POWER ELECTRONICS APPLICATIONS TO PV SYSTEM

Types of Solar Power Generation System

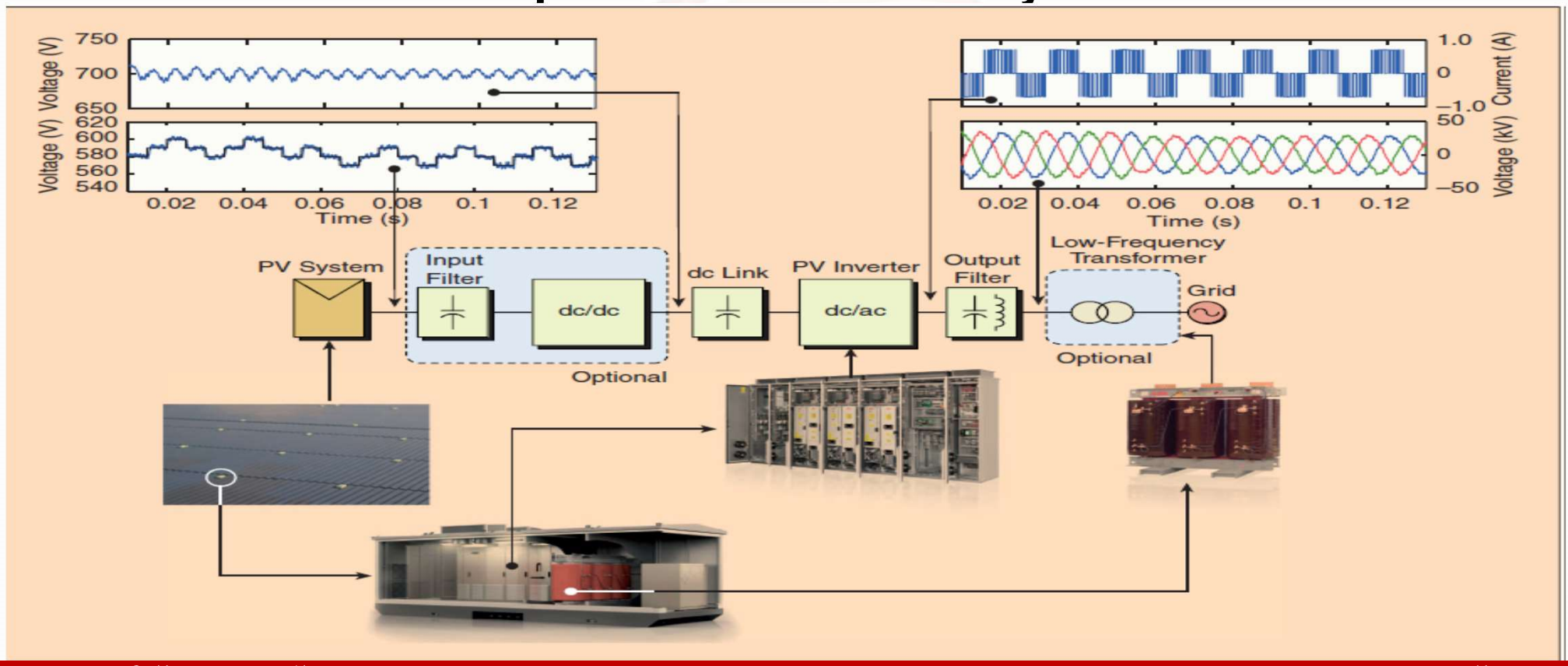
The three main types of solar power systems

1. **On-grid** - also known as a grid-tie or grid-feed solar system

2. **Off-grid** - also known as a stand-alone power system (SAPS)

3. **Hybrid** - grid-connected solar system with battery storage

Components of PV System



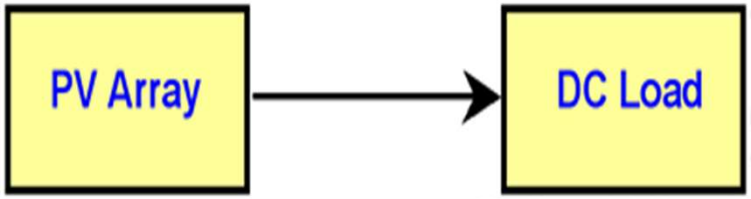


Figure 2. Direct-coupled PV system.

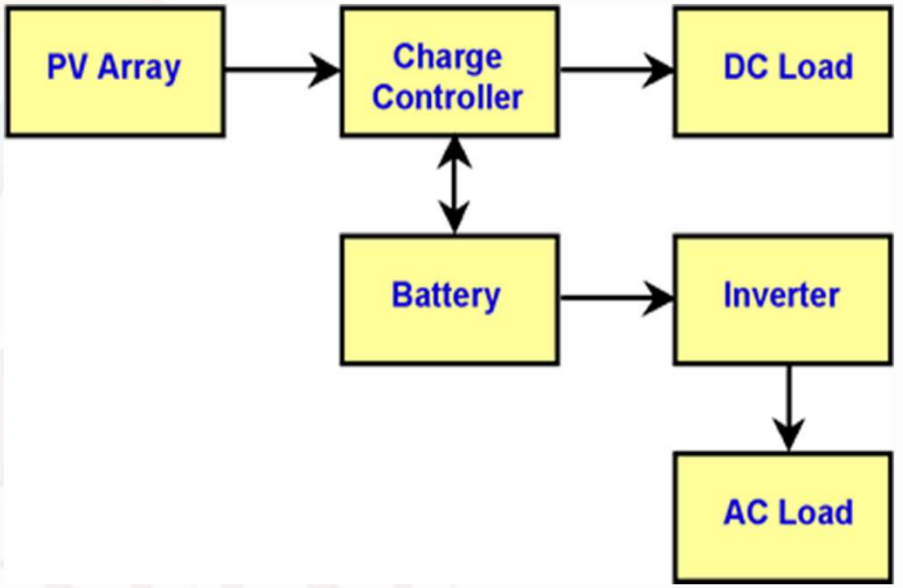
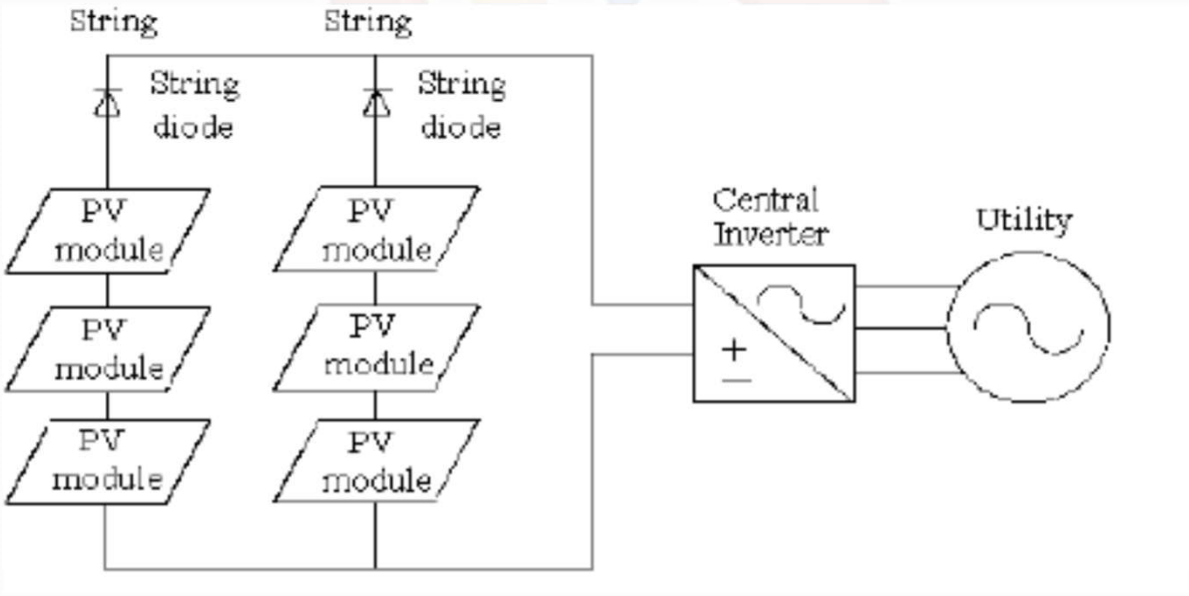


Figure 3. Diagram of stand-alone PV system with battery storage powering DC and AC loads.

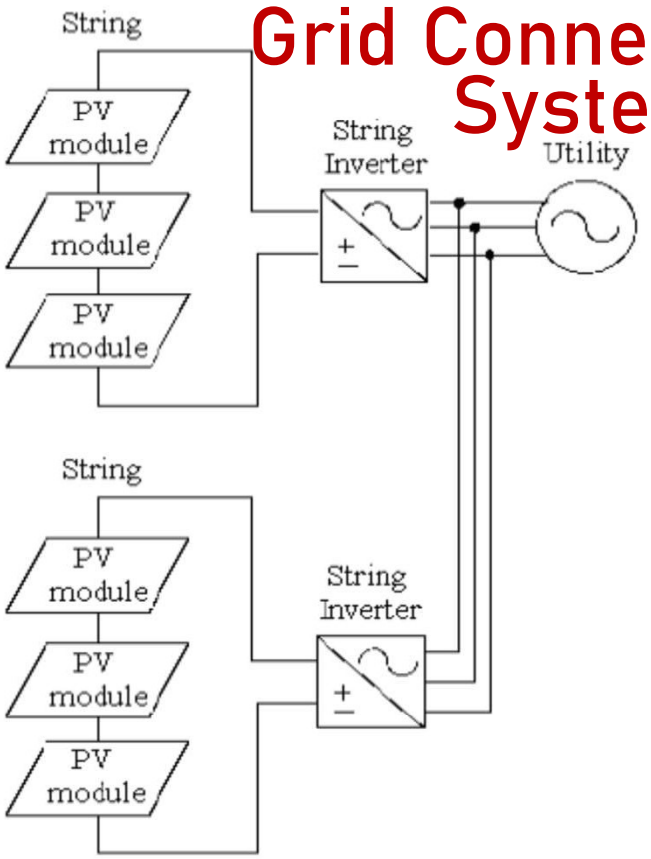
Grid Connected PV System

In the case of grid-connected PV plants, the PG is connected to the AC grid by means of a proper electronic power conditioning system based on a power electronic inverter. Inverters in PV plants perform many functions. They convert the generated DC power into an AC power compatible with the utility. They also contain the protective functions that monitor grid connections and the PV source and can isolate the PV array if grid problems occur.

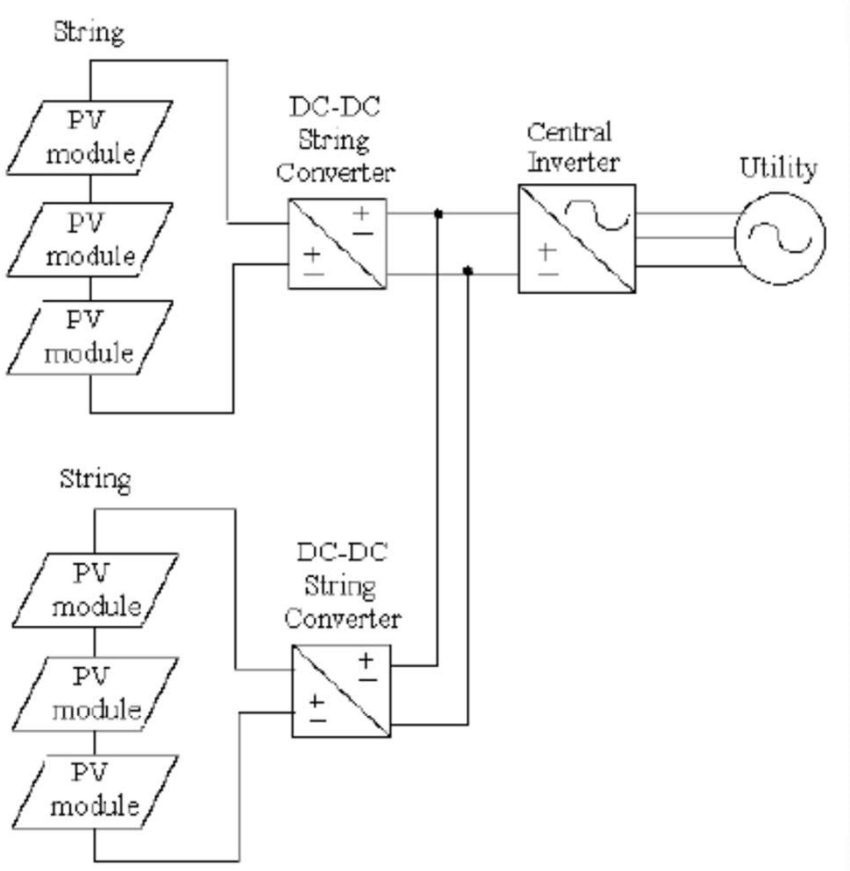


PV plant layout with central inverter

Grid Connected PV System

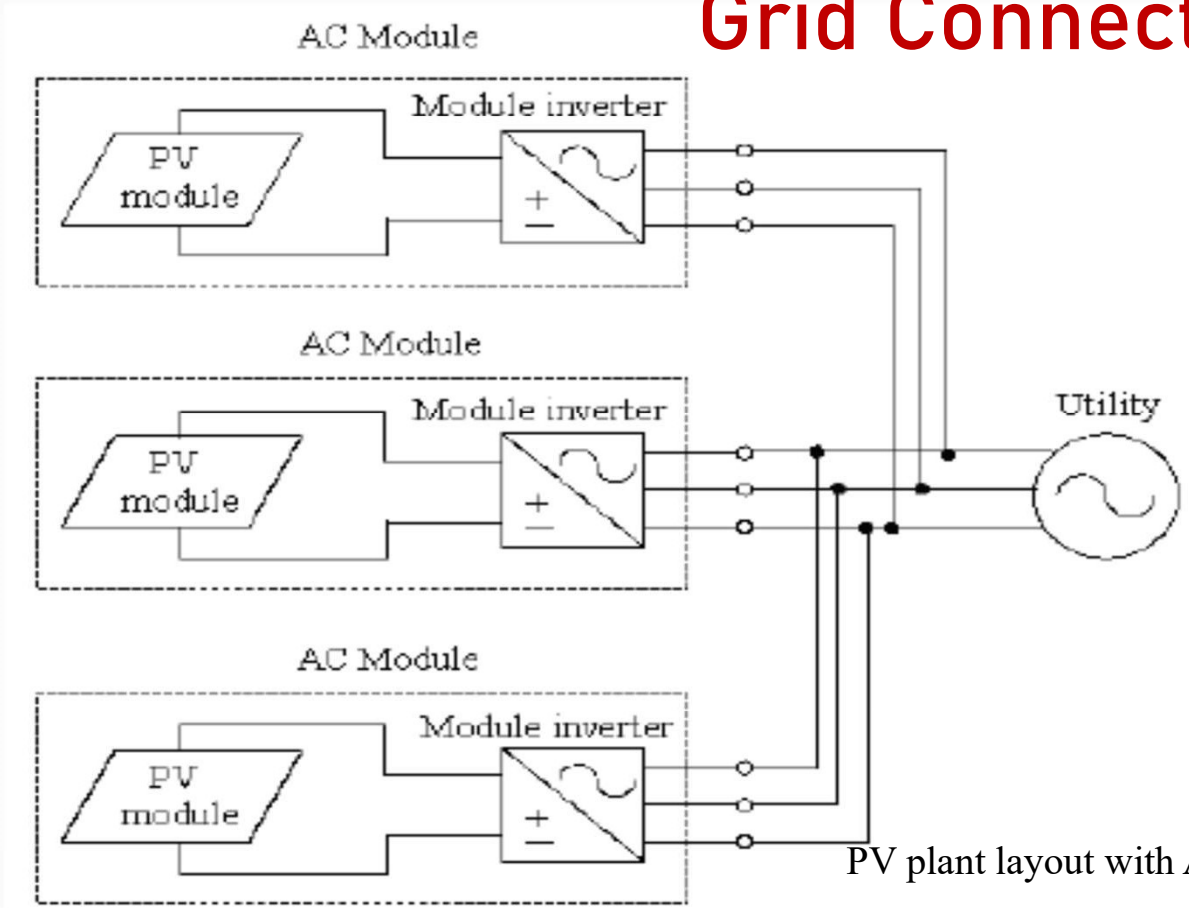


PV plant layout with an inverter for each PV string



PV plant layout with a multi-string inverter

Grid Connected PV System



PV plant layout with AC-module inverters

PV System Design

The goal for a solar direct electricity generation system or photovoltaic system is to provide high-quality, reliable, and green electrical power.

Criteria for a Quality PV System

The criteria for quality PV system are as follows:

- Be properly sized and oriented to provide electrical power and energy
- Good control circuit to reduce electrical losses, overcurrent protection, switches, and inverters
- Good charge controller and battery management system, should the system contain batteries

Power-Conditioning Unit

The choice of the PCU has a great impact on the performance and economics of the system. It depends on the type of waveform produced, which in turn depends on the method used for conversion, as well as the filtering techniques of unwanted frequencies. Several factors must be considered when selecting or designing the inverter:

- The power conversion efficiency
- Rated power
- Duty rating, the amount of time the inverter can supply maximum load
- Input voltage
- Voltage regulation
- Voltage protection
- Frequency requirement
- Power factor