



# International Journal of Innovative Research in Science Engineering and Technology (IJIRSET)

*(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)*



**Impact Factor: 8.699**

**Volume 14, Issue 5, May 2025**

# Energy Management in Hybrid Renewable Energy- Based Electric Vehicle Charging Station

Vanaja. M<sup>1</sup>, Jayakumar. K<sup>2</sup>

Master of Engineering in Power Systems, J.J. College of Engineering and Technology, Trichy, Tamilnadu, India<sup>1</sup>

Professor, Department Electrical and Electronics Engineering, J.J. College of Engineering and Technology, Trichy, Tamilnadu, India<sup>2</sup>

**ABSTRACT:** The proposed system will ensure the energy management in the hybrid renewable based electric vehicle DC charging station. Batteries are taken as charging station in the proposed system. Three renewable sources are combined in the DC grid along with DC load. The various sources are; PV, Wind and super capacitor. Two numbers of batteries are used to charge from the grid. The controller will ensure the sufficient energy for the charging station. When there is a excess power in the grid that is greater than the need of charging station will send to dc load. It will ensure the reliability of the system to maintain the charging station power availability anytime. MPPT algorithm is used in the PV to produce maximum power. Environmental benefits such as Reduce air pollution, Reduce reliance on fossil fuels, Reduce noise pollution, Sustainable transportation, Support the development of EVs are the main benefits of Electric vehicles.

**KEYWORDS:** PV power, stability, Electric Vehicle, Charging station

## I. INTRODUCTION

With the fast development of electrifications of vehicles, EV charging stations are booming in coming years. Meanwhile, the growing demand for charging power, and the stochastic patterns of charging behaviors are creating the scarcity of electricity and significant power fluctuations to the power system. To ensure the system stability and the supply-demand balance of the electricity market, several technical measures are necessary, such as more ancillary power reserve, appropriate demand-side energy management, etc. Moreover, the higher penetration level of renewable energy sources in the conventional power system can be leveraged to sustain the power peak induced by the charging demand with proper system operation strategies[01-05].

This project presents an overview of the latest research of EV charging stations and highlights some important issues and challenges in power architectures design, energy storage techniques, control strategies of micro-grid, and energy management optimization. In addition, the hierarchical control system is specifically outlined, which offers decoupled control objectives in different layers of microgrid systems for EV charging. Typical coordinated control techniques and energy management strategies aiming to achieve the optimum performance of EV charging stations are investigated in detail. Further, the future research directions are extensively discussed at the end of this proposed system[06-09].

## CHALLENGES IN EV CHARGING

However, despite the rapid development of EV and renewable energy technologies, some challenges have emerged. First and foremost, the intermittent nature of renewable energy and the stochastic EV behaviors can lead to significant power fluctuations, seriously affecting the stability of local grids. The power quality of local grids can be influenced by stochastic charging behaviors and the unstable random generations of renewable energy. In addition, a large-scale EV integration into a main grid also means new incremental loads on the electric utility. This may result in undesirable load congestion and voltage drop problems within the distribution network. Last but not least, a higher penetration of EVs means requiring more upgrades to the power utility and constructing more EVCS, as well as the attendant periodic maintenance[10-15].



The high investment and the high operational costs are the main barriers that restrain the expansion of the EVs in the transport market. A proper profit mechanism needs to be designed to motivate the enthusiasms of both the investors and the customers. To overcome these challenges, a great deal of effort has been devoted to the system operation of the EV charging micro-grid, and the energy management systems. Thus, the system operation and the energy management of the EV charging station involve the following aims:

A stable electric system for EV charging, including the bus voltage (AC or DC), and the frequency. Coordinated control of different power sources in the EV charging micro-grid system that can support the V2G capability

The SOC management of the EVs and the local energy storage system (ESS)  
The EV charging cost minimizations through a TOU (time of use) tariff or the dynamic tariff provided by the distribution system operator (the grid operator)[16-18]

## **II. LITERATURE SURVEY**

### **1. A comprehensive review on electric vehicles smart charging: Solutions, strategies, technologies, and challenges**

Omid Sadeghian <sup>a</sup>, Arman Oshnoei <sup>b</sup>, Behnam Mohammadi-ivatloo <sup>a, c</sup>, Vahid Vahidinasab <sup>d</sup>, Amjad Anvari-Moghaddam

The role of electric vehicles (EVs) in energy systems will be crucial over the upcoming years due to their environmental-friendly nature and ability to mitigate/absorb excess power from renewable energy sources. Currently, a significant focus is given to EV smart charging (EVSC) solutions by researchers and industries around the globe to suitably meet the EVs' charging demand while overcoming their negative impacts on the power grid. Therefore, effective EVSC strategies and technologies are required to address such challenges. This review paper outlines the benefits and challenges of the EVSC procedure from different points of view. The role of EV aggregator in EVSC, charging methods and objectives, and required infrastructure for implementing EVSC are discussed. The study also deals with ancillary services provided by EVSC and EVs' load forecasting approaches. Moreover, the EVSC integrated energy systems, including homes, buildings, integrated energy systems, etc., are reviewed, followed by the smart green charging solutions to enhance the environmental benefit of EVs. The literature review shows the efficiency of EVSC in reducing charging costs by 30 %, grid operational costs by 10 %, and renewable curtailment by 40 %. The study gives key findings and recommendations which can be helpful for researchers and policymakers.

### **2. Analysis on Charging Safety and Optimization of Electric Vehicles**

Jiang linru; Zhang yuanxing; Li taoyong; Diao xiaohong; Zhang jing

Power grid side charging and equipment side charging for safety charging of electric vehicles are analyzed. Based on different charging modes, this paper aims to optimize the structure designing in safe charging mode. Facing the future, electric vehicles connect with the power grid, and charging safety which become the focus in this field. It analyzes the structure of charging equipment, and introduces the measures of safe charging in two aspects: power grid side charging safety and equipment side charging safety. The feasibility of improving the power quality of electric vehicle charging side is studied, and the optimal solution strategy of safety charging electric vehicle in power grid is put forward. According to the measurement information and battery using conditions, the internal temperature of the battery system can be effectively regulated by the heat management system so that the battery charging and discharging process can be carried out in a suitable temperature range. Avoiding battery safety hazard is caused by cumulative high and low temperature operations. The experiment results show that the increasing of charging load and the discordance of structure designing increase the operating pressure of power grid, but compare with fuel vehicles, which electric vehicles have energy saving and emission reduction to maximize the benefits. A comprehensive and systematic solution to the safety accident of electric vehicles are given, which can effectively control the charging safety of electric vehicle and eliminate the potential danger. It has guiding significance for the popularization of electric vehicle.

### **3. Research on Plug-in Hybrid Electric Vehicle Bus Utility Factor Based on Real-World Data**

Shuo Wang; ZhaoSheng Zhang; Yankai Hou; Peng Liu; Zhenpo Wang

The energy consumption and emission of plug-in hybrid electric vehicle (PHEV) vary with the use characteristics of the vehicle and the proportion of pure electric mileage. Based on the actual road operation data of 169 PHEV buses in six

typical cities such as Beijing and Shanghai in 2018, this paper analyzes the use characteristics (including travel characteristics and charging characteristics) of PHEV buses by constructing the characteristic data set, and studies the calculation method of pure electric mileage proportion based on the use characteristics. One of the most important results is that the actual charging frequency of PHEV buses in China is low, the charging power is small, basically with no charging travel behavior characteristics, resulting in a significant reduction in utility factor, which will make the actual energy saving and emission reduction effect greatly reduced. The research reflects the use status of PHEV buses in typical cities of China, which can lay a foundation for the research on energy consumption and emission test methods of PHEV buses, and provide suggestions for the formulation of test methods and standards for energy consumption and emission of PHEV buses.

### III. PROPOSED SYSTEM

#### 3.1 Block Diagram

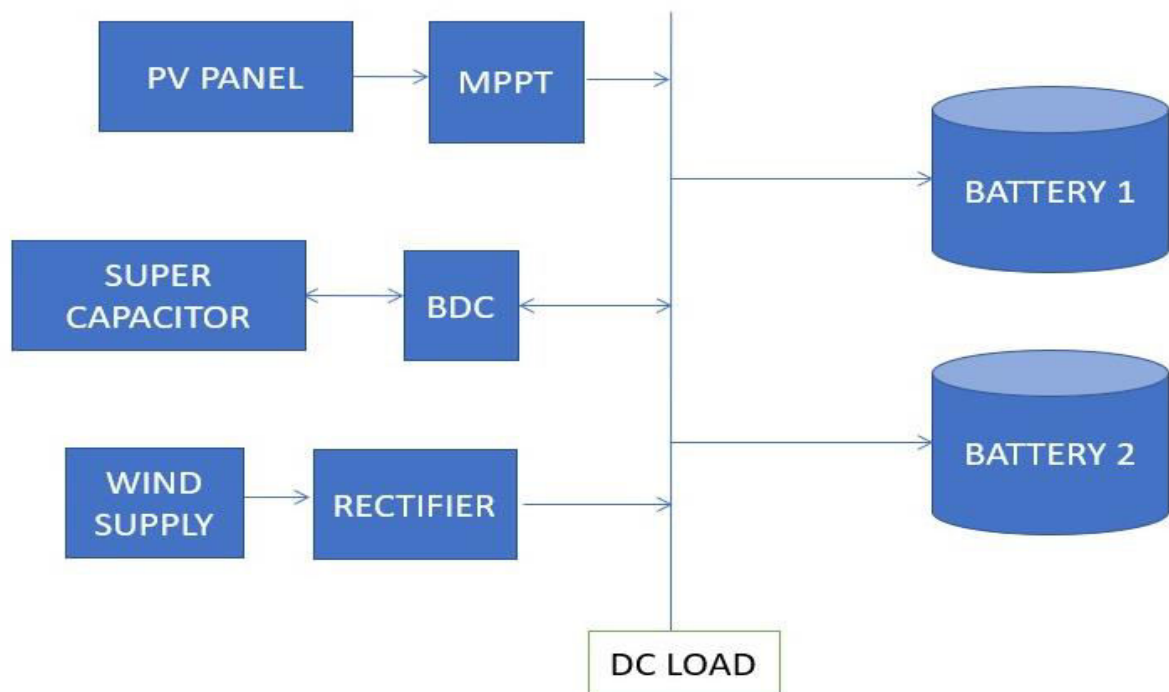


Fig 3.1 Block Diagram

In this system the battery of one or multiple electrical vehicles are charged when connected to conventional three phase grid through controlled rectifier and DC-DC converter. The conventional grid is integrated with multiple renewable sources which include PVA and wind farm. The battery charges utilizing maximum power from the aforementioned renewable sources. During deficit renewable power conditions three phase grid provides power for battery to charge through rectifier. The energy management control structure for the test system including grid with domestic loads, EV charging station, renewable sources is modeled. Different operating conditions with variable environmental factors impacting the renewable sources and EV battery charging are analyzed using MATLAB Simulink software. Graphical representation with time as reference is done using 'powergui' toolbox.

### 3.2 Simulation Diagram

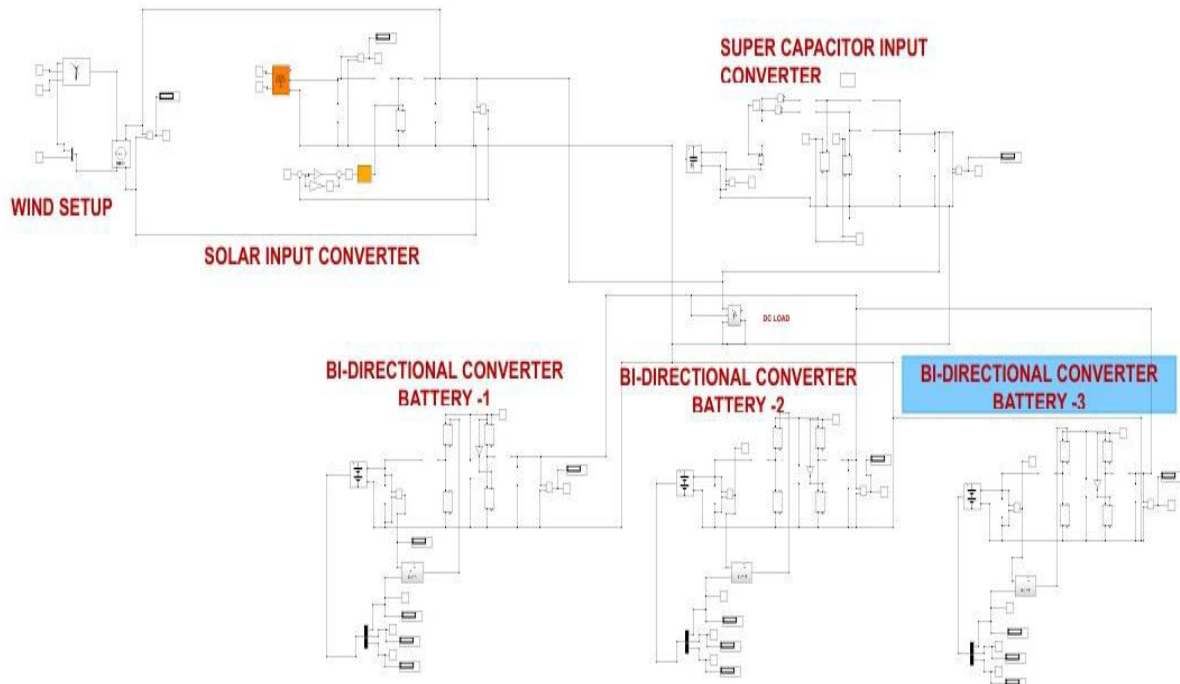


Fig 3.2; Simulation Diagram of proposed system

The simulation diagram consists of three set of battery units and bidirectional converter units. The proposed system has three renewable source like Solar PV, Wind mill and Supercapacitor. The objective of the proposed system is to maintain constant voltage throughout 24 hours even when there is power production failure in any source.

### 3.3 Simulation Outputs

#### SIMULATION OUTPUT (BATTERY 1 @ 7V )

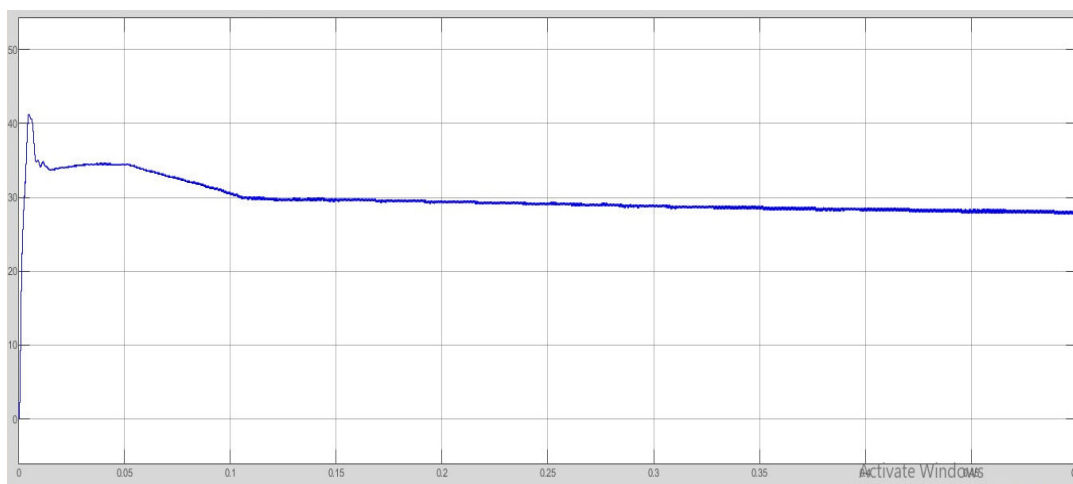
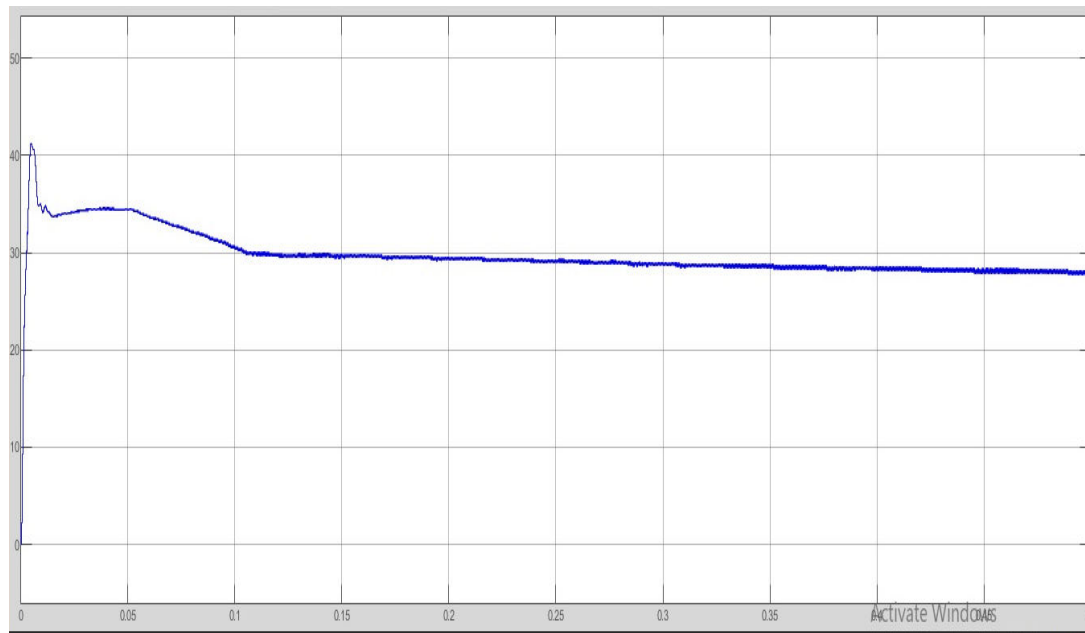


Fig Simulation output at battery voltage 7V

The simulation results shows the output of the converter or voltage across charging point is kept at constant level though the voltage of the one battery getting reduced.

#### **SIMULATION OUTPUT(BATTERY1 @ 12V)**



**Fig Simulation output at battery 12v**

The above simulation output of the proposed system shows the constant output voltage across the charging point when battery voltage is maintained at 12V.

#### **IV. CONCLUSION**

The aim of this proposed system is to maintain constant and continuous output in the Electric vehicle charging station. If the Power production in the hybrid power plant is higher than the need of charging station, the surplus power will be given to the dc load connected in the dc grid. So that the reliability of the charging station and the usage of the electric vehicle will increase. The increase in number of electric vehicle charging station and reliability of charging will increase the sale of EVs globally. It is very much essential country like India where large number of middle class people are ready to buy budget cars.

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