

# OVERVIEW OF SMART BI-DIRECTIONAL SINGLE-STAGE INVERTER FOR BATTERY MANAGEMENT SYSTEM

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## ABSTRACT

Renewable energy systems have provided the way to electricity generation by reducing the environmental hazards and reducing the combustion of fuel. Grid connected renewable generation systems needs bidirectional power flow. The battery management system can make it possible to increase the reliability of grid connected systems. Electric vehicle is future of automobile industry with the advantages over the conventional vehicles. Electric automobile is increasing in Indian market with the technological advancements.

The battery management of electric vehicles is one of the major concerns in design of electric vehicles. Authors have proposed the single stage battery management system using inverter. The renewable systems have replaced the conventional power generation methods and which is renewable based generation is going to increase in coming ten years. Bidirectional energy flow makes it possible to design grid connected renewable energy system.

**KEYWORDS:** Battery Management System, Inverter, Renewable Energy, Bidirectional power flow etc.

## INTRODUCTION

Bidirectional energy flow is necessary for the application of electric vehicle to charge and the battery and to drive the motors [1]. Different control strategies are presented by the researchers over the years for power control in photovoltaic systems [2]. Bidirectional charger is capable to control the power flow in the applications like grid connected generating system [3].

Management of the energy is always important in the generating systems. Reducing the number of steps of power conversion helps in enhancing the efficiency of the system [4]. Solar cells produce the electricity which must be effectively converted to the desired form of electricity in order to utilize. Better conversion efficiency depends upon the number of stages of power conversion [5]. The converter topologies evolved with development of electronics components is useful to control the power effectively [6].

Electric vehicles are increasing and being the choice of customers in developing countries like India. The governments are spreading the awareness about the impact of combustion of fuel across the people and also making policies to support the renewable based systems. Use of renewable energy for electric vehicles is proposed by many researchers but still it is not completely implemented in any vehicle running on road.

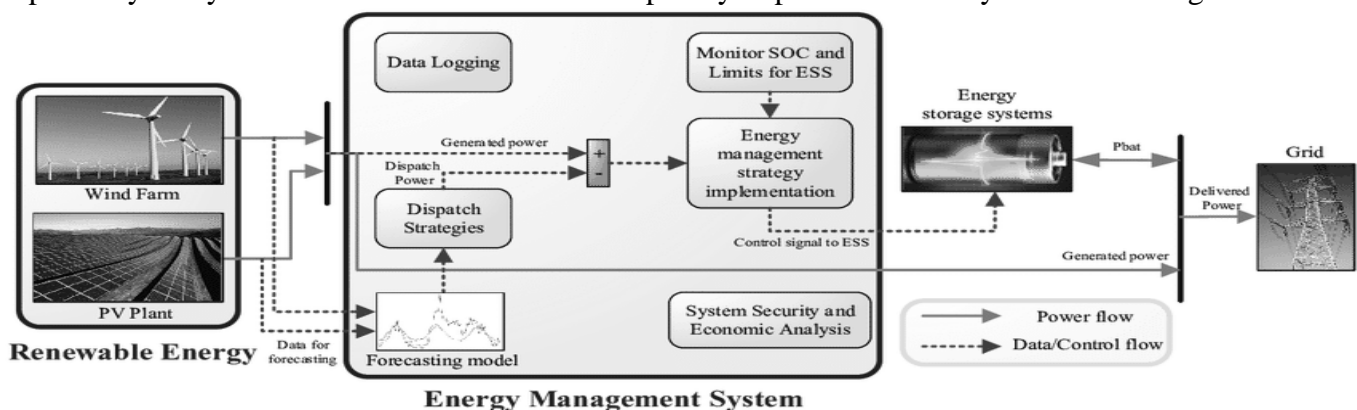


Fig.1: Energy Management System for Renewable Generation

About sixty percent of Indian vehicles will be replaced with the electric vehicles in next twenty years. The major challenges with electric vehicles are the capacity of battery and capacity to size ratio. Grid connection of the renewable sources is possible with flexible bidirectional power flow between the batteries and grid.

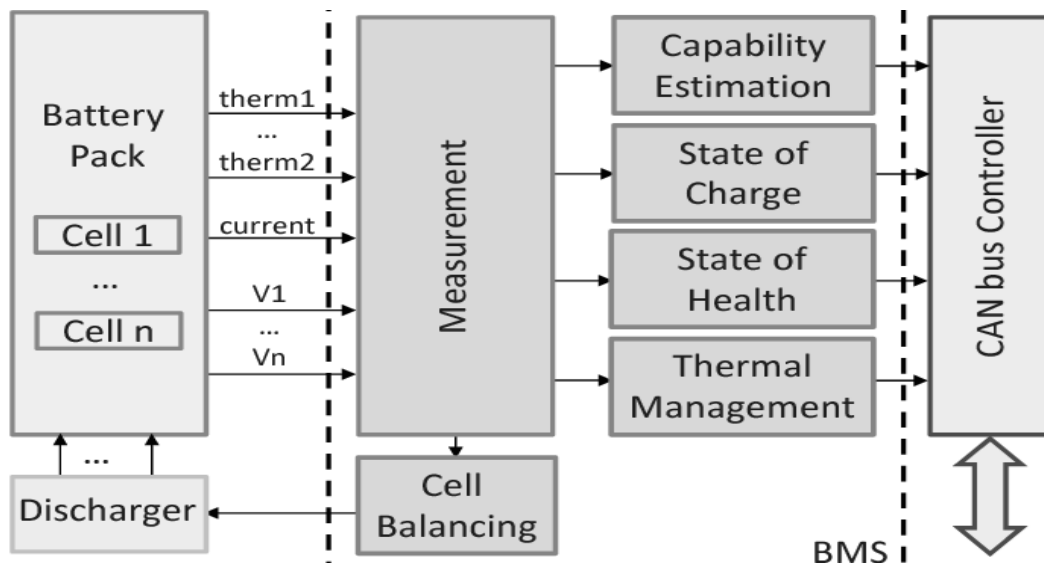


Fig.2: Battery Management System

The generalized system of battery management is shown in the figure above. Number of batteries can be need to be connected in parallel and series combination. The energy flow is bidirectional in such systems when connected to grid as shown in figure above.

### MOTIVATION OF THE WORK

Renewable systems are the future of electricity generation. Especially the countries like India are capable of photovoltaic generation throughout the year. The grid connected renewable systems faces the issues related to the battery management system such as the reduced power capacity in batteries, overcharging and discharging problems, reduced battery life, etc.

Hence the battery management system for proper utilization of the batteries by means of controlling the bidirectional power flow is necessary. Authors have proposed the battery management system from perspective of renewable energy systems in this paper. The software implementation is the part of proposed work for development of the management system of battery.

### BLOCK DIAGRAM

The basic block diagram of the proposed system is shown below in figure 3 for the single stage bidirectional power flow system for renewable systems.



Fig.3: Block diagram of the proposed system

The environmental issues are very serious now a days and this is the time to take major steps towards reducing the carbon footprints. Reducing the pollution is very much needed thing in today's world. The renewable system is the only way to generate the electricity cleanly.

To increase the generation through renewable systems it is necessary to design a proper management system for power control. The bidirectional power flow is proposed from battery to grid in the proposed system shown above. Many of researchers have been done to control battery charging and discharging control but

very few of them include bidirectional control. This thesis shows the design of bidirectional AC-DC-DC-AC with cut-off for given long life to batteries.

## CONCLUSION

Renewable energy system are lacking in terms of reliability when it comes to grid connection. India has taken third position in Asia as a largest solar based electricity generating country. Further, the grid connected solar systems are being installed in India with implementation of control strategies to energy. Authors have discussed the overview of energy management system for renewable grid connected systems in this paper. We can conclude that the need of management system for battery is there for control of the power flow to between the grid and the generating station. These systems are important to enhance the reliability of the renewable systems.

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