

Plug In Hybrid Electric Vehicle

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A plug-in hybrid electric vehicle is a vehicle mainly consist of a diesel engine with a motor and a battery. Usually, it operates on battery but as we know the range of the battery is limited that's why we need a diesel engine with a motor to extend the range of the vehicle. The demand of vehicle is increasing day by day with the increase in population and also we have limited resources (i.e diesel, petrol, etc.) with us so, there is a great need to shift from gas-powered automobile to electric vehicle. This paper gives the brief idea about the plug-in hybrid electric vehicle, it's characteristics and the problem of an overload of the grid due to the presence of a large number of plug-in hybrid electric vehicle (PHEV) and its solution is also discussed. Controlled and uncontrolled charging and what are the benefits of control charging in PHEV is also discussed in this paper.

Keywords: hybrid , motor , resources , need , automobile , Controlled ,PHEV

I. INTRODUCTION

Electrical vehicles, for example, electric vehicle (EV), battery electric vehicle (BEV) and Plug-in hybrid electric vehicle (PHEV), are being considered as an answer for ecological and monetary concerns, for example, global warming, ozone depleting substance outflow and non-renewable energy source assets consumption. These vehicles need a lot of electrical energy and it will lead to overloading of the grid. Plug-in hybrid electric vehicle is a vehicle which operates on diesel engine along with a battery. As the range of battery is limited that's why we use an engine to extend the range of the vehicle. In today's scenario, the idea of PHEV (Plug-in hybrid electric vehicle) is on demand because with the petroleum and gasoline vehicle we are facing environmental problem and scarcity of petroleum and gasoline. So, with the use of PHEV, it eliminates the problem of scarcity of fuels up to some extent[1]. PHEV consist of a battery, engine, reservoir, converter, motor and a device which is used to connect the grid to the vehicle. Mostly, PHEV works on battery if the battery discharges completely then it will shift on an engine to increase

the range of vehicle[2],[3]. With the use of PHEV'S, the problems that may arise is the overload of the grid if we use PHEV in large quantity.

Fig.1 shows the components of plugin hybrid electric vehicle. i.e battery, converter, reservoir, engine and motor.

The battery is used for the storage of electricity in the form of dc. Storage of electricity depends on the capacity of the battery. Larger the capacity of the battery the larger will be its storage and if the capacity of the battery is small the smaller will be its storage. The next component that we are using is the converter, the main purpose of the converter is to convert the dc power that is in the battery into ac power and fed it to the motor. Reservoir, to extend the range of vehicle. we need a parallel fuel system so for this we use the reservoir. The main purpose of the reservoir is to contain the fuel and run the vehicle with the help of a diesel engine when the battery will be fully discharged or in an emergency condition.[16]

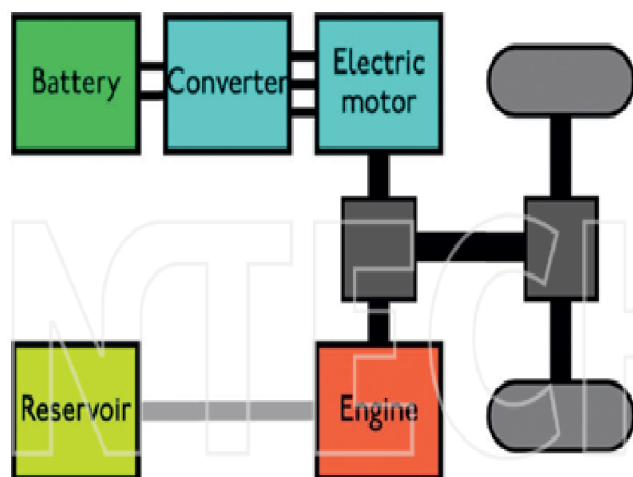


Fig.1 Components of plugin hybrid electric vehicle

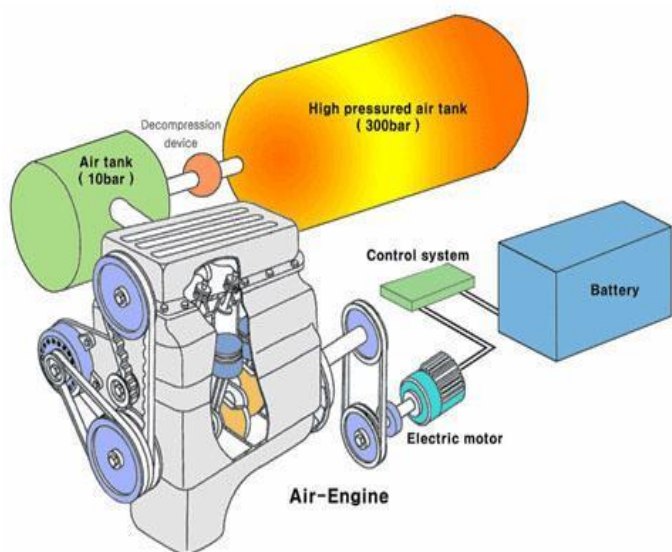


Fig 2.engine diagram of phev[15].

FIG 2.Shows the engine diagram of plugin hybrid electric vehicle.air tank, battery, control system,, and air engine are the components used in this fig.

II. PHEV CHARACTERSTICS

PHEV Characteristic includes the time of charging, leaving time of the vehicle, daily usage of the vehicle by the owner and varying on the behavior of the owner.

A. PHEV Battery capacity

Battery capacity plays an important role in the PHEV Characteristics. The capacity of battery

decides the range of vehicle if the capacity of the battery is large then it will have the larger range hence will cover more distance as compared to the vehicle that has a smaller capacity of the battery. The energy that is required to charge the battery depends upon the battery that we are using. If the size of the battery is large then we need more electricity for charging or vice-versa. Table1. shows the consumption of energy(COE) per mile and the size of different types of battery [4]. Table1. Shows the different class of vehicles and the energy consumed by them.Table 2.shows the electric range of different vehicles

Table1. Different class of vehicles and the energy consumed[12]

vehicle category	coe (kwh/m)	phev 30 (kwh)	phev 40(kwh)	phev 60(kwh)
small sedan	0.26	7.8	10.4	15.6
medium size sedan	0.30	9	12	18
medium size suv	0.38	11.4	15.2	22.8
top model size suv	0.46	13.8	18.4	27.6

Table 2 selling of vehicle with different electric range[12]

percantage(%)	phev 30	phev40	phev60
	21%	59%	20%

In the TABLE 2. We can see the selling of different electric range of vehicle. The percentage of different electric range selling of vehicle is given.

Charging time

charging time is the time by which a vehicle is plugged into the grid for the charging. Charging time is very difficult to determine as we don't know when does the owner of the vehicle charge its a vehicle. Charging of vehicle depends upon the behavior of owner of the vehicle and the state of battery if the battery is completely discharged then it will need more charging time to charge the battery as compared to the battery which is not fully discharged. To consider the charging time, we consider that every owner charges it's a vehicle at least once a day and considering last excursion time as the begin time of charging.

Electricity requirement for charging

The electricity requirement of the battery varies as the charging state of the battery depends upon the usage of the vehicle. If we are using a vehicle for the larger time then we need more electricity for the charging of battery as compared to the vehicle that we are using for a smaller time. as the state of the battery depends upon the distance traveled by the vehicle per day[12].

Departure Time

Departure time is the time by which an owner use its a vehicle. We can't define the exact time of departure as we don't know the behavior of the owner. So we consider that every vehicle will charge at least once a day. Almost, every person uses it's vehicle once a day[5].

III. GRID OVERLOADING AND IT'S SOLUTION

Electricity generated by us is used to fulfill the load demand. We don't have a bulk amount of electricity and In the future, we can clearly see the increasing demand for PHEV vehicle as with the increasing population the demand for PHEV is also increasing. And if we connect all the vehicles to the grid then our load demand will increase the generation and this will lead to instability of load. So, with the

increased PHEV, the challenges that a grid can face having to be investigated.as, in the previous paper hyddt talks that we don't know about the charging time of every vehicle. So, there is a possibility that a grid may be overloaded sometimes because of the presence of a large number of the vehicle in the grid at the same time and suggests that the management of load plays a very crucial role to avoid the overload of the grid[6]. Then Hyder conclude that maximum time the grid will be at it's peak if we don't deploy any support charging network in cities[7] whereas Schneider et al. said that at night our grid doesn't run at its full capacity so the charging time to charge the vehicle should be at night as it will somehow eliminate the problem of overloading of grid[8].

IV. PHEV CONTROL CHARGING

For the control charging of phev, it is assumed that every owner who uses PHEV have the smart meter in their house for the calculation of the unit consumed by them. PHEV operation mainly depends on two modes ie. Depleting time(DT) In how much time the battery of PHEV will deplete and battery sustaining time(ST) of the vehicle[9],[10]. therefore, the distance traveled (DT) 'n' by vehicle per day is the sum of depleting time and sustaining time $n = n_{dt} + n_{st}$. when our vehicle will be in depleting time mode then the vehicle will use the energy or electricity by the battery. It will either use the whole energy at a time or it will use it in fractions. As we know that the range of battery is limited hence, with the battery our vehicle can run some distance when our vehicle will reach it's sustaining period then the operation of the vehicle will shift and it will run in gasoline or petroleum[11].

V. CONCLUSION

In today's world, we are fastly shifting from a gasoline vehicle to PHEV. Currently, we are facing a problem of polluted environment, global warming, etc. and this is due to the emission of CO₂ gases in the environment. Our transport system emits a large

amount of CO₂ in the environment so there is a great need to shift from a gasoline vehicle to PHEV. PHEV usually operates on electricity with the help of a battery and during the emergency, it operates on gasoline or petroleum. So, this step is somehow reducing the CO₂ gas emission up to some extent. With some advantages, PHEV also has some disadvantages. The main disadvantage is the range of PHEV battery is limited apart from this if we use PHEV in large quantity then the problem of overloading of the grid may arise and it will lead to the shortage of electricity in the grid. To eliminate the problem of overloading of the grid in future we have to obtain the concept of load management or we can only charge the vehicle during the night as most of the load usually off during night time

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