

# Grid Independent and Battery less Solar Photovoltaic Power Converter

By

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## Abstract

Today the renewable energy is playing a key role in the world. In that the solar energy one of the important sources. The majority of the countries utilizing the solar energy. To consume the solar energy in to our daily life, the solar power converters are taking vital role; the present available converters are two types they are,

- 1) Solar grid-tie/ grid-connected converters and
- 2) Solar battery backup converters

For grid-tied converters the grid supply is compulsory as a primary supply along with PV-array, and for battery backup converters battery supply compulsory as a primary supply along with PV array. It is observed that the above converters will not work without primary supplies even the PV source available. So it is not possible to utilize the solar energy without primary supplies with existing converters. To conquer this issue, the new innovative converter planed as a “Grid Independent and Battery-less Solar PV Power Converter” to utilize the solar energy directly via this new converter concept without any primary supply.

**Key Words:** Grid-tied, Battery less, Photovoltaic, Converter, Solar array, Energy.

## I. Intruction

### 1.1 Solar Photovoltaic Power Converter

**Grid-tied** (also known as **grid-Connected** or **utility-connected**) systems are designed to operate in parallel with a utility electric AC-supply [2].

These configurations are most common. At night or during cloudy weather, the electricity is supplied by the mains supply in grid-tied converters, and during the daylight hours the system generates some power, commencement the consumption of electric supply from the utility and reduction in electric bills [1]. The balance of the kWh energy required by user loads is automatically drawn from the input grid lines in grid tied converters.

The main disadvantages of such systems is that,

- a. Normally they do not provide any back-up during grid failures / interruption even if sun is shining; even the PV array is producing enough energy. Its meaning is that the grid supply mandatory for grid-tied converters along PV array, no grid means no output.
- b. Secondly, it required Net-metering compulsory. If the PV panels are producing more electricity than usage, the system will feed the excess of the energy back to the utility, i.e. it will export to grid. (It may even spin electric meter backwards, further reducing

- monthly bills. But in some states/countries we have to pay for energy back to the utility also if NO net-metering system).
- c. So, there by these Grid-tied solar systems are not suitable for small capacity applications like domestic /residential applications, these are only suitable for large scale and commercial power plants only.

To overcome these above demerits, the latest topology is introducing for the future development of solar power utilization.

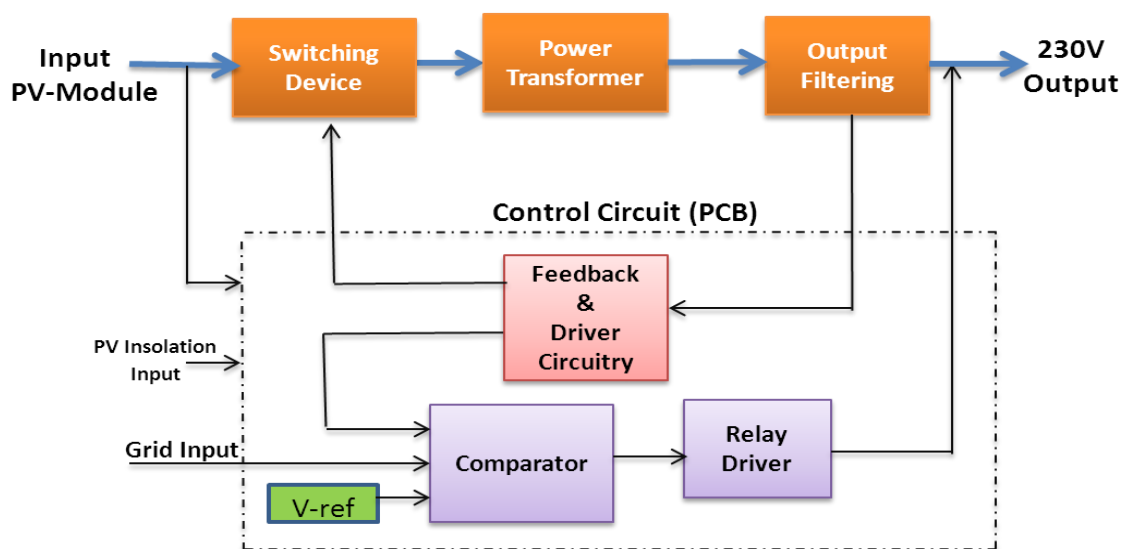
The latest concept is titled as **“Grid Independent and Battery less Solar Photovoltaic Power Converter”**. It does not require any battery backup and primary/ reference grid supply etc. it can work even at grid interruption at sun shine hours.

There will be no grid export issue and not required net-metering with this system and much suitable for low & medium capacity systems like domestic /residential applications etc.

## 2.1 Design Description

The following block diagram shows the circuit blocks to generate the necessary signals:

### Block Diagram



**Fig.1** Block diagram of grid independent, battery less Solar Photovoltaic Power Converter.

In the above block diagram [1], the heart of the converter is feedback & MOSFET driver circuit. The DC is fed to the resonance circuit from the DC source of PV-modules. Then it builds up oscillations at the designed frequency at a low voltage. The frequency depends on the values of oscillator elements [1]. The low AC output voltage from the oscillator is then fed to a step-up transformer for raising the output AC voltage up to the required level.

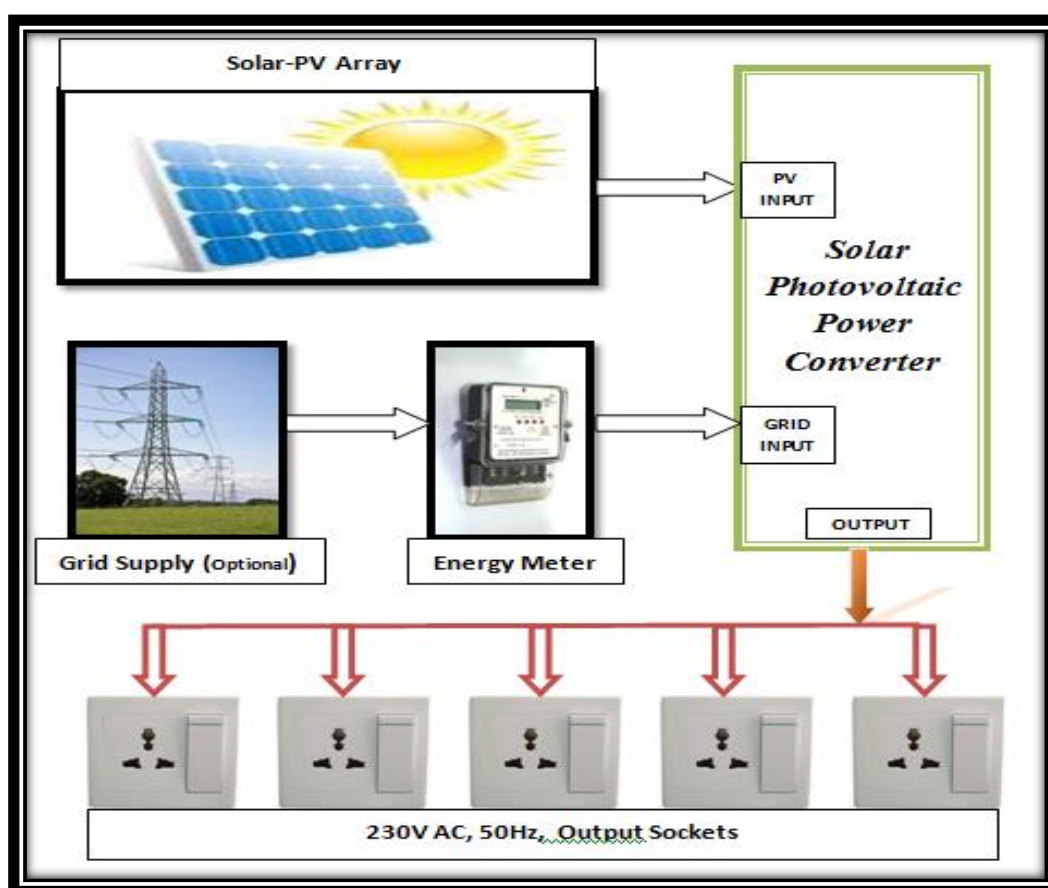
The solar direct photovoltaic power converter requires only with few components, like SG 1525A, LM 124, LM 158, SG7812 etc. The heart of this converter is PWM (Pulse Width-Modulation) control integrated circuit; the LM 124 (OP-AMP) IC used for various protections such as over-load, SPV- low, feedback circuits [1].

The main sections of control circuit of solar direct photovoltaic power converter are,

- a) Power Supply & Feedback Section
- b) PWM plus generator Section
- c) Power MOSFET & driver Section
- d) Over-load & PV- low Section
- e) Intelligent Grid-interactive section

### 3.1 Working Concept

The solar direct photovoltaic power converter will interact with Grid-supply (optional) and PV-supply at sunshine hours as per insolation-level, but at night time it will stick with Grid-supply only (If grid supply connected) [1]. The working concept of the system is shown in the below fig.2



**Fig.2** Working concept of the grid independent, battery less solar photovoltaic power converter.

## 4.1 Conclusion

This new grid independent, battery less solar photovoltaic power converter designed with Quasi-sine wave output; it can adequately power most house hold appliances. It is more economical, 99% of appliances run happily with Quasi-sine wave [6]. It does not require any battery backup and primary/ reference grid supply etc. it can work even grid blackout at sun shine hours. There will be no grid export issue with this system. It is purely suitable for residential applications & shopping-Malls etc.

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