

2020

A report on ELECTRIC VEHICLES



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I-Abstract

The latest technology or latest trend that we are experiencing today in automobile sector is about electric vehicle. As pollution rate is increasing drastically, many environmental organizations are suggesting that shifting from internal combustion engine to electric vehicle will not only reduce the consumption of fossil fuel but also it will reduce the poisonous gases in air.

What is an electric vehicle? Electric vehicle is a type of vehicle which uses electricity as a source to power electric motor. This sounds good but switching complete world to electric vehicle is a challenging task because the mileage and battery backup that we get in electric vehicle is very less when compared to internal combustion engine vehicles but building up a battery that gives equal competition to ICE is another challenging task. There are many type of electric vehicle we have they are Hybrid electric vehicle and battery based electric vehicles. What is a hybrid vehicle? A vehicle that uses both fuel and battery as a source to power itself, whereas battery based electric vehicles uses battery as a source.

Then, you can have a question that why we are using hybrid vehicles? The answer to this question can be that hybrid vehicles was discovered so that instead of directly switching to fully electric vehicles, a person should get habituated to mechanism and working process of electric motor. In hybrid vehicle, electric motor will rotate the axials not the internal combustion engine because IC engine is not directly connected to motor it is connected to various operators in between. And there are various methods of improving battery system in fully electric vehicles that will be discussed in the report further.

II-Illustrations:

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III - Introduction

Are you worried about air pollution in today's world? If yes, then you should know about electric vehicles. What is an electric vehicles? Electric vehicle are a type of vehicles which use electricity to run the motor. Or vehicle which uses battery as a source to run the mechanism. This type of vehicles are eco-friendly and operate with zero emission. In this report you will about hybrid vehicle and electric vehicles and you can come to the conclusion that "How present electric vehicle can be developed so that it can dominate Internal Combustion Vehicles (ICV) and hybrid vehicles. But, in today's market Electric vehicles are very expensive and their mileage is very less when compared to Internal combustion cars and hybrid cars. Electric cars have many advantage i.e. you need to spend very less on the electricity bills, even some countries are providing free charging points for electric cars owners, so that they can attract many people towards electric cars.

1.1. Scope of the report:

This report will refer to the latest scenario of electric vehicle in market and how automobile sector is attracting or giving awareness to customers about electric vehicles. This report has also considered the ideas and question of many people from which more efficient solution is mentioned.

1.2. Problem statement

The main problem that today's electric market facing is on battery backup. There are lots of changes made in battery system from late 90s to present world of automobile, but still batteries are not performing upto the mark. The main problem is that arrangement of battery cells or grids which loses its conductivity or division layer after a long use. And one more problem is that people have very less knowledge on electric vehicles.

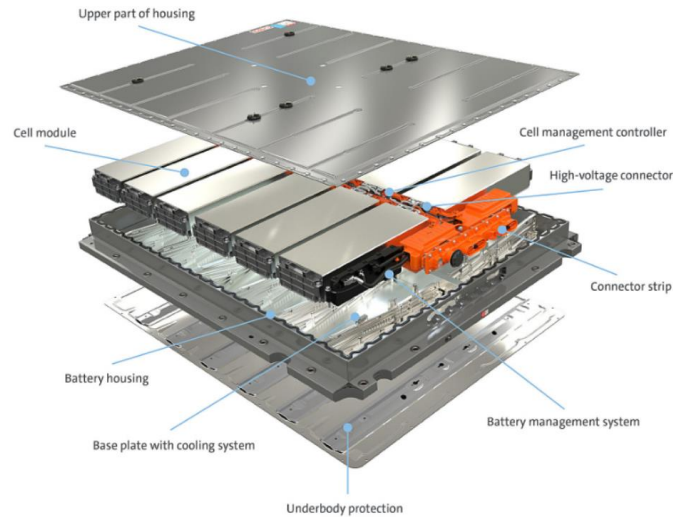


Fig: 1

[Source: <https://www.newmobility.global/e-mobility/volkswagen-group-components-produces-battery-systems-evs-built-meb-platform/>]

1.3.Outline of the report

In this report we will be discussing about the battery management system in various types of electric vehicles.

- Firstly, we will discuss about the structure and advantages of various types of electric vehicles followed by their capabilities.
- Secondly, we will discuss about what all developments are going on and what all can be done to improve the structure and performance of the vehicle.
- Finally, we will conclude that on “Will electric vehicles compete with internal combustion vehicle and hybrid vehicle.

IV -LITERATURE REVIEW

2.1 History of electric vehicles:

Electric vehicles have come into picture from late 1880s [16], experiments on electric vehicle was accelerated after the invention of lead-acid battery with rechargeable facility and there were many improvements which greatly increases the capacity of such batteries and lead directly to their manufacture on an industrial scale. Interest in motor vehicle drastically increased in late 1890s and by 1900s electric vehicles made themselves as part of common life in our society like all the taxis we electrically powered and many more. [16]Electric vehicles had a number of advantages over there 1900s competitors because they did not have noise, smell and they don't eject harmful carbon gases and the cost of maintenance is very less.

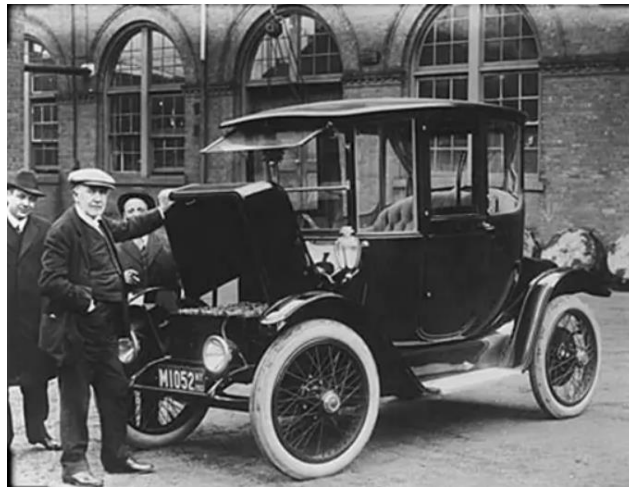


Fig: 2

[Source: <https://en.wikipedia.org/wiki/File:EdisonElectricCar1913.jpg>]

Electric vehicle were also preferred because they did not require manual effort to start. Electric vehicle were marked as suitable vehicle for women because these are light-weight and easy to control. Acceptance of electric cars was initially hampered by a lack of power infrastructure, but

by 1912, many homes were wired for electricity, enabling a surge in the popularity of cars. In US by turn of the century, 40% of automobiles were powered by stream, 38% by electricity, and 22% by gasoline. A total number of 33,842 electric cars were registered in US and US the only country that gain a lot acceptance on electric vehicles. As the demand of electric vehicles was increasing day by day, the electricity that was supplied was getting insufficient, by which Hartford Electric Light Company through the GeVeCo battery service for electric trucks[16]. From this what happen is that the customer has to buy the vehicle from the company without battery and he has to buy the battery or power from General Vehicle Company which was paid based on how many miles you are travelling.

[16]After 1920s the number of oil refineries increased and the cost of petrol, diesel which decreased the purchase cost, by which the cost of gasoline vehicles have come down. From here people changes there mind about electric vehicles. Soon, the situation has become critical for the electric automobile sector that they have to close the production for the electric vehicle.

V- Methodology and Technology

The methods that are to be implemented depends on type of vehicle we are taking into consideration, that may be your EVs, HEV, ICV etc.. Let us consider all type of models and there methods.

3.1 Battery Electric vehicle(BEV's) :

These Battery Electric vehicle are fully-electric vehicles come with rechargeable battery and they do not contain any type of internal combustion engine inside them. Instead of that they use electric motor.[2] These type of vehicles contains a large size of battery packs with can run the vehicle.

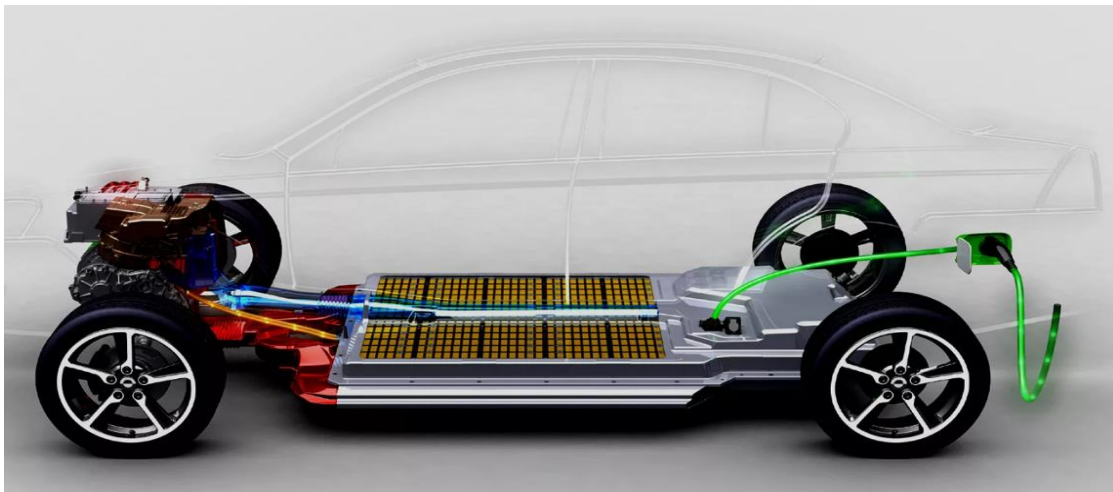


Fig:3

[Source: Google images]

As battery packs are large, they will take more time to get fully charged. Keeping this in mind all automobile industry developers have optimized the battery and life and charging time. They have categorized charging in three levels i.e. Level-1, level-2, level-3.

Level-1 charging: This type of charging requires 120V of power i.e. the power that is supplied to our household. Level-1 charging takes around 8-hours to charge a battery pack, will support a mileage of 75-80 miles of distance of travel. This type of charging is done typically when your vehicle is parked at home. And Level-1 charging is supported by all types of vehicles in present market.

Level-2 charging: This type of charging is found in large work stations and requires a power supply of around 240V, to support mileage of 75-80miles of distance. The time duration is charge is 4 hours. Which was made possible by building some charging stations. A automobile company called “Volkswagen” is working on smart Level-2 charging stations in which you have just go and park your car in the charging station and robots will come and charge you cars and the bill will be

pasted near your plug-in switch. This process will be successful only when there are more electric vehicles on road.

Level-3 charging: This is DC fast charging or a fast charger that can charge your battery pack in very less time and will support a distance of around 80-90 miles of distance in single charge. But this technology is a bit costlier than the above two mentioned Levels of charging. And there are very less fast charging stations.



Fig: 4



Fig: 5



Fig: 6

[Source-4, 5, 6: Google images]

3.2 Hybrid Electric Vehicles (HEV):

There are six types of hybrid electric vehicles

Note: Here inverted part can be replaced by controller because it acts as both power controller as well as sensor board.

3.2.1 Series Hybrid vehicles:

This category is very much used to power light vehicles like scooters, small passenger cars because this structure is not that responsive for heavy duty vehicles. Whatever the type of hybrid vehicle you consider, the engine is never directly connected to axial. [3] In this mechanism internal combustion engine is connected to a generator which is connected to a charger or a controller which controls the mechanism. Here there are two stages of operation i.e. firstly, the mechanism

operates in fully electric mode in which electric motor is powered by the battery till it is fully discharged. When the battery is discharged the second stage comes into picture in which the engine starts and empowers the generator which supplies the power to both battery as well as the electric motor.

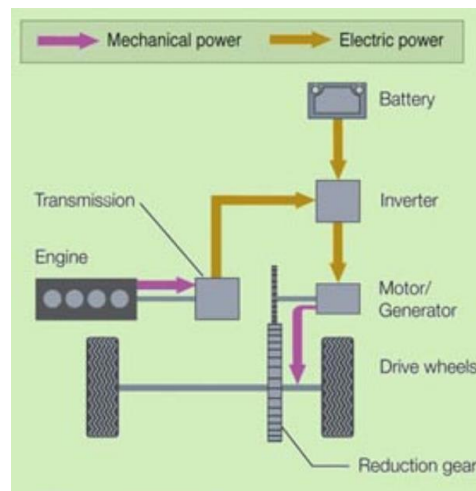


Fig: 7

[Source: http://autocaat.org/Technologies/Hybrid_and_Battery_Electric_Vehicles/HEV_Types/]

3.2.2 Parallel Hybrid vehicles:

In this category of vehicle was developed to fulfill the requirement for 4X4 vehicles in the market. This mechanism is powerful than series hybrid because in series the power source is only a battery whereas here when more power is required, both electric motor and internal combustion engine both run the axial simultaneously.

[4]In this mechanism generator is not included because whenever there is a requirement for generator the electric motor rotates in anti-clockwise direction and generates the power to charge the battery mean while internal combustion engine rotates the axial.

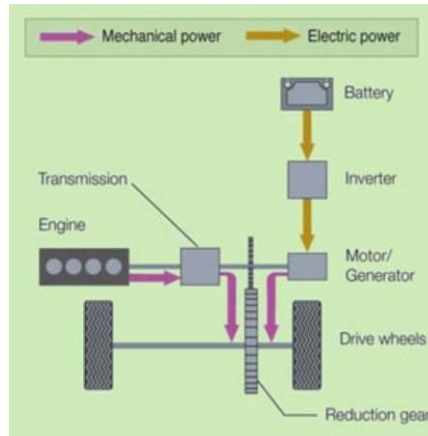


Fig: 8

[Source: http://autocaat.org/Technologies/Hybrid_and_Battery_Electric_Vehicles/HEV_Types/]

3.2.1 Series-parallel Hybrid vehicles:

This mechanism is the combination of both series and parallel hybrid mechanism. This mechanism has increased the efficiency of the electric vehicles. There are three mode in which this mechanism can work.

Fully electric mode: when the battery is fully charged, electric motor takes power from the battery and rotates the axial.[5]

(Here internal combustion engine is used to charge the battery with the help of generator).

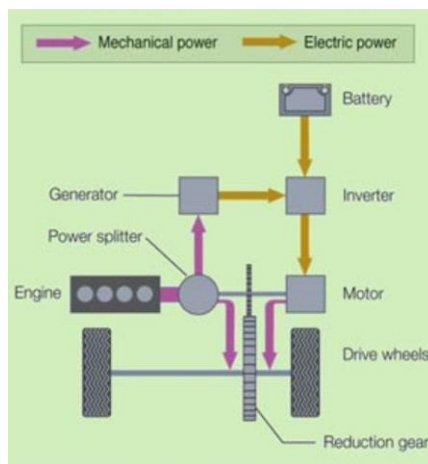


Fig: 9

[Source: http://autocaat.org/Technologies/Hybrid_and_Battery_Electric_Vehicles/HEV_Types/]

Engine only: When the battery gets discharged, sensors will turn on the internal combustion engine and with the help of power splitter, the axial is rotated as well as generator transmits power to battery. (This mechanism will continue till the battery is fully charged, once the battery is charged, engine will be shut down and electric motor will run the axial).

Engine assist: This mechanism comes into picture when maximum power is required to move the vehicle forward. For example: when you drive your car on an inclined road, at that time battery power is insufficient to push the car forward, that is why engine is turned on to fulfill the required power for the car.

3.2.3 Plug-in Hybrid vehicles:

All type of hybrid type that are explained above are charged with the help of generator. But this mechanism are only possible when the vehicle is on or in running position. [7] This problem was rectified and automobile industry made an option of charging the battery with external sources. The benefit with this is that when you are not using the vehicle, your battery can still be charged by adding a plug-in source. So, that usage of fossil fuel can be minimized.

This was the first step towards non-internal combustion engine vehicles and this type of vehicles are now encouraged by all the industry experts and central governments of various countries.

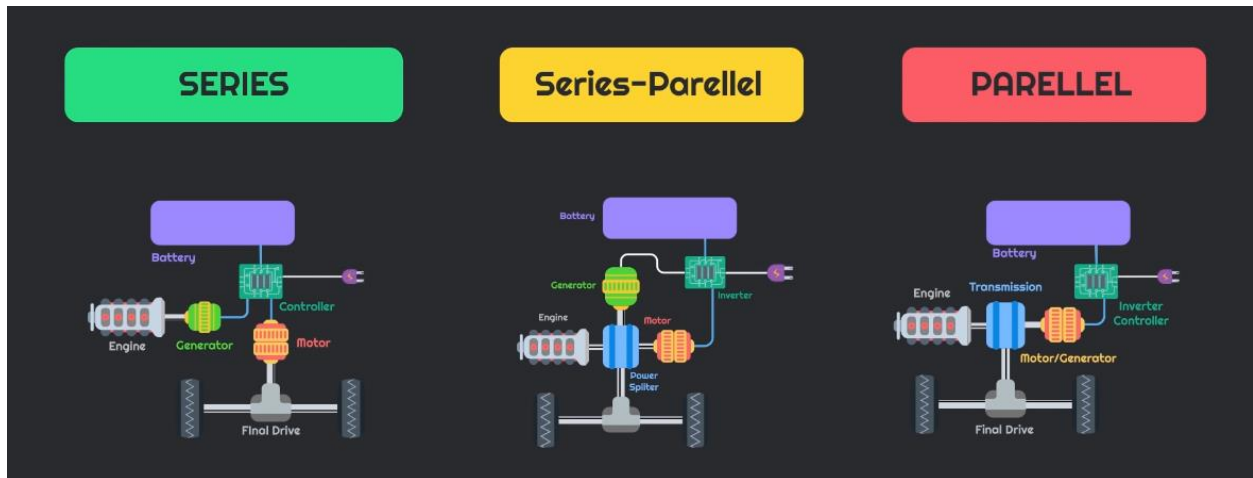


Fig: 10
[Source: YouTube video]

VI-Results & Conclusion

This study says that there are many developments going on in electric vehicles in present market and industry experts are coming up with many new technology that is from a basic electric car to present modern electric car which has a capability of 90% efficiency of electric motor.

There are many questions that I have asked to people about the knowledge that they have regarding electric vehicle and their future expectations on electric vehicles.

Conclusion improvement on battery system:

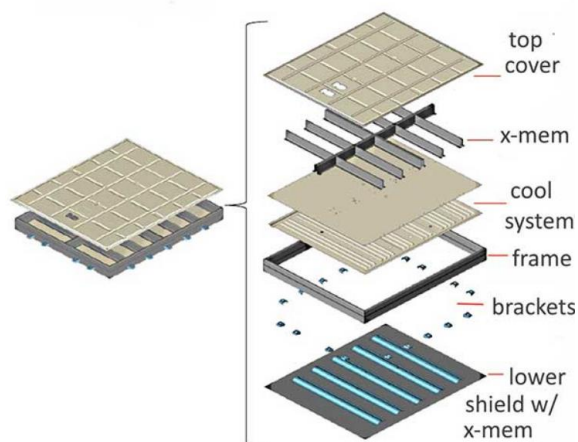


Fig: 11

There are 4 ways to improve battery performance and life

1) Protecting battery from overheating:

In this process battery is operated under a particular temperature difference i.e. +20 Celsius to +30 Celsius. This battery system was equipped with temperature sensors that will monitor the temperature and alert the driver.

2) Controlling state of charge and state of health:

This section will give the user the readings of battery level that will help him to decide how much distance the vehicle can travel.

State of charge: This will show the charging level of battery

State of Health: This is measurement of battery ability to store energy.

3) Balancing cell status :

Battery system contains small batteries in them, in which long conducting strings are connected in series if the battery is in use from long time then this balancing cell system will help the cells from overstress. By doing this the backup of the battery is improved.

4) Tolerance setting:

You all know that batteries inside a pack are connected in series, if one of the cell is degraded or defected the cell before that have a tendency for over charging. So this system will help the battery system to switch to the pack in which the cells are not damaged. \

VII-References list

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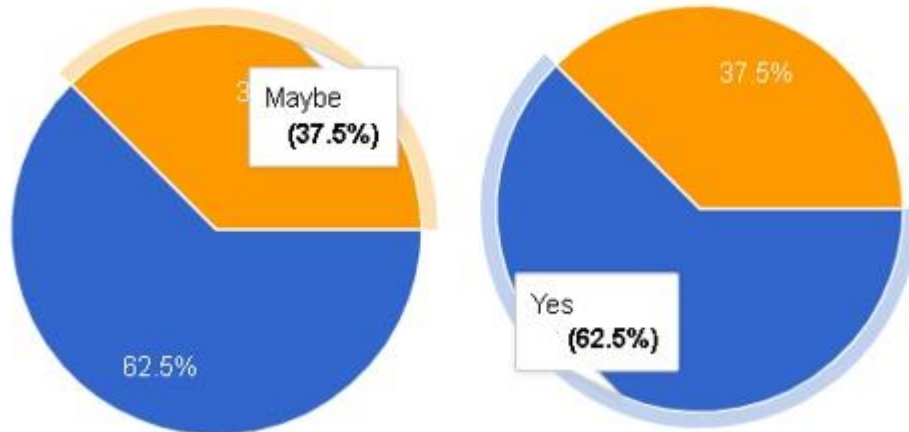
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VIII-APPENDIX

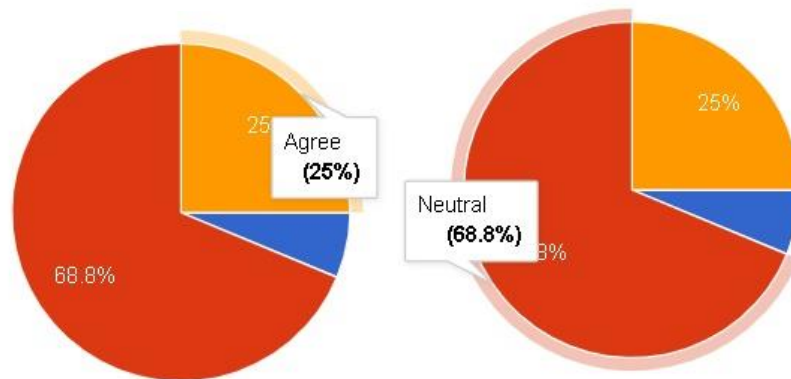
1.1: Analysis of knowledge of people on electric vehicles

Here are the results of some questions.

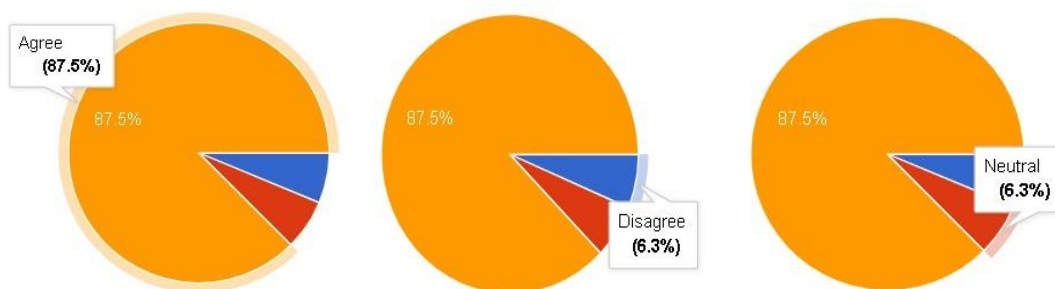
- 1) Do you think electric vehicles are much quieter than other vehicles?



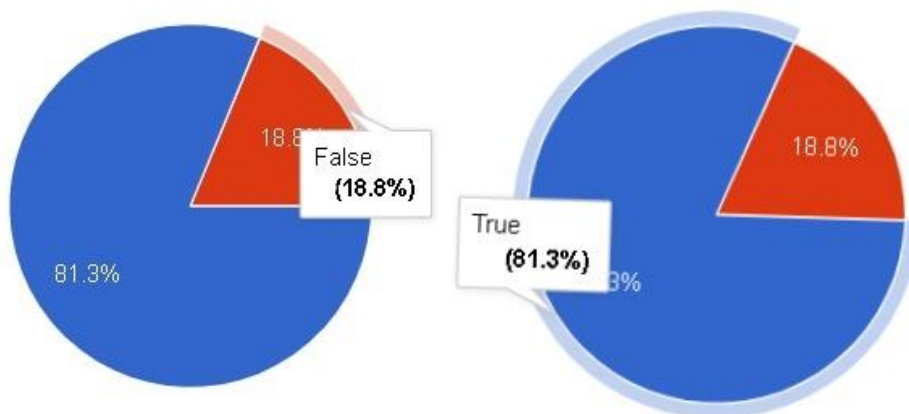
- 2) Do electric vehicles have excellent acceleration as compared to IC engine vehicles?



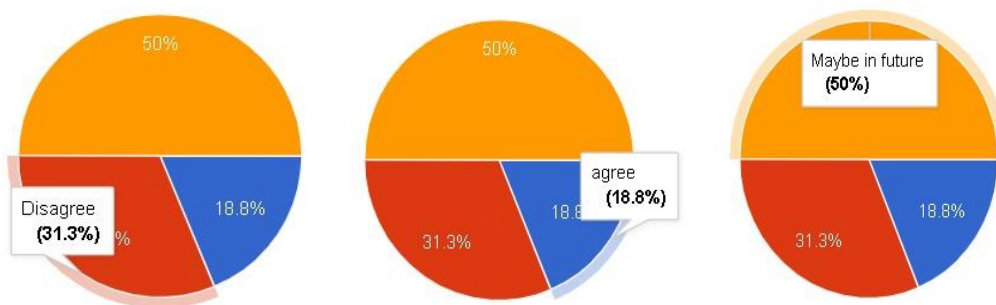
- 3) Is it true that Electric vehicles are environmentally friendly because they have zero emissions?



- 4) The cost to charge an electric vehicle is much less than the fuel costs for a petrol or diesel vehicle?



- 5) Electric vehicles cost about the same to buy as petrol or diesel vehicles?



- 6) Electric vehicle technology has improved and they now have a much better range?



The above analysis tells us that the knowledge about electric vehicle in our society is very less and automobile sector and government of all country should take initiative to spread awareness among the present generation.

1.2 Vehicle cost structure

Cost of electric vehicle depends on the model that the customer is selecting like whether it is a 4-wheel drive or 2-wheel drive.

Component group	Component / specification	Time range (Today = 2013)	Units	Vehicle types
Energy storage	High voltage traction battery	Today to 2030	EUR or EUR/kWh	BEV PHEV FCEV
	Fuel tank CNG tank Hydrogen tank	Today to 2030	EUR or EUR/kg fuel	ICEV FCEV
Powertrain	Power electronics Charger Converter	Today to 2030	EUR or EUR/kW	BEV PHEV FCEV
	Electric motor Fuel cell ICE & ICE parts	Today to 2030	EUR or EUR/kW	All
Vehicle body	Interior parts Exterior parts Electronics and systems	Today	EUR or EUR/kg	All
Materials	Metals CFRP Plastics	Today	EUR/kg	All
Manufacturing and additional costs	Vehicle assembly Manpower Distribution costs, margins	Today	EUR or EUR/h	All

Fig: 12 [Source: 14 reference]

BEV: Battery Electric Vehicle with a battery capacity of 20 to 40 kWh

PHEV: Plug-in Hybrid Electric Vehicle with a battery capacity of 5 to 10 kWh

FCEV: Fuel Cell Electric Vehicle

ICE: Internal Combustion Engine;

ICEV: Internal Combustion Engine Vehicle

CNG: Compressed Natural Gas.

1.3 Cost of batteries in coming years

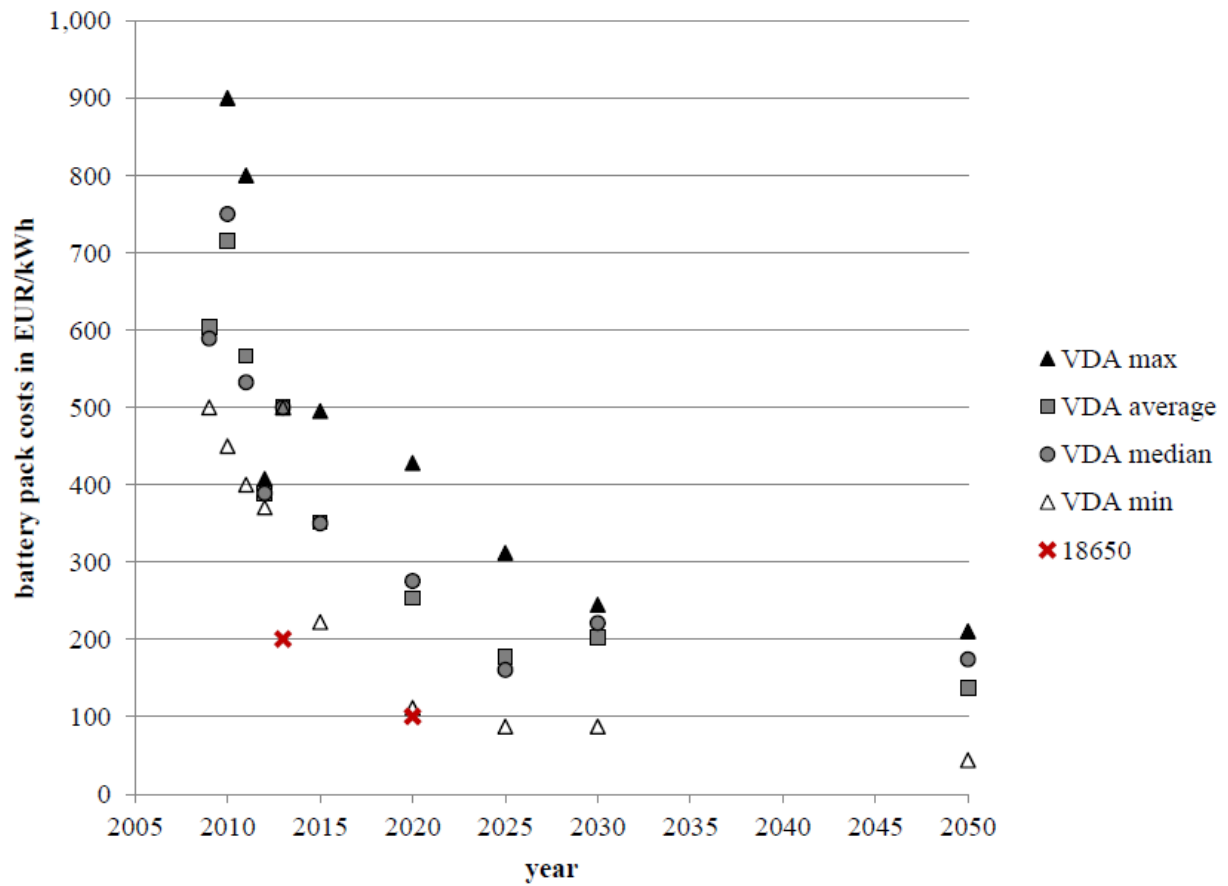


Fig: 13[Source: 14 reference]