LATEST ADVANCEMENT IN ELECTRIC VEHICLE

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ABSTRACT

Nowadays the use of electrical vehicles (EV) has increased. Because of that the fuel energy consumption has been decreased. EV are the best alternative with respect to bad environmental effects and change in climate. In this paper different areas are covered related to EV such as types of EV which are mainly classified into three categories plug-in-hybrid electric vehicles (PHEVs), hybrid electric vehicles (HEVs), Battery electrical vehicles (BEVs). Analyze different functionalities in EV and discuss about the latest developments and upcoming challenges in EV technology. We conclude with the recent progress in areas of battery efficiency, battery storage size, affordability, sustainability can be resolved.

Keyword: Latest developments in EVs, Hybrid EVs, Plug-in-hybrid EVs, Battery EVs, EVS innovations.

1. INTRODUCTION

The automobile industries are playing an important role in enhancing the human lifestyle. In the case of using conventional vehicles it affects on the environment due to decreasing amount of fossil fuels and reducing the greenhouse gases (GHG) [1]. Because of that the researcher are paying attention on utilization of renewable energy in more number. Renewable energy system is the best alternative to the conventional form of energy. Many automotive industries are doing new innovations in the sector of EV technology. The development has been done in many cities all over the world [2]. Recently in EV technology, mainly working on battery charging-discharging time, lifespan of the battery, reducing battery size, increasing vehicle speed. The concept of rechargeable batteries in EV give the huge progress in few years [3]. Number of batteries has been studied such as lead acid, niMH, lithium ion batteries and tested for EV [4]. After testing lithium ion was the most suitable battery for EV. This battery has high efficiency, high energy density and the life of the battery is more then any other battery [5]. One more advancement is that is charging of the battery with the help of renewable energy system, because of this charging cost of the battery has reduced [6]. In the recent years research has been made to fulfil the various challenges which are coming in in EV technology. The working of EV on charging of battery using renewable generation and charging through the gird is the next step to advancement. In this work researcher are doing experiment to examine the possible impact on power system because of charging EV load [7]. Now in section 2 there is the main categories of EV in detail. After that in section 3 there will be the comparison of different functionality in EV. In section 4 there will be the summary of latest advancement of EV technology and finally section 5 will be of conclusion.

2. CATEGORIES IN ELECTRICAL VEHICLES

Table 1. Categories in EVs

Vehicles Category	Utilize Conventional Engine	Manner in which to Charge Battery
HEV	YES	On internal board
PHEV	YES	On internal board or External loading
BEV	No	External loading

Recently in manufacturing of EV, three principle electric categories come from the start that is preparation phase to end which is production phase.

A. HYBRID ELECTRIC VEHICLE:

Hybrid electric vehicles (HEVs) that combines a conventional internal combustion engine (ICE) system with an electric propulsion system. As there is the electric propulsion system combine, the fuel economy is much better than the conventional. The configuration of the HEV is given in fig. 1 [8].

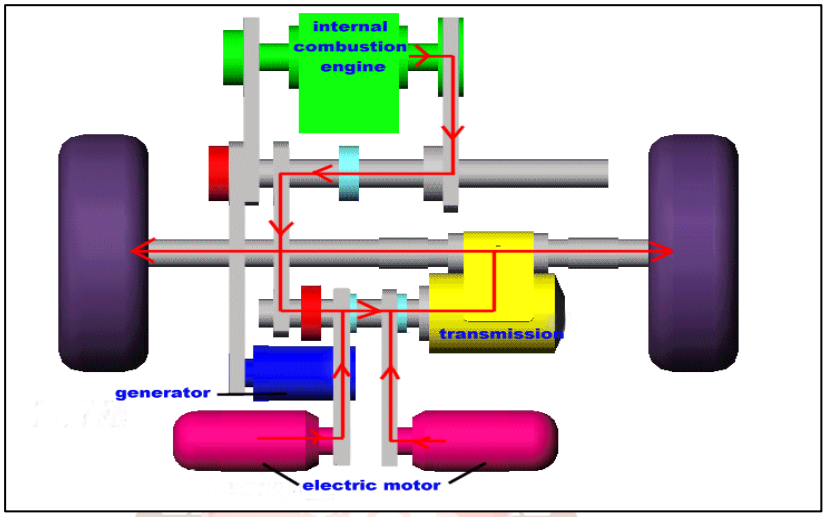

Figure. 1. Diagram mechanism of a HEV

B. BATTERY ELECTRIC VEHICLE

Battery electric vehicle (BEVs) are pure electric vehicles, that exclusively use chemical energy stored in rechargeable battery packs. In this vehicle main parts are electric motor, battery pack and power controller which is shown in fig. 2 [9].

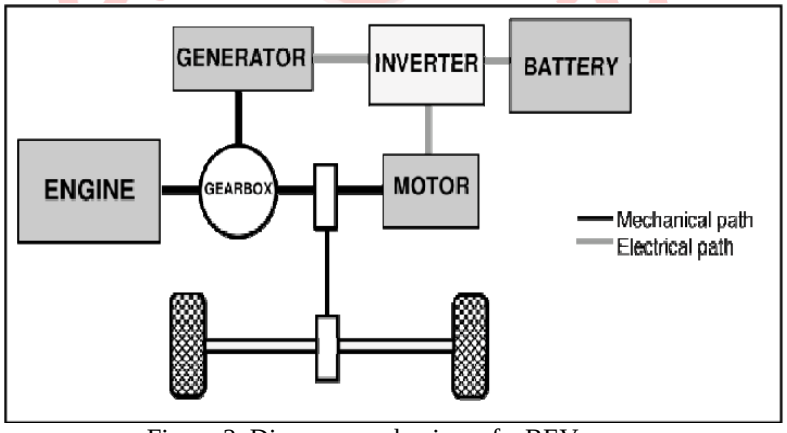

Figure.2. Diagram mechanism of a BEV

C. PLUG-IN-HYBRID ELECTRIC VEHICLE

A plug-in-hybrid electric Vehicle(PHEVs) is the hybrid type electric vehicle in which battery can be recharged by plugging it into an external source of electric power, as well as by its on-board engine and generator. In that it is consist of double motorization, ICE and battery pack shown in fig. 3[10].

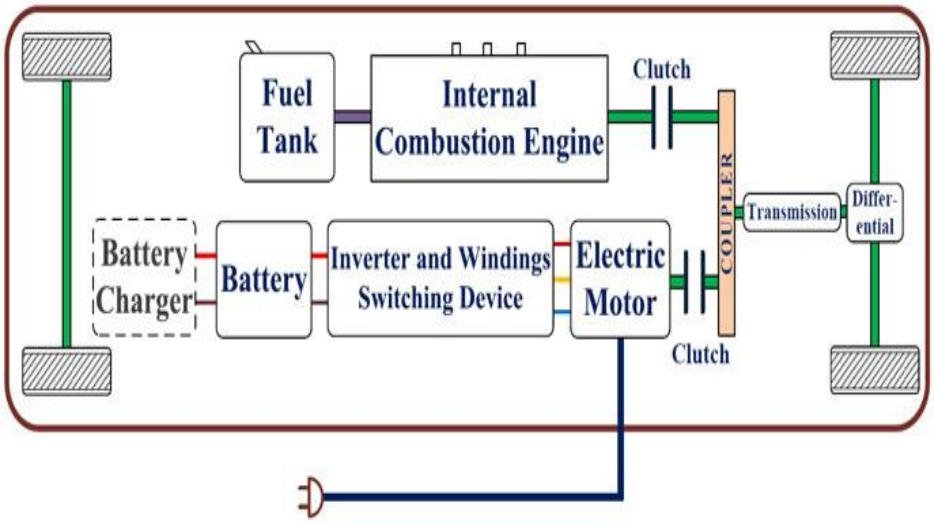

Figure.3. Diagram mechanism of a BEV

3. ANAIYSIS OF DIFFERENT FUNCTIONALITY IN EVs

As shown below table 2 is the analysis and comparison of technical specifications of different EVs. And table 3 shows the fuel economization [11-12].

Table 2: Analysis and Comparison of Technical Basic Functionalities

Vehicles Category	Operation mode	Battery type	Maximum driving distance (km)	Maximum speed (km/h)
HEV	Charging assisting	NiMH	900-1200 (hybrid)	170
PHEV	Charging assisting	NiMH	20-60 (electric)	160
PHEV	Mixed mode	Li-ion	900 (hybrid)	160
BEV	Charging depleting	Li-ion	120-400	80-200

E-ISSN NO:2349-0721

Table 3: Analysis and Comparison of fuel consumption and CO2 Emissions

Vehicles Category	Electricity consumption (kwh/km)	Well-to-wheel fuel economy (1/100 km)	CO2 emission (gCO2/km)
HEV	NA	4.7	109
PHEV	0.225	5.68	132
BEV	0.175	3.77	88

4. RECENT TECHNICAL ADVANCEMENT IN EV TECHNOLOGY:

A. BATTERY ADVANCEMENT:

An EV battery is a battery used to power the electric motor. These batteries are mainly lithium ion batteries. These batteries are designed for high ampere-hour capacity. It takes 7 hours to charge for the 300 miles range, because of that user get disappointed by using EVs. Moreover to use EV, recently some progress has been done to increase charging time. Now 90 miles of range EV takes 30 minutes to charge with the help of fast DC charger. Fig. 4. Shows cost targets of different manufacturers upto the year 2022 [13].

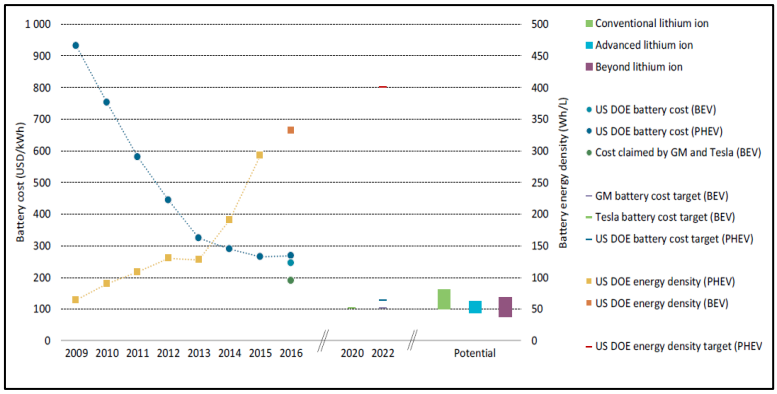

Figure. 4. Peaks reached of battery cost and energy density

B. ADVANCE BATTERY RECHARGING METHODS:

VEHICLE TO GRID (V2G)

The topic of V2G is certainly not far away from the EVs, V2G technology presented as a system that offers an ability of controllable, duplex electrical energy between the EV and the electrical network. On average, a vast majority of vehicles remain parked a long period per day on the same reserved space; the V2G corresponds to the idea, of using the batteries of EVs during these long parking areas, to store the energy produced, at times when the demand is lower than the electricity produced and reinject it into the network, when the demand is higher than the quantities produced . The developments and uses of this system could help regulate electricity flows and integrate RESs into the grid, by increasing the reserve capacity of the national grid operator and by eventually eliminating power plants, used during peak electricity consumption that produces highly carbonaceous electricity.

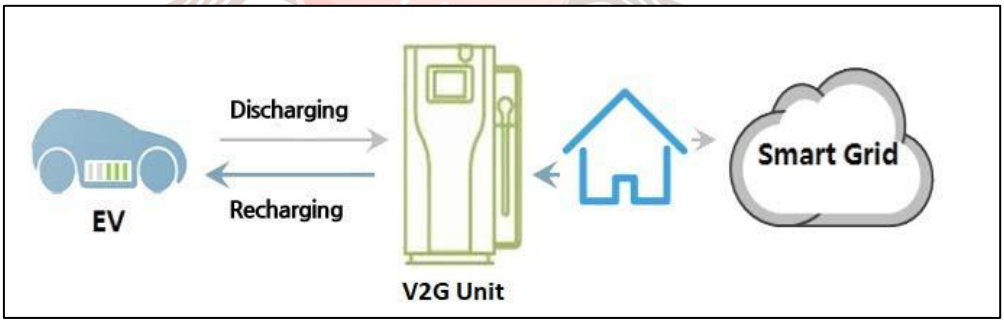

fig. 5. V2G Technology

ENERGY STORAGE WITH HYDROGEN:

This option is required to charge the EVs directly from RESs to the vehicle, indirectly with hydrogen integrated energy storage system based on hydrogen storage. Hydrogen is one of the most abundant elements of the planet and has the highest energy per mass of any fuel. For the reason that hydrogen produced on a large scale to play a significant part in the energy transition. Solar energy / H_2 hybrid systems are innovative solution to the issue of storage RESs.

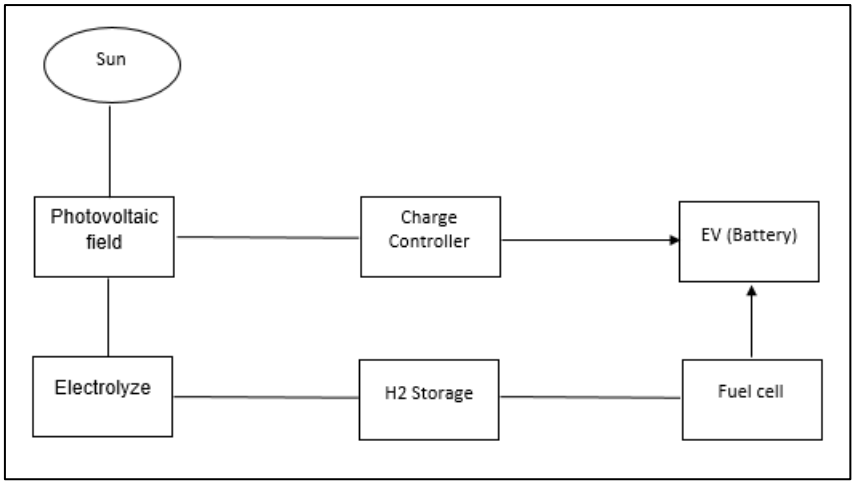

Fig. 6. Solar hydrogen production and storage process

5. CONCLUSION

In this paper all the areas regarding EV technology has been covered such as categories of EVs, their basic functionalities, fuel economy, CO2 emission factor and the latest technical development in EV such as battery enhancement, V2G, energy storage with hydrogen. There are three basic categories that are HEVs, BEVs, PHEVs in detail. There was the analysis and comparison between main three basic types of EVs in which HEVs are the batter option because it offers higher driving distance compared to other two it is due to the existence of internal combustion engine.

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IEJRD
E-ISSN NO:2349-0721