

# Design and Modelling of the Sun Grid System Using MATLAB

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**ABSTRACT:** Power can be generated from either renewable or non renewable sources. Renewable sources are preferred to avoid pollutants emission and depend on fossil fuels to reduce. The proposed solar energy conversion unit consists of a solar array, Bidirectional DC-DC converter, single phase inverter and AC bus. The inverter converts DC power from the PV panel into AC power and given it to the load which is connected to the grid.

**KEYWORDS:** Solar panel; Bi directional DC DC converter; Inverter;DC bus;AC bus

## I. INTRODUCTION

Solar PV system power generation have low maintenance and zero pollution.Cleanest, reliable way of generating electricity using solar. In this proposed system low cost, compact in size and high reliability and high efficiency. As the cost of the solar cell decreases, the conversion from solar to electrical energy increases which is economical. High efficiency is obtained by switching the output power between load and grid. In most occasions, 220VAC and 110VAC are needed for power supply. Because direct output from solar energy is usually 12VDC, 24VDC, or 48VDC, it is necessary to use DC-AC inverter in order to be able to supply power to 220VAC electronic devices. Inverters are generally rated by the amount of AC power they can supply continuously.

## II. RELATED WORK

The aim of the paper 1 is the development of a solar generation photovoltaic system based on a power electronics standard cell for applications of micro grid. The proposed system is capable of providing security in standalone operation delivering power uninterrupted to critical loads and seamlessly transitioning between grid connected modes and stands alone. To mitigate the variability effect of the generation and load demand a state of the 20kWh lithium ion battery is used to balance in the system power flow. This work presents a photovoltaic solar generation system able to work with the grid or in a micro grid environment. The control algorithms developed for this application allow the system to work in off grid mode of operation and seamlessly transition from off-grid to grid connected and vice versa, without changing the control algorithm when changing mode of operation. The objective is achieved by using an algorithm that controls the DC power flow together with an energy storage device to mitigate the unpredictable nature of the source and loads and to maintain a power balance between input and output. On the load side the seamless transition with the grid is achieved by controlling the inverter stage as a voltage source with a voltage and frequency drop terminal characteristic.

In paper 2, Photovoltaic inverter that is in charge of electric power conversion is a critical component used in solar photovoltaic power systems. Many concerns are focused on the operation of photovoltaic inverter due to the worse designing may cause the terrible influences on safety, performance and grid interconnection characteristics of solar photovoltaic power systems. The standard focuses on the technical specifications and includes general principles, response to abnormal conditions, power quality, islanding, and test instructions and requirements for design, production, installation evaluation, commissioning, and periodic tests. Photovoltaic inverter is responsible for energy conversion on the application of solar photovoltaic power system. In order to assure the quality and reliability of the generation system, it is important to estimate then performance of PV inverter used in the field.

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In paper 3, solar inverters are designed specifically to handle photovoltaic (PV) panels, to efficiently extract the most amount of power, and to transform it properly so that it can be injected into the grid. The singularities of the application allow for opportunities that can be exploited for better performance. Inverters for PV applications are designed to operate at very low voltage variations, almost at a fixed frequency, and with a power factor usually greater than 0.8. In this work, such new topology provides operational characteristics close to a 5-level topology. This achievement is accomplished by adding just a few more power-electronic components required for a 3-level topology. A complete 3 phase system is designed and simulated.

### III. DESIGN

Panel ranges from 12V to 18V with a current of 4.75A and output power of 50W with duty cycle of 50%

$$V_o = \frac{V_i}{1-D} \quad (1)$$

$$L = \frac{(V_o - V_i + V_d)(1 - D)}{I_{load} * f} \quad (2)$$

Assuming in Bi directional DC DC converter,

First voltage, which is fed to inverter i.e. 48v.

Inductor value=150\*10<sup>-6</sup> H; Capacitive value=250\*10<sup>-6</sup> F; R<sub>L</sub>=500 ohm

Second voltage is fed to battery i.e. 24v.

Inductor value=2000\*10<sup>-6</sup> H; Capacitive value=250\*10<sup>-6</sup> F; V<sub>d</sub>=0.6

### IV. PROPOSED SYSTEM

PV panel of 12v is considered and given to a DC DC converter and 48V of DC voltage is obtained that is given to a single phase inverter and at AC bus 230v is obtained. DC DC converter taken here is the boost converter. In boost converter the output voltage or power is more than the input voltage or power. In the bi directional converter, one voltage is given to inverter i.e 48V and other voltage is given to the battery is 24V.

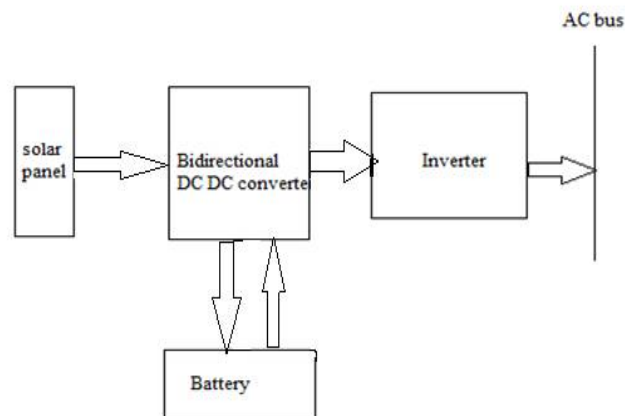


Figure 1: Proposed system

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## V. SIMULATION IN MATLAB

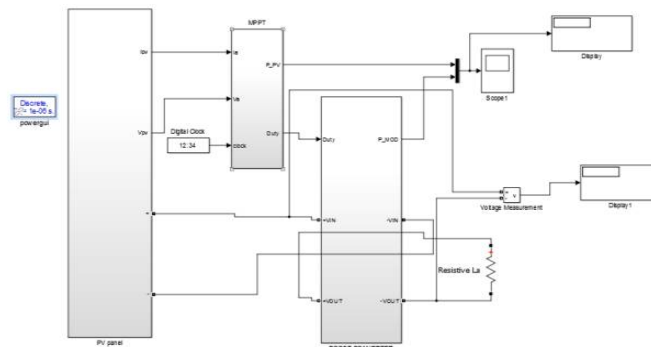


Figure 2: Simulation of proposed system

Table 1: Output obtained from different values of PV panel input

Input voltage from the panel	Output voltage obtained from the inverter
12V	165.4
14V	184.6
16V	197.4
17V	213.5
18V	228.4

## VI. CONCLUSION

Low cost single phase inverter using solar is designed. The performance analysis of single phase inverter is presented using MATLAB. The inverter converts DC power from the PV panel into AC power and given it to the load which is connected to the grid, when the PV power is greater than the load the excessive power is fed to the grid. Hardware implementation of this system is difficult because getting maximum output i.e. 100% efficiency from the PV panel is not possible and implementation of a boost converter to obtain 48V is difficult. This will be scope for future work using different other technology and even for higher current rating.

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