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"A REVIEW ON CHARGING METHODOLOGY FOR ELECTRIC VEHICLES"

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Abstract— In the transportation sector, electric mobility became a trend problem as ever. The use of electric vehicles is an essential component of electric mobility. Electric vehicle (EV) is a vehicle type that uses mostly an electric motor that core services from a charged power storage unit. By plugging in the grid or maintaining it in batteries EV receives electricity. EV Charger is an electrical device that transforms alternating current energy into a controlled direct current for overfilled energy for the energy storage system (i.e. battery). The battery is the foundation of an EV energy storage system. There is also a very significant role for the battery charger in EV technology. Battery charge chargers of EV are split into two distinct types: on-board in EV and off-board (in a set location). The paper explains charging technology, standards, charging levels, or modes of charging for commercial vehicles. For commercial EV manufacturers, all concerns about chargers are raised. Consequently, this paper can easily see the broad picture of the electric charging system.

Keywords: Chargers, Electric Vehicle Charger, Charging Methods, Charging Standards

1.INTRODUCTION

Energy efficiency is today's top importance motivated by a significant concern about climate change & by increasing oil prices in countries that depend heavily on fossil fuels imported. A large portion of oil consumption is in road vehicle run for transportation system by 2030 as per the report made by international energy outlook, the transportation sector will increase its oil consumption share in the world market is up to the 55 % [1]. Innovations in the transport industry are aimed at improving energy efficiency.A large amount of money is spending on the research to update power electronics, mechanical structures, and information and control systems of the electrical transportation system. EVs have recently increased rapidly as green energy is needed by the planet. The CO2 released by traditional gasoline vehicles is mainly due to air pollution in the metro cities. Now a day development in electric vehicles is going to give an alternative for conventional vehicle engine i.e. ICE [2][3], development is going on in Battery EV (BEV), Plug-in Hybrid EV (PHEV), in its dissimilaroutlines [3], & Fuel-Cell EV (FCEV). battery technology for EVs is also being established for researchers to achieve a fast charging rate. The next two years will also hire a large number of EV s. Over 5 million EVs are expected to be used by 2020. EVs will normally operate for 100 km, so a charge station as a gas station is necessary. 3significant charging stations have to deal with: quick charge (within 30 minutes), long lifetime batteries (low charging temperature rises), and optimization (every vehicle supplier should be used) [1] [2]. The battery charger typically uses a constant current (CC) or constant voltage (CV) system. CC offers a shorter charging period for a battery that raises temperature; however, CV provides a low charge time boost. The CC & CV methods cannot fulfill 30 minutes of charging time & lower temperature specifications of EV users with a voltage per cell (V/Icell) limit & max charging current (Imax) from battery suppliers, [3]. For rapid charging at a high current rate pulse charging technology is the best choice. In this method of charging the rated values of Voltage per cell & max current supplied with higher peak voltage and current. Hence charging time is reduced as compared to the conventional charging method [5] [6]. The central part of Electrical Vehicles plug-to-wheels (PTW) drive train efficiency is Charger. Plug to battery energy flow is the middle stage of charging.

The efficiency of PTW for EVs is near about 45 to 50 %. To improve the PTW efficiency, reliability, power density, lower cost charger is needed to develop. " plug-to-wheels (PTW)" technology of an EV is the same as " tank-to-wheels (TTW)" technology of the conventional vehicle. In EVs also updates, the battery pack as well as the charging plug-in unit replace the fuel tank. Therefore, the analysis of PTW energy efficiency, the most critical of these is P2B efficiency, is necessary for an EV charging system plus a drive train system. Commercial EVs today have on-board loaders that yield input from an outlet of an AC wall.

on-board charger system includes an AC/DC color corrector, DC/DC correction process & DC/DC charger converter with a high frequency (HF). The above-said arrangement has three alteration steps which lead to huge power losses [4] [5]. Hence overall energy efficiency of PTW is significantly low, just like a regular gasoline vehicle. The electrical vehicles run on the road today have PTW efficiency is in between 15-20%.

Considering AC input, lots of changes have been made to reduce the size of the charger, without affecting the efficiency & cost of the charger. 2-stage charger comprises an AC/DC converter by PFC boost stage & DC/DC 0-voltage transition preceded by a ZVS (Zero Voltage Switching).

The various vehicles recently introduced on the market by most automakers are becoming more and more popular. Electrochemical batteries, ultra-condensers, and full-cell modules are the primary energy storage systems of these cars. However, the cars have limited autonomy, taking account of the existing energy storage limitations of such technologies. However, electrical batteries are the most used equipment to store electricity, various energy storage devices models can be used.

However, they are typically used along with ultracapacitors, such as for regenerative braking, to conserve energy in transient moments. In reality, ultra-capacitors are used to receive tremendous energy in a limited period & to supply this energy for the next acceleration or to charge batteries. [7] [8].

2.ELECTRIC VEHICLES

2.1. Vehicles & energy sources: -

Like any vehicle that provides energy from a battery to any or more moving energy. In conventional EV (ICEV) internal combustion fuel is incinerated to provide the mechanical energy to drive the fuel forward. As mentioned in Jorgensen [5] a range of EV technologies are now in usage or belowgrowth. HEV has a minor electric battery that provides power to the power train to increase the combustion engine's operating power.The HEV battery can be operated by motor or by a process called a regenerative breakage through the captured kinetic braking energy. HEVs are more fuel effectual than ICEVs, but a key source of power is liquid fuels. A PHEV is similar to an HEV but thrua larger battery & network connection. grid connection enables energy to be charged &a bigger battery capacity allows the car to operate long-distance in all-electric modes.

A battery EV (BEV) is entirely loaded in an onboard large battery with power from the grid. The energy efficiency of electricity generators is much higher than that of ICEVs, with traditional efficiency of 15– 18%, while BEVs are as efficient as 60– 70% [5]. Fuel cell vehicles (FCV), in which the generator produces electricity in the fuel cell stack, are often used as a form of an electric vehicle. FCVs have an integrated fuel source including natural gas or hydrogen, or can rely completely on fuel cells or have a hybrid battery installed, such as HEV or PHEV. FCVs are available. In the interests of a sustainable hydrogen economy, the usage of FCVs for transport would also be important for FCVs if they are manufactured by renewable energy water electrolysis or biomass sources.The vast common of hydrogen in the world is currently derived from fossil fuels, there are still hurdles in creating a sustainable hydrogen economy [3]. The transition to the economy of hydrogen is too general for this article, while electrolysis hydrogen constitutes a significant potential use for green energy. In so far as a traditional transport fuel, such as ethanol or biodiesel, can be substituted by sustainably produced biofuels, HEVs can be run from renewable energies. In their internal combustion engine, PHEVs maybe use biofuels, whereas renewable energy charged from the grid will completely power both the PHEVs and the BEVs. The technology used to store electricity from the grid are also vehicles with a capacity: PHEVs and BEVs (referred to as EVs) Electrical energy.

In 2nd half of the seventies, following the first major oil crisis, renewable energy like solar energy was used to give energy. Economic issues became the main factors at the time or interest in those processes decreased as oil prices dropped. The green energy usage is presently motivated by the need to reduce the strong environmental effects of usage of fossil energy systems. Sun delivers more than 150,000 terawatts of power to Planet. Round half of energy reaches the earth's surface, as well as the other half, is reproduced in an atmosphere of outer space.It will be enough to meet global energy demand just by a limited fraction of available solar energy touching the surface. While a majority of renewable energy is generated from the sun, we apply to the direct use of solar radiation by solar power. One of the biggest opportunities for research & technology we have is the development of effective ways to absorb, transform, store, and use solar energy at an inexpensive rate. Solar energy networks have two major limitations:

a) Electricity costs resulting are still not competitive
b) Solar is not accessible often when desirable.

Major study efforts are based on techniques to reduce these disadvantages; regulation is one of those. Though in most power generation procedures, the primary energy source (fuel), since it is a key control element, cannot be operated in solar energy systems (Camacho et al. (1997)), the main source of energy is solar radiation & it varies in seasonal or daily basis, as it is disrupted from a control perspective. Solar plants have all the necessary characteristics (nonlinearity or uncertainties) to apply advanced control techniques that can cope with changes in dynamics. As secure PID controllers cannot cope with any of the above issues, they must be discarded by low benefit, providing slow replies. As the process dynamics change due to environmental and/or operational conditions, they will cause high variations when they are tightly tuned. Through using more effective management methods, the number of hours in solar plants would increase and the cost per kW hour of output would be decreased.

3.CHARGING METHODS

This new charging form, comparable to electrical charging systems of EVs, was not assisted by the power grids, so the effect produced by the proliferation of electricity can't be overlooked. the challenge is to fix energy grids faster and more eco-sustainable than possible. as soon as possible. EVs are a new load type that leads to new problems, but which also provides new actuating options. The problem arises from the capacity to charge big number of vehicles concurrently, that can excess power grid & affects the battery charging systems' non-sinusoidal current consumption.

The energy consumption profile from the energy grid can be controlled by smoothing normal signal attenuation of renewable power sources and ensuring voltage & frequency reliability of power grid vehicles is among opportunities given as they allow cooperation with the electric grid to store or provide battery power in parked vehicles.Some vehicles, including public charging stations, let their batteries to be charged offboard, but almost every vehicle is equipped with its battery charger systems as described above. This charging device is an AC-DC power circuit that needs to be measured to maintain the battery life of vehicles with insignificant features.

To avoid damage during the charging or discharging phase, batteries must also be monitored during their service. Depending on the device characteristics you like the AC DC power circuit that may be executed using various topologies [8]. Key divisions in which the various battery charging systems for EVs can be divided are graphically displayed in Figure 1.

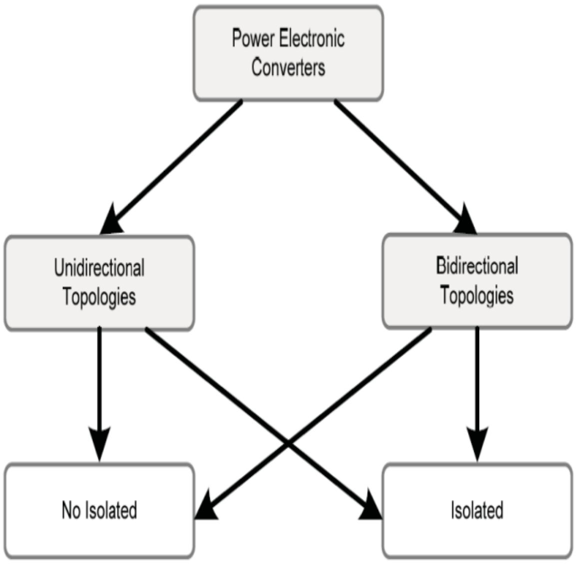

Fig 2. Significant categories of ac-dc power charging systems for power converters.

3.POWER ELECTRONICS CIRCUITS TOPOLOGIES

Usually, battery charging systems have 2 power-electronic converters: AC-DC converter, occurs by a DC-DC converter, for the topology of the power electronic circuit. Both transmission lines of power can have separate topologies and can be organized with or without separation between indifferent forms. AC-DC is applied to change the voltage of AC from the de-energy system to DC voltages. DC-DC converter changes rectified tension to a voltage of the battery as well as regulates the battery loading process. Figure 2 demonstrates the major topologies of the AC-DC power converters applied to rectify AC voltage of power grid & Figure 3 shows the main DC-DC battery charging & discharge processes topologies.

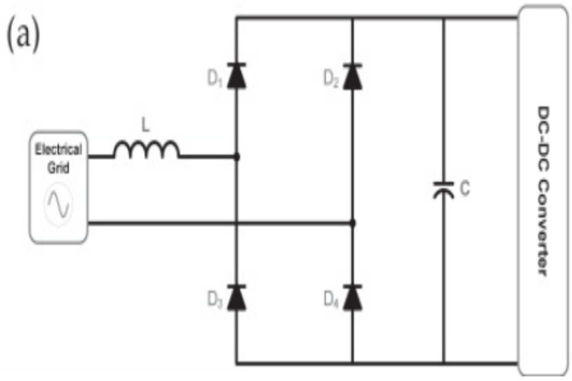

Fig.3(a).Unidirectional full-bridge non-controlled converter

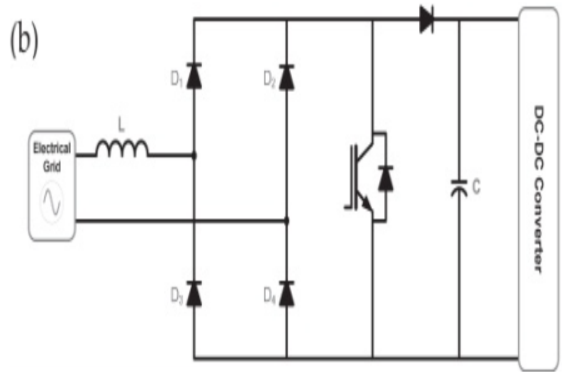

Fig.3(b).Unidirectional full-bridge non-controlled converter followed by a boost converter

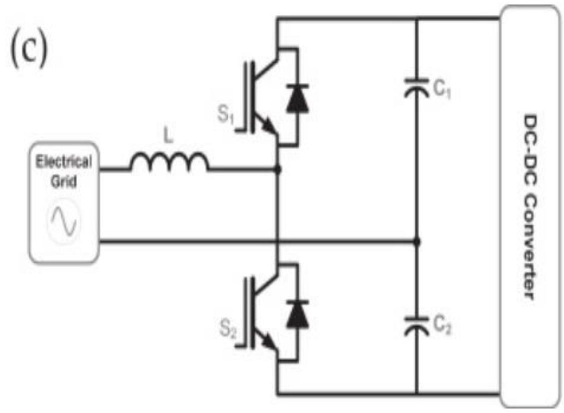

Fig.3(c).Bidirectional half-bridge full-controlled converter

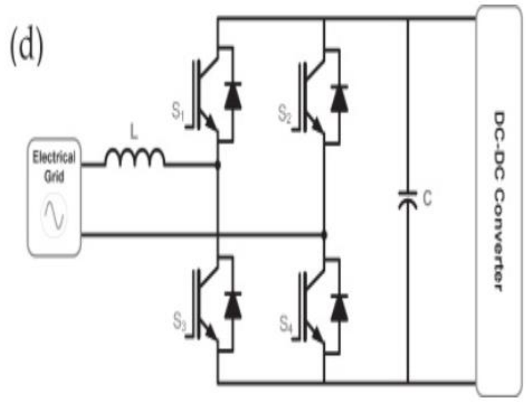

Fig.3(d).Bidirectional half-bridge full-controlled converter

As seen in Fig3(a), the simplest AC-DC power converter usages diodes for rectifying applications. AC-DC power converters are easy to use, their construction is easier and they are less destructive. output voltage & current consumed are therefore not regulated, however,the waveform of current expended does not have a pure sine wave, and so this type of power converters playing a lead role to affect the value of electrical grid power quality. On the other side, a waveform of consumed current & output voltage can be controlled using power switching semiconductors. The benefit of a more complicated power circuit or control mechanism (that could be digital or equivalent, with higher costs of installation and maintenance) relative to an AC-DC converter with diodes, is that it has a sine quantity of electric current usage that does not influence the efficiency of the power grid. The waveform can be regulated with this topology &the latest consumed power factor. Because the wave shape of absorbed current can be managed well, it only functions unidirectionally (G2V), which is disadvantageous. A topology like the one seen in Figures 3 (c & d) is required to allow a bidirectional energy flow. The difference between these 2 converters is the number & output voltage frequency of power semiconductors & condensers. converter output voltage frequency obtainable in figure 3(c) is twice the converter in figure 3(d). The DC-DC buck converter is a common topology used in battery charging systems. This topology is not isolated as seen in Figure 3(a), but only allows for one-way operation (G2V). In combination with the configuration of a DC-DC boost converter, a bidirectional topology can be obtained as seen in Fig 3(c). power flows from the power grid to batteries (G2V) during the battery charge process & converter functions in form of DC-DC buck converter. The converter is a DC-DC boost converter as current flows from batteries to a power grid (V2G). High-frequency transformers can be used if galvanic isolation is needed. Fig 3(b) reveals an isolated unidirectional DC-DC converter topology, as well as an isolated bidirectional DC-DC converter topology, is presented in Fig 3(d). As can be shown, these isolated topologies use more power semi-conductors than non-isolated topologies, and their control mechanisms are also complexed.

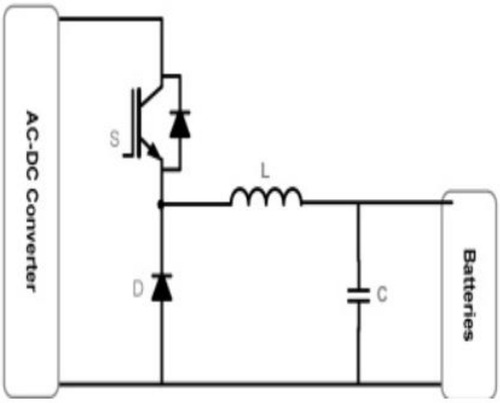

Fig.3(e).Unidirectional buck converter

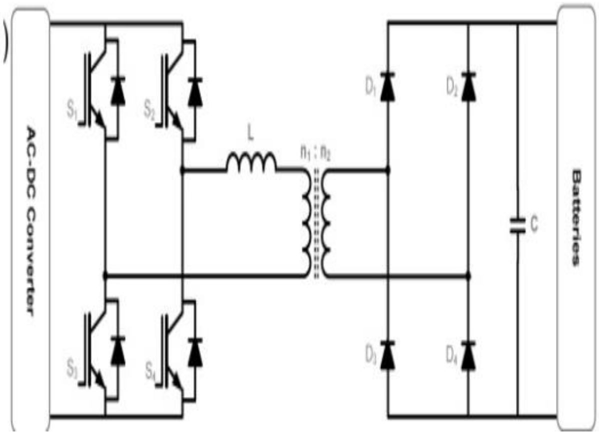

Fig.3(f). Unidirectional isolated converter

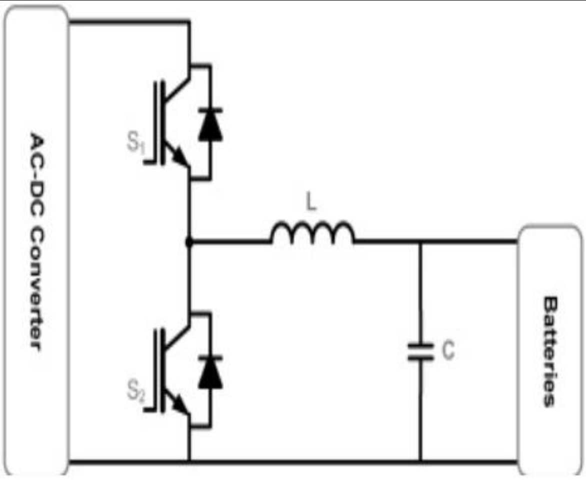

Fig.3(g). Unidirectional isolated converter

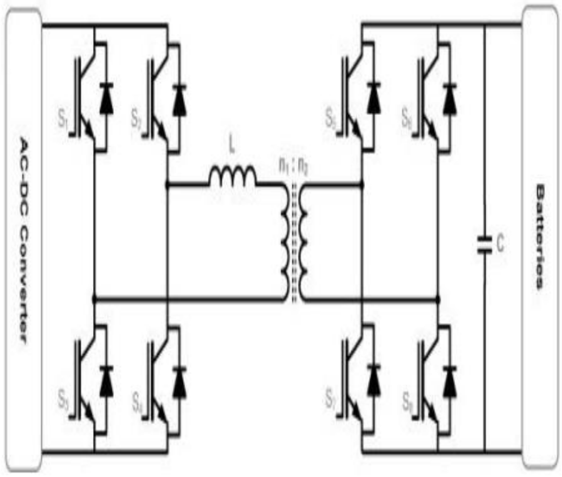

Fig.3(h).Bidirectional isolated converter

The standard configuration of an electric battery charging system is a mixture of related digital control system of AC-DC or DC-DC converters. voltage & current in power grid side, DC connection voltage & voltage & current in batteries should be determined for required control. A block diagram of all converters, digital control systems is shown in Fig.3(i). [9][10][11][12].

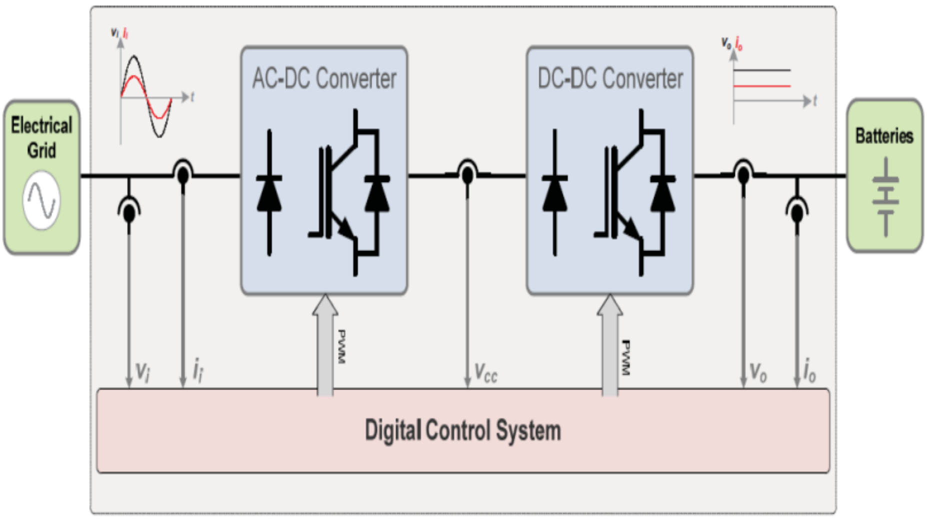

Fig.3(i).Bidirectional isolated converter

4. BATTERY MANAGEMENT

To settle the critical issues battery management system (BMS) is proposed in EV technology. BMS includes a data acquisition unit, communication unit & battery position estimation model. Along with these unit' s thermal management & high voltage, management is introduced for improvement in battery safety. Notwithstanding significant advances in battery chemistry or material, the monitoring condition, the regulation of the load/discharge as well as thermal control, cell balance, health prognosis &security of big battery energy generation are still needed in terms of efficient & reliable BMS. absence of such devices is possibly aimed for conservative usage of batteries (excess energy power, evoking unwanted weight, volume & expense, for instance, 20– 50 percent). Without suitable BMSs, the effects of bad electrical and thermal operational and maintenance practices will occur or premature failure like a thermal runaway. incorporation of battery storage in a grid in a relation of performance, security, reliability, or economies therefore plays a critical role in battery management [13] [14].

The following are the core features of a BMS. [15][16]:
a) Data acquisition: Current, voltage, temperature data measurement or processing, etc.
b) State estimation: High-precision calculation of status of charge (SOC), power level (SOP), health situation (SOH), temperature level, so on.
c) Charge/discharge control: charge current/voltage regulation, power electronics interface, so on.
d) Cell balancing: Equalization of passive or active loading or voltage.
e) Thermal management: maximum temperature stability for cells inside the battery pack and temperature deviation.
f) Safety protection: Hardware setup for the prevention of overlap discharge or overheating as well as the constructive fault isolation or alarming hardware/software redundancies.

5.CONCLUSION

Future developments in electric charging often include fast charging, contactless charge, or renewable or feasible energy charging. Also, the area of study covers vehicles to grids or vehicles to residences. To reduce the charging time to a reasonable level, quick pulse charging is an important problem when manufacturing electric vehicles. If the battery is charged rapidly and overloaded, it will lead to overheating, weakening of performance, or battery damage. Deep discharge is also a root of continuous damage. BMS supports the improvement of battery life, decreases damage levels, or improves battery stack capacity, efficiency, durability, or safety.

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