

Solar Power Photovoltaic System

Naseema P¹, Afrin Sadaf S K², Fiza Taj³, D Ghousiya Taskeen⁴, Mr. H M Elia Sundaram⁵

^{1,2,3,4,5} Department of Electrical and Electronics Engineering

^{1,2,3,4,5} Rao Bahadur Y. Mahabaleswarappa Engineering College, Ballari

Abstract- Solar photovoltaic (PV) systems provide a clean and renewable method of generating electrical energy directly from sunlight. This project presents the design and operation of a solar power photovoltaic system consisting of a 2 kW solar panel array, 150 Ah battery bank, and 2 kVA inverter. The solar panels convert solar energy into DC electrical energy, while the battery stores the generated energy for use when solar radiation is insufficient. The inverter converts the stored DC power into AC power suitable for supplying AC loads. The system provides a practical solution for reducing dependence on conventional energy sources and can be useful for applications where reliable and renewable power is required.

Keywords- Battery, Inverter, Photovoltaic Panel, converter, DC panel board

I. INTRODUCTION

The increasing demand for electrical energy and the environmental problems associated with conventional energy sources have increased the importance of renewable energy systems. Solar energy is one of the most abundant and environmentally friendly renewable energy sources. A photovoltaic system converts solar radiation directly into electrical energy using photovoltaic cells.

The proposed solar power PV system uses a 2 kW solar panel array, 150 Ah battery, and 2 kVA inverter. The solar panels generate DC power from sunlight, the battery stores electrical energy, and the inverter converts DC power into AC power for suitable loads. This system demonstrates the practical use of solar energy for electrical power generation and storage.

II. PROBLEM STATEMENT

The problem is to design and implement an efficient Solar Power Photovoltaic (PV) system that can generate reliable electricity, reduce dependence on non-renewable energy sources, and provide an eco-friendly power solution, especially for off-grid and rural applications.

III. OBJECTIVES AND SCOPE

A. Objectives

- Converts sunlight into electrical energy using the Photovoltaic Effect.
- Produces electricity without pollution or harmful gases.
- Provides electricity where grid supply is not available.
- Saves money in the long run after installation.

B. Scope

The scope of the project includes the design, installation and operation of a renewable energy system sensors, DC-DC converter and inverter.

IV. SYSTEM DESCRIPTION

The system is made up of the following main blocks.

A. Solar Array:2kw

A 2 kW solar array is the primary energy-generating component of a solar power PV system. It is made up of multiple photovoltaic (PV) panels connected in series and parallel combinations to obtain the required voltage and current. When sunlight falls on the PV cells, the photovoltaic effect converts solar radiation directly into DC electrical energy. The generated DC power is collected through cables and supplied to the charge controller, battery, or inverter according to the system design.

B. Charge Controller

The charge controller is an important component of a solar power PV system that regulates the electrical energy supplied from the 2 kW solar array to the battery. Its main function is to control the charging voltage and current so that the battery is charged safely and efficiently.

C. Battery Bank:150AH

The 150 Ah battery bank is used to store the electrical energy generated by the solar PV array so that it can be used when sunlight is unavailable, such as during the night or cloudy conditions.

D. Inverter:3KVA

The 3 kVA inverter is an important component of the solar PV system that converts the DC electrical power generated by the solar panels or stored in the battery into AC electrical power suitable for household or other AC loads.

E. DC Panel Board

The inverter converts the DC power of the battery into AC power so that standard AC loads can be operated.

V. WORKING PRINCIPLE

The solar PV system operates by receiving solar radiation through the 2 kW solar panel array. The generated DC power is controlled and supplied to the battery through the charging system. The 150 Ah battery stores the electrical energy for later use. When AC power is required, the stored DC power is supplied to the 2 kVA inverter. The inverter converts the DC voltage into AC voltage, which can then be supplied to suitable electrical loads.

VI. HARDWARE REQUIREMENTS

- Solar Array:2kw
- Charge controller
- Battery Bank:150AH
- Inverter:3KVA
- DC Panel Board
- AC Distribution Board
- AC Loads

VII. EXPECTED RESULTS

The proposed solar PV system demonstrates the conversion of solar energy into useful electrical energy. The 2 kW solar panel array provides renewable DC power, while the 150 Ah battery provides energy storage. The 2 kVA inverter makes the stored/generated DC energy suitable for AC loads. The system can help reduce dependence on conventional electrical sources and utilize clean renewable energy.

CONCLUSION

The solar power photovoltaic system provides an effective method of converting solar energy into electrical energy. The proposed system consists of a 2 kW solar panel array, 150 Ah battery, and 2 kVA inverter. The system demonstrates how solar energy can be generated, stored, and converted into AC power for suitable electrical loads. It provides a practical approach toward utilizing renewable energy and reducing dependence on conventional power sources.

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