid Electric Vehicle (HEV)

HEVs employ both an ICE and an electrical power train to power the vehicle. The combination of these two can come in different forms which are discussed later. An HEV uses the electric propulsion system when the power demand is low. It is a great advantage in low speed conditions like urban areas; it also reduces the fuel consumption as the engine stays totally off during idling periods, for example, traffic jams. This feature also reduces the GHG emission. When higher speed is needed, the HEV switches to the ICE. The two drive trains can also work together to improve the performance. Passing needs a boost in speed, therefore the ICE and the motor both drives the power train. During braking the power train runs the motor as generator to charge the battery by regenerative braking. While cruising, ICE runs the both the vehicle and the motor as generator, which charges the battery. The power flow is stopped once the vehicle stops. Figure 5 shows an example of energy management systems used in HEVs. The one demonstrated here splits power between the ICE and the electric motor (EM) by considering the vehicle speed, driver's input, state of charge (SOC) of battery, and the motor speed to attain maximum fuel efficiency

Plug-In Hybrid Electric Vehicle (PHEV)

The PHEV concept arose to extend the all-electric range of HEVs. It uses both an ICE and an electrical power train, like a HEV but the difference between them is that the PHEV uses electric propulsion as the main driving force, so these vehicles require a big battery capacity than HEVs. PHEVs start in all electric modes, runs on electricity and when the batteries are low in charge, it calls on the ICE to provide a boost or to charge up the battery pack. The ICE is used here to extend the range. PHEVs can charge their batteries directly from the grid (which HEVs cannot), they also have They consume less fuel as well and thus reduce the associated cost. The vehicle market is now quite populated with these, Chevrolet Volt.

Fuel Cell Electric Vehicle (FCEV)

FCEVs also pass the name cell Vehicle (FCV). They got the name because the guts of such vehicles is fuel cells that use chemical reactions to supply electricity. Hydrogen is that the fuel of choice for FCVs to hold out this reaction, in order that they are often called 'hydrogen cell vehicles'. FCVs carry the hydrogen in special high pressure tanks, another ingredient for the power generating process is oxygen, which it acquires from the air sucked in from the environment. Electricity generated from the fuel cells goes to an electrical motor which drives the wheels. Excess energy is stored in storage systems like batteries or super capacitors. An advantage of such vehicles is they can produce their own electricity which emits no carbon, enabling it to reduce its carbon footprint further than any other EV..

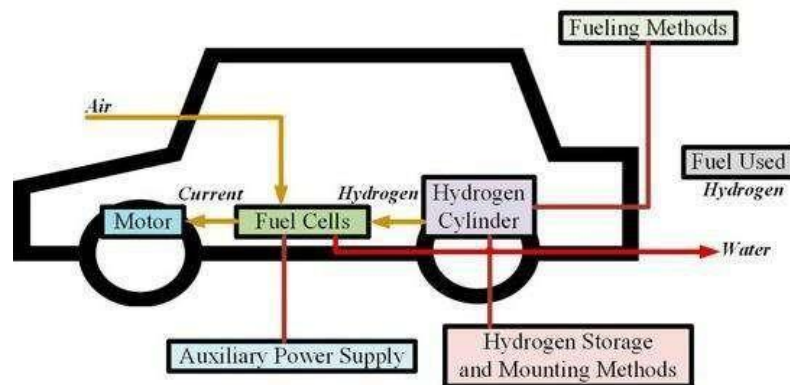


Fig4. FCEV configuration

ADVANTAGES OF ELECTRIC VEHICLE :-

- I. **No Gas Required:** Electric vehicles are entirely charged by electricity which provide by you, meaning you don't need to buy any gas ever again.
- II. **SAVINGS:** These vehicles can be fuelled for very cheap prices and many new cars will offer great incentives for you to get money back from the government for going green.
- III. **NO EMISSIONS:** Electric vehicles are 100% ecofriendly as run on electrically powered in engines. it does emit toxic gaseous or smoke in environment as it runs on clean energy source.
- IV. **SAFE TO DRIVE:** Electrical vehicle undergoes same fitness and testing procedures test as other fuel power cars in case accident occurs, one can accept air bags to open an electricity supply to cut from battery .this can prevent you an others passengers in cars from serious injury
- V. **COST EFFECTIVE:** Earlier owning an electric vehicle would cost a bomb. But with more technological advancement, both cost maintenance has gone down.

DISADVANTAGES:-

- I. **RECHARGE POINTS:-** Electric fueling stations are still in developing stages. Not a lot of places you can go daily basis will have electric fueling stations for you vehicle that means if you are on long trip and run out of a charge, you may stuck where you are.
- II. **ELECTRICITY ISN'T FREE:-** Some time electric vehicle require a huge charge in order to function properly so it reflect on your electricity bill on each month.
- III. **SHORT DRIVING RANGE AND SPEED:-** Electric vehicle are limited by range and speed. most of these vehicle have range about 50-100 miles and need to recharged again .

IV. **LONGER RECHARGE TIME**:-As electric vehicle take about 4-6 hrs to get fully charged. Therefore you need lot of power stations.

V. **BATTERY REPLACEMENT**:-Depending on the type and use of batteries of all electric vehicle are to change every 3 to 10 years.

CONCLUSION & FUTURE WORK

The paper discusses the development of in electric vehicle. The paper first describes basic concept, types and discusses the energy sources. Important to produce vehicle that do less, have a longer range, and use less energy. Lower our toxic emission and localize green house effect. Lithium ion battery technology has been developing rapidly.especially at the cell level, but cost is still high. Cost of an electric vehicle manufactured is very high so we need new system to reduce a cost.

Many different approaches have been proposed to enhance our understanding of fundamental vehicle system performance challenges ,but among the entire types vehicle, each control technique has its advantages and disadvantages.

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