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# A SURVEY ON OFFBOARD ELECTRIC VEHICLE BATTERY CHARGER USING PV ARRAYS.

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**ABSTRACT:**

The area of survey is battery charging systems. This paper is inclusive of information about a different battery charging methodologies reviewed & demonstrated by experts with MATLAB simulations & prototype. The suggested system employs PV array electricity to charge the EV battery via a power converter topology because solar is one of the potential renewable energy sources that can be easily exploited to charge EV batteries. Renewable energy sources (RESs) are used to charge the EV battery because they are inexhaustible and pollution free. An off-board EV battery charging system that charges the EV battery from solar PV arrays via a bidirectional DC-DC converter in stand-still mode and discharges the EV battery to drive the dc load in the EV during operation. Due to the intermittent nature of the PV cell Power converters are required to charge the EV battery bank charge without interruption.

**KEYWORDS:**

Green Transportation, Renewable energy Source (RES), Onboard chargers (OBC), Hybrid Vehicle (HV)

**INTRODUCTION:**

In the 18th century, the Industrial Revolution introduced IC engines to the globe, and since then, it has been developing day by day with the newest automation and IoT technologies. However, no changes have been made to the engine's inner heart to diminish emissions of gases. Globally, high levels of $CO_2$ & pollutants in the atmosphere snubbed the environment. To minimize the impacts of gases, technological experts and automotive businesses are now experimenting with EV vehicles in the markets, which are outperforming IC engines and dominating the automotive industry.

Electric vehicles are currently considerably contributing to the reduction of carbon emissions and gases. Regardless, the biggest challenge is figuring out how to charge the EVs.

**BASIC CONCEPT BEHIND EV BATTERY CHARGERS/CHARGING:**

Feeding EV battery charging stations directly from the energy grid is one method. This experiment finds that it increases grid load demand, reliability, grid instability and power quality issues. Due to massive losses, it costs high electricity bills, and maintenance charges. As a result, technically and economically it is not a cost-effective model.

Solar power is one of the finest renewable energy sources (RES) available on the planet. As a potential RES, solar is a freely available, abundant zero-emission energy source and shall be used to charge EVs with help of PV arrays. This concept is known as green transportation which is an increasingly popular concept on a global scale at the present. The proposed methodology is to comprehend the various methods utilized to charge EV batteries using solar power.

**CHARACTERISTICS OF IDEAL BATTERY CHARGER:**

The features of an effective battery charger listed below match an ideal battery charger.

- Light weight and compact in volume,
- Reliable
- Efficient
- Low cost
- Ease for Maintenance
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**ONBOARD BATTERY CHARGERS:**

If the charging circuit is built into the EV power train, it is referred to as an onboard charger. These battery chargers are mostly seen in hybrid vehicles. The majority of EVs now include an onboard charger (OBC), and the manufacturer offers a charger with the vehicle. These chargers, in conjunction with the onboard charger, may be used by the customer to charge a vehicle from a household power outlet. However, because of the simplicity of these chargers and their lack of sophisticated features, charging a regular EV takes around 8 hours.

**OFF BOARD BATTERY CHARGERS:**

An off-board charger is designed to facilitate fast charging. This is indeed much similar to a gas filling stations. It provides a high output voltage compare to onboard battery charger.

**LITERATURE SURVEY:**

[1] In this paper, author, reviewed different Battery Charger Topologies, Charging Power Levels, and Infrastructure for Plug-In Electric and Hybrid Vehicles. Also, they mentioned the information on international charging codes & work codes. The major focus of the author on this paper is to understand the difference between unidirectional bidirectional chargers & integrated battery chargers' convertors. They have widely described the merit and demerits of each other. Under the concept of integrated battery charger converter, they reviewed topologies like One-Motor with One-Power Converter, One-Motor with two-Power Converter & Two motors with power converters. The author explained these concepts in detail with various configurations viz. isolated and non-isolated configurations. The contactless charger which is superior to all the methodologies adopted by the expert also explained by the author with the conductive and inductive charging methods.

This research examined the present state of battery chargers, charging power levels, and EV infrastructure. Battery performance is determined not only by the kind and design of the batteries but also by the characteristics of the chargers and the charging infrastructure. There are three types of battery architecture and charging power levels: Level 1, Level 2, and Level 3. These Charger systems are classified as either off-board or on-board, with unidirectional or bidirectional power flows. Unidirectional charging reduces hardware requirements, simplifies connector concerns, and reduces battery deterioration. Bidirectional charging allows for the infusion of battery energy back into the grid. Typical onboard chargers limit power to suit weight, space, and cost requirements. It is possible to circumvent these issues by employing the electric driving system as an integrated charger. The most significant advantage of integrated chargers is that they offer low-cost high-power (Levels 2 and 3) bidirectional rapid charging with a unity power factor. The presence of a charging infrastructure minimizes the need for and expense of onboard energy storage. Conductive or inductive onboard charger solutions are available. Long-term, inductive charging has the potential to assist dynamic roadbed systems. Various charger power levels and infrastructure configurations were given and evaluated based on power, charging time and location, cost, appropriateness, required equipment, and other considerations. The success of EVs is dependent on uniformity of criteria and infrastructure decisions, efficient and smart chargers, and improved battery technology.

[2] Author focused on technologies used in EV charging scheme. She has reviewed Many distinct types of electric vehicle (EV) charging technologies that have been reported in the literature and put into practice. In terms of converter topologies, power levels, power flow directions, and charging control systems, this study provides an overview of existing and proposed EV charging solutions. A review of the primary charging methods is also provided, to highlight an efficient and quick charging procedure for lithium-ion batteries in terms of extending cell cycle life and maintaining high charging efficiency. After presenting the most significant aspects of charging technologies and strategies, the final section of this study uses a genetic algorithm to predict the appropriate size of charging systems and, based on a sensitivity analysis, the possible future scenarios.

[3] Author offered an effort in this research work to reduce the consequences of the intermittent nature of PV arrays by incorporating a power electronic converter into the circuit. We learned from this paper that, whereas onboard battery chargers have complicated control logic implementations. Power quality concerns can contribute to the result. To counter this disadvantage, the author concentrated her efforts on the development of offboarding battery chargers using sepic converters. She provided a MATLAB simulation and developed a prototype to better understand the nature of the dynamic response. The author concluded that an offboard battery charger has flexible performance over radiation circumstances based on the examination of experimental outcomes and Simulink results.

[4] Author has specifically focused on designing of Improved sepic convertor. This PFC converter is cascaded to a DC-DC converter architecture to manage the current through the battery during the charging process. This suggests that the suggested converter produces the same output voltage at a reduced duty cycle. Because of the decreased duty cycle, the proposed converter is suited for high power rating EV chargers because the switch conduction loss is significantly reduced. The key benefit of this converter over typical SEPIC PFC converters is the decrease in semiconductor switch voltage for a similar output voltage. This converter's performance is adequate for steady-state and abrupt transients in input voltage, with an enhanced gain and lower switch voltage stress over traditional ones.

[5] In this paper, described A plug-in electric vehicle battery charger based on MODIFIED SEPIC PFC and LLC scheme proposed in this paper. Furthermore, a innovative approach is presented for actively controlling the dc link voltage and tracking the maximum efficiency point of an LLC converter over the wide voltage range of a high voltage battery pack up in an electric vehicle application. Comprehensive circuit modelling and loss analysis are performed at the maximum efficiency point of the LLC converter. The performance analysis of a modified SEPIC dc-dc converter with an inverter has maintained a wide output voltage

under low input voltage conditions. The operational analysis and design are completed for the modified converter's 400W power output. The SEPIC and MODIFIED SEPIC performances are validated in the MATLAB/Simulink environment.

[6] In this paper, author concluded review of different convertor-based battery chargers' Electric vehicles (EVs) can be charged with renewable photovoltaic (PV) solar power, and contribute to the integration of solar power in the electricity network via vehicle-to-grid systems. In such systems, the role of consumers becomes crucial as they both generate and store energy. Fast charging for electric vehicles is a decisive green light for the prevailing acceptance of EVs. It could be a solution to consumers' range anxiety and the assurance of electric vehicles. This paper reviews different converter-based battery chargers for electric vehicles. There are many DC-DC converter-based chargers available and research is still going on to enhance the performance of this charger.

**CONCLUSION:**

We are now focusing our attention on Offload battery chargers and their approaches after studying the research work, numerous experiments performed by the experts and the conclusions they reached. We now intend to show a sepic power converter with a next-generation controller, such as fuzzy, zeta, or equivalent, for offloading battery chargers with PV arrays.

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