



SOLAR PANEL BUSINESS INSIGHTS

SOLAR ENERGY ANALYSIS AND PRICING DYNAMICS

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Solar Panel Business Insights

Various Research on Solar Panels

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Introduction:

This report is based on the research on Solar Panels and the various companies. That deal in solar panels in India . This Project is carried out by the second year Students of BBA 2023-2026, as a part of Marketing course.

A solar panel is a device that converts sunlight into electricity by using photovoltaic (PV) cells. PV cells are made of materials that produce excited electrons when exposed to light. The electrons flow through a circuit and produce direct current (DC) electricity, which can be used to power various devices or be stored in batteries. Solar panels are also known as solar cell panels, solar electric panels, or PV modules.

Solar panels are usually arranged in groups called arrays or systems. A photovoltaic system consists of one or more solar panels, an inverter that converts DC electricity to alternating current (AC) electricity, and sometimes other components such as controllers, meters, and trackers.



Industrial and Domestic Users of solar panels include:

Industrial users: Major industries in India, such as cement, textile, paper, steel, chemical, dairy, and ceramic, are increasingly using solar power to reduce electricity costs and avoid grid outages.



Domestic users: Solar panels are used for homes, and Tata Solar is a leading producer of solar panels for household, commercial, and industrial applications



Components of Solar Panels:

A solar panel is made up of several key components that work together to convert sunlight into electricity through the process of photovoltaic conversion. Here's a breakdown of its components and how they work:

1. Photovoltaic (PV) Cells:

- The core of a solar panel is the photovoltaic cells, typically made of semiconductor materials like silicon. These cells absorb sunlight and convert it into electrical energy.
- Each PV cell consists of two layers: a positively charged layer (p-type) and a negatively charged layer (n-type), forming a p-n junction.

2. Glass Cover:

- Protects the PV cells from environmental factors like dust, debris, and weather, while allowing sunlight to pass through. It is typically made of tempered glass for durability and efficiency.

3. Encapsulant:

- A layer of transparent material (often EVA, Ethylene Vinyl Acetate) that holds the PV cells in place and provides protection from moisture and mechanical damage. It also enhances the durability of the cells.

4. Backsheet:

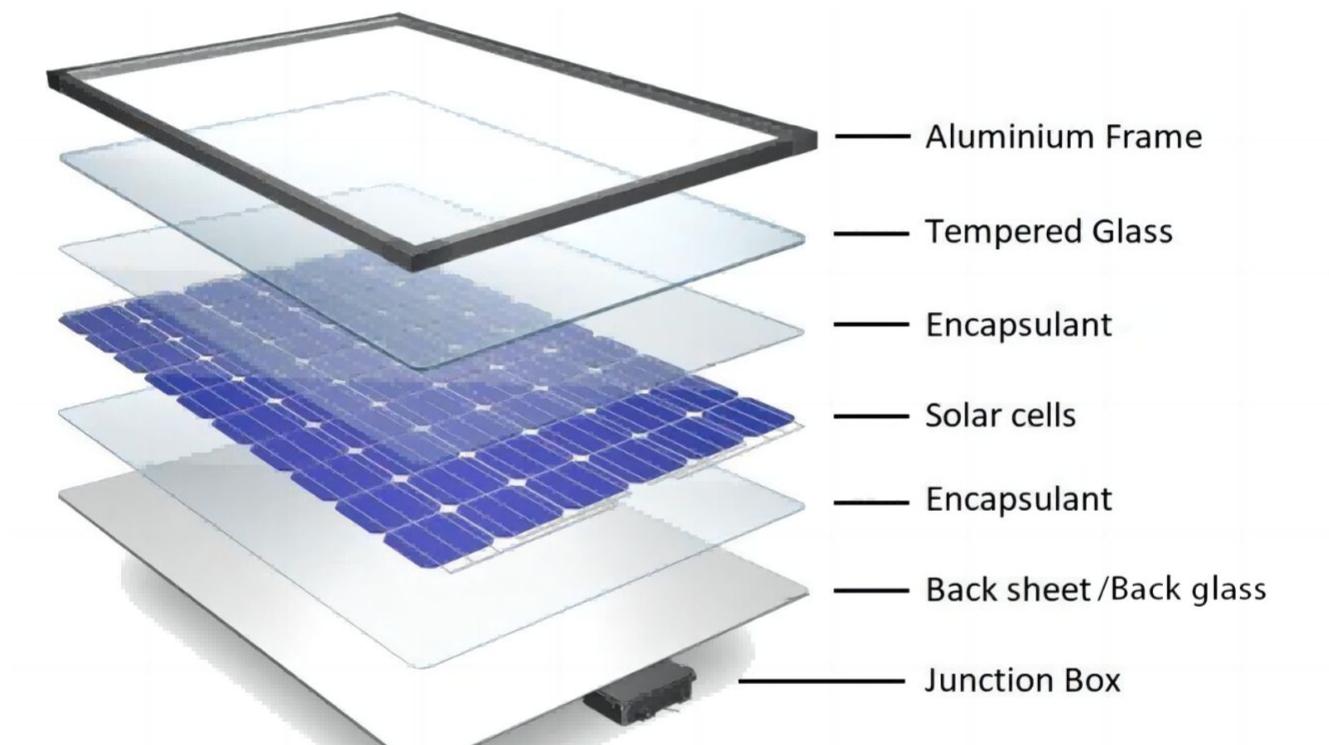
- The backsheet is a layer at the back of the panel that acts as a barrier to protect the internal components from moisture and other environmental factors.

5. Frame:

- The solar panel is encased in an aluminum frame, providing structural support and enabling easy mounting onto rooftops or ground structures.

6. Junction Box:

- A junction box is attached to the back of the panel and contains the electrical connections, diodes, and wiring that carry the electricity generated by the panel. It prevents power loss and ensures proper current flow.



Features of Solar Panels:

1. Efficiency: The efficiency of a solar panel refers to how well it can convert sunlight into electricity. Higher efficiency panels typically produce more electricity.

The efficiency of solar panels varies depending on the type of panel, the amount of sunlight, and the temperature:

- **Panel type:** Monocrystalline panels are the most efficient, with an efficiency rating of 15–22%. Polycrystalline panels are less efficient, with an efficiency of 15–20%, while thin-film panels are the least efficient, with an efficiency of 10–20%.
- **Sunlight :**More sunlight and the right angle and direction for the solar panel can increase efficiency.
- **Temperature:** Hotter climates can slightly reduce efficiency, with the ideal temperature being around 25°C. Solar panels can also produce electricity more efficiently in colder temperatures.
- **Weather:** Cloud cover and shade can also cause solar panels to produce less energy. Snow can prevent solar panels from generating electricity.

2. Cost: The cost of solar panels can vary depending on the brand and quality. Some companies offer more affordable options, while others may have premium pricing for higher quality panels.

- In India, the price of solar panels typically ranges from ₹2.40 to ₹3.60 per watt, with the entire solar panel installation cost falling between ₹50,000 and ₹2,00,000. However, remember, this is just an estimate.

- . Many solar energy companies in India offer financing options to make the transition to clean energy more accessible. Investing in solar panels is an investment in your future.

3. Warranty: The warranty offered by the company can provide peace of mind and protection against potential defects or issues with the panels.

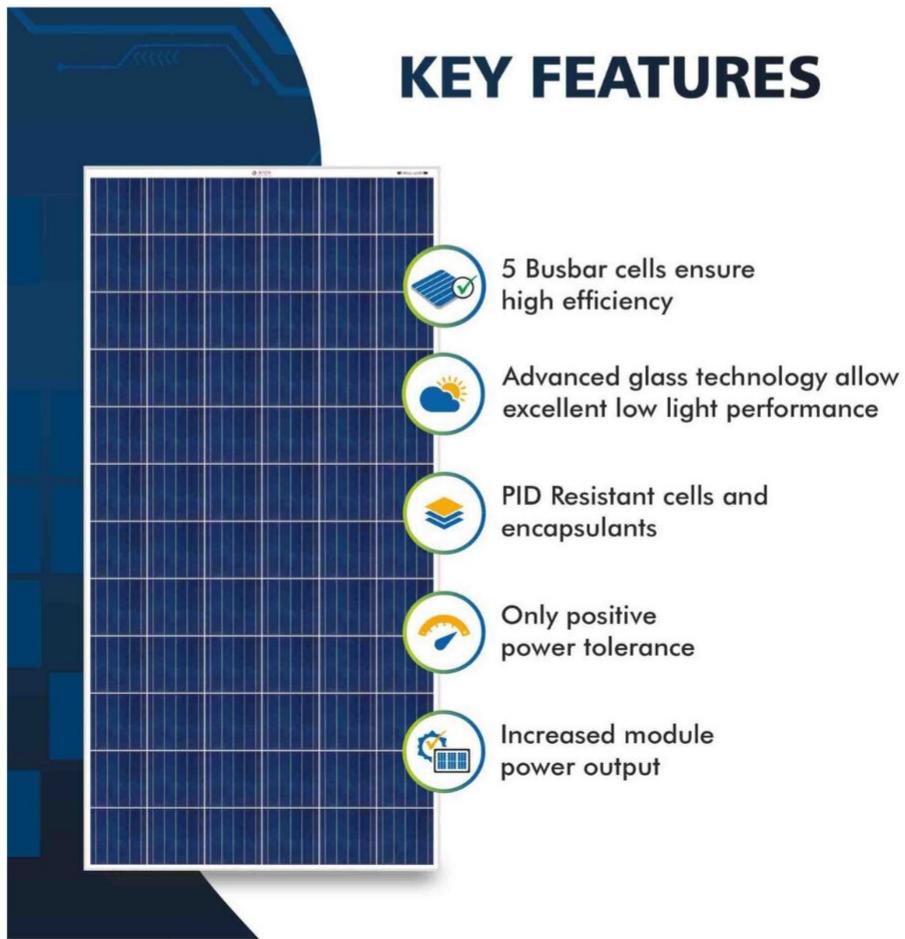
4. Performance in low light conditions: Some solar panels are designed to perform better in low light conditions, which can be important for areas that receive less sunlight.



5. Durability: The durability of solar panels is important for ensuring they can withstand various weather conditions and last for a long time.

- A solar panel's lifespan isn't measured by when it stops producing electricity entirely. Instead, we use its "useful life" to determine its lifespan, which is about 25 to 30 years.
- Solar panels slowly degrade and produce less and less electricity over time. Older solar panels can be useful for small applications with low electricity demands, but most people retire their solar panels after about 30 years.

6. Monitoring systems: Some companies offer monitoring systems that allow homeowners to track the performance of their solar panels and optimize energy production.



Types Of Solar Panels:

1. Monocrystalline Solar Panels:

- **Description:** Made from single-crystal silicon.
- **Efficiency:** High efficiency (15-22%).
- **Lifespan:** Long lifespan (25+ years).
- **Cost:** Generally more expensive but offers better performance in smaller spaces.



2. Polycrystalline Solar Panels:

- **Description:** Made from multiple silicon crystals.
- **Efficiency:** Moderate efficiency (13-16%).
- **Lifespan:** Slightly shorter lifespan (25 years).
- **Cost:** Typically less expensive than monocrystalline.



3. Thin-Film Solar Panels:

- **Description:** Made from a variety of materials (e.g., cadmium telluride, amorphous silicon).
- **Efficiency:** Lower efficiency (10-12%).
- **Lifespan:** Shorter lifespan (10-20 years).
- **Cost:** Generally cheaper and flexible but requires more space for installation.





4. Bifacial Solar Panels:

- **Description:** Can capture sunlight from both sides.
- **Efficiency:** Higher energy production potential.
- **Application:** Often used in large-scale installations.



5. Building-Integrated Photovoltaics (BIPV):

- **Description:** Integrated into building materials (e.g., solar shingles).
- **Efficiency:** Varies widely.
- **Application:** Aesthetic solutions for buildings.



6. Concentrated Photovoltaic (CPV) Panels:

- **Description:** Use lenses or mirrors to focus sunlight onto high-efficiency cells.
- **Efficiency:** Very high efficiency (up to 40%).
- **Application:** Typically used in large-scale solar farms.

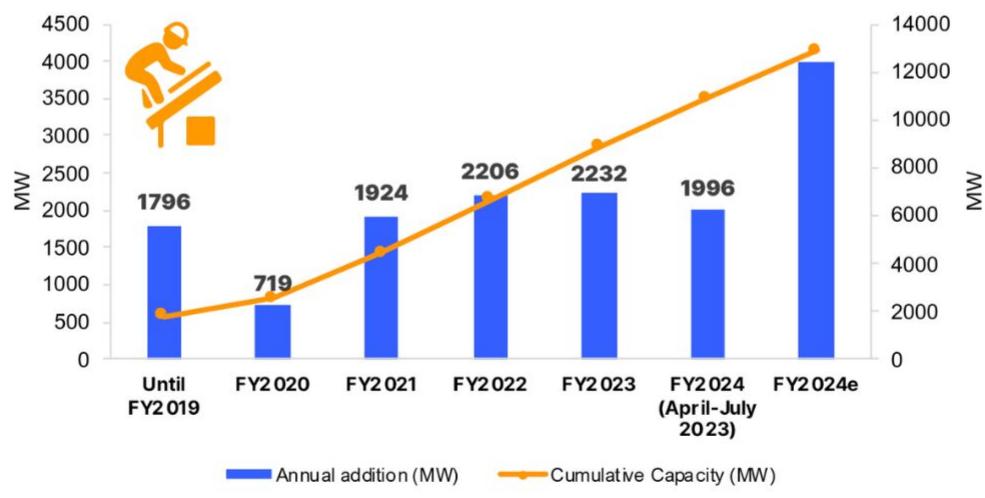
Installing Solar Rooftop In India And Global:

The cost of installing a solar rooftop system varies by location, but here is some information about the cost of solar rooftops in India and globally:

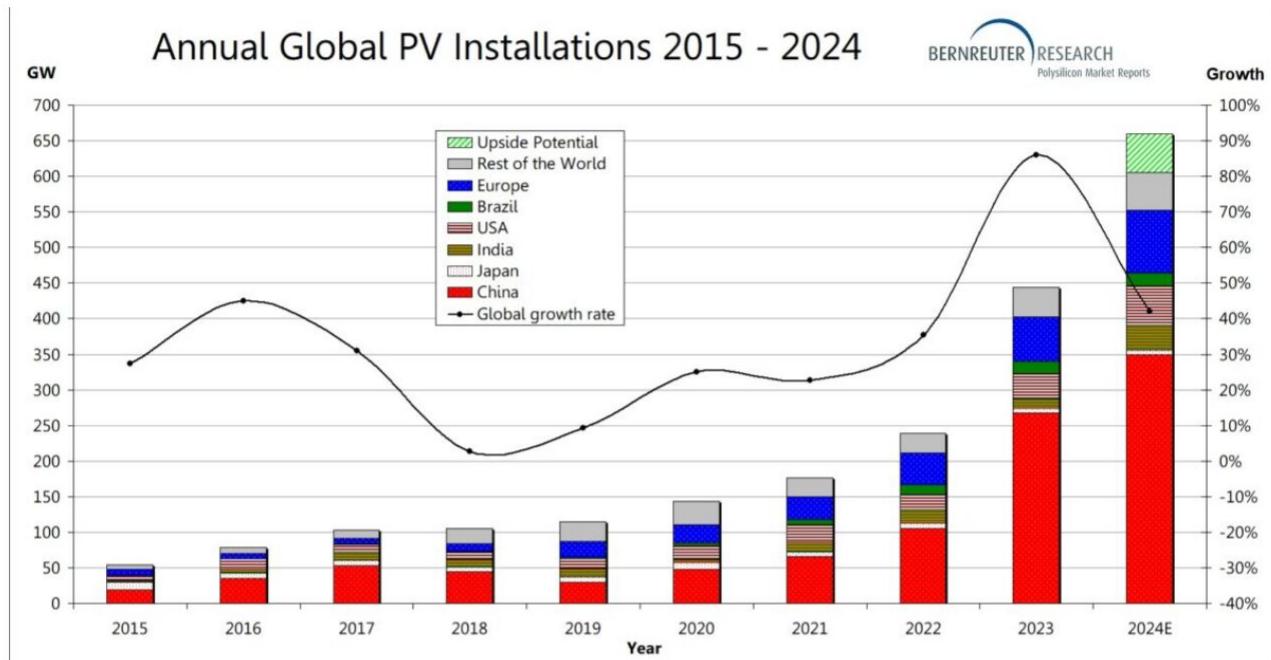
India: The average cost of a 3kW solar panel system in India is between Rs. 1,89,000 and Rs. 2,15,000. The cost of a solar panel system can vary depending on the type of structure, roof specifications, shading, and utility. The cost of a 1 kW solar panel can range from Rs. 37,500 to Rs. 42,000, depending on the wattage and type.

India's rooftop solar capacity grows sharply in 2023

The falling costs of solar modules will help sustain growth momentum in the near-to-medium term.



Global: The cost of rooftop solar photovoltaics has dropped more than 80% in the last decade. Rooftop PV systems for households can be installed for around USD 1 per watt.



Subsidies: The central and state governments in India offer subsidies to reduce the upfront cost of installing solar rooftop systems. The central government offers a 40% subsidy for residential/institutional up to 3kW, and a 20% subsidy for 3-10kW. State governments like Gujarat, Maharashtra, Delhi, and Uttarakhand offer additional capital or interest subsidies from 20% to 90% of costs.

The cost of Rooftop in India Depends On Several Factors:

The cost of a solar rooftop in India depends on several factors, including the size of the system, the type of solar panels, the inverter, the mounting structure, the wiring, and labor charges. The average cost per watt for solar panels is between Rs 75,000 and Rs 85,000. Here are some average costs for different sized systems:

- 1 kW: Rs 75,000 to Rs 85,000
- 2 kW: Rs 1,50,000 to Rs 1,70,000
- 3 kW: Rs 1,89,000 to Rs 2,15,000
- 4 kW: Rs 2,52,000 to Rs 2,85,600
- 5 kW: Rs 3,15,000 to Rs 3,57,000
- 10 kW: Rs 5,31,000 to Rs 6,07,000

The cost of a solar rooftop can be reduced through subsidies from the central and state governments. For example, the central government offers a 40% subsidy for residential and institutional systems up to 3 kW, and a 20% subsidy for 3-10 kW. Some states, like Gujarat, Maharashtra, Delhi, and Uttarakhand, offer additional capital or interest subsidies of up to 90% of the cost.

The payback period for a solar rooftop system is typically 6-10 years. Factors that affect the payback period include the total cost, average power usage, tax incentives, power production, utility cost, and the increase rate in utility cost.

Installation costs range from Rs 2.20 lakh to 3.5 lakh for a 3KW - 5KW system. Manageable EMIs of Rs 4,000 - 5,000 per month are available, reducing financial burden. Government provides subsidies for rooftop solar systems.24 Jan 2024

The rate of government subsidies for solar panels in India, but here are some examples:

Capacity of rooftop solar	Installation Cost (Rs.)	Subsidy (Rs.)
1 kW	85,000 to 95,000	22,500
2 kW	1,70,000 to 1,85,000	45,000
3 kW	2,50,000 to 2,70,000	67,500
5 kW	4,00,000 to 4,25,000	1,12,500

Solar Rooftop Price - 2024

1kW - Rs. 60,000	Central Subsidy: Rs. 18,000	State Subsidy: Rs. 30,000 (only in UP)
2kW - Rs. 120,000	Central Subsidy: Rs. 36,000	State Subsidy: Rs. 30,000 (only in UP)
3kW - Rs. 180,000	Central Subsidy: Rs. 54,000	State Subsidy: Rs. 30,000 (only in UP)
4kW - Rs. 240,000	Central Subsidy: Rs. 54,000 * 3 + 9,000 * 1 = Rs. 63,000	State Subsidy: Rs. 30,000 (only in UP)
5kW - Rs. 2,90,000	Central Subsidy: Rs. 54,000 + 18,000 = Rs. 72,000	State Subsidy: Rs. 30,000 (only in UP)
6kW - Rs. 348,000	Central Subsidy: Rs. 54,000 + 27,000 = Rs. 81,000	State Subsidy: Rs. 30,000 (only in UP)
7kW - Rs. 406,000	Central Subsidy: Rs. 54,000 + 36,000 = Rs. 90,000	State Subsidy: Rs. 30,000 (only in UP)
8kW - Rs. 464,000	Central Subsidy: Rs. 54,000 + 45,000 = Rs. 99,000	State Subsidy: Rs. 30,000 (only in UP)
9kW - Rs. 4,95,000	Central Subsidy: Rs. 54,000 + 54,000 = Rs. 1,08,000	State Subsidy: Rs. 30,000 (only in UP)
10kW - Rs. 550,000	Central Subsidy: Rs. 54,000 + 63,000 = Rs. 1,17,000	State Subsidy: Rs. 30,000 (only in UP)

Substitute for solar energy:

Solar energy is a renewable energy source that can be used as an alternative to fossil fuels. Other renewable energy sources include:

- **Wind energy:** Uses the kinetic energy of moving air to generate electricity. Wind power is one of the cheapest energy sources. However, wind turbines can be noisy and may harm bird populations.
- **Hydroelectric power:** Uses the power of falling water to generate electricity. In the United States, it is the largest renewable energy source for electricity.
- **Geothermal energy:** Uses the constant temperature of the earth to heat homes in the winter and cool them in the summer.
- **Bioenergy:** Generates electricity, heat, and transportation fuel from biomass.

Renewable energy sources are important because they are more plentiful than fossil fuels and produce little to no harmful emissions.



Solar energy can be used in a variety of ways, including:

Solar panels: Convert sunlight into electricity using photovoltaic cells. Solar panels are used in homes, businesses, and industries.

Evaporation ponds: Shallow pools that use evaporation to concentrate dissolved solids. Evaporation ponds are used to obtain salt from seawater, concentrate brine solutions, and remove dissolved solids from waste streams.

Clothes lines: Use sunlight and wind to dry clothes without using electricity or gas.



Pricing Analysis:

Brands	No of Varieties	Low price	High price	Special Features	Offers
Gse renewable	Rooftop & ground mounted solar pannels	Rs. 5737	Rs. 8150	Solar solutions	Maintenance service for business of all sizes
Tata power	Rooftop & Ev charging stations	230.8	494.85	Smart home automation & micro grids	Clean energy platform services
Vikram solar	Solar modules	Rs. 8000	Rs. 102500	Vert small power tolerance of +3wp	Construction service and operations
Waaree	Solar modules & solutions	Rs. 9200	Rs. 100000	Framed glass transparent black sheet & M6 mono PERC cells	Solar combos & 30% discount
Jackson	Diesel generator & pv modules	16.5	21.5	High power output & anti reflecting coating	Solar modules for residential& commerical use
Hindustan power	Solar farms cells	Rs. 5399	Rs. 15500	NA	Guarantee lifespan of 25 years
Adani	Solar pv cells	Rs. 8000	Rs. 1,100,000	Anti reflective glass coating & bypass diodes	Solar inverter 10 kw hybrid inverter
Asun	Rooftop solar	Rs. 3lakh	Rs. 12lakh	2 axis tracker	NA
Geo power	Solar DC (air conditioner),A led lighting, solar street lights & bldc fans	Rs. 70000	Rs. 357000	Solar lights	NA
Saatvik	Bifacial, mono PERC, poly	Rs. 49000	Rs. 200000	Halfcut MBB modules	NA

Insights:

Price Range Overview:

The lowest prices for solar panel from 5k to 20k while the highest prices 3lakh to 12lakh . This wide price spectrum indicates varying market segments, with some Companies targeting budget-conscious customers and others appealing to those seeking premium offerings

Competitive Positioning:

Companies like Gse renewable and Hindustan power company maintain competitive pricing with averages around 5k to 20k, respectively. This positioning could attract a large customer base looking for quality at reasonable prices.

Market Opportunities:

The Indian solar energy market generated revenue of USD 10.4 billion in 2023, which is expected to witness a CAGR of 13.4% during 2024–2030, to reach USD 24.9 billion by 2030. The primary reason for the growth is the government's policies and initiatives, which have increased awareness about solar energy adoption.

Solar Panels Technology Insights:

The Solar Panels Market segmentation has been segmented by technology into solar PV and concentrated solar power. The solar PV segment dominated the market growth in 2021 and is projected to be the faster-growing segment during the forecast period, 2022-2030 because major governments' concerns about energy security, reducing their carbon footprints, and clean energy are growing

By Making use of these insights, businesses can better position themselves to meet customer needs and preferences in a competitive landscape.

Now Solar panel is not only for rich people use it also has reached to low Income group people which has been shown in the given below image.

