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# REVIEW ON GRID INTERFACING OF MULTIMEGAWATT PHOTOVOLTAIC INVERTERS

**Mr. Vilas S. Solanke*, Mr. Naveen Kumar**

*PG Student, Dept. of Electrical Engineering, MSS,s College of Engineering & Technology, Jalna (MS), India

Assistant Prof., Dept. of Electrical Engineering, MSS,s College of Engineering & Technology, Jalna (MS), India

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## ABSTRACT

This paper presents review on the latest development of control of grid connected photovoltaic energy conversion system. Also this paper present existing systems control algorithm for three-phase and single phase grid-connected photovoltaic (PV) system. This paper focuses on one aspect of solar energy, namely grid interfacing of large-scale PV farms. This Grid-connected photovoltaic i.e. PV systems can provide a number of benefits to electric utilities, such as power loss reduction, improvement in the voltage profile, and reduction in the maintenance and operational costs of the electric network.

**KEYWORDS**: Photovoltaic, Grid-Connected, Three-Phase, Single Phase, Electric Network.

## INTRODUCTION

Now days we are suffering from the various environmental problems such as global warming, climate change, pollution, formation of greenhouse gases, increase in temperature, decrease in water table, water scarcity, and depletion of ozone layer. All these problems are arrives due to the pollution. Maximum pollution occurs due to the use of traditional energy recourses such as fossils fuel. Energy demand is increasing rapidly and it becomes very difficult to generate power from conventional energy sources because of price of fuel is also increasing simultaneously hence renewable energy forms are used mostly. Hence solar photovoltaic systems are becoming more popular [1].

Traditional energy recourses (TER) are having lots of disadvantages, the development of renewable energy sources (RES) is a latest researcher's area. RES provides different advantages such as simplicity of allocation, high dependability, absence of fuel cost, low maintenance and lack of noise and wear due to the absence of moving parts, so that photovoltaic (PV) generation is increased. In order to improve the power-supply reliability and quality requires new strategies for the operation and management of the electricity grid [2].

Photovoltaic cells i.e. PV cell generate electric energy from the solar energy. Because of cost of the photovoltaic cells is very high, investment on solar energy will be very high. Solar cells provide the electrical energy in the form dc and it is essential to store this electrical energy and precede it whenever load is required [3].

## EVOLUTION OF GRID-CONNECTED PHOTOVOLTAIC SYSTEM

Evolution of grid connected PV system has past and the present technologies. The past system was based on centralized inverters and these inverters are connected to the number of modules. These modules may be connected in series or in parallel pattern. These past system contains some limitations such as the necessity of high voltage DC cables between the modules and the inverter, power losses due to a centralized MPP Tracking (MPPT), mismatch between the modules and at last the string diodes. In the present system the grid integration of RES applications is used in the photovoltaic systems provides many benefits of using RES in distributed (aka dispersed, embedded or decentralized) generation (DG) power systems. These present provides many advantages such as no losses generated by the string diodes and an individual MPPT can be applied for each string [2].

## EXISTING SYSTEM

Areen Shankar et al. [3] developed inverter for photovoltaic module with grid synchronization system. This proposes system provides the use of a multi level voltage source inverter without transformer is a reasonable solution for the input to grid in the lower power range. Fig. 1 shows general arrangement used in photovoltaic standby power supply units. This system contains five modules i.e. Photovoltaic cells, Controlled Charger Circuit, DC to AC Inverter, Grid Synchronization and Power Grid. The main function DC to inverter circuits is that to convert the dc voltage to ac voltage of required frequency and voltage. In this inverter circuit there are two approaches; one is connect the cells in series to generate high voltage dc and use high voltage dc to ac inverter circuit and second is use low voltage power devices for the inverter and step up the voltage using transformers. This proposed system used fifteen level multilevel inverter is employed as dc to ac inverter for photovoltaic power supply system to obtain the sinusoidal output voltage and current. PV cell is in DC mode and grid power in AC mode hence here system required the DC to AC by a power converter, hence DC to AC by a power converter used for conversion. This conversion topology consists of two switches in each bridge. To check the accuracy of this system or for the result, a single-phase, 1KVA, R-L load simulation model is taken. It is found that inverter voltage and grid voltage synchronization 15 level inverter output waveform is reduce and it contain 11 level to maintain 230V supply, when 16A current is injected in grid supply.

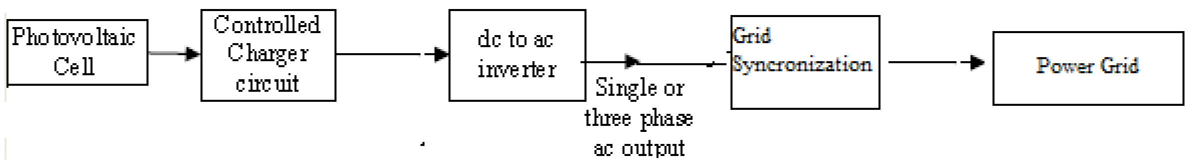


*Fig. 1 Functional block diagram of photovoltaic power supply unit [3]*

Syahrul Ashikin Azmi et al. [4] present suitability of selective harmonic elimination (SHE) for low-loss multimegawatt grid connected photovoltaic (PV) inverters. This paper proposes a new implementation technique for selective harmonic elimination (SHE) that utilizes the third harmonics to spread the switching angles over 90◦ instead of being located in a narrow range as generated also this method or technique include simplicity in implementation and flexibility in PWM waveforms. This feature of SHE provides easy practical work at high modulation indices when a large number of harmonics are eliminated. Figure 1 shows Schematic diagram of a grid-connected PV inverter with SHE and THI PWM using a dSPACE1106 hardware implementation, where active and reactive powers are regulated using direct power control, and the filter bus voltage is assumed constant. Inverter power injection into the grid is regulated in the synchronous reference frame, the inverter ac-side dynamic can be expressed in the *dq* axes and voltage magnitude at the filter bus is aligned with the *d*-axis

$$\frac{dI_{fd}}{dt} = -\frac{R_f}{L_f} I_{fd} + \frac{[V_{cd} - V_{fd} + \omega L_f I_{fq}]}{L_f} \qquad (1)$$

$$\frac{dI_{fq}}{dt} = -\frac{R_f}{L_f} I_{fq} + \frac{[V_{cq} - V_{fq} - \omega L_f I_{fd}]}{L_f}. \qquad (2)$$

Experimental verification of this paper provides a comprehensive experimental demonstration of the potential superiority of SHE over carrier-based PWM in a megawatt grid-connected PV inverters. This paper provides the simplicity of a SHE implementation for grid-connected inverters, exploiting modern DSP floating-point capabilities.

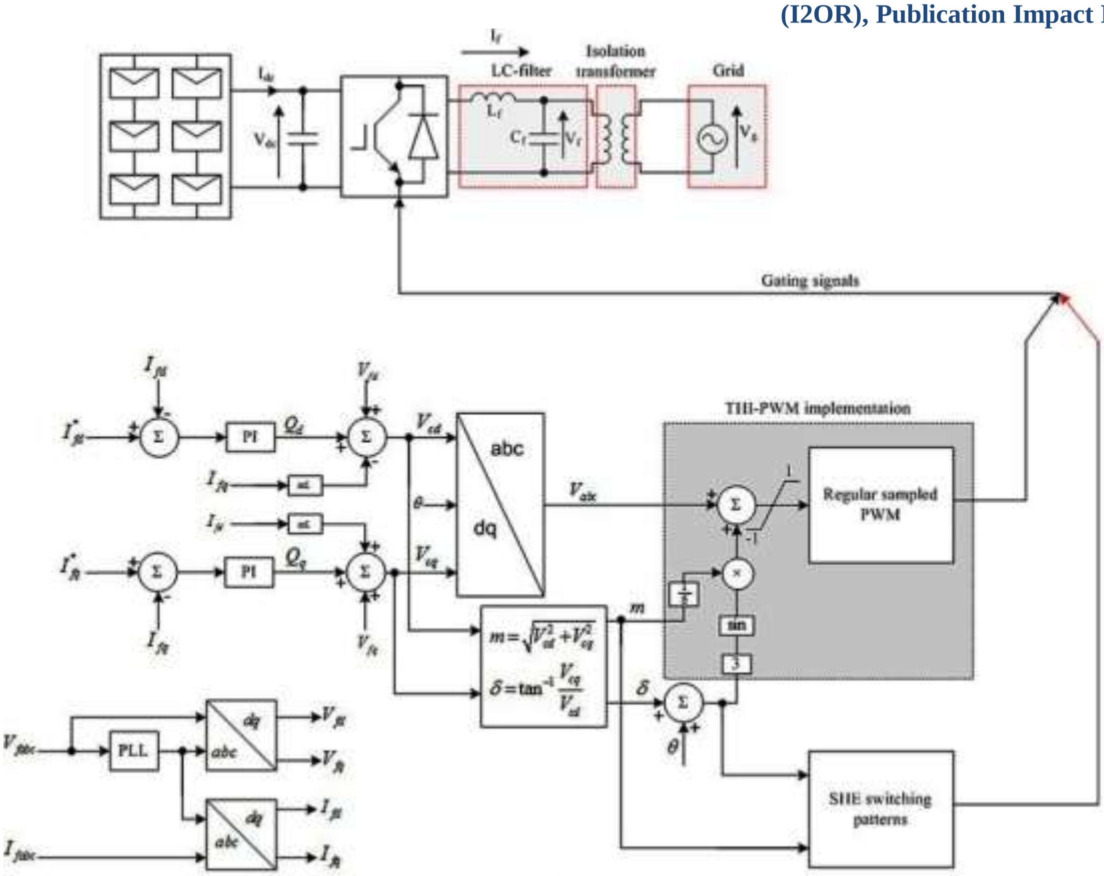

*Fig. 1 Schematic diagram of a grid-connected PV inverter with SHE and THI PWM using a dSPACE1106 hardware implementation [4]*

## CONCLUSION

This Grid-connected photovoltaic i.e. PV systems can provide a number of benefits to electric utilities, such as power loss reduction, improvement in the voltage profile, and reduction in the maintenance and operational costs of the electric network. This paper presents review on the latest development of control of grid connected photovoltaic energy conversion system.

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