CURRENT NEWS

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CHOOSING A ROOFTOP SOLAR PV SYSTEM WISELY - PART 2: WHAT MAKES A SOLAR MODULE?

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In the previous edition, we explored solar cells, their technology, types, and materials. In this part, we will focus on how these solar cells and other essential components come together to form a solar module - a complete unit that efficiently captures sunlight and converts it into electricity.

Components of a Solar Module

Crystalline silicon-based solar modules are widely used in residential rooftop solar PV systems due to their affordability and long-term performance. These modules consist of multiple layers, each designed to ensure efficient and reliable operation over time.

A publication from

CAG

Citizen consumer and civic Action Group

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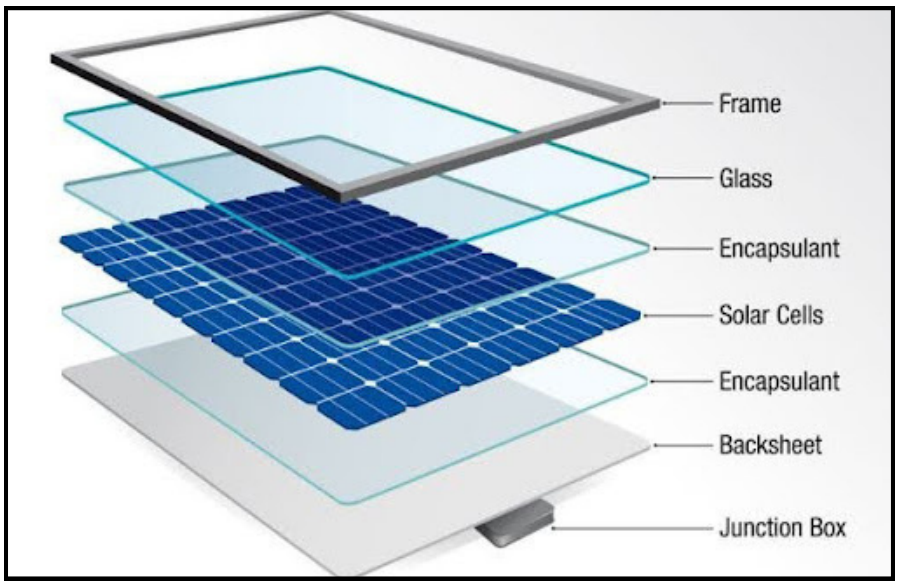


Figure 1 : Structure of a Solar PV module | Clean Energy Reviews

- **Bus Bars**

A solar module is made up of several solar cells connected in series. These cells have thin rectangular strips on their front and rear surfaces called bus bars. Made of copper coated with silver, bus bars help conduct the direct current (DC) generated by the cells. The silver plating enhances conductivity and reduces oxidation. Each bus bar is linked to very fine vertical lines known as fingers, which collect the current and direct it to the bus bars. Flat copper strips called tab wires are soldered to the bus bars to connect the solar cells in series. Several cell strings are then connected in parallel using bus wires, and these lead to the junction box where the total electrical output is collected.

Figure 2: Bus bars and fingers | Sino Voltaics

- **Encapsulant**

Encapsulants are transparent polymer layers placed between the glass cover and the backsheet of a solar module. They play a vital role in protecting the solar cells from physical damage, moisture, and dust. They also improve the module's optical performance by allowing more sunlight to pass through. These sheets can withstand high temperatures, resist UV rays, and help prevent short circuits, contributing to the long-term durability of the solar module. Ethylene Vinyl Acetate (EVA) sheets are commonly used encapsulant materials in solar modules

- **Glass (referred to as Solar Glass)**

The front side of a solar module is covered with a special type of tempered glass, which is highly transparent and durable. Unlike regular glass, this solar glass is about 3.2 mm to 4 mm thick and contains very low iron content, allowing up to 91% of sunlight to pass through. It is also stronger and more flexible, designed to resist impacts, heat, and harsh weather conditions. Solar glass must comply with international safety standards such as EN12150 and ASTM to ensure reliability in real-world conditions.

- **Backsheet**

While the front of the module is protected by tempered glass, the rear is usually covered with a backsheet made of Tedlar material, a tough polymer film that guards against UV rays, moisture, and mechanical stress. This backsheet extends the module's lifespan even in extreme weather. In the case of bifacial solar modules - which generate power from both sides - a special type of transparent glass is used on the back instead of Tedlar, allowing sunlight to enter from the rear as well.

Figure 3 : Tedlar backsheet on a solar module | Maysun Solar

Figure 4 : Bifacial solar modules with no Tedlar backsheet | Solar Solutions

- **Aluminium Frame**

Solar modules are enclosed in anodized aluminium frames made from strong and corrosion-resistant alloys like 6063 or 6005. These frames provide structural support and ensure that the modules are securely mounted.

- **Junction Box**

The junction box is a crucial component located at the back of the module. It houses electrical connections and transmits the module's output to the external system. It consists of bypass diodes, cables with connectors

Figure 5 : Junction Box at the back of solar module | EWI

1.Bypass Diodes

Bypass diodes, located within the junction box, protect the module from power loss due to shading or cell damage. Since solar modules are connected in series, if one module is shaded or faulty, it can reduce the performance of the entire string. Bypass diodes help reroute the current around the affected cell, maintaining consistent energy output and improving overall system efficiency.

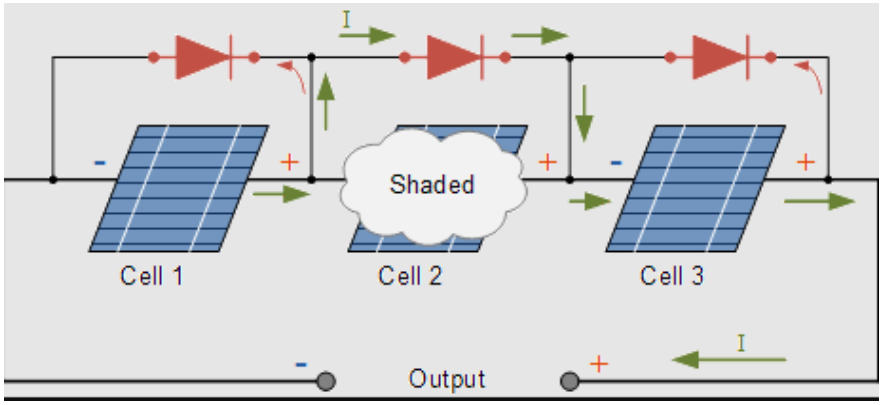


Figure 6 : Working concept of bypass diodes in solar module | Sun Gold Solar

2. MC4 Connectors

MC4 (Multi-Contact 4mm) connectors are standard components used to connect solar panels and other parts of the PV system. These connectors come in male and female types and allow panels to be quickly and safely connected in series. Designed for durability and secure locking, MC4 connectors ensure optimal power transmission to the inverter and simplify system assembly and maintenance.

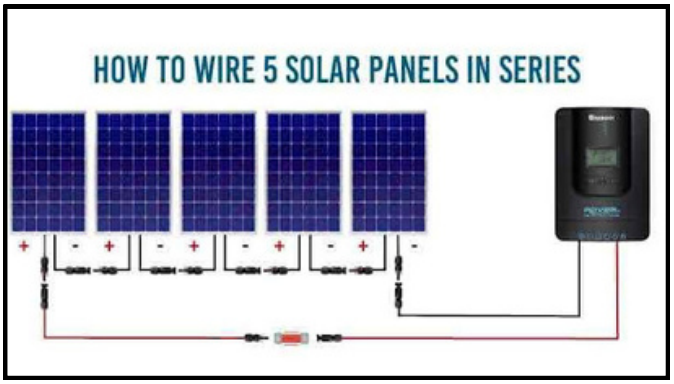


Figure 7 : Solar module connected using MC4 | Mowgli Adventures

- **RFID Tags**

Radio Frequency Identification (RFID) Tags are small electronic chips embedded on the solar modules. They store detailed information like manufacturing data, serial numbers, and performance history which can be read using the RFID reader. This helps in tracking, quality assurance, and warranty claims.

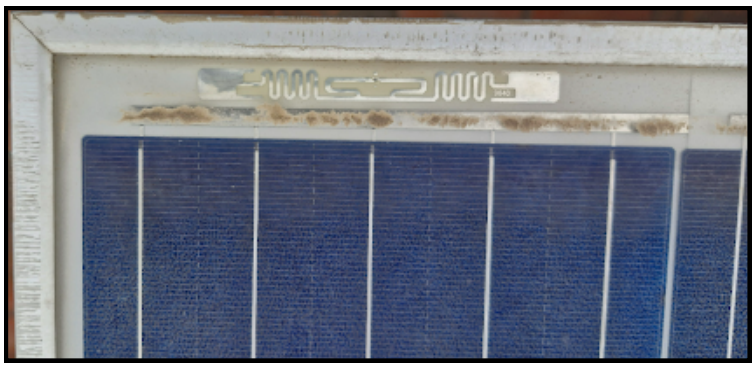


Figure 8: RFID Tag | CAG

- **Nameplate**

The nameplate on a solar module provides key information for identification, performance, and system planning. It typically includes:

  - Name and logo of the manufacturer or supplier
  - Type designation and serial number
  - Maximum system voltage
  - Rated nominal power (Pmax) at STC (Standard Test Conditions)
  - Maximum negative power tolerance at STC
  - Rated short-circuit current (Isc), open-circuit voltage (Voc), voltage at maximum power point (Vmp), and current at maximum power point (Imp) at STC

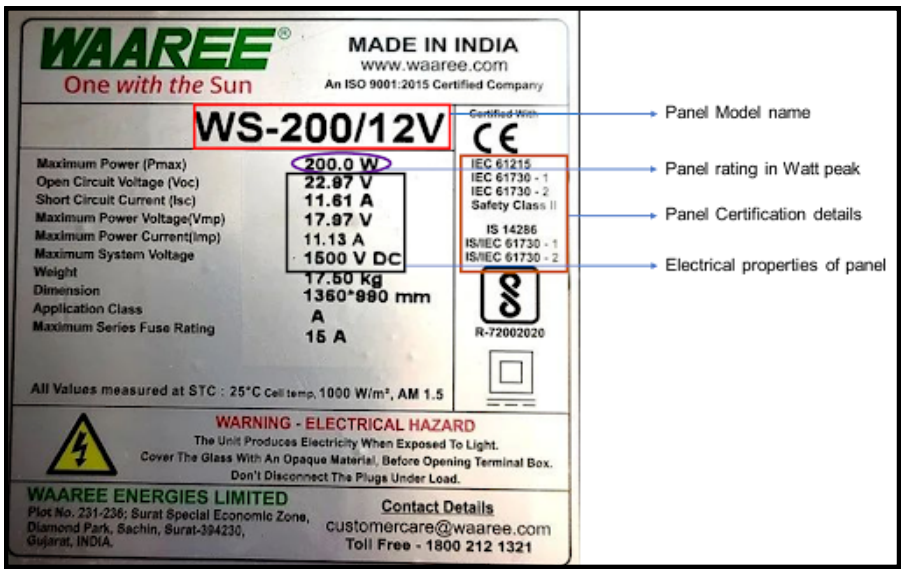


Figure 9: Nameplate of a solar PV module | WAAREE

It's important to note that the maximum power (Pmax) listed is measured under standard test conditions. Standard Test Conditions (STC) are an industry-wide benchmark to rate PV module performance, defined at 25°C cell temperature, 1000 W/m² irradiance, AM1.5 solar spectrum. In real-time usage, actual output is typically 15-20% lower due to factors like temperature, shading, and angle of sunlight. Peak power is usually reached only during optimal sunlight hours.

Conclusion

In conclusion, understanding the structure of a solar module—from bus bars and Ethylene Vinyl Acetate (EVA) sheets to aluminium frames and junction boxes—gives users a better insight into the technology behind solar power. In the next part of this blog series, we will explore the specifications and certifications of solar modules to help you make well-informed decisions when purchasing solar modules.

CONSUMER FOCUS

The petitioner, a domestic consumer, registered a complaint with the Assistant Engineer (AE) about an electric pole and service wire providing service connection to his neighbour, that were passing through his property. The complaint was registered in 2021 to remove the electric post and wire from his property. The AE informed that the infrastructure could not be moved as it was erected in a public space, given adequate safety clearance, did not interfere with the petitioner's property or the public.

Dissatisfied with the response of the AE, the petitioner approached the Consumer Grievance Redressal Forum (CGRF) in 2024, seeking the removal of the pole and wires. The petitioner further sought monetary compensation for the mental agony caused to him over the past 3 years. The petitioner contended that the electric poles posed a safety hazard to the general public. Furthermore, it was contended that the respondent (TNPDCL) had not followed the procedures for the erection of the electric poles. The petitioner stated that the respondent had not secured a No Objection Certificate (NOC) before setting up the electrical connection. The petitioner also contended that he had objected to the installation of the electrical poles multiple times, both verbally and in writing.

The respondent argued that they had adhered to the procedures outlined in Regulation 29(6) of the TNE Supply Code 2004 when installing the electrical equipment. Additionally, they asserted that they had secured all necessary clearances. Furthermore, the respondent emphasised that there was no encroachment on the petitioner's property, as the service wire in question was installed within the compound of a neighbouring house.

After considering the input from both parties, the CGRF concluded that the poles and lines were installed with appropriate safety clearances. However, if the petitioner still wanted to shift the pole, he may contact the respondent and submit a request for the relocation of the pole on a DCW (Deposit Contribution Work) basis. The respondent would then review the petitioner's request and take the necessary steps, provided these were technically feasible. Aggrieved by the CGRF order, the petitioner filed an appeal petition to the Tamil Nadu Electricity Ombudsman.

Ombudsman's findings:

It was noted that the issue revolved around the service wire that provided electricity to the petitioner's neighbour. The petitioner claimed that the service wire in question travelled across his premises. However, the Ombudsman observed that the service wire never physically passed through the petitioner's property. Instead, the wire is laid along the adjacent building's compound wall, as stated by the respondent.

In this context, the Ombudsman referred to Regulation 29(6) of the TNERC Distribution Code, 2004 which reads as follows:

> *"(29) Service Lines: (6) The Consumer shall permit the Licensee to install all requisite equipments such as Transformers, switchgears, meters, etc., and to lay necessary cables or overhead lines and to provide connections thereto on the consumer's premises and shall also permit the Licensee to extend supply to other consumers through the cables, lines and equipments installed in the consumer's premises, provided that supply to the consumer in the opinion of the Engineer is not thereby unduly affected."*

The above regulation clearly states that a consumer must allow the Licensee (DISCOM) to install essential equipment such as transformers, switchgears, meters, and necessary cables or overhead lines on their premises. Furthermore, the consumer must also permit the DISCOM to extend the electricity supply to other consumers through the installed cables, lines, and equipment on their premises, provided that the supply to the primary consumer is not affected.

SOURCE: OMBUDSMAN CASE

NEWS FROM TAMIL NADU

Your next WhatsApp message could be an alert from EB

The Tamil Nadu Electricity Regulatory Commission (TNERC) has directed the Tamil Nadu Power Distribution Corporation Limited (TNPDCL; erstwhile Tangedco) to communicate the reason for the disconnection of power connections by sending WhatsApp or SMS messages to the consumers. The direction was given during a review meeting held recently by the TNERC with the officials of the TNPDCL. The discussions mainly focused on identifying the corrections required in the billing and application software to ensure full adherence to the TNERC Regulations. Other directions include effecting service connections after confirming the installation of the generation meter and making necessary entries of the details of the meter for solar consumers above 10 kW, and creation of necessary provisions in the billing software to facilitate refund of the credited amount at the end of settlement period for net feed-in consumers when the consumer opt for a refund. For the consumers who have exceeded the contracted demand for the third time, the regularization of demand is seen only in the ledger viewed by the Licensee officials, whereas the same is not reflected in the billing status viewable by the consumer. This denies the legitimate rights of the consumer. The IT wing shall update the billing software so that whatever updation carried out in the department ledger should also be reflected in the billing status including check reading entry by various agencies," the discom was told. Moreover, for all the online applications, after inspection, there should be a provision for rejecting the application or changing the data in line with the actual site condition such as underground and overhead status by the concerned section officer.

SOURCE: DT NEXT, 24 APRIL 2025

NEWS FROM ACROSS THE COUNTRY

Renewable energy accounts for 86% of new power capacity addition in FY25: Report

expansion, with nearly 86 per cent of the 33 gigawatts (GW) power capacity addition in financial year 2024-25 (FY25) has come from renewable sources, according to a report by Antique Stock Broking. The report highlighted that India's total installed power capacity has now reached 475 GW, with 33 GW added over the past year. A large part of this addition was driven by renewable energy, reflecting the country's continued shift towards clean energy. It said, "India's installed power capacity reached 475 GW in FY25, with 33 GW added over the past year. Notably, 86 per cent of this capacity addition came from renewable sources". As a result, the share of renewables in India's total installed capacity has risen to 36 per cent, marking a steady rise from the previous years. In March 2025 alone, India added 5 GW of new power capacity, all of which has came from renewable sources. This strong addition in a single month shows the growing policy support and increasing investor interest in the renewable energy sector. The report noted that this trend is a clear sign of the structural shift in India's energy mix, with renewables becoming a central pillar. This momentum is expected to benefit companies across the clean energy value chain. The report also provided an update on power generation trends. It mentioned that India's power generation growth, which was strong at around 6 to 7 per cent year-on-year (YoY) in February and March 2025, has slowed down to about 2 per cent YoY in April 2025. However, there were signs of improvement during April, as power generation showed no growth in the first 10 days but picked up in the latter part of the month. Due to the combination of slower growth and a high base from last year, short-term power prices have declined by 14 per cent YoY so far in April 2025. Despite this, power sector stocks have performed well, gaining between 10 per cent and 20 per cent over the past two to three months.

SOURCE: ANI NEWS, 28 APRIL 2025

WORLD NEWS

40% of world's electricity from non-fossil sources but power sector's carbon emissions at all-time high

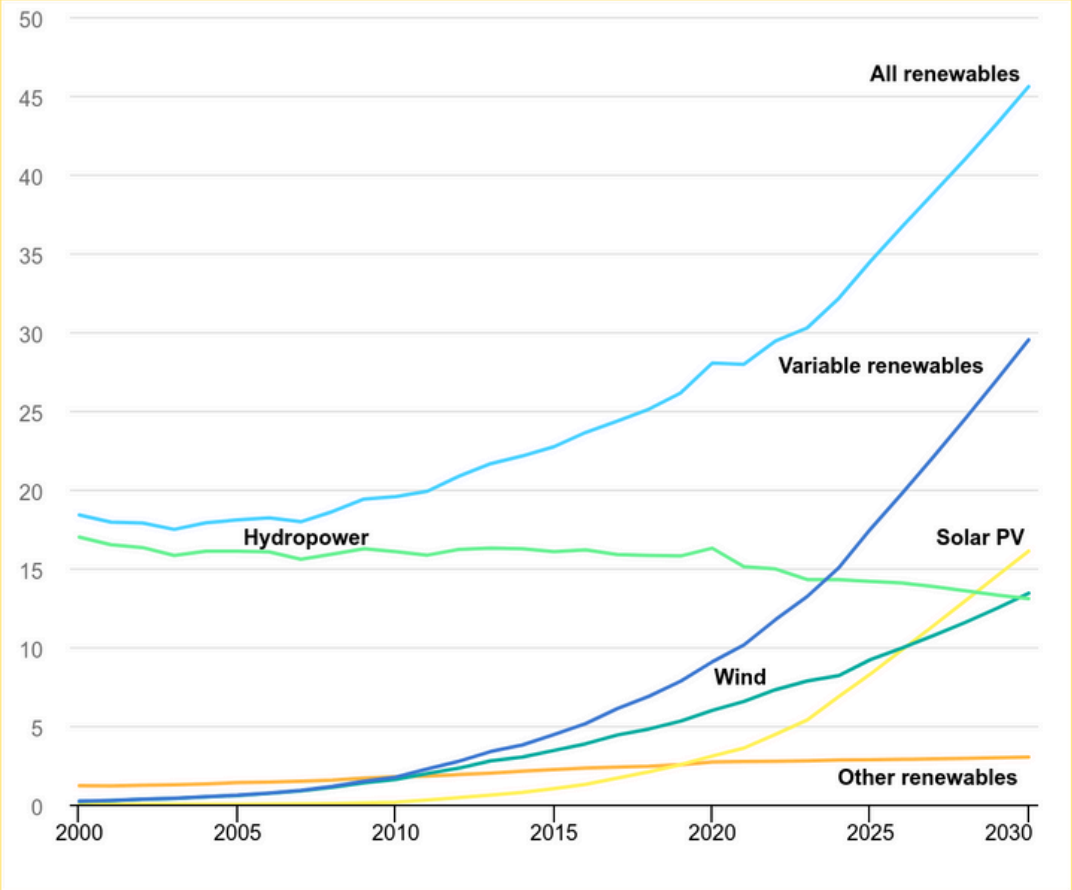
Global electricity generation from clean sources crossed a major milestone in 2024, with non-fossil sources—comprising renewables and nuclear—accounting for more than 40 per cent of the world's total power supply, according to a new report by energy think tank Ember. According to the report, nuclear, solar, wind and other renewable energy sources collectively generated 40.9 per cent of global electricity last year, adding a record 858 terawatt-hours (TWh) to the energy mix. Solar continued its rapid ascent with generation doubling over the past three years to surpass 2,000 TWh. Solar energy was the largest contributor to new electricity generation for the third consecutive year, adding 474 TWh and also remained the fastest-growing power source globally for the 20th year in a row, with a 29 per cent annual increase, it said. The report said that China led this growth, accounting for 53 per cent of the global increase in solar generation. "The country's clean energy output met 81 per cent of its rise in electricity demand in 2024. The global solar boom shows no signs of slowing, with 2024 marking the highest-ever capacity installations—more than twice the volume recorded in 2022," it added. India also made significant gains, overtaking Germany to become the world's third-largest generator of electricity from wind and solar. The country produced 215 TWh from these sources in 2024, well behind China's 1,826 TWh and the United States' 757 TWh, but nearly doubling its output in five years. Despite being a late entrant into these renewable sectors, India's clean energy growth remains on a strong upward trajectory. The report also highlighted that hotter temperatures were the primary factor behind this increase. The jump in fossil-based power in 2024 (245 TWh) was nearly identical to that of 2023, despite a much sharper rise in overall electricity demand last year, the report said.

SOURCE: FIRSTPOST, 08 APRIL 2025

PUBLICATIONS

- **Energy Statistics India 2025 , MOSPI**
- **Green Hydrogen Certification Scheme of India, April 2025, MNRE**
- **Accelerating India's Energy Transition through Industrial Clusters, WEF**
- **Energy and AI, IEA**
- **Renewable energy in climate change adaptation: Metrics and risk assessment framework, IRENA**

SHARE OF RENEWABLE ELECTRICITY GENERATION BY TECHNOLOGY, 2000-2030



SOURCE: IEA, DECEMBER 2023

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