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Increasing demand for Solar Photovoltaic System in urban and rural development in India

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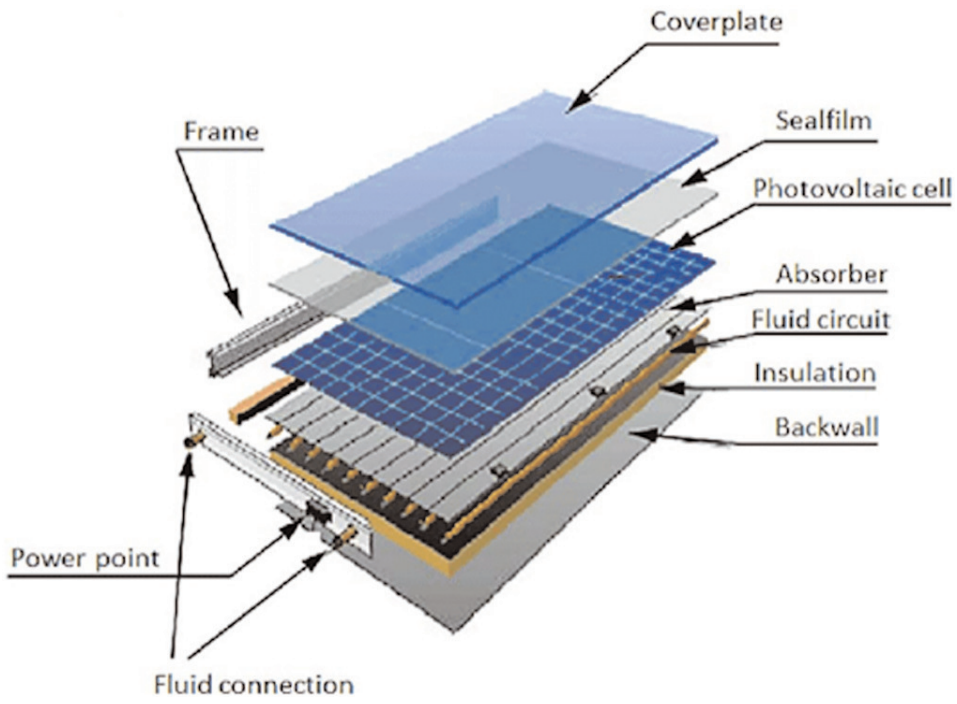
- **Abhishek Patel** Scientist, Central Arid Zone Research Institute, Regional Research Stations Kukma-Bhuj (Gujarat)



India is endowed with vast solar energy potential as it due to acquires 250 to 300 sunny days (most states) in a whole year.Country receives solar flux of 4-7 kWh per sq. m per day which provides the total solar energy potential of about 5,000 trillion kWh per year over India's land.Recently, India achieved 5th global position in solar power deployment by surpassing Italy.Solar power capacity has increased by more than 11 times in the last five years from 2.6 GW in March 2014 to 30 GW in July 2019. Presently, the solar tariff in India is very competitive and has achieved grid parity.

In recent times, greater awareness towards the need of the utilization of renewable energy sources increased in the agricultural sector such as water lifting from the open wells and tube wells and water supply in the field under remote villages through irrigation systems.

What is Solar Photovoltaic System?

It is a device which converts sunlight into electrical energy. The solar cell converts the photons which present in solar rays to direct-current (DC) and voltage. A single PV device is known as a cell. An individual PV cell is usually small. These cells are made of different semiconductor materials and are often less than the thickness of four human hairs. A single PV cell typically produce about 1 or 2 watts of solar electric power.

- The PV cells are connected in a chainand produced higher amount of energy as per desire. They are connected in a series form a module or panel.
- The electricity produced from a solar panel (or array) is in the form of direct current (DC).For easier consumption of solar electricity, it must first be converted from DC to AC using an inverter

Science fact !

When the sunlight strikes on the semiconductor surface, an electron springs up and is attracted towards the N-type semiconductor material. This will cause more negatives in the n-type and more positives in the P-type semiconductors, generating a higher flow of electricity, this is known as the photovoltaic effect. The amount of current generated by a PV cell depends on its efficiency, its size (surface area), and the intensity of sunlight striking on the surface.

Components of Photovoltaic System

It mainly consists of solar panel, inverter, racking, wiring, combiner,

disconnect, circuit, breaker, and electric meters. This will also vary according to the desired application. Some of the major components are being described:

- Solar panel (made from crystalline silicon)is the combination of series of solar cells with having a semiconductor property. It captures photons from the sunlight and convert them into electric energy by the process called the photovoltaic effect. most widely made from crystalline silicon having efficiency around 33%. Many other semiconductor materials and new technologies available nowadays are giving higher efficiencies, but due to higher operating costs it is not very much economical to operate by farmers under rural livelihood aspect.Invertor device are used to convert the incoming direct current into an alternating current (AC). Most inverters have conversion efficiencies of 90% or higher.
- Racking is the mounting apparatus that fixes the solar array to the ground or rooftop. It is mainly made of steel or aluminium and is designed for surviving in extreme weather (wind speed up to 150 km/h). Flat roof and pitched roof systems are available under racking.A flat roof involves the weighted ballast to hold the array to the roof using gravity, while the pitch roof system is mechanically anchored to the roof structure.
- Other Components involves various miscellaneous but essential components, such as combiners, disconnects, breakers, meters, and wiring, etc. are used for proper functioning of solar photovoltaic system.

Why demand for Solar Photovoltaic (SPV) System?

With increased energy demand, the need for alternatives of fossil fuel and clean or green energy sources is also increasing continually.Solar energy is the most abundant form that is freely available worldwide.Solar Photovoltaic (PV) cells are one of the substitutes for us where it can fulfil the energy demand with the green energy sources. However, there are some other facts available with increases the demand of SPV system.

- Conventional electricity is not supplied for sufficient time in the rural livelihood.
- The cost of conventional energy is one of the aspects.
- It is difficult to extend the electric grid to the remote villages.

Application of SPV system

- **Lightning:** PV system has to bloom up with LED technology and commonly used in billboard, parking lots, straight light in highway, lightening of trains, etc. and their uses are increasing continually.
- **Electricity for remote areas:** The remote location of the countries, which is quite far from the distribution network of the electricity. PV systems are an attractive option for these cases, by rural electrification - either through off-grid or mini-grid systems.
- **Irrigation scheduling:** The PV system plays an important role to

overcome the scarcity of problems during peak irrigation times specially in remote areas and villages. These pumping systems can supply the water directly on the field or can store the water for future needs.

- **Communications:** To boost-up the communication system, many relay towers are installed in remote areas by providing power using SPV panels and even used in space technology.Hence the PV system is installed as a viable substitute or solution for generators or other power sources.
- **Signal and charging facility:** PV systems can be a reliable power source for major application such as lighthouse, aircraft warning signal which is usually so far from main grid system. Another aspect regarding the use of SPV is providing the facility of charging electric vehicles in a different definite location around the regions. However, this is the futuristic technology in Indian commercials.

Future aspects toward solar utilization

Froma future perspective, energy storage will play a key role in making Renewable Energy a sturdy source of power and further reducing the landed cost of renewable electricity. Additionally, with the advent of Electric Vehicles, using renewable energy in the charging infrastructure will further boost the growth of the industry as well as the improved farming system by using solar energy.

The National Institute of Solar energy assessed the country's solar potential with 748 GW assuming 3% wasteland area to be covered by solar PV module. The national solar mission was launched in 2010, with active participation from States to promote ecologically sustainable growth. The objective of themission to targets installing 100 GW grid-connected solar power plants by the year 2022.INDCs (India's Intended Nationally Determined Contributions) scheme targets

- To achieve about 40 percent cumulative electric power of installed capacity from non-fossil fuel-based energy resources.
- To reduce the emission intensity of its GDP by 33 to 35 percent from 2005 level by 2030.

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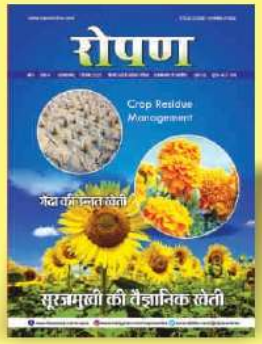

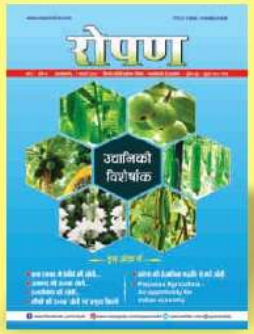

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