



Industry Report on Solar Power Generation Sector (Global, Europe, Africa and India) Battery Energy Storage System

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Prepared for Soleos Energy Ltd



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Abbreviation Table:

Abbreviation	Full Form
AC	Alternating Current
Adv. Est.	Advance Estimate
AI	Artificial Intelligence
BESS	Battery Energy Storage System
BoS	Balance of System
Bn	Billion
CAGR	Compound Annual Growth Rate
C&I	Commercial and Industrial
CPI	Consumer Price Index
Cr	Crore
CSP	Concentrated Solar Power
CY	Calendar Year
DC	Direct Current
DNI	Direct Normal Irradiance
EBITDA	Earnings Before Interest, Taxes, Depreciation, and Amortisation
EPC	Engineering, Procurement and Construction
ESS	Energy Storage System
Est.	Estimated
EU	European Union
F	Forecast
FDI	Foreign Direct Investment
FTA	Free Trade Agreement
FY	Financial Year
GDP	Gross Domestic Product



GFCF	Gross Fixed Capital Formation
GST	Goods and Services Tax
GW	Gigawatt
GVA	Gross Value Added
IIP	Index of Industrial Production
IMF	International Monetary Fund
INR	Indian Rupee
IPP	Independent Power Producer
IT	Information Technology
kW	Kilowatt
LPI	Logistics Performance Index
Mn	Million
MOSPI	Ministry of Statistics and Programme Implementation
MNRE	Ministry of New and Renewable Energy
MW	Megawatt
m-o-m	Month on Month
NSO	National Statistics Office
O&M	Operations and Maintenance
OPEX	Operating Expenditure
P	Projected
PAT	Profit After Tax
PE	Private Equity
PFCE	Private Final Consumption Expenditure
PLI	Production Linked Incentive
PPA	Power Purchase Agreement
PV	Photovoltaic



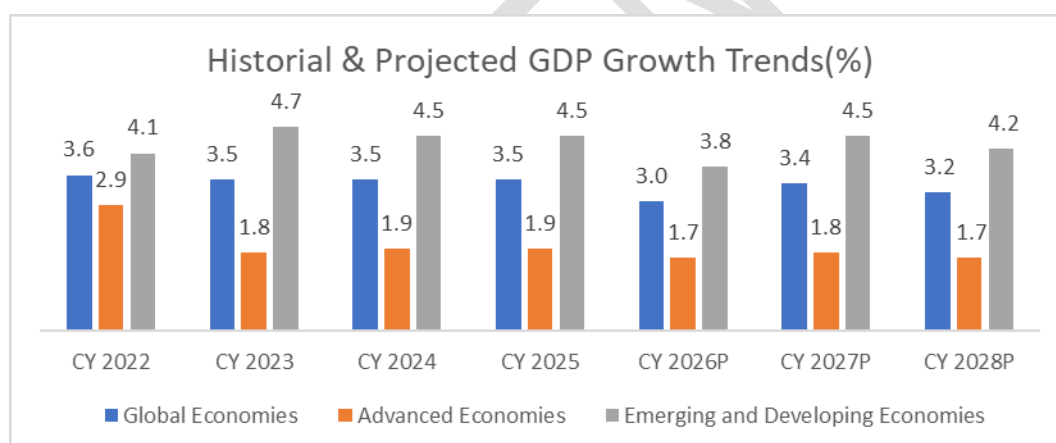
R&D	Research and Development
RBI	Reserve Bank of India
RE	Renewable Energy
RES	Renewable Energy Sources
RESCO	Renewable Energy Service Company
ROA	Return on Assets
ROCE	Return on Capital Employed
RTC	Round-the-Clock (Renewable Power)
SPV	Solar Photovoltaic
Tn	Trillion
TWh	Terawatt-hour
USD	United States Dollar
WEO	World Economic Outlook
WPI	Wholesale Price Index
Y-o-Y	Year on Year



Global Economic Overview

The global economy continues to demonstrate resilience despite ongoing geopolitical uncertainties, supply chain disruptions and evolving monetary policy conditions across major economies. According to the International Monetary Fund ("IMF"), global economic growth grew at 3.5% in CY2025. The global economy is navigating a period characterized by the interplay of geopolitical uncertainty and accelerating technological transformation. While ongoing geopolitical tensions continue to create challenges for global trade, energy markets, and supply chains, rapid advancements in artificial intelligence (AI), automation, cloud computing, advanced manufacturing, and digital infrastructure are supporting productivity gains and investment activity across major economies.

Despite the economic disruptions arising from regional conflicts, the impact on global growth has thus far been more contained than initially anticipated. Inflation expectations, financial conditions, and commodity markets have remained relatively resilient, allowing economic activity to continue expanding. Looking ahead, technological innovation, digitalization, and evolving supply-chain strategies are expected to remain key structural drivers shaping medium-term global growth prospects.



Source – IMF Global GDP Forecast Release, July 2026¹

Note: Data till CY2027 are sourced from the IMF's July 2026 World Economic Outlook (WEO) Update. The CY2028 data are sourced from the IMF World Economic Outlook Database.²

Regional GDP Growth

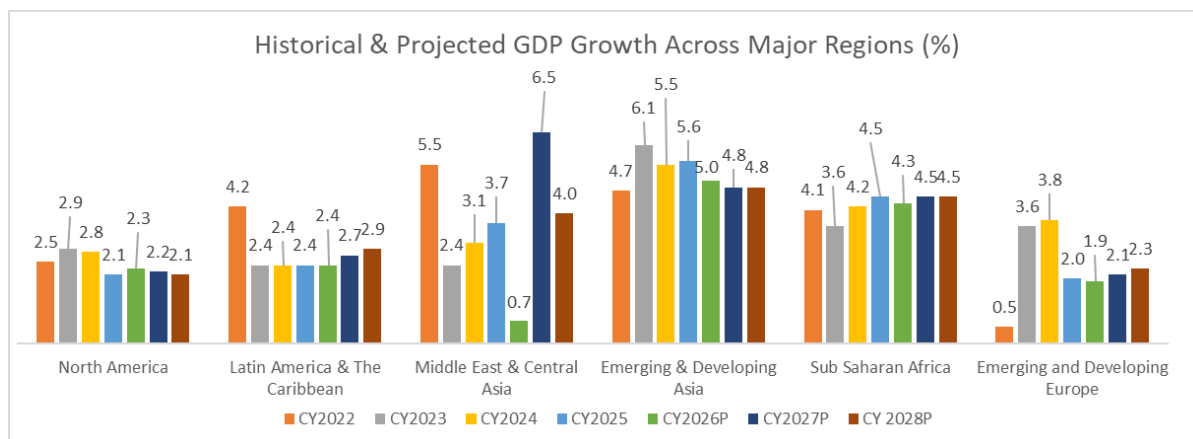
The chart highlights significant divergence in economic growth trajectories across major regions during CY2022-CY2028P. While Emerging & Developing Asia continues to lead global growth, regions such as the Middle East & Central Asia exhibit higher volatility due to geopolitical and commodity-related factors.

¹ <https://www.imf.org/-/media/files/publications/weo/2026/update/july/english/text.pdf>

² https://www.imf.org/external/datamapper/NGDP_RPCH@WEO/OEMDC/ADVEC/WEOWORLD



Meanwhile, North America, Latin America, and Sub-Saharan Africa are expected to display relatively stable growth patterns over the forecast period.



Source – IMF Global GDP Forecast Release, July 2026³

Note: Data till CY2027 are sourced from the IMF's July 2026 World Economic Outlook (WEO) Update. The CY2028 data are sourced from the IMF World Economic Outlook Database.⁴

North America- Stable and Mature Growth Profile:

North America is expected to maintain a steady growth trajectory, with GDP growth moderating from 2.5% in CY2022 to around 2.1-2.3% during CY2024-CY2028 P. The region benefits from resilient consumer spending, strong labor markets, and ongoing investments in technology and digital infrastructure. Although growth is lower than emerging markets, the consistency reflects the maturity and resilience of its economic structure.

Latin America & Caribbean- Gradual Stabilization:

Growth in Latin America & the Caribbean is projected to normalize after a strong 4.2% expansion in CY2022, settling between 2.4% and 2.9% through CY2028P. The moderation reflects tighter monetary conditions and slower global demand; however, improving domestic consumption, easing inflationary pressures, and commodity sector support are expected to sustain moderate economic expansion across the region.

Middle East & Central Asia- Sharp Volatility Followed by Recovery:

The Middle East & Central Asia region displays the most pronounced fluctuations among all regions. Growth rises from 2.4% in CY2023 to 3.7% in CY2025, before plunging to 0.7% in CY2026F, reflecting geopolitical disruptions, energy market uncertainty, and trade route constraints. A strong rebound is expected thereafter, with growth surging to 6.5% in CY2027 before normalizing to 4.0% in CY2028P, supported by recovery in energy production, infrastructure investments, and normalization of regional trade.

³ <https://www.imf.org/-/media/files/publications/weo/2026/update/july/english/text.pdf>

⁴ https://www.imf.org/external/datamapper/NGDP_RPCH@WEO/OEMDC/ADVEC/WEOWORLD



Emerging & Developing Asia- Global Growth Engine

Emerging & Developing Asia continues to outperform all major regions, maintaining growth above 4.5% throughout the period. After peaking at 6.1% in CY2023, growth is projected to stabilize between 4.8% and 5.6% during CY2024-CY2028P. Strong domestic demand, expanding manufacturing capabilities, infrastructure investments, digital transformation initiatives, and favorable demographics continue to position the region as the primary contributor to global economic growth. India and Southeast Asian economies are expected to remain key growth drivers.

Sub-Saharan Africa-Consistent Growth Momentum:

Sub-Saharan Africa demonstrates a relatively stable growth outlook, improving from 3.6% in CY2023 to around 4.3-4.5% during CY2026-CY2028P. Economic activity is supported by urbanization, demographic growth, infrastructure development, and recovery in commodity-related sectors. Despite external risks and fiscal challenges in certain economies, the region is expected to maintain steady medium-term growth momentum.

Emerging & Developing Europe- Recovery After Sharp Slowdown:

Emerging & Developing Europe experienced a significant slowdown from 3.8% in CY2023 to just 0.5% in CY2022, reflecting the lingering impact of geopolitical tensions and energy market disruptions. Growth subsequently recovered to 3.6% in CY2023, before moderating and stabilizing around 2.0-2.3% during CY2025-CY2028P. Continued geopolitical uncertainty and energy dependency are expected to constrain growth, although improved trade activity and fiscal support measures provide some stabilization.

Trade and Commodity Market Trends

Commodity markets continue to operate in a high-price environment. Energy prices remain significantly above pre-conflict levels, with the IMF projecting average crude oil prices of approximately US 89 per barrel in CY2026, representing a year-on-year increase of around 32%, while natural gas prices are forecast to rise by roughly 22%. Elevated energy costs are also expected to push fertilizer prices up by approximately 26% and food prices by about 8%, reflecting higher transportation and production costs.

Global trade activity is expected to moderate in the near term, with world trade volume growth projected to decline from 5.0% in CY2025 to 3.5% in CY2026, before recovering to 4.3% in CY2027 as supply-chain conditions improve and demand stabilizes.



Global Economic Outlook⁵

According to the IMF, global GDP growth is projected at 3.0% in CY2026 and 3.4% in CY2027, compared with an average growth rate of approximately 3.5% during CY2024-CY2025. Growth in advanced economies is projected at 1.7% in 2026 and 1.8% in 2027, with the overall impact of the Middle East conflict remaining relatively contained compared with emerging market and developing economies. Net energy exporters are partly cushioned by favorable terms-of-trade effects, while net energy importers face greater pressure from higher energy prices. In the United States, growth is projected at 2.3% in 2026 and 2.2% in 2027, supported by fiscal policy, accommodative financial conditions, continued technology-related investment and productivity strength. The impact of the Middle East conflict is expected to remain limited given the United States' position as a net energy exporter. In the euro area, growth is projected at 0.9% in 2026 and 1.2% in 2027, with higher energy prices, weak consumer confidence and soft underlying momentum weighing on activity.

In **emerging market and developing economies**, growth is projected to slow to 3.8% in 2026 before recovering to 4.5% in 2027. The outlook varies across economies, reflecting differences in commodity dependence, geographic exposure, remittances and tourism receipts, sensitivity to financial conditions, and positioning within the global technology value chain. China's growth is projected at 4.6% in 2026, as higher global oil prices, prolonged uncertainty and structural headwinds are expected to weigh on activity. India remains among the fastest-growing major economies, with growth projected at 6.4% in 2026, supported by strong momentum in private consumption and services activity. Malaysia's economy is projected to grow by 4.7% in 2026, benefiting from data center activity and an upturn in the global technology cycle. Thailand's growth forecast has been revised upward by 0.4 percentage point to 1.9%, supported by emergency fiscal measures, robust technology-related exports and investment. Vietnam's 2026 growth projection has also been revised upward by 0.4 percentage point to 7.5%, driven by stronger-than-expected technology exports and robust domestic demand. By contrast, small island developing states are expected to experience slower growth due to higher energy costs, weaker tourism and lower remittance inflows.

In the **Middle East and Central Asia**, growth is projected to drop sharply to 0.7% in 2026 before rebounding to 6.5% in 2027, representing a downward revision of 1.2 percentage points for 2026 and an upward revision of 1.9 percentage points for 2027. The outlook reflects a longer closure of the Strait of Hormuz than previously assumed and the resulting larger rebound. Iraq, Kuwait and Qatar, among the commodity producers most affected by disruptions to energy output and transportation, are projected to experience sharp economic contractions in 2026, followed by double-digit expansions in 2027. Saudi Arabia is expected to be relatively less affected due to its more diversified export routes, with growth projected at 1.7% in 2026 and 5.5% in 2027. Iran's 2026 growth forecast has been revised upward by 0.7 percentage point

⁵ <https://www.imf.org/-/media/files/publications/weo/2026/update/july/english/text.pdf>



to –5.4%, reflecting stronger-than-expected oil exports and some relaxation of export restrictions, while its 2027 forecast has been revised downward by 0.3 percentage point. Commodity importers in the Middle East and North Africa are expected to remain relatively resilient despite higher energy and food prices, while economies in the Caucasus and Central Asia continue to benefit from favorable economic conditions and growth prospects.

In **Emerging and Developing Europe**, growth is expected to remain restrained at around 2.0%, reflecting subdued economic activity and continued geopolitical and energy-related pressures. Russia's growth is projected at 1.1%, with stronger export revenues, partly driven by higher commodity prices, providing some support to the economy. However, the outlook remains challenging for energy-intensive economies and countries dependent on fossil fuel imports, as higher energy prices continue to weigh on economic activity. These pressures are partly offset by the positive impact of increased defense spending, which is supporting economic activity across parts of the region.

Key factors impacting Global Macroeconomic landscape

- **Geopolitical tensions** remain one of the most significant sources of macroeconomic uncertainty. Ongoing conflicts continue to influence commodity prices, transportation networks, and trade flows, contributing to elevated energy costs and inflationary pressures. While baseline projections assume a gradual normalization of global energy and logistics conditions, further disruptions remain a key downside risk.
- **Trade fragmentation and supply-chain diversification** are becoming increasingly important. Higher tariffs, geopolitical tensions and policy uncertainty are encouraging companies to diversify sourcing, regionalize production networks and strengthen supply-chain resilience. The resulting shift toward nearshoring, friend-shoring and multi-sourcing is increasing the strategic importance of supply-chain redundancy, even where this involves higher operating costs.
- In **Global Trade and Commodity Markets**, Commodity prices remain elevated, with energy prices around 25% above pre-war levels. The IMF projects the average petroleum spot price index at USD 89 per barrel in 2026 and natural gas prices at USD 15, corresponding to increases of 32% for crude oil and 22% for natural gas compared with 2025. Fertilizer prices are projected to rise by 26%, while food prices are expected to increase by 8%, reflecting higher energy, fertilizer and transportation costs. World trade volume growth is projected to slow from 5.0% in 2025 to 3.5% in 2026, before recovering to 4.3% in 2027.
- **Technology adoption and sustainability** are becoming core strategic priorities. Rapid advances in artificial intelligence, cloud computing, automation, data centres and digital infrastructure are supporting technology-related investment and productivity growth. At the same time, rising electricity demand from digital infrastructure is increasing the importance of energy efficiency,



advanced cooling systems, grid reliability and renewable-energy integration. The IMF identifies continued technology-related business investment and productivity strength as an important support to US growth, while the IEA highlights the growing role of rare-earth-dependent technologies such as AI data centres, electric vehicles, wind turbines and advanced industrial equipment.

- **Critical-mineral supply concentration** is becoming a strategic economic risk. Rare-earth supply chains remain highly concentrated, particularly for magnet rare earths used in electric vehicles, wind turbines, industrial motors, AI data centres and defence applications. According to the IEA's latest 2026 assessment, China continues to dominate the global rare earth supply chain, accounting for around 60% of global mined production of magnet rare earths, more than 90% of refined output, and almost 95% of permanent magnet production⁶.

⁶ <https://www.iea.org/news/new-projects-partnerships-and-policies-are-needed-to-address-supply-chain-risks-for-rare-earth-elements>



India Macroeconomic Analysis

Against the backdrop of a moderating global growth environment, India continues to be one of the fastest-growing major economies globally. Supported by strong domestic demand, increasing investments, rising consumption expenditure and sustained policy reforms, the Indian economy has demonstrated robust growth momentum relative to most large economies. According to the IMF, India's GDP is projected to grow at 6.4% in CY2026 and 6.7% in CY2027, significantly higher than several advanced and emerging economies.

Country	CY 2020	CY 2021	CY 2022	CY 2023	CY 2024	CY 2025	CY 2026 P	CY 2027 P	CY 2028P
India ⁷	-5.8%	9.7%	7.6%	9.2%	7.1%	7.7%	6.4%	6.7%	6.5%
China	2.3%	8.6%	3.1%	5.4%	5.0%	5.0%	4.6%	4.1%	4.0%
United States	-2.2%	6.1%	2.5%	2.9%	2.8%	2.1%	2.3%	2.2%	2.1%
Japan	-4.2%	2.7%	0.9%	1.4%	-0.2%	1.1%	0.6%	0.7%	0.6%
United Kingdom	-10.3%	8.6%	4.8%	0.4%	1.0%	1.4%	1.0%	1.3%	1.6%
Russia	-2.7%	5.9%	-1.4%	4.1%	4.9%	1.0%	1.1%	1.1%	1.0%
Germany	-4.1%	3.9%	1.8%	-0.9%	-0.5%	0.2%	0.7%	1.0%	1.2%

Source: World Economic Outlook, July 2026⁸

Note: The data presented till CY 2027P are taken from the IMF's July 2026 World Economic Outlook (WEO) and the CY2028 data are sourced from the IMF World Economic Outlook Database.⁹

Growth across major economies is expected to remain mixed. The United States is projected to grow by 2.3% in CY 2026 and 2.2% in CY 2027, while China is expected to expand by 4.6% in CY 2026 and 4.1% in CY 2027. Among other major economies, Germany is projected to grow by 0.7% in CY 2026 and 1.0% in CY 2027, while Japan is expected to expand by 0.6% and 0.7%, respectively. The United Kingdom is projected to grow by 1.0% in CY 2026 and 1.3% in CY 2027, while Russia is forecast to grow by 1.1% in both years. Against this backdrop, India continues to stand out as one of the fastest-growing major economies globally. The IMF projects India's growth at 7.7% in CY 2025, 6.4% in CY 2026, 6.7% in CY 2027 and 6.5% in CY 2028.

India's growth trajectory is underpinned by a broad-based expansion across key sectors of the economy. The country's large domestic market, favourable demographics, increasing urbanization, growing middle-income population and expanding industrial base continue to support economic activity. In addition, structural reforms, infrastructure development initiatives and efforts to strengthen domestic manufacturing capabilities have contributed to enhancing India's long-term growth potential.

⁸ <https://www.imf.org/-/media/files/publications/weo/2026/update/july/english/text.pdf>

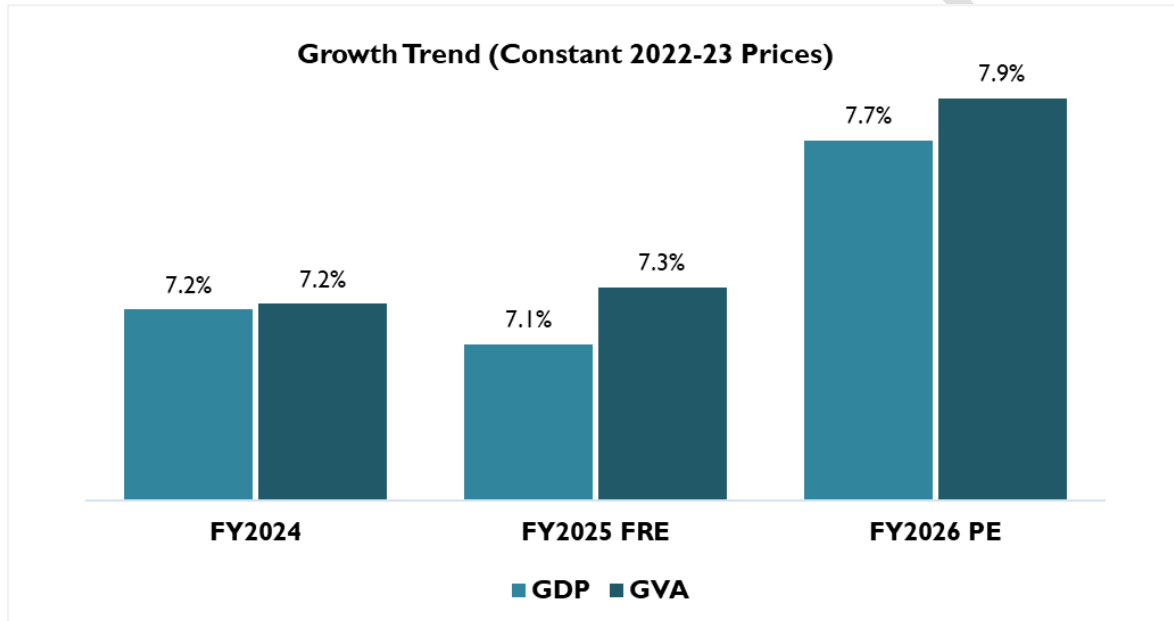
⁹ https://www.imf.org/external/datamapper/NGDP_RPCH@WEO/OEMDC/ADVEC/WEOWORLD



Historical GDP and GVA Growth Trend

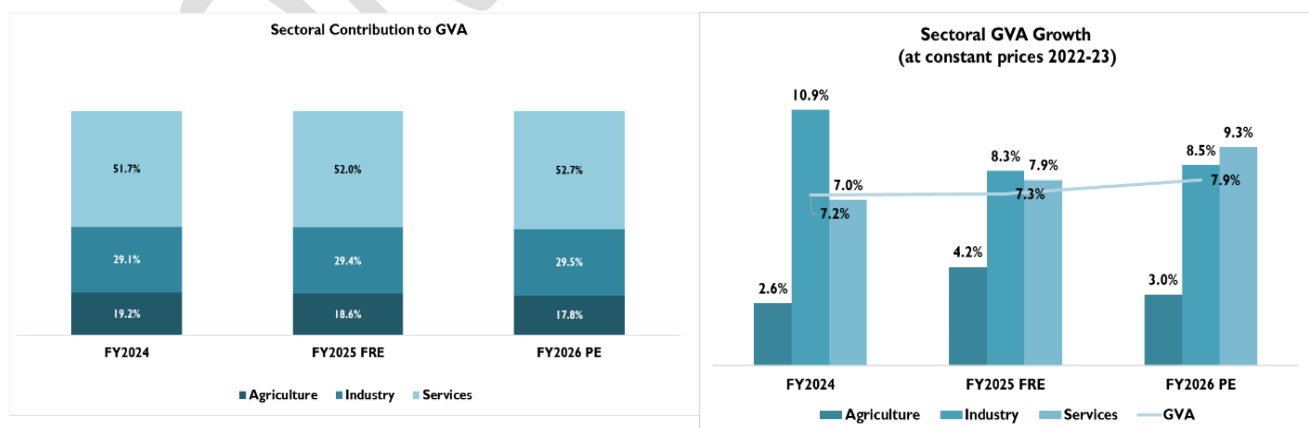
As per MOSPI's Provisional Estimates, India Real GDP (GDP at constant prices) for FY 2026 is estimated to reach INR 323.12 lakh crore, compared to the First Revised Estimate (FRE) of INR 299.89 lakh crore for FY 2025. This represents a growth rate of 7.7% in 2026, higher than the 7.1% growth recorded in 2025.

Similarly, Real GVA for FY 2026 is estimated to reach INR 294.91 lakh crore, up from INR 273.36 lakh crore in FY 2025. This indicates a growth rate of 7.9%, compared with the 7.3% growth achieved in the previous year.



Source: Ministry of Statistics & Programme Implementation (MOSPI), National Account Statistics: FY2025, FRE is First Revised Estimate; PE is Provisional Estimates

Sectoral Contribution to GVA and Annual Growth Trend



Source: Ministry of Statistics & Programme Implementation (MOSPI), CMIE Economics Outlook
FRE is First Revised Estimate; PE is Provisional Estimates



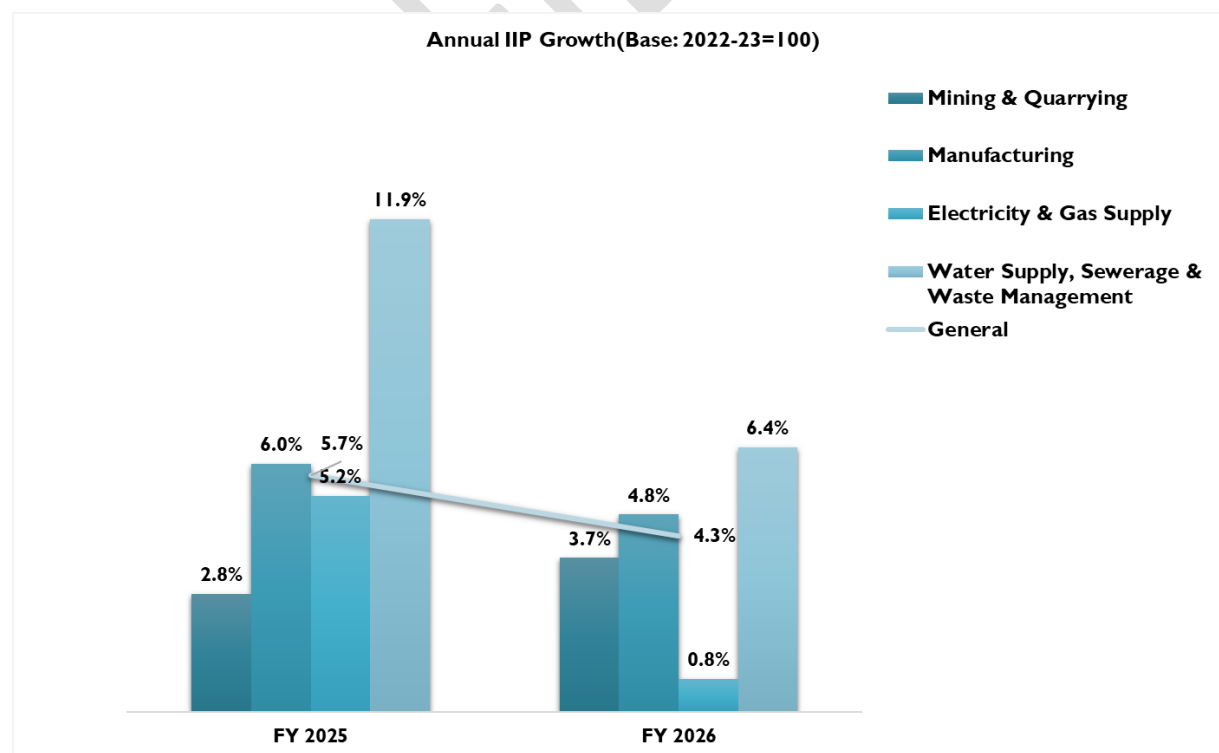
Sectoral analysis of GVA reveals that the industrial sector experienced steady growth momentum in FY 2026, recording a 7.9% y-o-y growth against 7.3% year-on-year growth in FY 2025. Within the industrial sector, growth moderated across sub-sectors with mining, and construction activities growing by 5.15%, and 7.36%, respectively in FY 2026, compared to 11.69%, and 7.30% in FY 2025. Growth in the utilities sector too moderated to 1.74% in FY 2026 from 2.87% in the previous year. The industrial sector's contribution to GVA increased marginally from 29.4% in FY 2025 to 29.5% in FY 2026.

The services sector continued to be the main driver of economic growth. It expanded by 9.3% in FY 2026 from 7.9% in FY 2025. The services sector retained its position as the largest contributor to GVA, rising from 51.7% in FY 2024 to 52.0% in FY 2025, with a further increase to 52.7% in FY 2026.

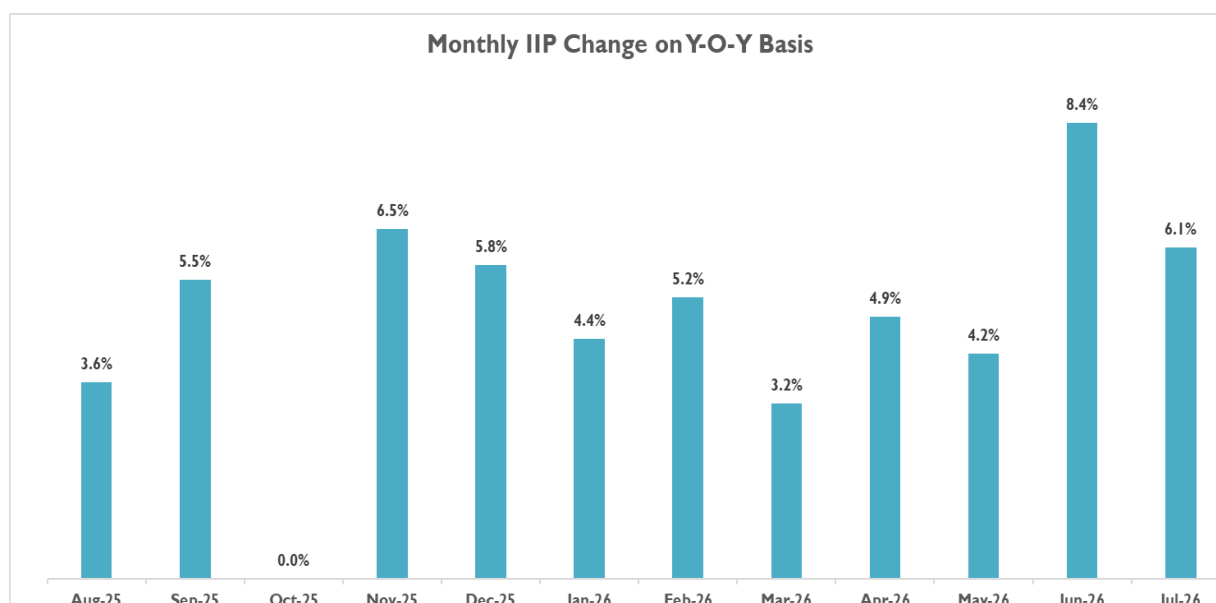
The agriculture sector saw an acceleration in growth, increasing from 2.66% in FY 2024 to 4.18% in FY 2025, before moderating to 3.0% in FY 2026. However, its contribution to GVA declined marginally from 19.2% in FY 2024 to 17.8% in FY 2026. Overall, Gross Value Added (GVA) growth rose to 7.9% in FY 2026 from 7.3% in FY 2025.

Annual & Monthly IIP Growth

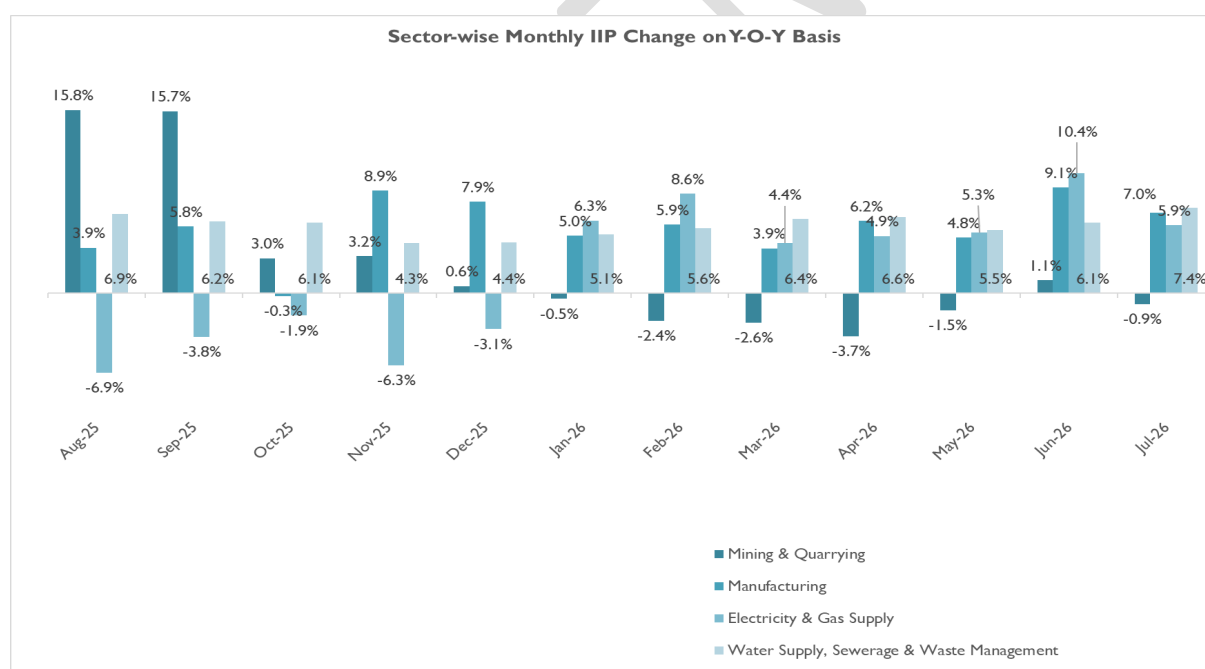
Industrial sector performance, as measured by the IIP, moderated in FY 2026, recording 4.3% y-o-y growth compared with 5.2% in FY 2025. The manufacturing sector grew by 4.8% in FY 2026, compared with 6.0% in FY 2025. The Electricity & Gas Supply sector recorded growth of 0.8%, compared with 5.7% in the previous year. Water Supply, Sewerage & Waste Management grew by 6.4% in FY 2026, compared with 11.9% in FY 2025. In contrast, Mining & Quarrying growth improved to 3.7% in FY 2026 from 2.8% in FY 2025.



Source: Ministry of Statistics & Programme Implementation (MOSPI)



Source: Ministry of Statistics & Programme Implementation (MOSPI)



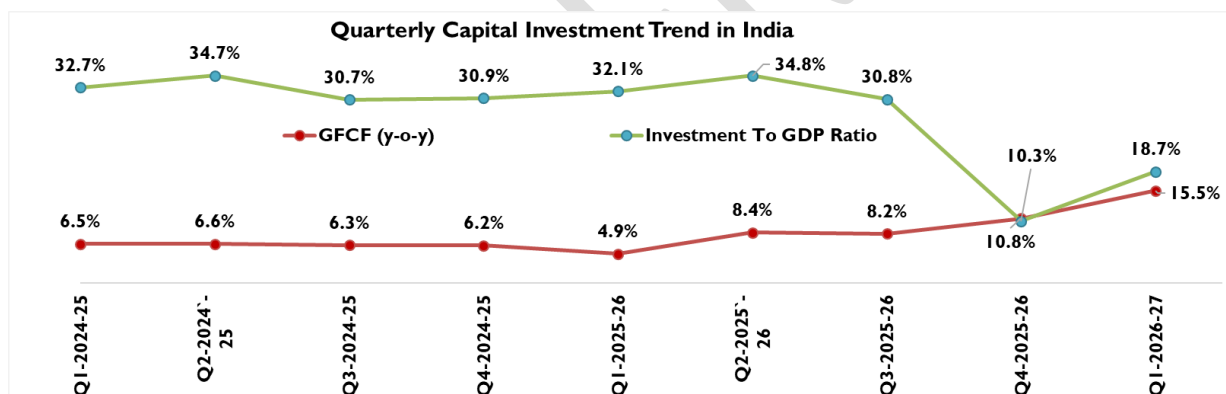
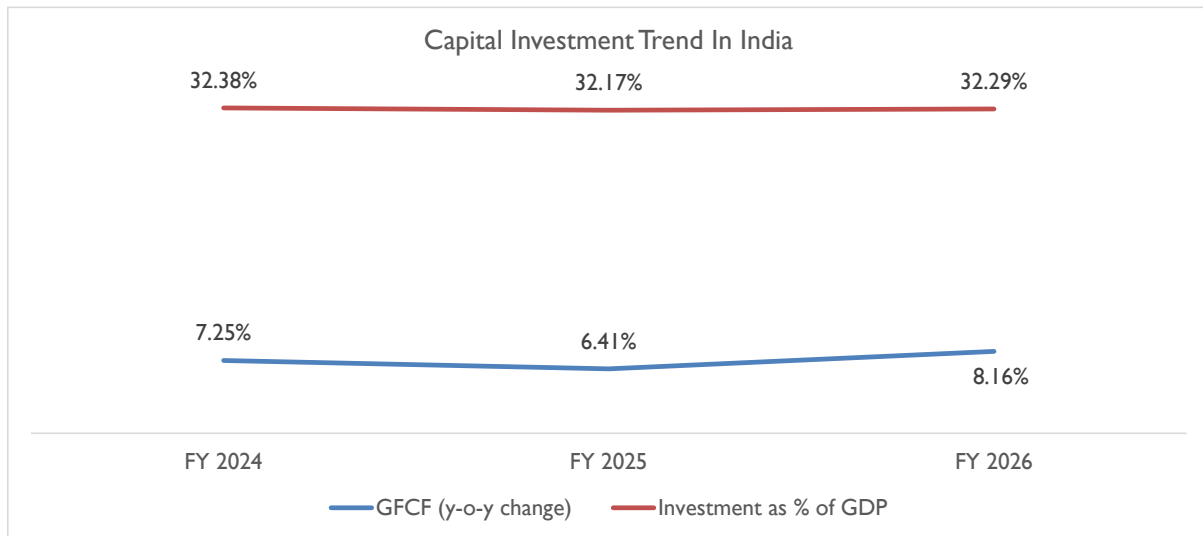
Source: Ministry of Statistics & Programme Implementation (MOSPI)

In the latest month shown, July 2026, IIP growth stood at 6.1% y-o-y, compared with 4.2% in May and 8.4% in June 2026. Sector-wise, Mining & Quarrying declined by 0.9%, while Manufacturing grew by 7.0%, Electricity & Gas Supply by 5.9%, and Water Supply, Sewerage & Waste Management by 7.4% in July 2026.



Annual and Quarterly: Investment & Consumption Scenario

Other major indicators, such as Gross Fixed Capital Formation (GFCF), a measure of investment, increased during FY 2026, registering 8.16% year-on-year growth compared with 6.41% in FY 2025, bringing the GFCF-to-GDP ratio to 32.29%.



Source: Ministry of Statistics & Programme Implementation (MOSPI), CMIE Economics Outlook

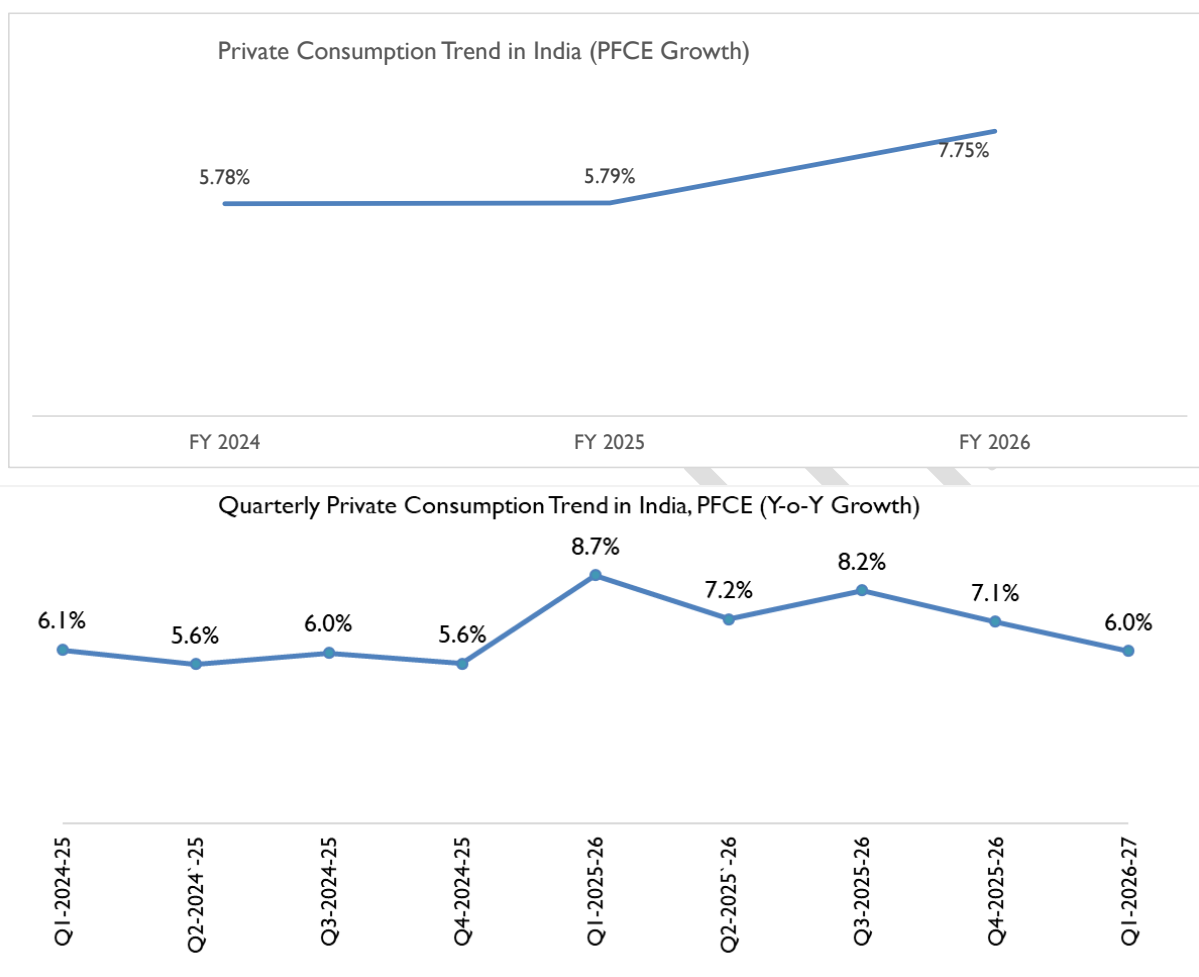
On a quarterly basis, India's capital investment indicators reflect a mixed but resilient investment environment, with the Investment-to-GDP ratio remaining relatively strong through most of the period, while GFCF growth showed significant fluctuations. The Investment-to-GDP ratio increased from 32.7% in Q1 FY 2024-25 to 34.7% in Q2, before moderating to 30.7% in Q3 and 30.9% in Q4. In FY 2025-26, the ratio improved to 32.1% in Q1 and further strengthened to 34.8% in Q2, the highest level recorded during the period. It subsequently moderated to 30.8% in Q3 and 10.3% in Q4, before increasing to 18.7% in Q1 FY 2026-27. This indicates a revival investment intensity in the latest quarters.

GFCF (y-o-y) growth remained broadly stable during FY 2024-25, ranging between 6.2% and 6.6%, before declining to 4.9% in Q1 FY 2025-26. Growth then accelerated significantly to 8.4% in Q2 and 8.2% in Q3, reaching 10.8% in Q4 FY 2025-26. However, the momentum picked up with GFCF growth increasing to



15.5% in Q1 FY 2026-27. Overall, while the earlier period reflects strengthening fixed capital formation and improved investment momentum.

Private Consumption Scenario



Sources: MOSPI, CMIE Economics Outlook

Private Final Consumption Expenditure (PFCE), a key indicator of household consumption and domestic demand, maintained healthy year-on-year growth throughout the period, although momentum moderated in the latest quarter. PFCE growth stood at 6.1% in Q1 FY 2024-25, before moderating slightly to 5.6% in Q2, rising to 6.0% in Q3 and easing again to 5.6% in Q4. In FY 2025-26, consumption growth strengthened significantly to 8.7% in Q1, before moderating to 7.2% in Q2 and recovering to 8.2% in Q3. Growth then eased to 7.1% in Q4 FY 2025-26 and further moderated to 6.0% in Q1 FY 2026-27.

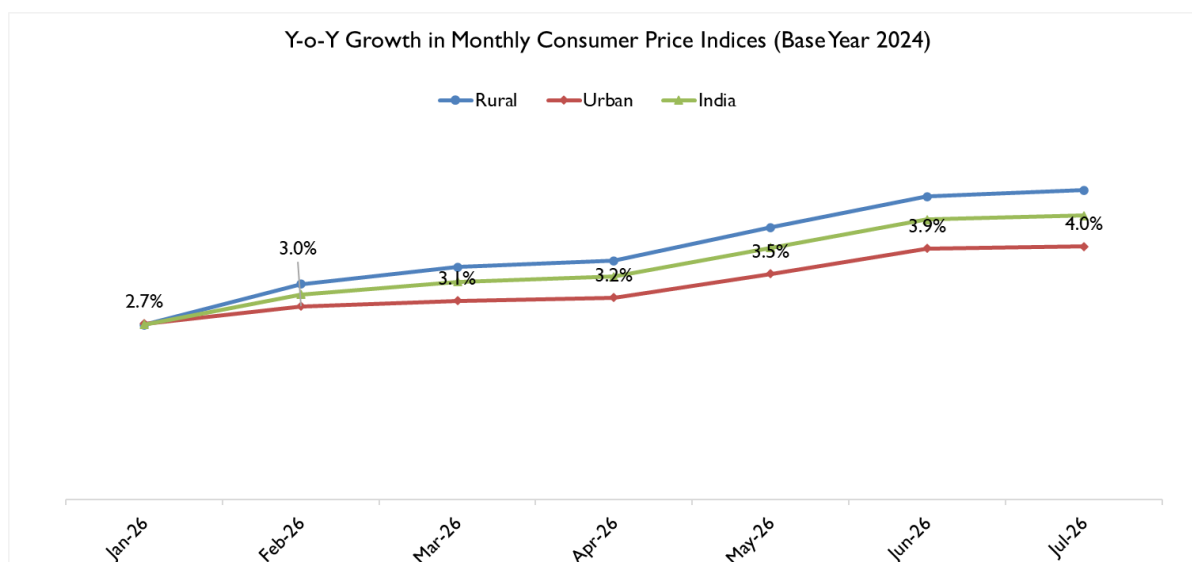
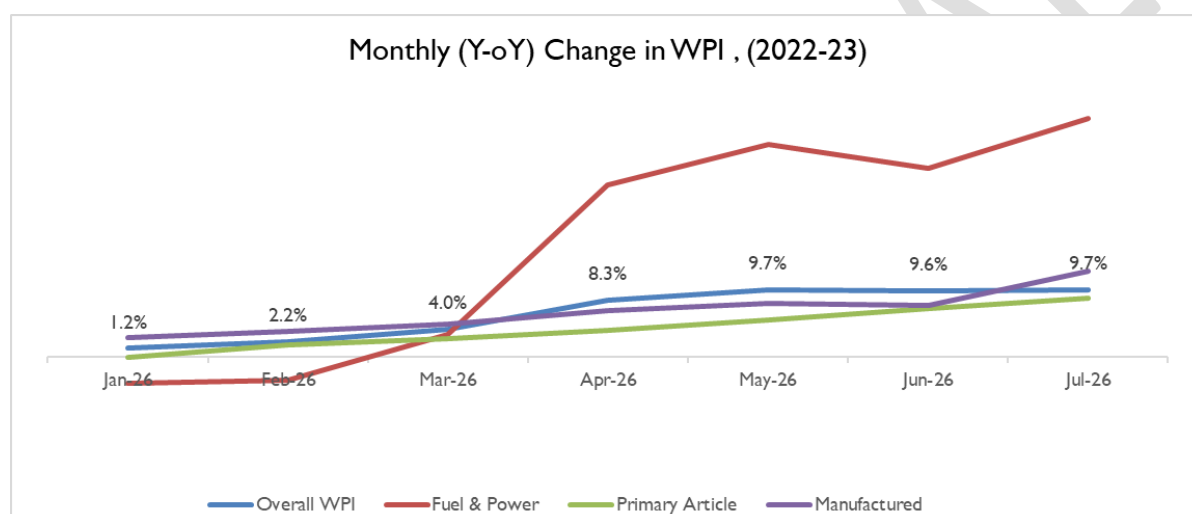
Overall, the data indicates that private consumption remained a key driver of domestic economic activity, with PFCE growth consistently above 5% and recording particularly strong momentum during FY 2025-26. However, the moderation to 6.0% in Q1 FY 2026-27 suggests some easing in household consumption momentum compared with the stronger growth recorded during the preceding quarters.

Inflation Scenario



All India Wholesale Price Index (WPI) inflation for July 2026 is 9.7 per cent on a year-on-year (YoY) basis, compared to 9.6 per cent in June 2026. The index for All Commodities for July 2026 stands at 109.7, whereas it was 109.6 in June 2026. Across Groups, 'Mineral Oils (containing Petroleum Products)', 'Crude Petroleum and Natural Gas', 'Manufacture of Chemicals and Chemical Products', and 'Manufacture of Basic Metals' continued to be major drivers of WPI inflation in June and July 2026.

Across the regions, YoY inflation for Rural, Urban, and India stood at 1.03 per cent, 0.71 per cent, and 0.94 per cent, respectively, in July 2026, compared with 7.24 per cent, 6.69 per cent, and 7.00 per cent, respectively, in June 2026. The indices for Rural, Urban, and India were 108.34, 107.45, and 107.94, respectively, in July 2026, compared with 107.24, 106.69, and 107.00, respectively, in June 2026.

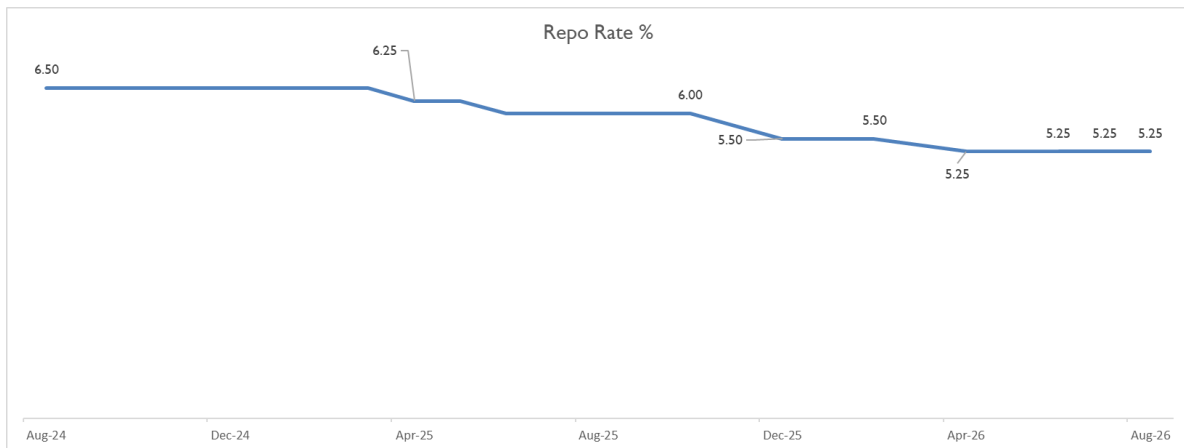


Source: MOSPI, Office of Economic Advisor

With effect from January 2026, the National Statistics Office (NSO) introduced a revised Consumer Price Index (CPI) series with base year 2024=100, incorporating revised item weights based on the Household Consumption Expenditure Survey (HCES) 2023-24. Under the revised series, All India CPI inflation increased



gradually from 2.7% in January 2026 to 4.0% in July 2026. Inflation rose from 3.0% in February to 3.1% in March and 3.2% in April, before accelerating to 3.5% in May, 3.9% in June and 4.0% in July. The trend indicates a steady pick-up in retail inflation during the first half of 2026, following relatively subdued price pressures at the beginning of the year. Rural inflation remained higher than urban inflation during the period, with the gap widening toward the latest months, indicating relatively stronger price pressures in rural areas.



Sources: CMIE Economic Outlook

On the monetary policy front, the RBI had cumulatively raised the repo rate by 250 basis points between May 2022 and February 2023, bringing it to 6.50%, where it was maintained through January 2025 to anchor inflationary expectations. With inflationary pressures moderating and the need to support economic activity, the RBI's Monetary Policy Committee (MPC) initiated an easing cycle in February 2025, delivering a cumulative 125 basis points of rate cuts through four reductions — 25 basis points each in February and April 2025, 50 basis points in June 2025, and 25 basis points in December 2025. The MPC subsequently maintained the repo rate at 5.25% through August 2026, reflecting a balanced approach between supporting growth and maintaining price stability. The policy repo rate currently stands at 5.25% as of August 2026.

Growth Outlook

The Union Budget 2026–27 sets out a quantitatively strong push to build resilient supply chains and develop next-generation industrial capacity. The INR 12.2 lakh crore public capital expenditure outlay is aimed at strengthening infrastructure, connectivity and economic competitiveness. The Budget proposes seven high-speed rail corridors, a new Dedicated Freight Corridor connecting Dankuni to Surat, and the operationalisation of 20 new National Waterways over the next five years. Employment and economic activity are also expected to be supported through infrastructure development, with a focus on Tier-2 and Tier-3 cities through the proposed City Economic Regions.

Employment measures extend across both urban and rural India in one sweep. In cities and large towns, capital expenditure is channelled into growth connectors such as the seven proposed high-speed rail corridors and improved infrastructure in Tier-2 and Tier-3 cities, supporting construction, logistics and



related economic activity. In smaller towns and villages, employment generation is expected to be supported through initiatives covering textiles, khadi, handloom and handicrafts, as well as tourism-linked skilling. The Budget also proposes Samarth 2.0 to strengthen the textile skilling ecosystem and build employment-oriented capabilities.

This domestic push is complemented by targeted measures to strengthen strategic supply chains. Dedicated Rare Earth Corridors in Odisha, Kerala, Andhra Pradesh and Tamil Nadu; customs-duty exemptions for capital goods required for processing critical minerals and manufacturing lithium-ion cells for batteries; and India Semiconductor Mission 2.0 aim to deepen domestic capabilities in critical minerals, advanced materials, semiconductor equipment and electronics. The Government has also increased the proposed outlay for the Electronics Components Manufacturing Scheme to INR 40,000 crore. These measures are intended to strengthen domestic manufacturing capabilities, develop strategic industrial ecosystems and reduce import dependence in critical supply chains.¹⁰

Alongside these domestic measures, India is also seeking to strengthen its external trade architecture through major trade agreements. The conclusion of the India–EU FTA negotiations in January 2026 marks a major strategic milestone, providing preferential access across 97% of EU tariff lines covering 99.5% of trade value. Around 90.7% of India’s exports are covered by immediate duty elimination, particularly benefiting labour-intensive sectors such as textiles, leather and footwear, tea, coffee, spices, sports goods, toys, gems and jewellery and selected marine products. The agreement remains subject to the necessary subsequent processes before implementation and is therefore not yet an operational FTA.¹¹

In a similar vein, the India–Oman Comprehensive Economic Partnership Agreement (CEPA) has moved from negotiation to implementation, having entered into force on 1 June 2026. Bilateral trade between India and Oman reached USD 11.18 billion in FY 2025–26, compared with USD 10.61 billion in FY 2024–25. Under the CEPA, Oman provides duty-free access covering 98.08% of its tariff lines and 99.38% of India’s exports by value, strengthening market access for Indian products across engineering goods, pharmaceuticals, agriculture and processed food, electronics, textiles, plastics, gems and jewellery and other sectors.¹²

At the same time, India has adopted a calibrated liberalisation approach by offering tariff liberalisation on 77.79% of its tariff lines, covering 94.81% of imports from Oman by value, while retaining exclusions and safeguards for sensitive domestic sectors. The agreement also provides gains in services, with Oman undertaking commitments across 127 services subsectors and improving provisions for professional mobility.

¹⁰ <https://www.pib.gov.in/PressReleasePage.aspx>

¹¹ <https://www.pib.gov.in/PressReleasePage.aspx>

¹² <https://www.pib.gov.in/PressReleaselframePage.aspx>



The ceiling for Intra-Corporate Transferees has been increased from 20% to 50%, supporting greater deployment of managerial and specialist personnel by Indian companies.¹³

However, these gains remain exposed to external geopolitical risks. The escalation of the West Asia crisis represents an external shock for India, transmitted primarily through energy markets, logistics and trade-linked business exposure. Heightened security concerns around the Strait of Hormuz have resulted in vessel diversions, longer sailing routes, congestion at transshipment hubs and higher freight, insurance and war-risk costs, creating operational uncertainty for export consignments moving to or through the region.

The early trade response following implementation has also been positive. The number of tariff lines exported to Oman increased from 2,879 in May 2026 to 3,371 in June 2026, while exports across these tariff lines increased to USD 622.8 million in June 2026 from USD 402.7 million in May 2026. These developments indicate an initial expansion in export diversification and utilisation of the preferential market-access framework, although the longer-term impact of the CEPA will depend on sustained exporter participation and trade flows.¹⁴

At the same time, perishable agricultural exporters and other import- and export-dependent businesses remain exposed to shipping delays and logistics disruptions. Diversions and longer sailing routes can increase transit times and logistics costs, while disruptions to maritime trade can create working-capital and delivery pressures for exporters. For import-dependent industries, delays in critical inputs can increase the risk of production disruptions, while sustained increases in freight, insurance and energy-related costs can place pressure on manufacturing and services margins. The Government's response, including RELIEF and measures to facilitate alternate routing and cargo movement, is intended to mitigate these extraordinary logistics and insurance pressures.

¹³ <https://www.pib.gov.in/PressReleaseIframePage.aspx>

¹⁴ <https://www.pib.gov.in/PressReleasePage.aspx>



Key Growth/Demographic Drivers for Economic Growth

Government focus on infrastructure development

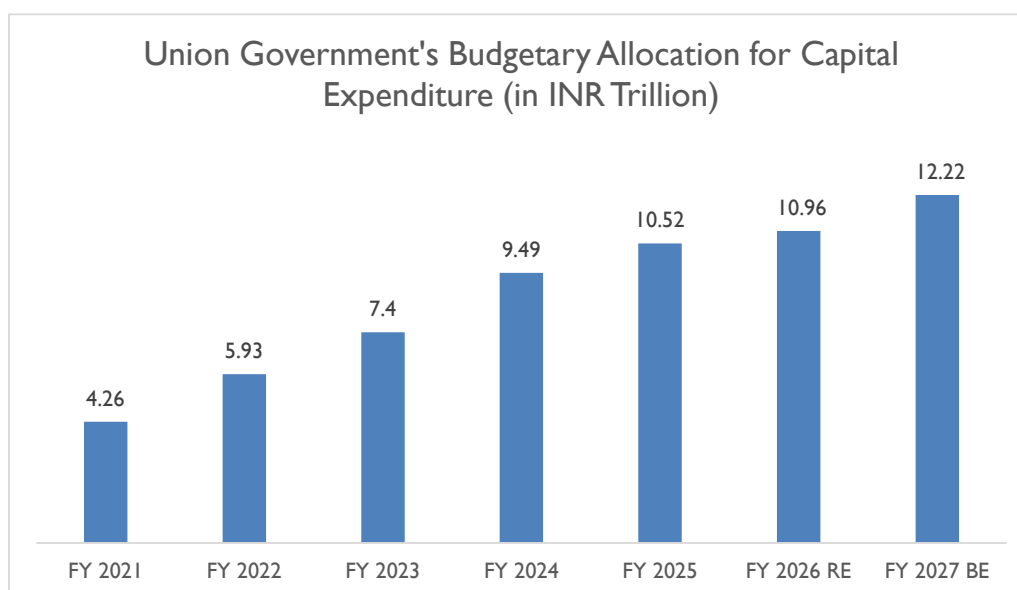
The infrastructure sector has received a strong boost in Budget FY'27, marked by a record INR 12.2 trn¹⁵ public capital expenditure allocation, reinforcing the government's focus on making assets more efficient and sustainable. The introduction of the landmark Infrastructure Risk Guarantee Fund aims to provide partial credit guarantees to lenders and revitalise private sector participation in large-scale projects. By lowering project risk premiums and easing borrowing costs, this mechanism is likely to help crowd in private capital and accelerate construction phase financing across the sector. The transport and logistics sector, in particular, will buoy infrastructure growth. Railways have received a substantial boost in allocation, which will help support the planned development of seven new high-speed rail corridors and a Dankuni-Surat DFC, which aims to cut logistics costs and improve national connectivity. Moreover, the rollout of 20 new National Waterways, new ship repair hubs and a scheme to double the share of coastal and inland water transport from 6.0% to 12.0% by 2047¹⁶ will together build a greener, more efficient multimodal freight network. Urban transformation continues through targeted development of Tier-2 and Tier-3 cities – with populations over 0.5mn – alongside the creation of City Economic Regions, each supported by multi-year, challenge-based financing to establish new growth hubs and reduce pressure on metros. A broader ecosystem of reforms strengthens medium-term sector prospects. The government aims to scale domestic construction and infrastructure equipment manufacturing, reducing import dependence and improving execution capability in tunnelling, metro construction and road building machinery. The monetisation of CPSE assets will be accelerated through dedicated REIT¹⁷ structures, helping unlock liquidity for redevelopment and new project pipelines. Additional support flows through region-specific initiatives, such as industrial corridor expansion, and tourism development in cultural and Buddhist heritage zones will further reinforce construction demand. Together, these measures will strengthen India's infrastructure ecosystem through higher public investment, improved risk mitigation tools and wider multimodal connectivity – creating a constructive environment for sustained growth in construction, logistics and urban development.

¹⁵<https://www.pib.gov.in/PressReleasePage.aspx?PRID=2222521®=3&lang=1#:~:text=Reinforcing%20the%20role%20of%20public,productive%20capacity%20across%20the%20economy.>

¹⁶ https://www.indiabudget.gov.in/doc/budget_speech.pdf

¹⁷ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2221817®=3&lang=1>





Union Budget, Government of India

Note: BE (Budget Estimates) and RE (Revised Estimates)

Development of Domestic Manufacturing Capability

The Government launched the Production Linked Incentive (PLI) scheme in early 2020, initially aimed at improving domestic manufacturing capability in large-scale electronic manufacturing and gradually extended to other sectors. At present it covers 14 sectors, ranging from medical devices to solar PV modules. The PLI scheme provides incentives to companies on incremental sales of products manufactured in India. This incentive structure is aimed at attracting private investment into setting up manufacturing units and thereby strengthening domestic production capabilities. The overall incentive outlay earmarked for the PLI scheme is estimated to be INR 2 trillion. If fully realised, the PLI scheme could add nearly 4% to annual GDP growth, by way of incremental revenue generated from the newly formed manufacturing units.

Strong Domestic Demand

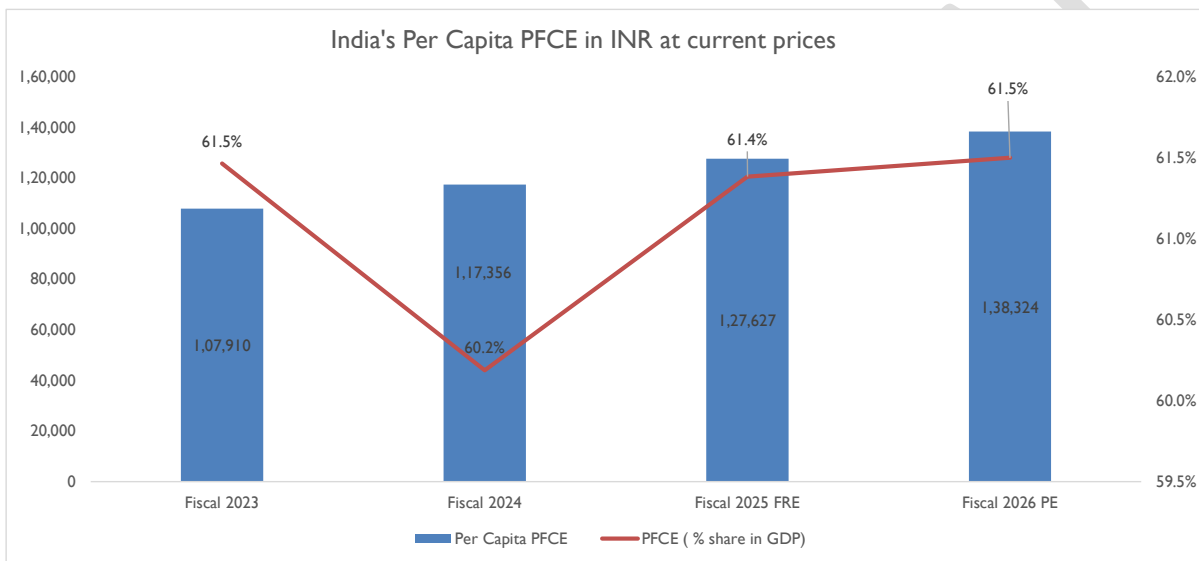
Domestic demand has traditionally been one of the key drivers of the Indian economy. After a brief lull caused by the Covid-19, domestic demand is recovering. Consumer Confidence surveys by the Reserve Bank and other institutions point to an improvement in the Consumer Confidence Index, which is a precursor of improving demand. India has a strong middle-class segment, which has been the major driver of domestic demand. Factors like fast paced urbanization and improving income scenario in rural markets are expected to accelerate domestic demand further. This revival is reflecting in the private final consumption expenditure (PFCE) metric.

India's per capita Private Final Consumption Expenditure (PFCE) at current prices has shown a consistent upward trend, indicating steady improvement in household consumption levels over the years. Per capita PFCE increased from INR 1,07,910 in Fiscal 2023 to INR 1,17,356 in Fiscal 2024, and further rose to INR 1,27,627



in Fiscal 2025 FRE. It is estimated to increase further to INR 1,38,324 in Fiscal 2026 FE, reflecting continued growth in consumer spending and improving consumption capacity.

PFCE as a share of GDP also remained healthy during the period, broadly staying above 60%. The share stood at 61.5% in Fiscal 2023, moderated to 60.2% in Fiscal 2024, before recovering to 61.4% in Fiscal 2025 FRE and further improving to 61.5% in Fiscal 2026 FE. This indicates that private consumption continues to remain a key driver of India's economic growth. Overall, the steady increase in per capita PFCE, along with a stable PFCE share in GDP, reflects resilient household demand and sustained consumption momentum in the economy.



Source: Ministry of Statistics & Programme Implementation (MOSPI)

FRE is First Revised Estimate; PE is Provisional Estimates

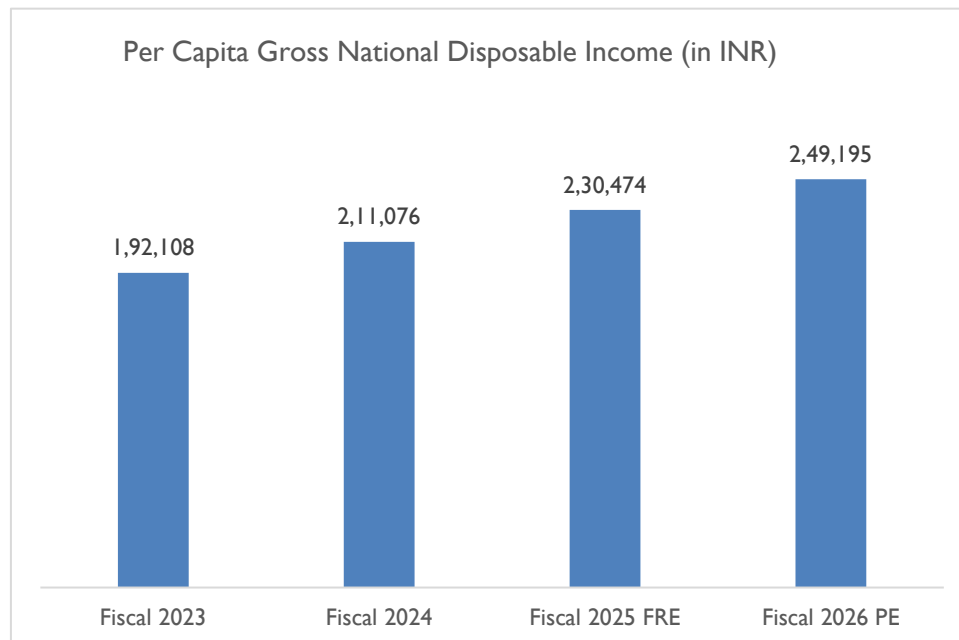
There are two factors driving this domestic demand: first, the large pool of consumers; and second, the improvement in purchasing power.

- The share of middle class increased from nearly 14% in 2005 to nearly 30% in 2021 and is expected to cross 60% by 2047¹⁸. This expanding middle class household segment is fuelling India's growth story and would continue to play a key role in propelling India's economic growth.
- Consumer-driven domestic demand is majorly fuelled by this growth in per capita income. As per National Statistics Office (NSO), India's per capita Gross National Disposable Income (GNDI) has shown a steady upward trend, reflecting improvement in overall income levels and disposable income capacity. Per capita GNDI increased from INR 1,92,108 in Fiscal 2023 to INR 2,11,076 in Fiscal 2024 and further rose to INR 2,30,474 in Fiscal 2025 FRE. It is estimated to increase further to INR 2,49,195

¹⁸ As per the survey conducted by People Research on India's Consumer Economy. Households with annual income in the range of INR 5 – 30 lakhs are considered as middle-class households.



in Fiscal 2026 PE, indicating continued growth in income levels across the economy. The consistent rise in per capita GNDI highlights strengthening purchasing power and improving household income conditions, which can support consumption demand going forward. Overall, the trend reflects a positive income environment, with rising disposable income expected to contribute to sustained private consumption and broader economic growth.



Source: Ministry of Statistics & Programme Implementation (MOSPI)

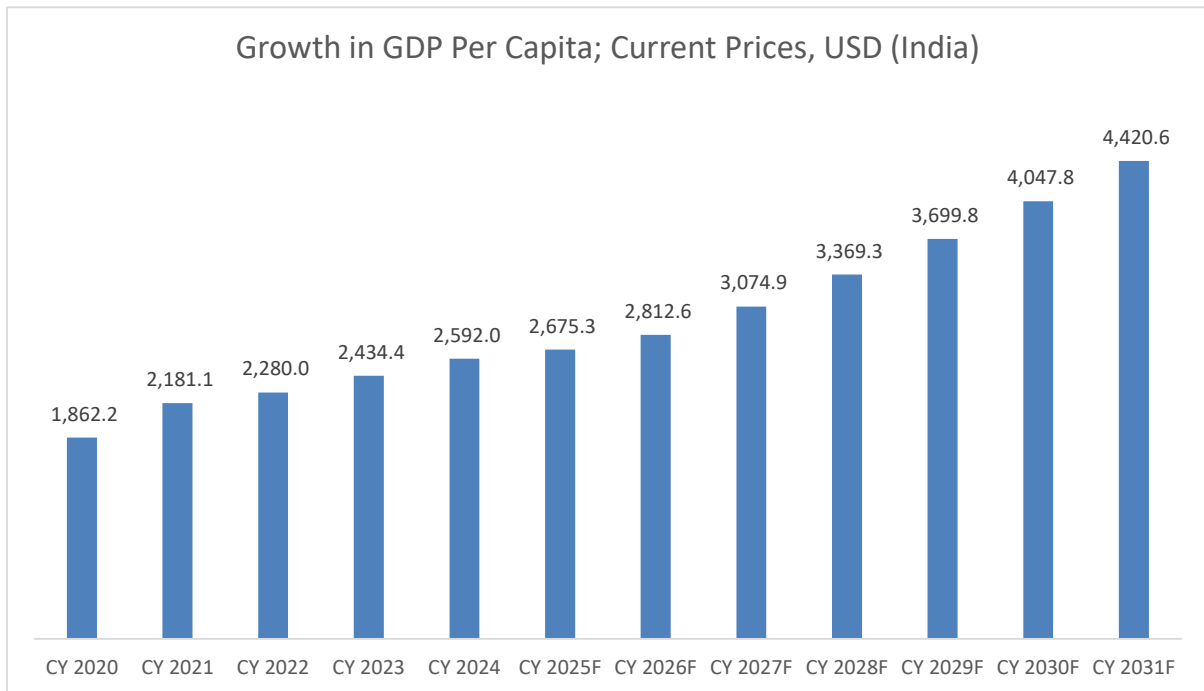
FRE is First Revised Estimate; PE is Provisional Estimates

India's Per Capita GDP Trends

India is poised to become the world's third-largest economy with a projected GDP of USD 5 trillion within the next three years, driven by ongoing reforms. As one of the fastest-growing major economies, India currently holds the position of the fifth-largest economy globally, following the US, China, Japan, and Germany. By 2027-28, it is anticipated that India will surpass both Germany and Japan, reaching the third-largest spot. This growth is bolstered by a surge in foreign investments and a wave of new trade agreements with India's burgeoning market of 1.4 billion people. The aviation industry is witnessing unprecedented orders, global electronics manufacturers are expanding their production capabilities, and suppliers traditionally concentrated in southern China's manufacturing hubs are now shifting towards India.

To achieve its vision of becoming the world's third-largest economy by 2027-28, India will need to implement transformative industrial and governmental policies. These policies will be crucial for sustaining the consistent growth of the nation's per capita GDP over the long term.



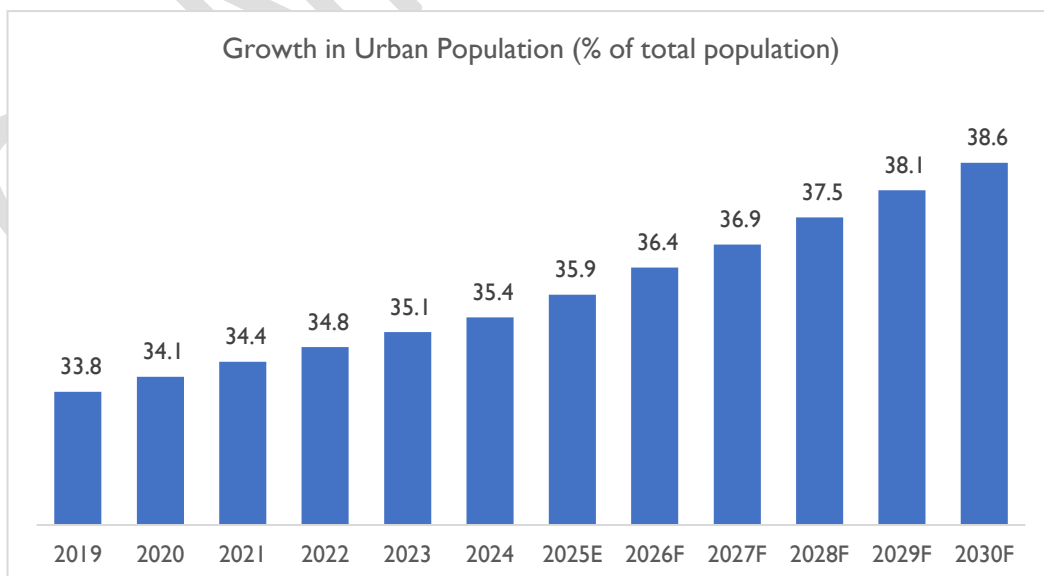


Source: IMF

From CY 2024 to CY 2031, India's per capita GDP is projected to grow at a compound annual growth rate of 7.9%. This growth will be driven by the service sector, which now accounts for over 50% of India's GDP, marking a significant shift from agriculture to services.

Increasing Urbanization

As per the Handbook of Urban Statistics 2022, India's urban population has been on a steady rise. Urban dwellers accounted for over 469 million in 2021 and are projected to rise to over 558 million by 2031 and further exceed 600 million by 2036.



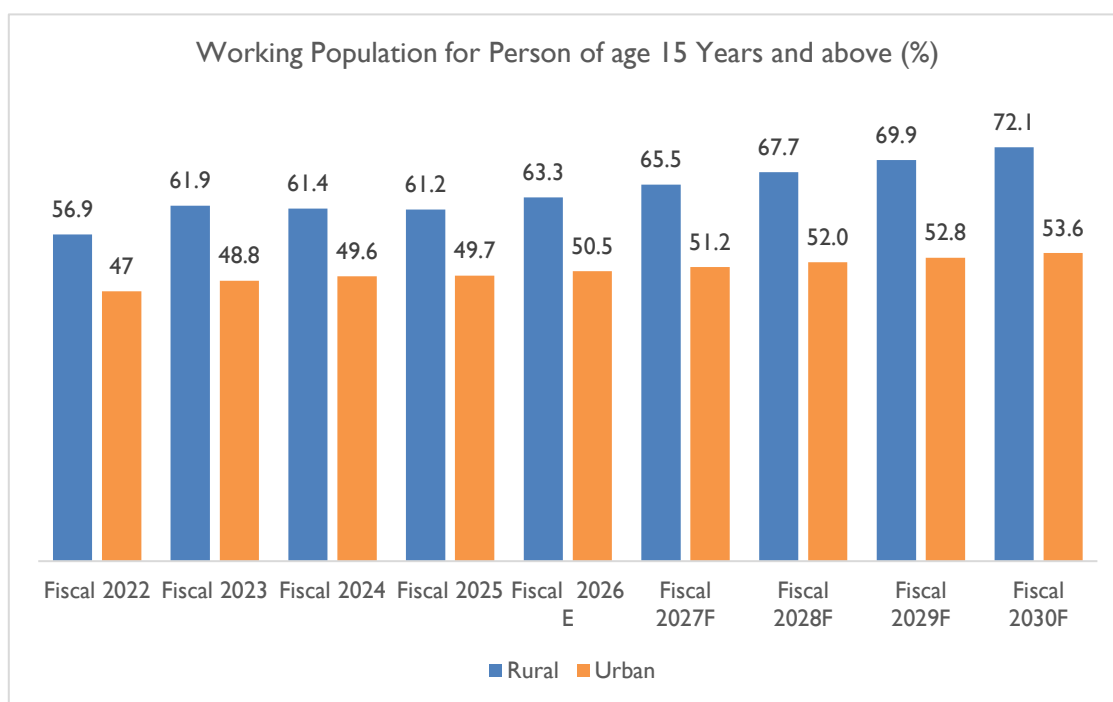
The share of urban population in total population has been rising steadily. In 2019, 33.81% of the total population was urban. By 2025, it had reached 35.9%, showing an increase over a span of five years of about 2.10%. The share of urban population is further forecasted to cross 38.6% by 2030. This increase in urban population is set to demand drastic changes in infrastructure development. Cities are a major driver for the construction industry. With cities expanding rapidly, there will be an increased need for improved housing, water supply, sewage systems, and electricity. Urban planning will need to account for higher population densities, necessitating the development of smart cities with integrated technology for efficient management of resources and services. The Smart Cities Mission targeted at 100 cities is aimed at improving the quality of life through modernised, technology-driven urban planning. This transformation will also require significant investment in public health, education, and recreational facilities to enhance the quality of urban living. The surge in urban population will also propel demand for improvement in multimodal transport infrastructure for freight and passenger travel requirements.

Rural vs. Urban Working Population by Age Group

As India continues to experience economic growth and development, the working population in both rural and urban areas is increasing. In the case of the urban population, this growth is reflected in the increase from a share of 47% in FY22 to 49.7% in FY25, whereas in rural areas, it grew from 56.9% in FY22 to 61.2% in FY25. This growth is driven by a combination of factors, including demographic changes, economic policies, and the expansion of various industries. The rise in employment opportunities across sectors such as agriculture, manufacturing, services, and information technology has contributed to the overall increase in the working population, thereby fostering economic stability and enhancing the standard of living for many Indians.

¹⁹<https://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS?end=2022&locations=IN&skipRedirection=true&start=1960&view=chart>





Source: Periodic Labour Force Survey (PLFS) Annual Report, Dun & Bradstreet Research and Estimates

Note: 2025 refers to the period January 2025 – December 2025 and likewise for 2024, 2023 and 2022

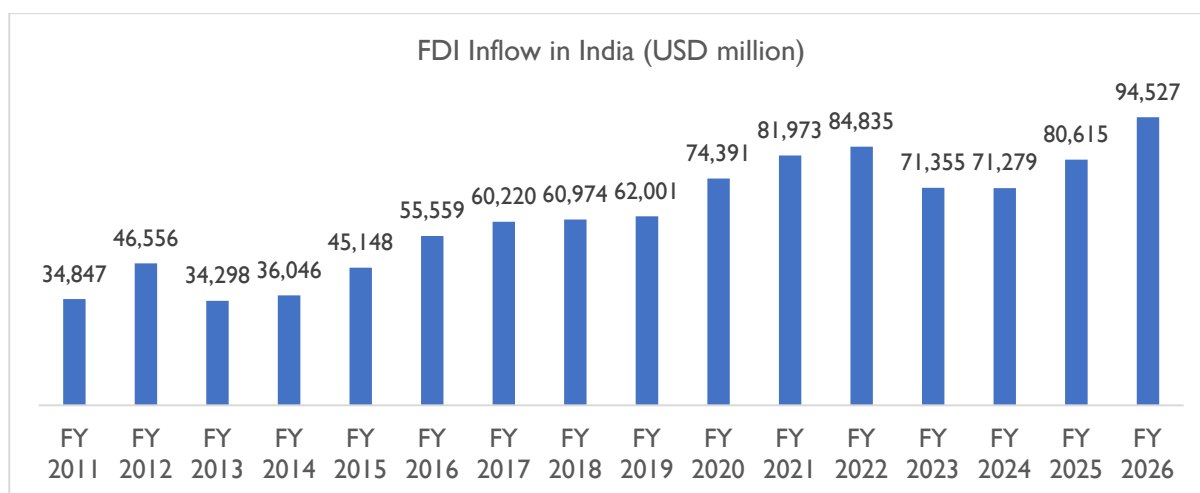
In urban areas, the working population is growing rapidly due to the proliferation of jobs in sectors like IT, finance, retail, and healthcare. Additionally, the development of infrastructure, such as improved transportation networks and housing, has made urban centers more accessible and desirable for the working population. In rural areas, the working population remains substantial, primarily due to the dominance of the agricultural sector. Government initiatives aimed at rural development, such as improved access to education and skill development programs, have also played a crucial role in enhancing employment prospects in these regions.

The dominance of the rural working population over its urban counterpart can be attributed to the labour-intensive nature of the agricultural sector, which ensures a consistent demand for human labor despite advancements in mechanization, sustaining employment rates in rural areas.

Foreign Direct Investment Trend in India

FDI inflows in India observed a steady increase from FY 2013 to FY 2022 while it witnessed a decline of 15% in FY 2023 and a decline of 0.1% in FY 2024 due to several factors, including the ongoing conflict between Russia and Ukraine, changes in US monetary policy, and other global uncertainties. However, the country has received substantial FDI inflows from April 2000 to March 2026. This increasing FDI can be attributed to the new investment facilitation measures like the National Single-Window System (NSWS), which streamlines the approval and clearance process for investors, entrepreneurs, and businesses, along with sectoral measures and PLI schemes, supporting growth prospects in tier-2 and tier-3 cities. Further, tax compliance for startups and foreign investors has been simplified and the Income Tax Act, 1961, was amended in 2024 to abolish angel tax and to reduce income tax rate chargeable on income of a foreign company.





Sources: Department for Promotion of Industry and Internal Trade



Solar Power:

Solar energy is the most viable form of renewable energy because the energy in sunlight can be converted into electricity using solar cells. These cells operate according to the photovoltaic effect (photo means light, and voltaic means electricity). It is this solar photovoltaic effect, which is key to harnessing solar power and converting it into electricity. Hence, solar cells are called Photovoltaic Solar Cells, Photovoltaics, or simply PVs. Solar Energy is produced by utilising sunlight to generate electricity and can be harnessed through two technologies: **Solar Photovoltaic system (SPV)** and **Solar Thermal system / Concentrating Solar Power (CSP) system**.

PV technology captures sunlight and converts it directly into electricity using semiconductor materials, making it highly versatile for both small-scale rooftop systems and large utility-scale installations. Its modular design enables flexible deployment across urban rooftops, industrial facilities, and expansive solar parks, making it the most widely adopted solar technology globally. The simplicity of PV systems, coupled with relatively low operational and maintenance requirements, has made it the preferred choice for rapid solar expansion.

In contrast, **CSP technology** harnesses solar energy by concentrating sunlight using mirrors or lenses to generate thermal energy, which is then converted into electricity through conventional heat engines or turbines. One of the key advantages of CSP is its inherent capacity for thermal storage, enabling power generation to continue after sunset. This makes CSP particularly suitable for utility-scale applications that require steady, dispatchable electricity. While more complex and capital-intensive than PV, CSP can complement other renewable sources by providing reliable power during periods of low solar irradiance.

Together, PV and CSP technologies form a complementary foundation for solar energy deployment. PV offers rapid scalability, flexibility, and suitability for distributed generation, whereas CSP provides stability and dispatchable power for grid-scale applications. By leveraging the strengths of both technologies, solar energy systems can address a wide spectrum of energy needs, from decentralised rooftop solutions to large-scale, continuous power generation, thereby supporting the broader transition toward clean, sustainable, and reliable energy systems.

Photovoltaic (PV) Technology:

Photovoltaic (PV) technology directly converts sunlight into electricity using semiconductor materials such as crystalline silicon or thin-film cells. When sunlight strikes a PV cell, photons excite electrons, generating an electric current that is captured and converted into usable electricity by inverters. **PV has become the dominant solar technology globally**, with cumulative installed capacity exceeding **1.86 TW**



(1,858.6 GW) by 2024 and an **annual installation stood at 451.9 GW in 2024²⁰**, reflecting overwhelming market preference driven by rapidly declining costs and scalability.

PV systems are widely appreciated for their versatility and adaptability. They can be deployed across scales such as residential rooftops, commercial buildings, floating solar arrays, and large utility-scale farms, and function well in various climates because they capture both direct and diffuse sunlight (i.e., even on partly cloudy days). Their relatively simple, modular design contributes to low installation and maintenance costs, increasing affordability and driving global adoption. However, PV is inherently intermittent where electricity production ceases at night and declines in cloudy weather, so grid integration often requires paired battery storage to ensure reliability.

Concentrated Solar Power (CSP):

Concentrated Solar Power (CSP) is a solar thermal technology that uses mirrors or heliostats to focus sunlight onto a receiver to generate high-temperature heat, which then drives steam turbines to produce electricity. Unlike photovoltaic (PV) systems, which directly convert light into electricity, CSP systems generate and store thermal energy, enabling power supply even after sunset when thermal storage is integrated. As of 2024, the total installed CSP capacity worldwide stood at approximately 7.58 GW, with annual additions of roughly 717 MW, a modest scale compared with PV but important for dispatchable renewables. China's CSP pipeline alone exceeds 8 GW in various development stages, indicating strong future growth potential beyond existing operational capacity.

Globally, CSP's unique value stems from its ability to include long-duration thermal storage (often using molten salts) that can deliver electricity well into the evening or night without batteries, addressing one of the main limitations of PV systems. Regions with high Direct Normal Irradiance (DNI), such as deserts, are especially suitable for CSP deployment. Despite ongoing technological advancements and integration with hybrid solar systems, CSP's high upfront capital costs and specific resource requirements (very strong direct sunlight) have limited its deployment, keeping it at a much smaller scale than PV globally. Continued research and supportive policies are seen as key to scaling CSP's role in dispatchable renewable power.

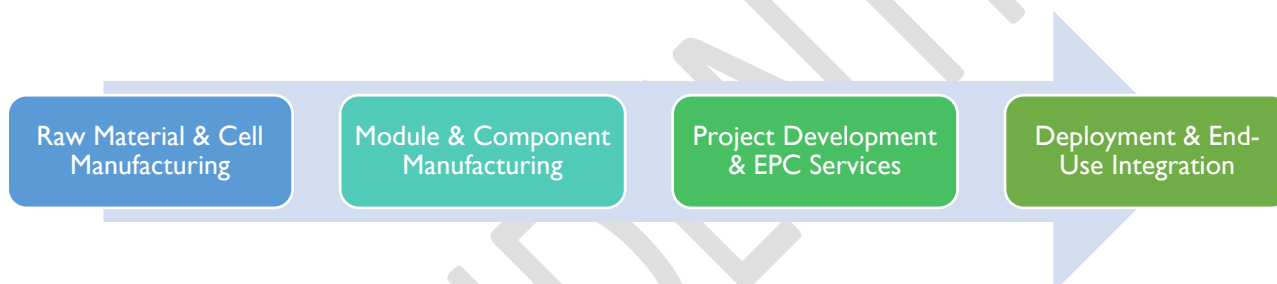
²⁰ [Renewable Energy Statistics 2025](#)



Brief Insight on the Industry Value Chain

The solar power generation landscape is underpinned by a multi-stage value chain that spans from raw material sourcing to large-scale energy deployment. At the initial stages, it focuses on the manufacturing of critical components such as solar cells, wafers, and modules, which act as the core building blocks of the photovoltaic (PV) ecosystem. Efficiency improvements, innovation in materials, and economies of scale in this stage directly shape the cost competitiveness and sustainability of solar power as a mainstream energy source.

As the value chain progresses, it integrates supporting components, project development, and end-use applications. This includes inverters, mounting systems, storage, and balance-of-system (BoS) elements, all of which enable the smooth operation of solar installations. The downstream segment emphasises engineering, procurement, and construction (EPC) services, financing, and grid connectivity, leading to deployment in both distributed rooftop projects and utility-scale solar parks. Together, these interconnected stages ensure that solar power transitions effectively from technology innovation to reliable energy delivery.

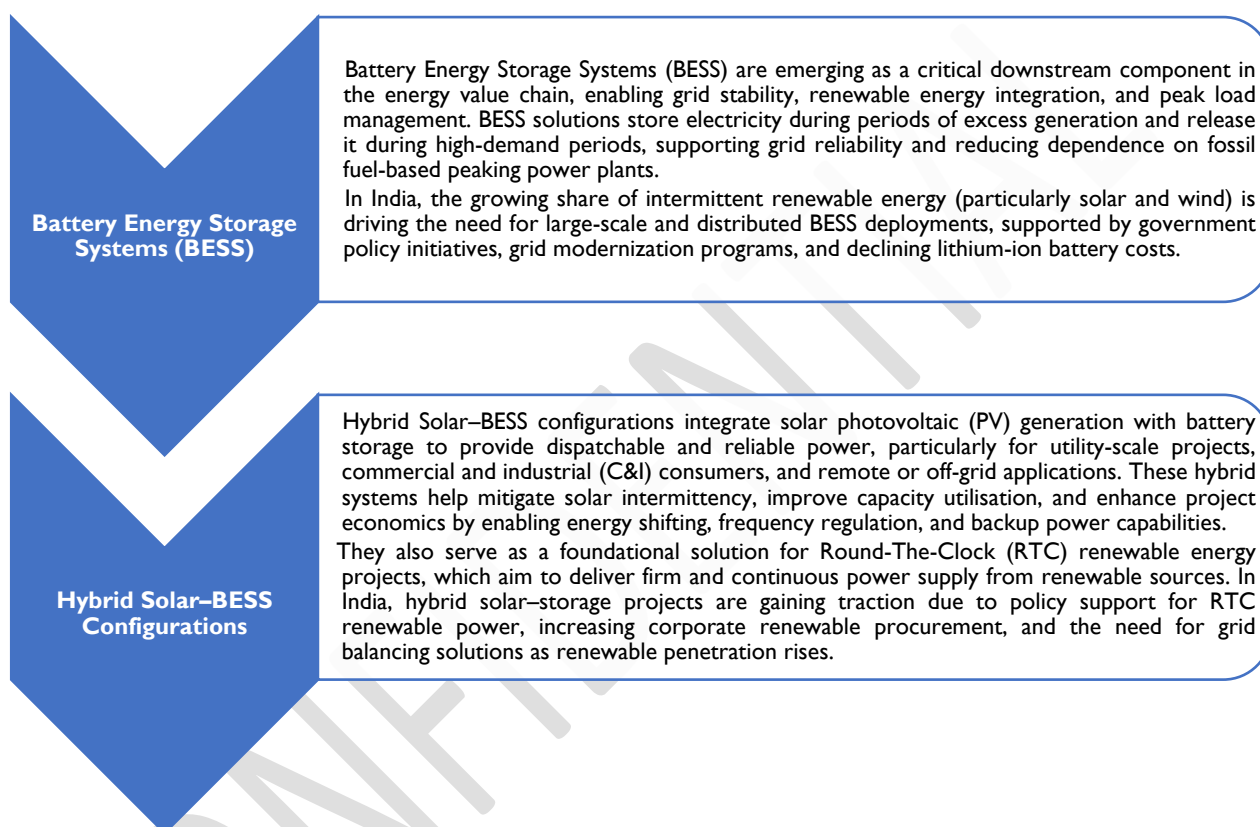


- **Raw Material & Cell Manufacturing (Upstream):** This stage begins with the extraction and refinement of silica into polysilicon, the foundational raw material for solar PV. The polysilicon is further processed into ingots, wafers, and solar cells, which constitute the core of photovoltaic systems. Key focus areas here include improving solar cell efficiency, reducing material costs, and adopting advanced technologies such as monocrystalline, polycrystalline, and thin-film cells. The competitiveness of this stage often determines a country's ability to scale domestic solar manufacturing capacity and reduce dependence on imports.
- **Module & Component Manufacturing (Midstream):** Once solar cells are produced, they are assembled into PV modules or panels, which become the primary units for installation. Supporting components, such as inverters, convert DC electricity to grid-compatible AC, while mounting structures ensure stability across rooftops, ground-mounted, or floating systems. Balance-of-system (BoS) components, such as cabling, junction boxes, and monitoring equipment, enhance overall performance. Increasingly, the integration of energy storage solutions is critical for ensuring reliability under intermittency and for facilitating hybrid applications.

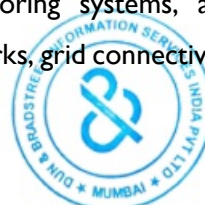
Battery Energy Storage Systems (BESS) and hybrid Solar–BESS configurations are increasingly being deployed as a part of the broader solar and renewable power generation ecosystem. In hybrid



configurations, battery storage infrastructure is co-located or integrated with solar PV generation assets to store excess electricity during peak generation periods and dispatch power during non-generation hours. These configurations enable improved grid stability, mitigate intermittency challenges associated with solar power, and support round-the-clock (RTC) renewable energy supply. BESS and hybrid Solar-BESS projects require specialised system design, power electronics integration, energy management systems, and grid interconnection frameworks, thereby expanding the scope of EPC services, financing structures, and operational models within the solar value chain.



- **Project Development & EPC Services (Downstream):** This phase involves translating manufactured components into operational solar projects through engineering, procurement, and construction (EPC) activities. It includes site identification, project design, financing arrangements, and compliance with regulatory approvals. Risk management and investor participation play vital roles, as large-scale projects require significant capital and policy support. Efficient execution at this stage ensures timely commissioning, cost optimisation, and long-term sustainability of solar assets.
- **Deployment & End-Use Integration:** The final stage focuses on deploying solar systems for electricity generation. This includes distributed applications such as residential, commercial, and industrial rooftop installations, as well as large-scale ground-mounted and utility-grade solar parks that supply power to the grid. Operation and Maintenance (O&M) services, digital monitoring systems, and performance optimisation are integral to ensuring reliability. Strong policy frameworks, grid connectivity infrastructure,



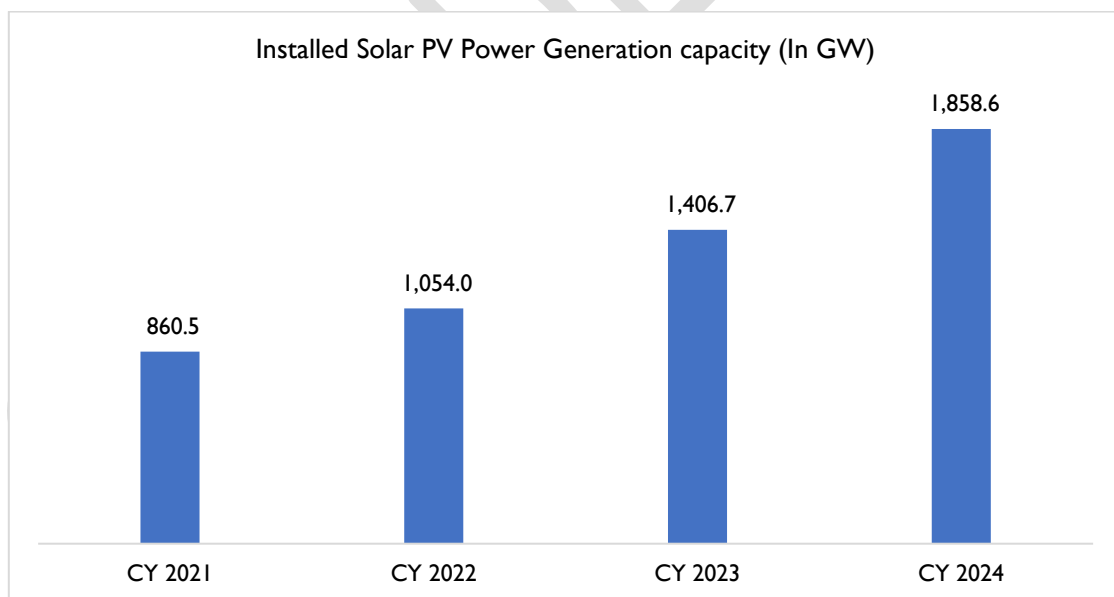
and investment incentives shape the scale and pace of deployment, making this stage the most visible outcome of the solar value chain.

In addition to deployment, Independent Power Producers (IPPs) play a critical role in the downstream segment of the solar value chain by owning, operating, and generating electricity from solar assets for long-term sale under power purchase agreements (PPAs) or through open access mechanisms. IPPs typically undertake project development either directly or through EPC contractors and derive revenue from the sale of power over the project lifecycle. Increasing participation of IPPs has strengthened capital inflows, improved project execution capabilities, and supported large-scale capacity addition across both utility-scale and hybrid solar projects.

Global Solar Power Generation Scenario

Installed Solar PV Power Generation Capacity in the World²¹

Global installed solar PV power generation capacity has grown rapidly, driven by declining costs, supportive policies, and decarbonisation goals. Solar has emerged as a key contributor to the global energy mix across both developed and emerging markets. Large utility-scale projects dominate capacity additions, with rooftop installations also increasing. Improved grid integration and storage adoption are enabling higher solar penetration. Overall, solar PV continues to strengthen its role in the global energy transition.



Source: International Renewable Energy Agency (IRENA)

The graph indicates a strong and accelerating growth trend in global installed solar PV power generation capacity from CY2021 to CY2024. Installed capacity increased from 860.5 GW in CY2021 to 1,054.0 GW in CY2022, reflecting steady capacity additions driven by falling technology costs, supportive government policies, and rising investments in clean energy. The growth momentum strengthened further in CY2023,

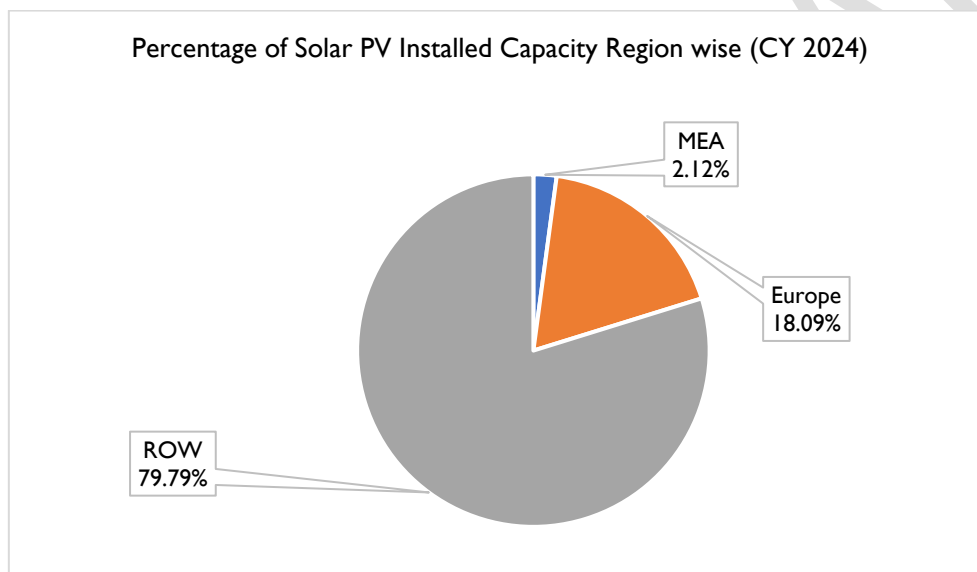
²¹ https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2025/Mar/IRENA_DAT_RE_Capacity_Statistics_2025.pdf



with global capacity reaching 1,406.7 GW, highlighting a significant year-on-year expansion as large-scale solar deployments intensified across key markets such as China, Europe, the US, and emerging economies.

The most notable acceleration occurred in CY2024, when global installed solar PV capacity surged to 1,858.6 GW, underscoring solar energy's position as the fastest-growing power generation technology worldwide. This sharp rise reflects increased focus on energy security, decarbonisation commitments, and the deployment of large-scale utility and hybrid solar projects. The trend also suggests improved grid integration, expanded manufacturing capacity, and stronger policy alignment across regions, positioning solar PV as a central pillar of the global energy transition.

Installed Solar PV Capacity by key Regions (for CY 2024)



Source: International Renewable Energy Agency (IRENA)

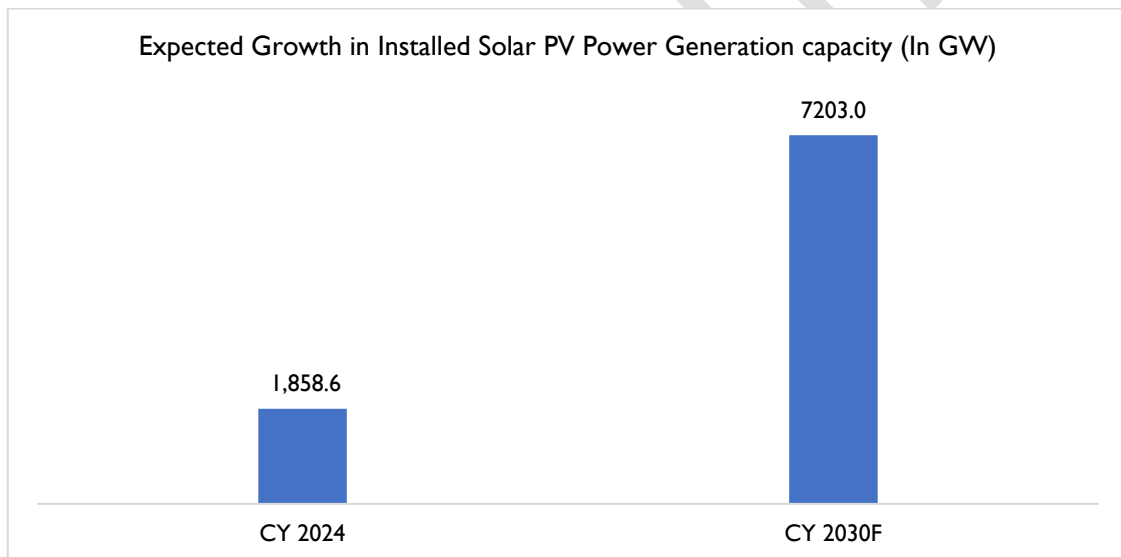
The chart highlights that Europe accounts for 18% of global solar PV installed capacity in CY 2024, equivalent to 336.30 GW, reflecting consistent progress in renewable energy deployment across the region. Growth in Europe is supported by strong policy mandates, decarbonisation targets, and efforts to reduce dependence on conventional energy sources. Continued investments in rooftop solar, utility-scale projects, and grid modernisation are expected to sustain capacity additions in the medium term.

The Middle East & Africa (MEA) region contributes a comparatively modest 2% share, amounting to approximately 39.48 GW of installed solar PV capacity. While the current share remains limited, the region holds significant long-term potential owing to high solar irradiation levels and a growing government focus on energy diversification. The Rest of the World (RoW) dominates the remaining share, accounting for 80% of installed capacity, indicating that global solar growth is largely driven by regions outside Europe and MEA.



Expected Growth in Global Solar Power Generation Installed Capacity (by 2030)

Global solar power generation capacity is expected to **expand dramatically by CY 2030**, underpinned by strong international commitments to climate action and clean energy transition. **Global solar capacity may surge to 7,203.0 GW by CY 2030F**, up from around **1,858.6 GW in CY 2024**, representing **roughly a 4-fold increase in less than a decade and reflecting sustained investment momentum and policy support across regions**. This expansion is driven by continued declines in solar technology costs, robust manufacturing growth projected to exceed demand, and the mobilisation of global capital toward sustainable energy projects. Solar is expected to lead renewable additions, providing the backbone for decarbonising power systems while creating millions of jobs globally and reshaping energy markets.



Source: International Renewable Energy Agency (IRENA), International Solar Alliance (ISA)²²

In addition to global projections, major economies and emerging markets alike are accelerating solar deployment to meet national climate and energy security goals. Under these growth scenarios, solar is forecasted to account for a significant share of new power capacity additions, with supportive financing, grid integration improvements, and technology advances enhancing its competitiveness. Emerging economies, including India, are also projected to become major growth markets, contributing a substantial portion of new capacity through utility-scale projects, distributed solar, and hybrid systems alongside storage integration.

²² The 2030 Projections are taken from the International Solar Alliance data and Press Information bureau (PIB) Government https://isa.int/uploads/publication_pdf/1730793270World_Solar_Market_Report_2024_Printready.pdf
<https://www.pib.gov.in/PressReleasePage.aspx?PRID=2070923®=3&lang=2#:~:text=Future%20Forecasts%3A%20Global%20solar%20capacity,needed%20to%20meet%20climate%20goals>



These trends position solar power as a central pillar of the global energy transition, transforming how electricity is generated and consumed worldwide by 2030F.

Insight on Type of Solar Power Installations: Roof top, Utility Grade and Hybrid

Rooftop Solar Installations:²³

Rooftop solar remains a key driver of distributed energy deployment globally. In 2024, global solar PV installations reached a record ~452 GW of new capacity additions, of which rooftop solar systems accounted for an estimated 37% (~167 GW), reflecting strong residential and commercial adoption in markets with supportive net-metering policies and high retail electricity prices.

By the end of 2024, global cumulative installed solar PV capacity reached ~1,858.6 GW. Of this installed base, rooftop and other distributed solar installations are estimated to account for approximately 37% (~687 GW), with the balance dominated by utility-scale solar projects. Rooftop Solar's contribution has been particularly significant in Europe, China, Japan, Australia, and parts of North America, where distributed generation economics remain favourable.

In Europe, rooftop and distributed PV played a dominant role earlier in the decade, accounting for over 50% of new solar capacity additions in several key markets in 2024. However, solar deployment in the EU moderated in 2025, with total PV installations estimated at ~65.1 GW, partly due to reductions in rooftop subsidies. As a result, the residential rooftop share of new capacity additions declined from ~28% to ~14%, indicating a gradual shift toward larger commercial and utility-scale projects.

In Africa, rooftop solar remains an emerging but growing segment. While the continent's total operational solar PV capacity stood at over 17.05 GW, rooftop and distributed systems are gradually expanding in urban residential and commercial applications. Utility-scale projects continue to dominate deployment, accounting for ~70% of projects under construction, although rooftop solar is expected to gain momentum as access to financing improves and grid reliability challenges persist.

Utility-Grade (Utility-Scale) Solar Installations:

Utility-scale solar PV remains the largest contributor to incremental global solar capacity additions. In 2024, utility-scale projects accounted for approximately 285 GW of the ~452 GW of new solar PV capacity added

²³ The segmentation between Solar PV Rooftop and Utility-Scale installations has been derived using the total capacity addition figure of 452 GW, as reported by IRENA. The percentage split applied to arrive at the segment-wise bifurcation is referenced from estimates published by the REN21 Network and is used solely to indicate the directional trend and relative distribution of additions between 2023 and 2024. This approach ensures alignment with IRENA's official total capacity data while leveraging REN21's segmental insights for indicative proportional analysis.

<https://www.ren21.net/gsr-2025/technologies/solar-pv/>



worldwide, driven primarily by large-scale deployments in China, which represented nearly two-thirds of global utility-scale installations during the year.

By the end of 2024, global grid-connected solar PV capacity exceeded ~1,858.6 GW, comprising both utility-scale and distributed installations. When including off-grid systems, behind-the-meter installations, and provisional late-year additions, total global solar PV capacity is estimated at ~2.2-2.26 TW. Within this broader installed base, utility-scale projects account for the majority of capacity and remain the dominant contributor to incremental power generation. Solar PV accounted for over 10% of global electricity generation in 2024, marking a key milestone for the technology, with utility-scale projects playing a central role in increasing grid-level penetration, cost competitiveness, and system reliability.

Europe's utility solar segment has grown strongly, contributing the majority of the EU's installed solar capacity of around 406 GW total by the end of 2025. While residential rooftop segments have slowed, utility and commercial-scale projects continue to underpin regional solar expansion. However, overall annual installations in the EU decreased slightly in 2025 to 65.1 GW, reflecting market contraction before expected stabilisation later in the decade.

Utility-grade solar dominates the African solar landscape. Africa's installed solar capacity has now exceeded 20 GW, with utility projects accounting for roughly 70 % of capacity under construction across the continent. Countries such as South Africa, Egypt, and Algeria are leading this deployment, with nearly 9 GW of utility-scale solar currently under development. Hybrid utility-scale projects (solar plus storage) are also gaining share in new pipelines, rising from about 4 % of past projects to approximately 20 % of projects either built or underway.

Hybrid Solar Installations:

Hybrid solar installations, especially those combining PV with energy storage systems (BESS), are becoming increasingly strategic as solar penetration deepens. In the utility segment, storage-paired solar projects are improving grid reliability and enabling flexible dispatch. Although segmented data on hybrid installations vary, the increasing rollout of battery storage solutions, with global battery installations rising sharply to tens of gigawatts, reflects this trend.

In Europe, hybrid solar projects are gaining importance as part of grid-flexibility strategies. Utility projects with integrated storage help balance supply on networks with high solar share. While data on specific installed hybrid capacity remains limited, the market trend is clear: a growing share of utility-grade PV capacity is paired with storage units to manage intermittency and support grid operations, as Europe seeks to maintain high renewable shares despite recent installation slowdowns.

In Africa, hybrid solar systems are particularly vital in regions with weak grid infrastructure or high outage rates. Although still nascent compared to utility standalone PV projects, hybrid installations (solar plus storage



or backup diesel generation) are increasingly included in development pipelines, with emerging projects in multiple countries. Nearly 20% of utility-scale solar projects, either built or under development, include storage components, indicating a shift toward more resilient hybrid deployments.

Global RTC Renewable Power Scenario

Globally, Round-the-Clock (RTC) renewable power has emerged as a strategic approach to overcome the inherent intermittency of standalone solar and wind generation. Initially, renewable energy deployment focused on maximizing installed capacity and energy output, with limited emphasis on dispatchability and reliability. However, as renewable penetration increased across regions such as North America, Europe, Asia-Pacific, and the Middle East, grid operators and utilities began prioritizing firm and predictable power supply, leading to the development of RTC procurement frameworks and hybrid renewable power configurations.

Globally, RTC solutions typically integrate solar and wind generation with energy storage systems (such as batteries), hydroelectric balancing, or limited thermal backup to ensure continuous power delivery across all hours. Governments and utilities have increasingly introduced long-term RTC power purchase agreements (PPAs) to ensure grid stability while accelerating decarbonisation. This evolution reflects a shift from variable renewable energy procurement toward **firm renewable capacity**, positioning RTC as a key pillar in the global energy transition.

Intermittency Challenges in Solar and Wind Power Generation:

- **Variability in Generation Profiles:** Solar and wind power output is inherently dependent on weather conditions, leading to significant fluctuations across hours, days, and seasons. This variability creates challenges in matching generation with real-time electricity demand.
- **Mismatch Between Generation and Demand Patterns:** Solar generation peaks during daytime, while electricity demand often peaks in the evening. Wind patterns can also be seasonal or region-specific, resulting in periods of surplus generation followed by deficits.
- **Grid Stability and Frequency Management Issues:** High penetration of intermittent renewables can cause voltage and frequency deviations, requiring additional balancing mechanisms and ancillary services to maintain grid stability.
- **Curtailement and Transmission Constraints:** In regions with high renewable deployment, transmission infrastructure constraints can lead to curtailment of excess renewable power, reducing effective utilisation of installed capacity.
- **Uncertainty in Power Procurement and Planning:** Utilities and large consumers face challenges in forecasting renewable generation, complicating long-term procurement planning and increasing reliance on backup power sources.



RTC Renewable Power as a Solution for Grid Stability and Predictability:

RTC renewable power addresses intermittency challenges by combining multiple renewable sources with storage and balancing mechanisms to deliver continuous and dispatchable electricity. By integrating solar and wind generation with battery storage, hydroelectric balancing, or limited thermal backup, RTC configurations smooth generation variability and ensure power availability across all hours. This significantly enhances grid reliability and reduces dependence on real-time balancing interventions by grid operators.

From a power procurement perspective, RTC solutions offer greater predictability compared to conventional thermal power sources. While thermal generation is exposed to fuel price volatility, supply chain disruptions, and unplanned outages, RTC power contracts typically provide long-term fixed or indexed tariffs with defined availability commitments. This enables utilities and large commercial and industrial consumers to achieve stable power supply planning and predictable energy cost structures, supporting operational and financial certainty.

At a global scale, RTC renewable power is increasingly recognized as a critical enabler of high renewable penetration without compromising grid stability. As power systems transition away from fossil fuels, RTC procurement models are expected to play a central role in ensuring reliable, predictable, and low-carbon electricity supply, bridging the gap between variable renewable generation and conventional baseload thermal power.

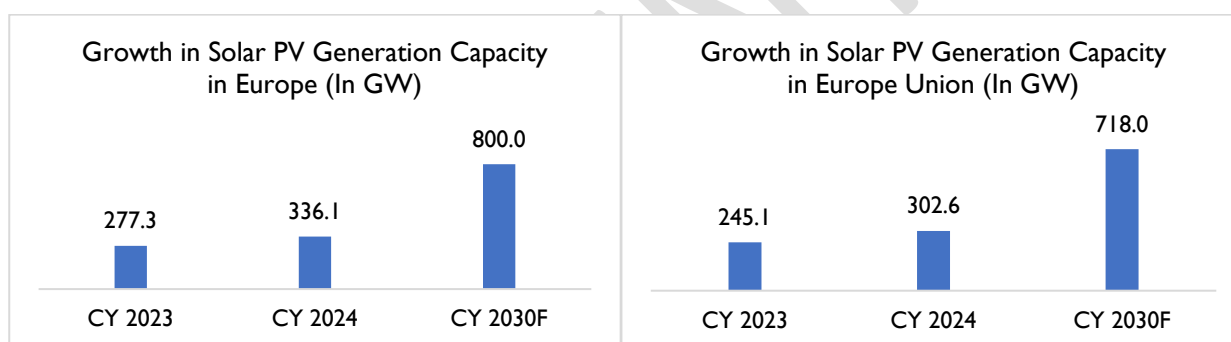


Solar Power Generation Scenario: Regional Scenario (focusing on Europe and Africa)

Installed Solar PV Power Generation Capacity

- Installed solar PV power generation capacity in the Europe region: ²⁴

Europe's solar power market has expanded rapidly in recent years as countries accelerate decarbonisation of the power mix and reduce dependence on conventional energy sources. Policy instruments such as renewable capacity targets, auction-led procurement, and incentives for rooftop and distributed solar, combined with improving project economics, have supported sustained deployment across both utility-scale and decentralised segments. As grid integration improves and storage/hybrid configurations scale up, solar is increasingly positioned as a foundational source within Europe's long-term energy transition strategy. Solar power generation capacity in **Europe overall** increased from **277.3 GW in CY2023** to **336.1 GW in CY2024**, indicating continued acceleration in installations across the region. Within this, the **European Union** accounted for **302.6 GW in CY2024**, highlighting its dominant contribution to Europe's solar base (nearly ~90% of the region's installed capacity in CY2024).



Source: International Renewable Energy Agency

Looking ahead, overall Europe's solar capacity is **estimated at ~800 GW by CY2030F**, while the EU is projected to reach **~718 GW by CY2030F**. This outlook implies continued large-scale capacity additions through the decade, supported by renewable energy mandates, electrification-driven demand growth, and ongoing investments in grid expansion and flexibility solutions (including storage and hybrid systems). While percentage growth may moderate as the installed base expands, the projected absolute

²⁴ **Note:** Publicly available sources do not provide a consolidated CY 2030 solar power capacity target at an overall Europe level. However, based on data published by International Renewable Energy Agency (IRENA) for CY 2024, the European Union (EU-27) consistently accounts for approximately 85–90% of total installed solar capacity in the Europe region. In addition, the European Commission has also published official solar capacity projections for the EU up to CY 2030 under its renewable energy and REPower EU frameworks. Accordingly, the overall Europe solar capacity for CY 2030 has been estimated by extrapolating EU-level projections, using the historical EU share of total Europe installations observed in CY 2024. This approach ensures internal consistency with available official statistics while providing a reasonable indicative estimate for overall Europe in the absence of direct regional targets.

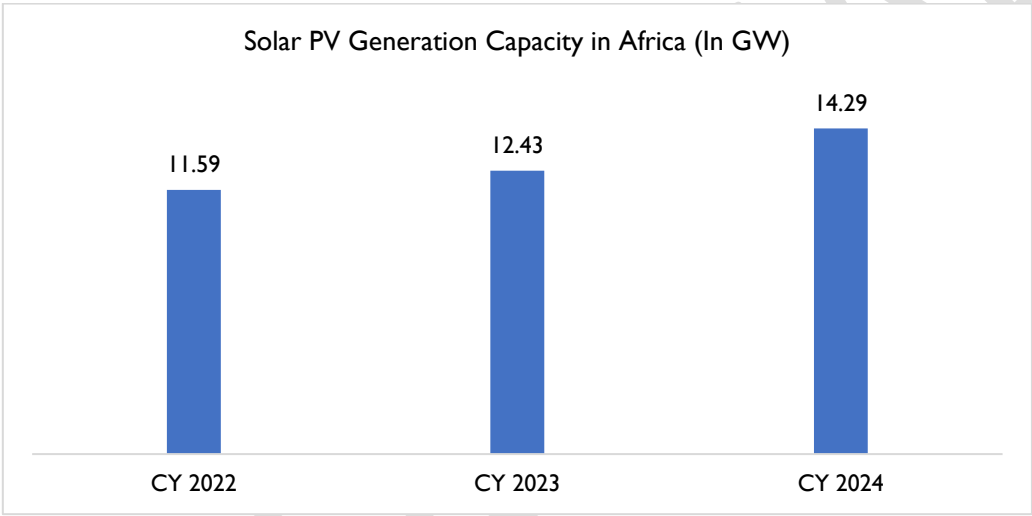
https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2025/Mar/IRENA_DAT_RE_Capacity_Statistics_2025.pdf



additions remain substantial, reinforcing solar power as a core pillar of Europe’s renewable energy build-out.

Installed solar PV power generation capacity in the Africa region²⁵

Installed solar PV power generation capacity in the Africa region has been increasing steadily, supported by the continent’s strong solar resource potential. Growth is driven by efforts to improve electricity access, reduce reliance on conventional fuels, and address energy security challenges. Both utility-scale projects and off-grid solar systems are contributing to capacity expansion. International funding support and policy initiatives are helping accelerate adoption. Despite progress, overall solar penetration remains relatively low, indicating substantial untapped potential.



Source: International Renewable Energy Agency (IRENA)

The graph shows a steady, consistent increase in solar power generation capacity in Africa from CY2022 to CY2024. Installed capacity rose from 11.59 GW in CY2022 to 12.43 GW in CY2023, indicating gradual progress in solar deployment across the continent. This growth reflects increasing adoption of solar energy to address electricity access gaps, reduce dependence on fossil fuels, and leverage Africa’s high solar irradiation potential.

The upward trend continued in CY2024, with capacity reaching 14.29 GW, marking an acceleration in installations compared to previous years. The increase is supported by growing investments from international development agencies, supportive government policies in select countries, and the expansion of utility-scale, off-grid, and mini-grid solar projects. Despite the positive trajectory, Africa’s solar capacity remains relatively low compared to global levels, highlighting significant untapped potential and long-term growth opportunities.

²⁵ https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2025/Mar/IRENA_DAT_RE_Capacity_Statistics_2025.pdf



Top 3 Countries with the Highest Installed Generation Capacity

Europe-

- **Germany:** Germany is Europe's largest solar PV market, with installed capacity reaching approximately 89.9 GW in CY 2024. The country has benefited from long-term renewable energy policies within the Energiewende framework, which have provided stable support for solar deployment. High penetration of rooftop solar across residential and commercial segments complements large utility-scale projects. Strong grid infrastructure and advanced forecasting systems enable effective integration of solar power. Rising electricity prices have further encouraged consumer adoption. Overall, solar plays a central role in Germany's clean energy transition.
- **Spain:** Spain has emerged as one of Europe's fastest-growing solar markets, with an installed capacity of about 36.3 GW in CY 2024. Growth is primarily driven by large -scale utility parks supported by competitive auction mechanisms. Favourable climatic conditions and high solar irradiation enhance project viability. Increasing corporate power purchase agreements (PPAs) are also supporting capacity additions. Policy stability has improved investor confidence in recent years. Solar energy is becoming a key contributor to Spain's power generation mix.
- **Italy:** Italy recorded installed solar PV capacity of approximately 36.0 GW in CY 2024, placing it among Europe's leading solar markets. The country benefits from a diversified solar landscape that combines utility-scale projects with widespread rooftop installations. Supportive regulatory measures and incentive programs have aided steady growth. Rising power prices have increased the attractiveness of self-consumption solar systems. Grid integration efforts continue to improve solar utilisation. Solar energy remains an important component of Italy's renewable energy strategy.

Africa

- **South Africa:** South Africa is the leading solar PV market in Africa, with installed capacity reaching approximately 6.17 GW in CY 2024. Growth has been driven by the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP), which has attracted significant private sector investment. Utility-scale solar projects dominate capacity additions, owing to high solar irradiation levels. Rising electricity shortages and concerns about grid reliability have further accelerated solar adoption. Solar power is increasingly important in diversifying South Africa's energy mix.
- **Egypt:** Egypt holds the second-largest solar PV capacity in Africa, reaching about 2.5 GW in CY 2024. Growth has been led by large-scale developments such as solar parks supported by feed-in tariffs and competitive procurement mechanisms. Strong government commitment and international investor

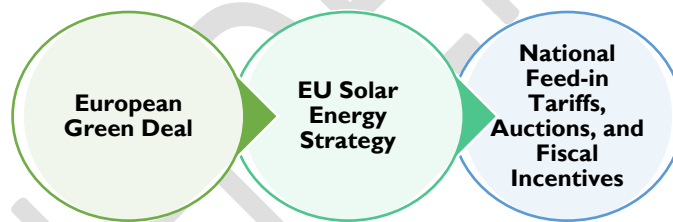


participation have supported project execution. Solar power is increasingly used to meet rising electricity demand and reduce reliance on conventional fuels. The sector continues to attract interest within Egypt's broader renewable energy strategy.

- **Tunisia:** Tunisia's installed solar PV capacity reached approximately 0.77 GW (770 MW) in CY 2024, reflecting gradual but consistent expansion of its renewable energy base. Growth has been supported by government-led renewable energy targets and procurement programmes aimed at increasing the share of renewables in the national energy mix. Utility-scale projects have contributed meaningfully to recent capacity additions, supported by favourable solar irradiation and policy measures encouraging private participation. Tunisia is also advancing distributed and commercial-scale solar installations to reduce dependence on imported fossil fuels and improve energy security. Solar power is expected to play a progressively important role in meeting rising electricity demand and supporting the country's long-term energy transition objectives.

Overview of Key Policies and Regulatory Frameworks Supporting Solar Power Generation in the Region

Europe: Key Policies & Regulatory Frameworks Supporting Solar Power Growth



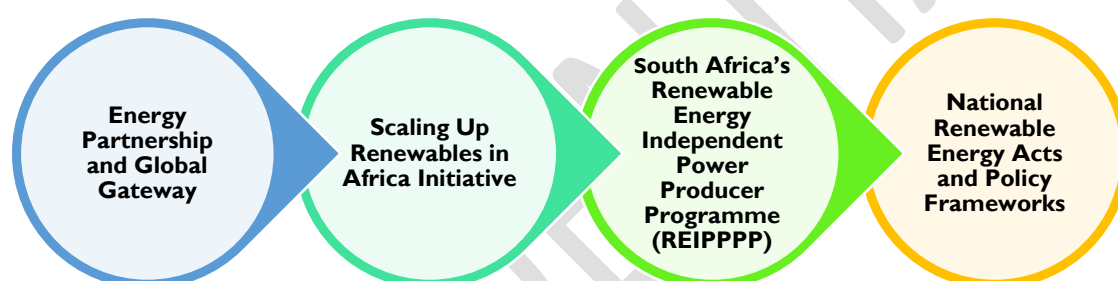
- **European Green Deal:** The European Green Deal serves as the central policy framework guiding the expansion of solar power across the EU. It commits member states to climate neutrality by 2050, positioning solar PV as a key decarbonisation technology. The policy integrates renewable energy targets with industrial, infrastructure, and climate strategies. It provides long-term regulatory visibility, encouraging private investment in solar projects. Funding mechanisms and structural reforms under the Green Deal further support grid integration and large-scale deployment. Overall, it creates a stable policy environment for sustained solar growth.
- **EU Solar Energy Strategy:** The EU Solar Energy Strategy outlines a coordinated approach to rapidly scale solar capacity across Europe by 2030. It promotes solar-ready building standards to mainstream rooftop PV installations. The strategy supports domestic manufacturing to strengthen supply chain resilience. Workforce development initiatives address skilled labour shortages in solar installation and



maintenance. It also improves coordination between national and EU-level policies. This structured roadmap enhances consistency and investor confidence in the solar sector.

- **National Feed-in Tariffs, Auctions, and Fiscal Incentives:** European countries complement EU-level policies with national incentive mechanisms supporting solar power. Feed-in tariffs and feed-in premiums provide stable and predictable revenue streams for solar producers. Competitive auction frameworks promote cost-efficient deployment of utility-scale solar projects. Fiscal incentives, such as tax credits, subsidies, and accelerated depreciation, reduce capital costs. These national measures improve project bankability and investment returns. Together, they play a crucial role in sustaining solar capacity additions across Europe.

Africa: Key Policies & Regulatory Frameworks Supporting Solar Power Growth



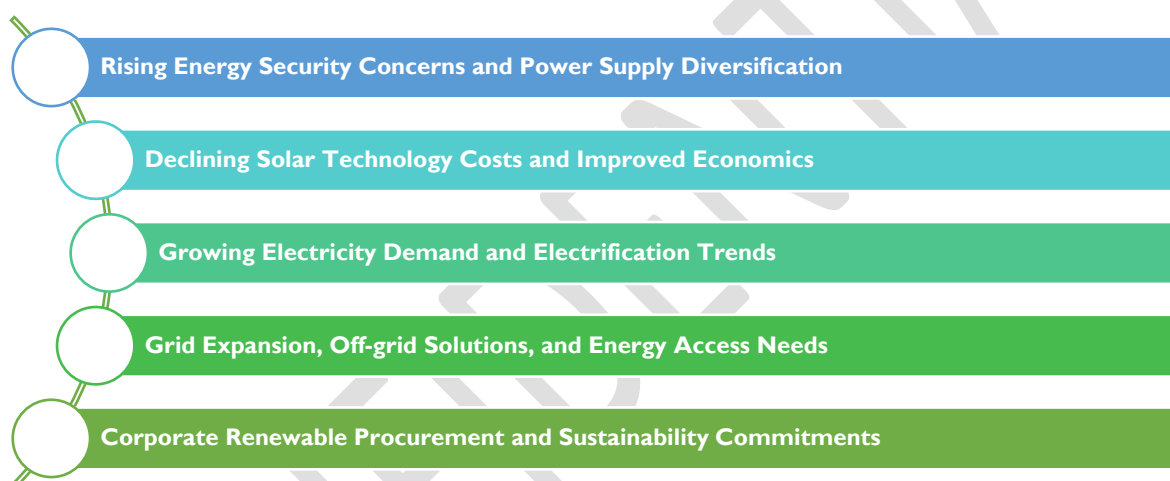
- **Energy Partnership and Global Gateway:** The Africa Energy Partnership provides a strategic platform for advancing solar power deployment across African countries. Through the Global Gateway initiative, financial support is extended via grants, blended finance, and risk-mitigation instruments. These frameworks aim to attract private-sector investment in solar infrastructure. Policy cooperation improves regulatory alignment and institutional capacity. Support also extends to grid expansion and cross-border power integration. Collectively, these measures strengthen the solar energy investment ecosystem in Africa.
- **Scaling Up Renewables in Africa Initiative:** The Scaling Up Renewables in Africa initiative mobilises large-scale funding to accelerate renewable energy development, particularly solar. It addresses energy access challenges by promoting both grid-connected and off-grid solar solutions. Financial backing reduces affordability barriers and improves project feasibility. The initiative aligns renewable deployment with socio-economic development objectives. Solar power is prioritised due to its rapid deployment potential and cost competitiveness. This initiative plays a critical role in expanding Africa's solar capacity base.
- **South Africa's Renewable Energy Independent Power Producer Programme (REIPPPP)** is a structured procurement framework that enables private investment in large-scale solar projects. It uses



competitive bidding to ensure transparent and cost-effective project selection. Long-term power purchase agreements provide revenue certainty to developers. The programme supports diversification away from coal-based power generation. It has attracted significant domestic and international investment. REIPPPP is widely regarded as a benchmark solar policy model in Africa.

- **National Renewable Energy Acts and Policy Frameworks:** Several African countries have enacted renewable energy laws to formalise support for solar power. These frameworks define licensing, tariff structures, and grid access regulations. Clear legal provisions reduce uncertainty for solar developers and investors. Policies aim to diversify national energy mixes and improve electricity access. Ongoing reforms strengthen alignment with climate commitments and development goals. Such regulatory clarity is essential to long-term growth in the solar market.

Analysis of key Market Factors that are Driving the Industry in the Region



➤ **Rising Energy Security Concerns and Power Supply Diversification**

Energy security has emerged as a critical driver for solar adoption in both Europe and Africa. Europe is accelerating solar deployment to reduce reliance on imported fossil fuels and manage geopolitical supply risks. In Africa, solar offers a means to diversify energy sources and reduce exposure to fuel price volatility. Distributed solar systems also enhance resilience against grid disruptions. This factor is pushing both utility-scale and decentralised solar investments across regions.

➤ **Declining Solar Technology Costs and Improved Economics**

The continued decline in solar PV module prices has significantly improved project economics. Lower capital costs have shortened payback periods and increased returns on investment for developers. In Europe, this supports subsidy-free solar projects, while in Africa, it improves affordability in price-sensitive markets. Advances in efficiency and system performance further enhance output. Cost competitiveness has positioned solar as one of the most attractive new power generation options.



➤ **Growing Electricity Demand and Electrification Trends**

Rising electricity demand driven by the electrification of transport, heating, and industry is boosting solar demand in Europe. In Africa, rapid population growth, urbanisation, and industrial expansion are increasing power consumption. Solar power provides a scalable solution for quickly meeting incremental demand. It is particularly effective at addressing peak-demand periods. These demand-side dynamics are reinforcing long-term solar capacity additions.

➤ **Grid Expansion, Off-grid Solutions, and Energy Access Needs**

In Africa, limited grid infrastructure and widespread energy access gaps are key drivers for solar deployment. Off-grid and mini-grid solar systems offer cost-effective electrification for remote and rural areas. In Europe, grid modernisation and digitalisation enable better integration of variable renewable energy. Solar combined with storage improves grid flexibility. These infrastructure dynamics strongly support solar adoption across both regions.

➤ **Corporate Renewable Procurement and Sustainability Commitments**

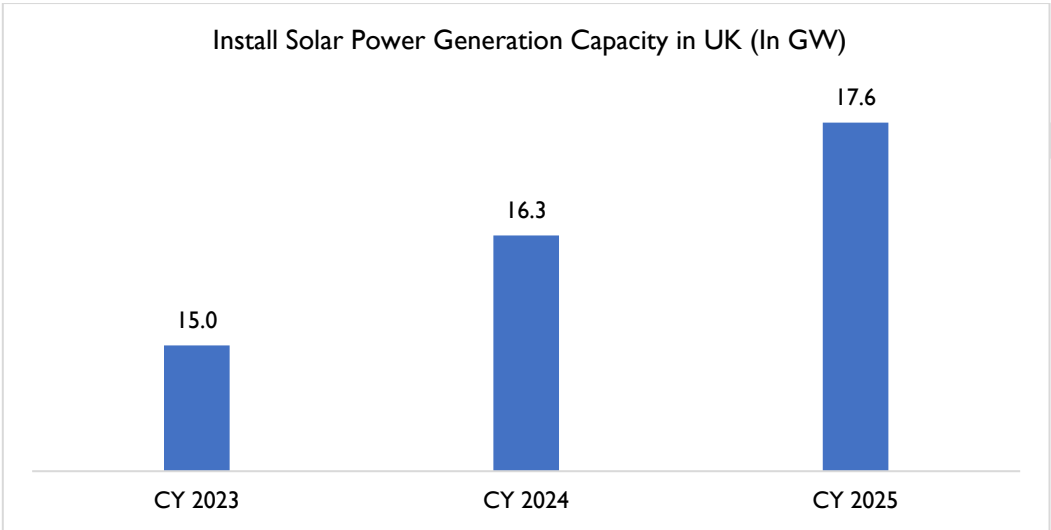
Corporate demand for clean electricity is increasingly shaping the solar market in Europe and parts of Africa. Large companies are signing power purchase agreements to meet decarbonisation targets and control energy costs. Solar projects benefit from predictable long-term offtake arrangements. In emerging African markets, corporate and industrial solar installations are gaining traction. This demand-side pull is accelerating private-sector-led solar investments.



Solar Power Generation: UK Scenario

Installed Solar Power Generation Capacity & Historical Growth Trends

The UK solar power sector is witnessing steady growth, driven by improving project economics and declining technology costs. Rising emphasis on decarbonisation and energy security has strengthened solar PV’s role in the power mix. Both utility-scale and rooftop installations are contributing to capacity expansion. Supportive policies and clearer planning frameworks continue to enhance market confidence.



Source: International Renewable Energy Agency (IRENA)²⁶

The chart highlights a steady and accelerating growth trend in the UK’s installed solar power generation capacity over the period CY 2023- CY 2025. Installed capacity increased from 15.0 GW in 2023 to 16.3 GW in 2024, indicating continued deployment momentum despite policy transitions and grid-related challenges. This growth reflects rising adoption across both utility-scale projects and distributed rooftop installations, supported by improving project economics and sustained investor interest.

The more pronounced jump in 2025, with capacity reaching 17.6 GW, underscores a clear acceleration in solar deployment. This step-up suggests stronger policy alignment, faster project approvals, and increasing contribution from large ground-mounted solar parks alongside rising residential and commercial rooftop installations. The trend also reflects heightened focus on energy security and decarbonisation, as solar power increasingly plays a strategic role in the UK’s electricity mix. Overall, the graph indicates that the UK solar market is transitioning from moderate growth to a stronger expansion phase, with annual capacity additions gaining pace. The upward trajectory suggests improving market confidence and a supportive regulatory

²⁶ https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2025/Mar/IRENA_DAT_RE_Capacity_Statistics_2025.pdf



environment, positioning solar PV as a key contributor to the UK's clean energy transition in the near to medium term.

Insight into Electricity Demand in the UK & Key Factors Driving the Electricity Demand in the Country²⁷

The UK's electricity demand has undergone a structural transition in recent years. While overall demand remained relatively flat or modestly declining during the 2010s due to energy efficiency improvements and deindustrialisation, recent years have marked a turning point. Electrification of end-use sectors such as transport, heating, and industry is gradually offsetting efficiency gains, leading to renewed growth in electricity consumption.

In Q3 2025, total UK electricity demand remained stable at 73.0 TWh, unchanged compared to the same period in 2024, indicating limited short-term growth in consumption. Over the same period, total electricity generation increased marginally by 0.4% to 64.9 TWh, reflecting modest improvements in domestic power output. Despite this increase, electricity generation remained relatively low for the time of year, resulting in continued reliance on imports. Net electricity imports declined slightly by 0.5% to 8.1 TWh, but still remained elevated, underscoring the structural role of cross-border electricity flows in balancing the UK power system amid variable domestic generation.

Looking ahead, electricity demand in the UK is expected to increase steadily over the medium to long term, driven by net-zero ambitions and a shift away from fossil fuels. The power sector is increasingly required to support wider decarbonisation across the economy, positioning electricity as the backbone of the UK's energy transition. This evolving demand profile is reshaping generation capacity planning, grid infrastructure, and renewable energy deployment.

Key Factors Driving Electricity Demand in the UK

- **Electrification of Transport:** The shift toward electric mobility is steadily increasing electricity consumption across the UK. Policy measures encouraging the phase-out of internal combustion engine vehicles, along with incentives for electric vehicle adoption, are expanding the number of EVs on the road. As charging networks grow across homes, workplaces, and public infrastructure the electricity load on both local distribution networks and the national grid is rising. Over the medium term, continued growth in electric mobility is expected to contribute materially to incremental electricity demand.
- **Transition in Heating Systems:** The gradual move away from gas-based heating toward electrically powered systems, particularly heat pumps, is another structural factor influencing electricity usage.

²⁷ https://assets.publishing.service.gov.uk/media/6941a13f58a21370f58f3054/Energy_Trends_December_2025.pdf



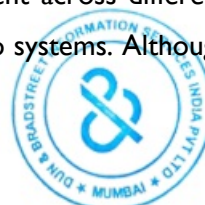
Supportive policy frameworks, building efficiency standards, and decarbonisation targets are encouraging adoption across residential and commercial properties. As more households and buildings rely on electric heating solutions, baseline electricity consumption is expected to increase, with a more pronounced impact during colder months.

- **Expansion of Data Centres and Digital Infrastructure:** The growing need for digital services, cloud storage, and data processing is leading to increased development of data centres across the UK. These facilities operate continuously and require stable, high-capacity electricity supply. As digital infrastructure expands to support artificial intelligence, online services, and enterprise data needs, electricity demand is rising both at local network levels and across the wider grid.
- **Electrification of Industrial Processes:** Industrial sectors are gradually adopting electric technologies to reduce emissions and align with climate commitments. Manufacturing, materials processing, and chemical industries are incorporating electric furnaces, motors, and automated systems in place of fossil-fuel-based equipment. This transition is expected to support a steady increase in industrial electricity consumption as companies move toward cleaner production methods.
- **Demographic and Urban Development Trends:** Moderate population growth and ongoing urban development are also contributing to rising electricity demand. Expansion in housing, commercial spaces, and public infrastructure is increasing energy use across multiple sectors. Greater reliance on electronic devices, digital connectivity, and electrified public services is reinforcing long-term demand growth. As urban areas become more energy-intensive, overall electricity consumption is expected to trend upward over time.

Analysis of Solar/Renewable Energy Policy in the UK

The United Kingdom's renewable energy strategy is shaped by its statutory commitment to achieve net-zero greenhouse gas emissions by 2050. This long-term objective has positioned renewable energy sources, including solar, wind, and other low-carbon technologies, as key components of the country's energy transition. Over time, the policy approach has moved away from heavy reliance on direct subsidies toward frameworks that emphasise market competitiveness, investment certainty, and integration of renewables into the wider power system. The focus is increasingly on ensuring that renewable deployment is both economically sustainable and aligned with long-term energy security goals.

Within this broader framework, solar energy policy supports deployment across different scales, ranging from large utility-scale installations to commercial and residential rooftop systems. Although earlier subsidy



schemes played a major role in establishing the solar market, current policy measures are more focused on creating stable investment conditions and improving infrastructure readiness. Planning reforms, enhancements in grid connectivity, and mechanisms that provide longer-term revenue visibility have helped sustain interest in solar projects. Solar generation is also being positioned as a complementary resource alongside offshore and onshore wind, contributing to the diversification of renewable supply and strengthening overall system reliability.

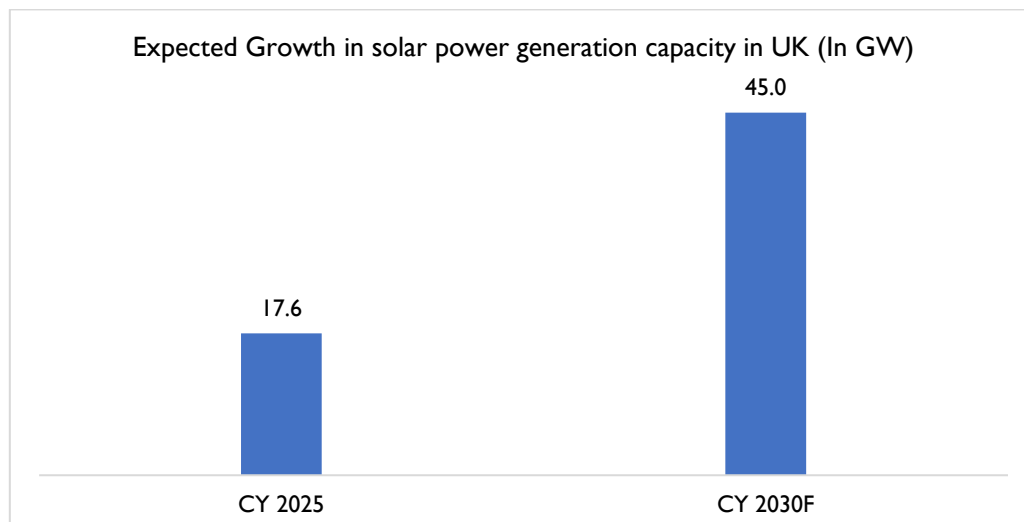
A central feature of the UK's renewable energy policy framework is the Contracts for Difference (CfD) scheme. This mechanism provides revenue stability for low-carbon electricity projects by offering long-term price certainty while helping to shield consumers from fluctuations in wholesale electricity prices. Recent allocation rounds have broadened access and refined support structures for renewable technologies, which have contributed to continued investor participation. Alongside generation support, government initiatives are also directed toward upgrading grid infrastructure, expanding energy storage capacity, and promoting system flexibility. These measures are intended to accommodate a growing share of variable renewable energy sources and maintain stability across the electricity network.

Overall, the UK's renewable energy policy environment is evolving toward a more integrated, system-wide perspective. In addition to supporting new generation capacity, policy efforts are addressing grid reinforcement, storage deployment, and demand-side flexibility. For solar energy and other renewable technologies, this approach is expected to support gradual capacity expansion while maintaining a balance between affordability, supply reliability, and progress toward broader decarbonisation targets across sectors such as transport, heating, and industry.



Expected Growth Forecast in Solar Power Generation Capacity in the UK

The UK solar power sector is expected to see strong capacity growth over the next few years, driven by ambitious clean energy targets and net-zero commitments. Solar PV's cost competitiveness and fast deployment timelines support its expanding role in the power mix. Growth will depend on effective grid upgrades and planning reforms. Both utility-scale and rooftop installations are expected to drive capacity expansion.



Source: Secondary Research²⁸

The graph indicates a significant expansion in the UK's solar power generation capacity, rising from 17.6 GW in CY 2025 to 45.0 GW by CY 2030F. This near-doubling of capacity over the forecast period reflects the UK government's clean energy ambitions and its commitment to accelerating renewable deployment as part of the net-zero strategy. Solar PV is positioned as a core contributor due to its relatively short project timelines and improved cost competitiveness. Achieving this growth will require a substantial increase in annual installation rates, supported by policy certainty, grid connection reforms, and faster planning approvals. The forecast also implies greater contributions from large utility-scale solar projects alongside continued growth in rooftop installations across residential and commercial segments. Overall, the projected capacity expansion highlights strong medium-term growth prospects for the UK solar market, contingent on effective policy execution and infrastructure readiness.

²⁸ <https://www.gov.uk/government/publications/solar-roadmap/solar-roadmap-united-kingdom-powered-by-solar-accessible-webpage>

Solar Energy UK (SEUK) UK Government Plan, The Clean Power Action Plan identifies that 45-47GW is our ambition for all solar by 2030



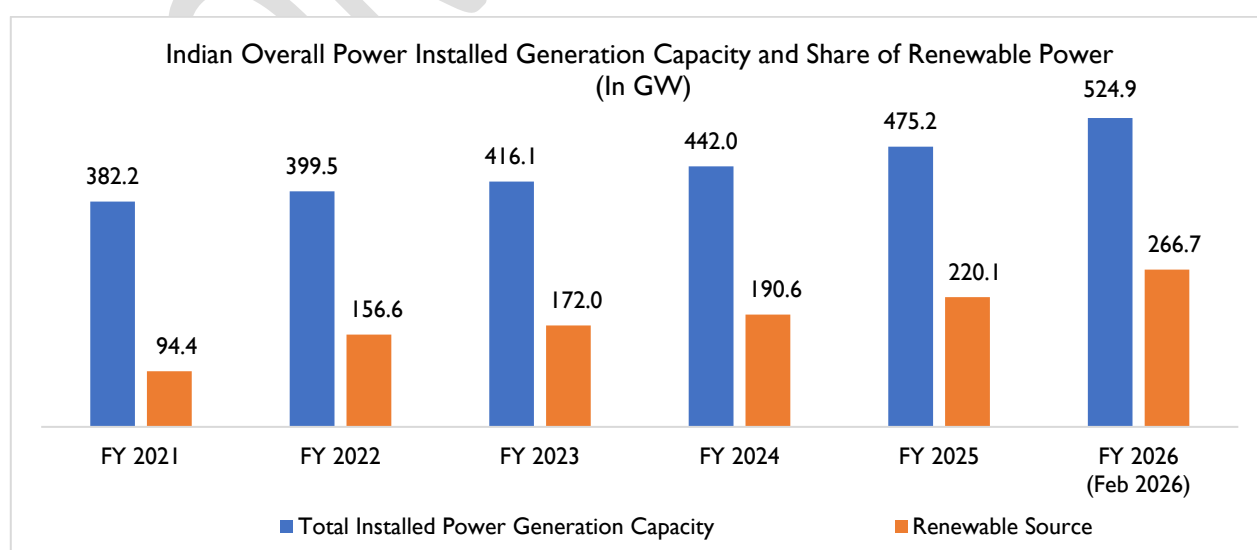
Solar Power Generation Scenario in India

India's power generation sector has evolved into one of the largest and most diversified in the world, driven by rising electricity demand from industrialisation, urbanisation, and increasing household consumption. Thermal power, particularly coal-based generation, continues to form the backbone of India's electricity supply due to its reliability and ability to meet base-load demand. At the same time, the country has made consistent progress in expanding its generation capacity through a mix of central, state, and private sector participation. Grid expansion, improved transmission infrastructure, and policy reforms have supported better power availability and reduced regional disparities in electricity access.

In parallel, India's power generation landscape is undergoing a structural transition, with a strong emphasis on renewable energy and sustainability. Solar and wind power have seen rapid capacity additions driven by government initiatives, competitive bids, and declining technology costs. Hydropower and nuclear energy continue to play a strategic role in providing low-carbon and stable power supply, though capacity additions are gradual. Overall, India's power generation scenario reflects a balanced approach, strengthening conventional sources to ensure energy security while accelerating clean energy adoption to meet long-term environmental and energy transition goals.

Installed Generation Capacity Scenario & Share of Renewable Power in Total Installed Capacity

India's electricity generation mix is gradually becoming more diversified, with renewable sources forming a larger share of total installed capacity over time. Conventional fuels such as coal and gas remain essential for ensuring reliable supply, particularly for meeting base-load requirements. However, much of the recent expansion in capacity has come from renewable technologies, led by solar and wind. Hydropower and biomass also contribute to the renewable portfolio, supporting a broader shift toward a lower-emission power system.



Source: Central Electricity Authority



In response to rising electricity demand from industry, commerce, and households, India has continued to expand its generation base. Total installed capacity increased from about 382 GW in FY 2021 to nearly 524 GW by Feb 2026, reflecting the addition of more than 140 GW within a relatively short span. This growth highlights sustained investment in power infrastructure and the need to accommodate increasing consumption across sectors.

A key development during this period has been the rapid expansion of renewable energy capacity. Installed renewable capacity rose from roughly 94 GW in FY 2021 to an estimated 266 GW by FY 2026. As a result, renewables now account for a substantially larger portion of the overall capacity mix, increasing from around one-quarter of total capacity to close to half. This indicates that renewable sources are becoming an integral component of India's power generation base.

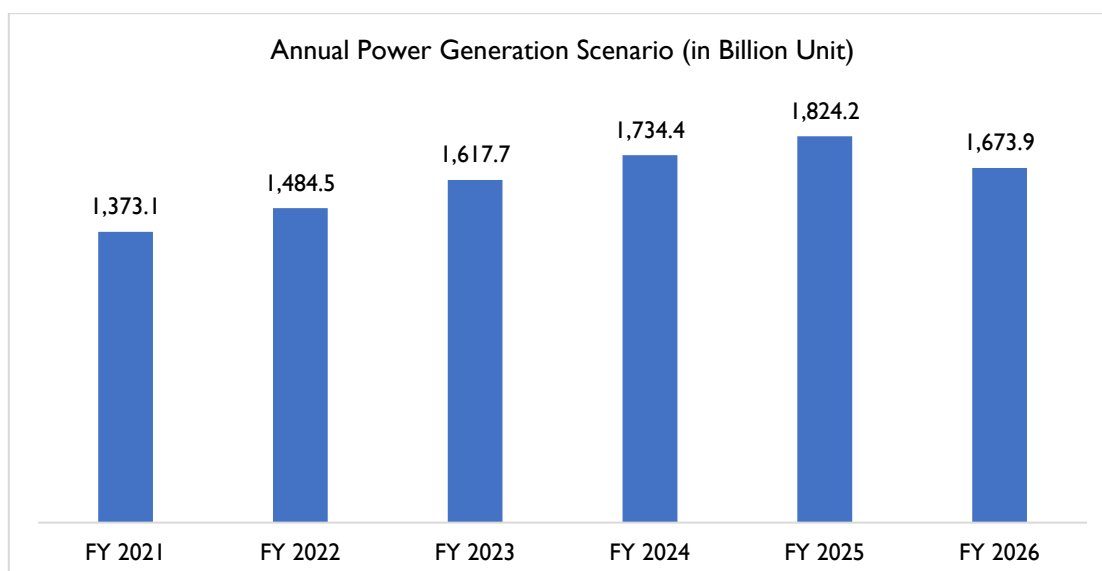
The overall direction of the sector points to a gradual rebalancing of the energy mix. While thermal power continues to play a critical role in maintaining grid stability and meeting continuous demand, most new capacity additions are coming from renewable sources. This trend aligns with national energy transition priorities and ongoing efforts to reduce emissions while ensuring sufficient and reliable electricity supply.

Annual Power Generation Scenario

India's electricity generation has shown a steady rise in recent years, reflecting growing demand from industrial activity, commercial establishments, and households. Expanding access to electricity, infrastructure development and broader economic growth have all contributed to higher consumption levels. Electricity remains a critical input for manufacturing, services, and public infrastructure, making the expansion of generation capacity essential for supporting economic development and improving quality of life.

The country's generation base continues to include a mix of conventional and renewable sources. Thermal power, primarily coal, still accounts for a significant portion of total generation, supported by hydro and gas-based plants. At the same time, solar and wind power are expanding at a faster pace, supported by policy initiatives aimed at increasing the share of clean energy. Measures such as national electricity planning frameworks and renewable energy programmes have encouraged diversification of the generation mix and gradual integration of low-carbon power sources. This approach reflects an effort to balance energy security, affordability, and environmental considerations.





Source: Niti Aayog

Available data indicate a consistent increase in India's annual electricity generation from approximately **1,373.1 billion units (BU) in FY 2021 to 1,824.2 BU in FY 2025**, reflecting steady growth over the period. Generation rose to **1,484.5 BU in FY 2022** (growth of ~8%), followed by **1,617.7 BU in FY 2023** and **1,734.4 BU in FY 2024**, driven by recovery in industrial activity, rising commercial demand, and increasing electrification across households. The overall trajectory highlights sustained capacity addition and improving utilisation levels across both conventional and renewable energy sources.

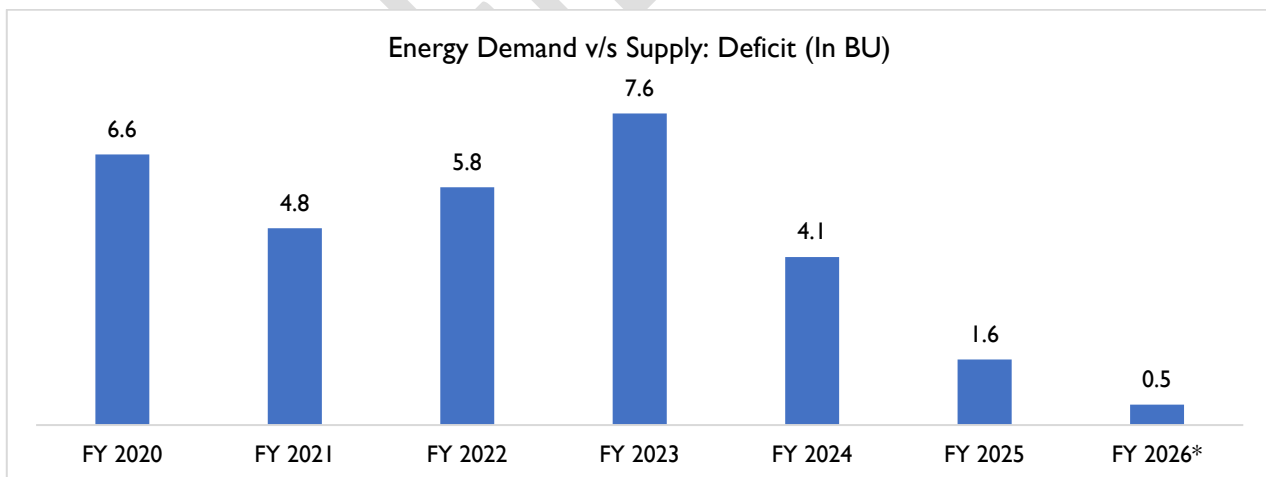
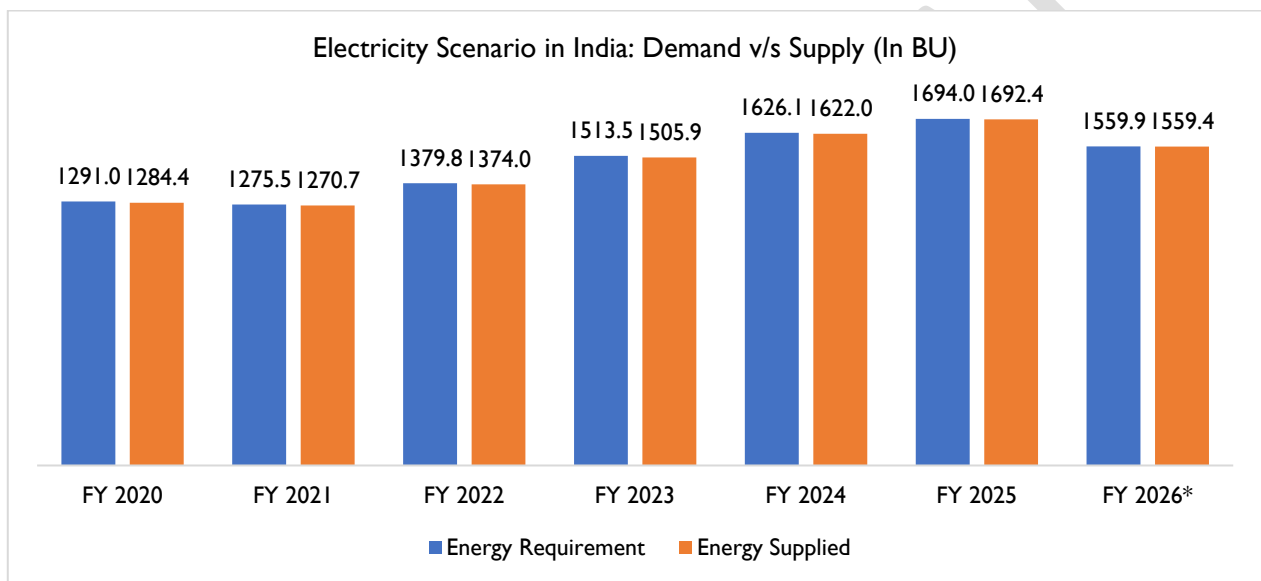
However, **FY 2026 shows a moderation**, with generation estimated at around **1,673.9 BU**, indicating a temporary decline compared to FY 2025. This could be attributed to factors such as variability in renewable generation, seasonal demand fluctuations, or short-term adjustments in supply-demand dynamics. Despite this near-term dip, the broader trend over FY 2021–FY 2025 reflects **cumulative growth of ~33%**, underscoring strong underlying demand fundamentals.

Overall, the trend demonstrates a structurally upward trajectory in India's power generation, supported by economic expansion, urbanisation, and increasing per capita electricity consumption. While short-term fluctuations may occur, continued investments in generation capacity, grid infrastructure, and renewable integration are expected to support long-term growth, with a focus on reliability, sustainability, and energy transition.



Annual Power Demand & Supply Scenario in India: Current Scenario & Historical Growth Trend

Electricity consumption in India has increased steadily over the past few years, supported by growth in economic activity, expansion of urban centres, and wider access to electricity in rural areas. Rising use of electrical appliances, industrial output, and infrastructure development have collectively contributed to higher power requirements. Between FY 2020 and FY 2025, the country's total energy requirement rose from around 1,291 billion units (BU) to approximately 1,692 BU, reflecting a compound annual growth rate of about 5.6%. This trend highlights the sustained rise in electricity demand associated with India's expanding economy and improving living standards.



Source: Central Electricity Authority, Ministry of Power

During the same period, electricity supply has broadly kept pace with demand, indicating improvements in generation capacity and system management. Power availability increased from roughly 1,284.4 BU in FY 2020 to about 1,692.4 BU by FY 2025. As a result, the gap between demand and supply narrowed considerably, with the shortfall declining from around 6.6 BU to nearly 1.6 BU. This reduction suggests better alignment



between generation and consumption, supported by capacity additions, improved grid coordination, and stronger transmission infrastructure.

The continuing reduction in the demand–supply gap points to progress in strengthening the power system’s ability to meet rising consumption. Even as electricity demand has grown year after year, shortages have remained limited. In FY 2026 (up to May), the deficit was reported at about 0.1 BU, indicating that supply and demand were nearly balanced during this period. This improvement reflects ongoing investment in generation assets, including renewable energy, as well as enhanced grid management and forecasting practices.

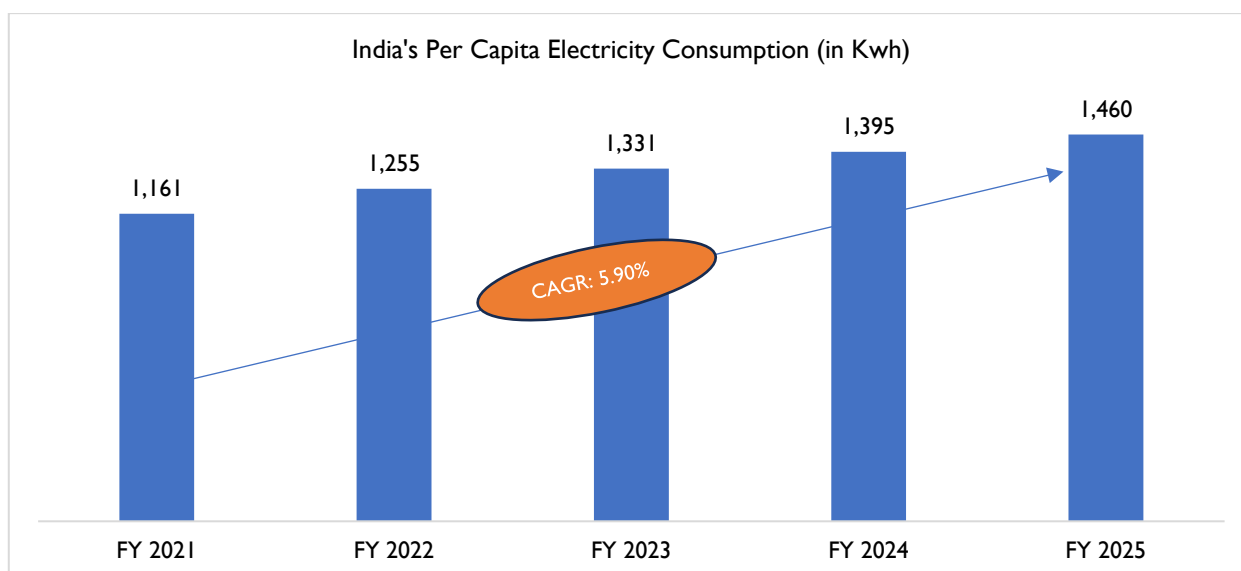
Peak electricity demand has also followed an upward trend. The country’s highest recorded demand rose from about 183.8 GW in FY 2020 to nearly 249.9 GW by FY 2025, representing a compound annual growth rate of roughly 6.3%. Higher cooling needs during summer months, increased industrial activity, and growing electrification across households and businesses have contributed to this rise. Overall, the data suggests that India’s power sector continues to expand its capacity and improve supply reliability in response to increasing demand across sectors.

Insight on per Capital Power Consumption Scenario in India

India's per capita electricity consumption has been steadily increasing over the years, reflecting its rapid industrialisation, urbanisation, and efforts to electrify rural areas. Despite this growth, India's consumption remains lower than the global average, reflecting the vast population and ongoing energy access challenges. Electricity consumption growth in India is driven by extensive rural electrification efforts, including Saubhagya and the Deen Dayal Upadhyaya Gram Jyoti Yojana, which have provided electricity access to millions of rural households.

Additionally, the expansion of industries, particularly in manufacturing, cement, steel, and textiles, has significantly fuelled industrial demand. The rapid pace of urbanisation, along with increasing appliance ownership and evolving consumption patterns, has further driven higher electricity consumption in the residential sector. Despite these advancements, India's per capita electricity consumption remains considerably lower than that of many developed nations, largely due to its vast population and diverse socio-economic conditions.





Source: Central Electricity Authority, Ministry of Power

India's per capita electricity consumption has risen sharply in the post-pandemic period, supported by economic normalisation, rising appliance penetration, urbanisation, infrastructure expansion, increasing rural electrification and higher industrial activity. Overall, per capita consumption grew at a CAGR of 5.90% during FY 2021–25, highlighting India's structurally strengthening electricity demand. Despite this progress, India's per capita consumption remains lower than that of many developed economies, indicating continued potential for demand growth as income levels rise and electrification deepens across sectors.

Analysis of Key Factors Driving the Power Demand in India

➤ Urbanisation and Rising Residential Demand

Rapid urbanisation and an expanding middle class are adding significantly to power demand in India. Urban households are adopting more electrical appliances and experiencing higher energy use, with residential electricity consumption rising at an estimated ~10 % annually in recent years. Intensifying heatwaves have also driven greater demand for cooling appliances such as air conditioners, with sales surging 40-50% in 2024 alone. These trends indicate that rising baseline residential consumption is a major driver of power demand.

➤ Industrial Sector Expansion

The industrial sector remains the largest electricity consumer, accounting for roughly ~41.8 % of total electricity use in recent years. Growth in manufacturing under policies such as Make in India and incentive schemes such as the Production Linked Incentive (PLI) is increasing demand for reliable, continuous power. Energy-intensive sectors such as metals, cement, chemicals, and heavy industries are key drivers of rising industrial electricity consumption, reflecting broader economic growth and investment flows.

➤ Electrification and Appliance Penetration in Rural India



Government electrification initiatives such as Saubhagya (PM Sahaj Bijli Har Ghar Yojana) have helped achieve near-universal household electrification, significantly increasing rural access to power. With reliability improvements and more consistent supply, rural households are also adopting electrical appliances at higher rates, further boosting demand. The expanding rural load, together with increased per-capita electricity consumption, is thus a substantial contributor to aggregate power demand growth.

➤ **Emerging New Load Drivers: Data Centres, EVs, and Digital Economy**

New sectors such as data centres and electric mobility are projected to become significant electricity consumers. For instance, data centre capacity is expected to grow from ~960 MW today to 7.5- 9 GW by FY30, substantially increasing electricity demand from roughly 8.4 TWh today to up to 80 TWh. Meanwhile, electric vehicle charging and associated infrastructure could add significant incremental load as the transition to EVs accelerates. These emerging segments point to future structural demand growth beyond traditional sectors.

Solar Power Generation in India

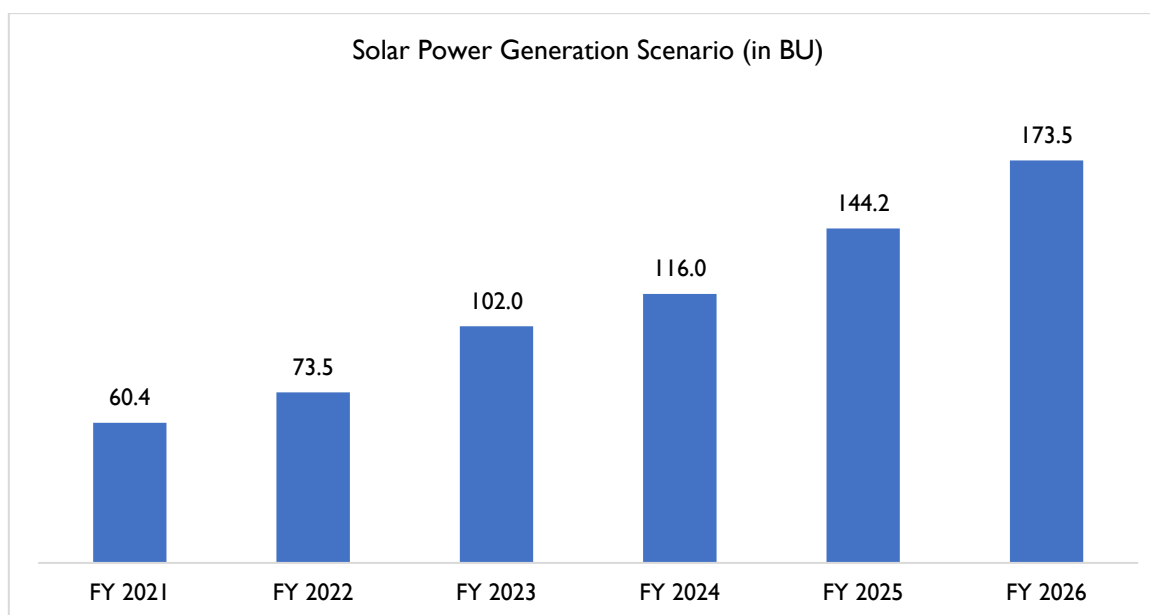
Solar power generation in India has become a cornerstone of the country's long-term energy transition, driven by strong policy support, market-based tariff discovery, and rapid project development. Government initiatives such as national solar missions, renewable purchase obligations, and production-linked incentives for domestic manufacturing have created a conducive ecosystem for sustained capacity addition. Large utility-scale solar parks across states such as Rajasthan, Gujarat, Karnataka, and Andhra Pradesh have enabled economies of scale, significantly reduced generation costs and made solar one of the most competitive sources of new power capacity.

In parallel, the expansion of rooftop solar across residential, commercial, and industrial segments has been supported by net metering policies and declining module prices, allowing distributed generation to complement centralised capacity. Growing participation from private developers, independent power producers, and institutional investors has further strengthened the sector, improving project execution capabilities and access to long-term capital. As a result, solar power has moved from being a niche renewable option to a mainstream contributor within India's overall power generation mix.

Insight into Solar Power Generation Scenario in India

Solar power has emerged as one of the fastest-growing contributors to India's electricity mix, reflecting both strong policy support and rapid capacity additions. Over the five-year period from FY 2021 to FY 2025, solar generation more than doubled, rising from 60.4 BU to 144.2 BU. This growth trajectory highlights the steady commissioning of utility-scale solar parks, the adoption of rooftop installations, and greater integration of solar into the national grid.





Source: Ministry of New and Renewable Energy, Central Electricity Authority

The most significant jump occurred between FY 2022 and FY 2023, when annual solar generation crossed the 100 BU milestone, representing a year-on-year growth of nearly 39%. Since then, output has continued to rise steadily, reaching 116 BU in FY 2024 and further scaling up to 144 BU in FY 2025. This reflects the rapid pace of solar installations, improved plant load factors (PLFs) in newer projects, and the expanding adoption of solar under government-led initiatives such as PM-KUSUM, the Solar Park Scheme, and rooftop solar programs.

In FY 2026, solar generation reached 173.525 BU,²⁹ a growth of 20.38% over FY 2025. With solar already accounting for the largest share among renewables, its role is expected to strengthen further as India pursues its 2030 target of 500 GW non-fossil capacity.

The sharp rise in solar generation underscores its central role in India's energy transition. Solar is not only reducing dependence on coal but also positioning the country as a global leader in the deployment of affordable clean energy.

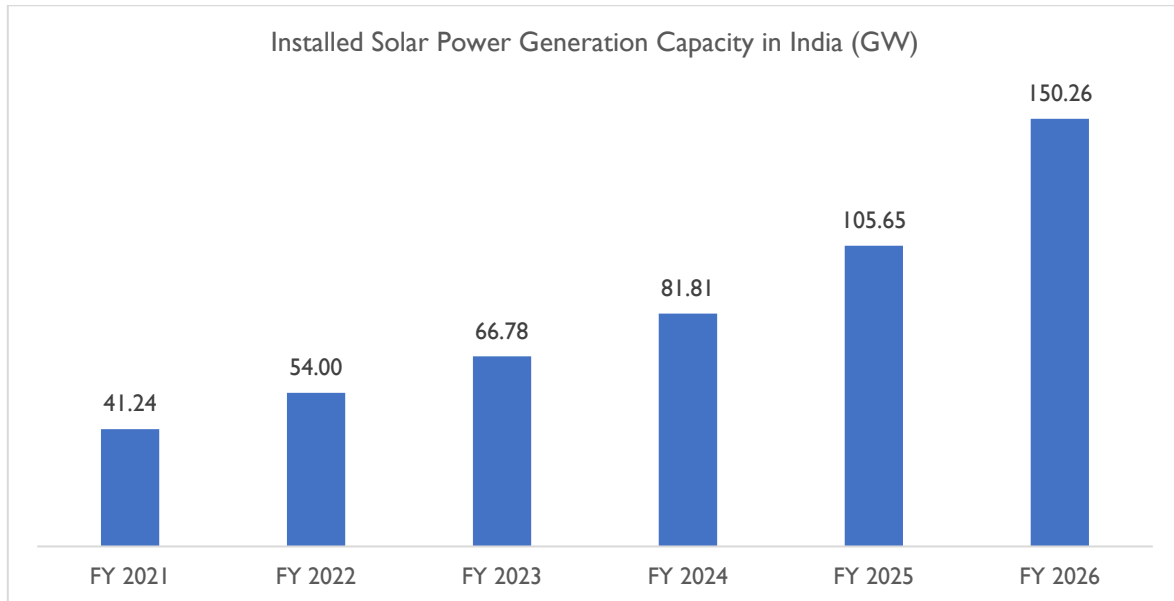
Installed Capacity & Historical Growth in Capacity

Over the past five years, India's solar sector has undergone a decisive transformation, emerging as the primary driver of renewable energy expansion and a central pillar of the country's clean energy transition. The growth has been marked by the steady scaling of large utility-scale parks alongside a rising contribution from rooftop and distributed solar systems, both strongly supported by national and state policies. Initiatives such as targeted rooftop subsidy schemes, incentives for domestic manufacturing, and competitive auctions have encouraged broader participation from public and private players. At the same time, the sector has diversified

²⁹ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2250039®=48&lang=2>



into hybrid and storage-linked projects, reflecting a shift toward addressing grid stability and reliability challenges.



Source: Ministry Of New and Renewable Energy, Niti Aayog

The graph illustrates a strong and consistent increase in India's installed solar power generation capacity over FY2021 to FY2026, reflecting the country's accelerating renewable energy transition. Capacity rose from 41.24 GW in FY2021 to 54.00 GW in FY2022 and further to 66.78 GW in FY2023, indicating steady expansion supported by rising investments, policy support, and increasing adoption of solar power across utility-scale and distributed segments.

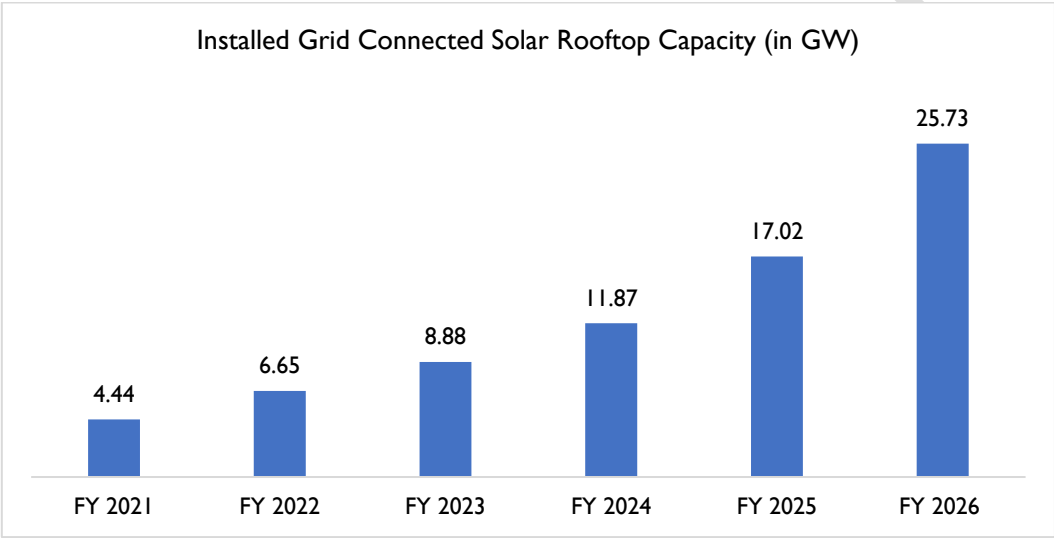
The growth trajectory strengthened further in the subsequent years, with installed capacity reaching 81.81 GW in FY2024 and crossing the 100 GW milestone at 105.65 GW in FY2025. This phase reflects a clear acceleration in capacity additions, driven by large-scale solar park developments, growing open access installations, and improved project execution across states. Increasing participation from private developers and enhanced tendering activity have also contributed to the rapid scale-up.

By FY2026, capacity had reached 150.26 GW, highlighting a substantial expansion of over 3.5 times compared to FY2021, translating into a strong CAGR of approximately 28–30%. The sharp increase between FY2023 and FY2026 indicates a transition into a high-growth phase, supported by declining solar tariffs, favourable policy frameworks, and India's long-term target of expanding non-fossil fuel capacity. Overall, the trend underscores India's strengthening position as a key global solar market and its continued focus on reducing reliance on conventional energy sources.



Solar Rooftop Segment in India (Installed Grid-connected Solar Rooftop Capacity in India)

India’s installed grid-connected solar rooftop capacity has shown a consistent upward trajectory over FY2021 to FY2026, reflecting increasing adoption of distributed solar solutions. Capacity grew from **4.44 GW in FY2021** to **6.65 GW in FY2022** and further to **8.88 GW in FY2023**, indicating steady expansion supported by improving awareness, declining system costs, and growing participation from commercial and industrial consumers.



Source: Niti Aayog, Ministry of New and Renewable Energy

The growth momentum strengthened in the subsequent years, with installed capacity rising to 11.87 GW in FY2024 and 17.02 GW in FY2025. This phase marks a clear acceleration in deployment, driven by enhanced policy support, streamlined net metering frameworks, and increasing focus on energy cost optimisation by businesses. Additionally, improved financing availability and EPC ecosystem maturity contributed to faster project execution.

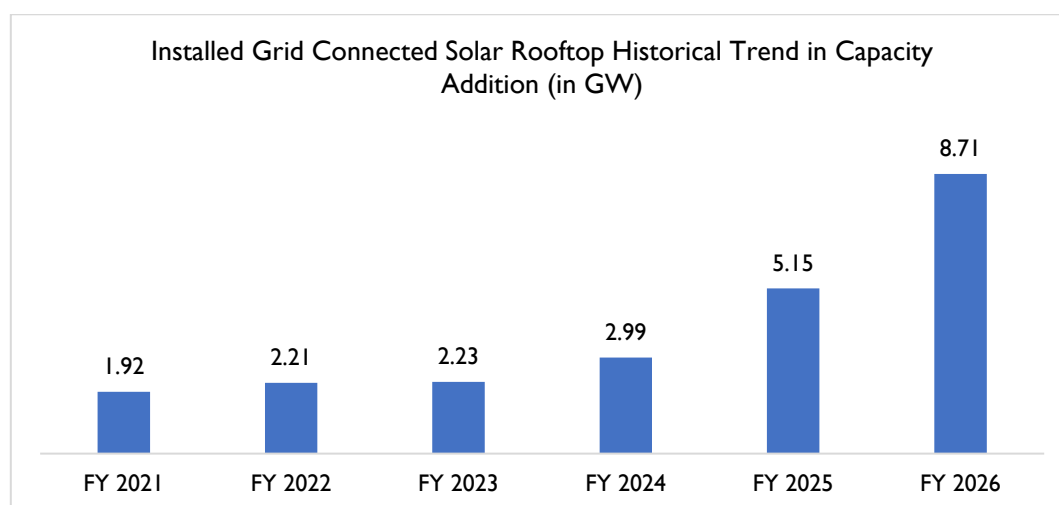
By FY2026, capacity reached 25.73 GW, highlighting a significant scale-up in rooftop solar installations across segments, particularly residential. Overall, the capacity has expanded by over 5.7 times during the period, reflecting a strong growth trajectory with an estimated CAGR of around 42%. The sharp rise in recent years indicates a transition towards mass adoption, supported by government initiatives such as rooftop solar schemes and increasing emphasis on decentralised renewable energy generation.

Historical Trend in Capacity Addition

The installed grid-connected rooftop solar capacity in India has grown rapidly over the past few years, reflecting the country’s strong push toward renewable energy and sustainable development. Supported by government policies, financial incentives, and falling solar equipment costs, rooftop solar has become



increasingly attractive for residential, commercial, and institutional users. The cumulative capacity, which was modest in the early 2020s, has surged in recent years, signalling a significant shift toward decentralised clean energy generation and contributing to India's broader solar and climate goals.



Source: Niti Aayog, Ministry of New and Renewable Energy

Over the past few years, India's rooftop solar capacity additions have demonstrated a clear acceleration, reflecting the sector's shift from gradual adoption to a high-growth phase. Annual additions increased from 1.92 GW in FY2021 to 2.21 GW in FY2022, followed by a relatively stable 2.23 GW in FY2023, indicating a period of steady but moderate expansion. A noticeable uptick was observed in FY2024, with capacity additions rising to 2.99 GW, reflecting improving execution and growing demand across commercial and industrial segments.

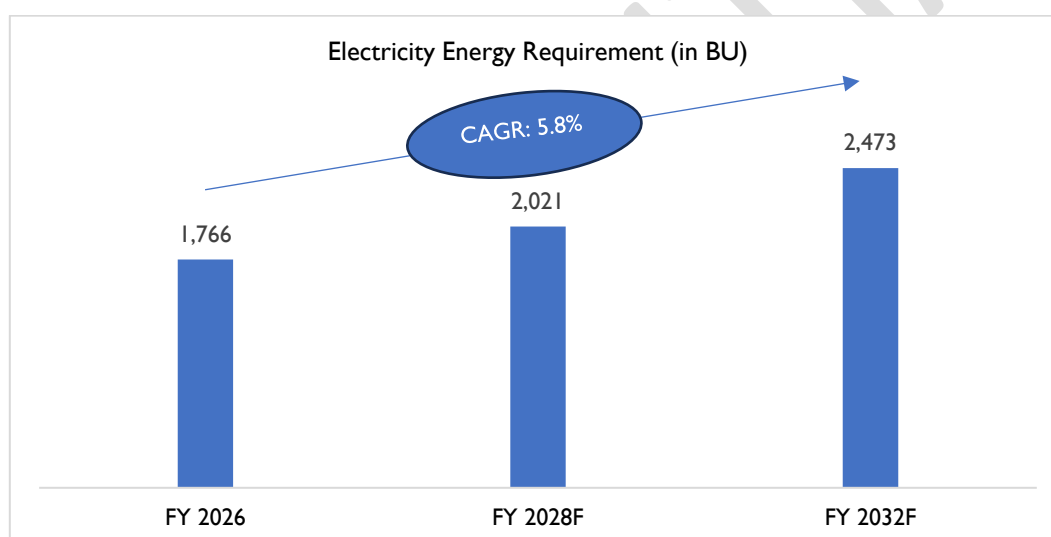
The growth momentum strengthened significantly in the subsequent years, with additions surging to 5.15 GW in FY2025 and further to 8.71 GW in FY2026,³⁰ representing a sharp scale-up in deployment. This translates to a more than 4x increase in annual additions between FY2021 and FY2026, highlighting a strong acceleration in market activity. The sharp rise in the last two years indicates a transition toward mass adoption, supported by improved policy implementation, increased participation from EPC players, and enhanced consumer awareness, particularly in the residential segment.

Overall, the trend reflects a structurally improving rooftop solar ecosystem, driven by favourable government initiatives such as capital subsidies and net metering frameworks, along with declining system costs and better financing access. The significant jump in recent years underscores the increasing role of distributed solar in India's energy mix and indicates strong future growth potential as rooftop solar continues to gain traction across residential, commercial, and institutional segments.

³⁰ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2250039®=48&lang=2>

Expected Growth in Electricity Demand in India

India has experienced a significant and steady increase in electricity demand, driven by rapid urbanisation, industrial growth, and the growing use of electricity across sectors such as transport, housing, and manufacturing. Government-led initiatives promoting household electrification, electric mobility, and renewable energy integration are further accelerating this demand. Schemes supporting rooftop solar adoption and clean energy use are driving greater consumption at the grassroots level, while emerging areas such as green hydrogen are beginning to shape future electricity needs. This rising demand reflects a broader transformation in India's energy consumption patterns as the country modernises and urbanises.



Sources: CEA (Electric Power Survey, 2022)

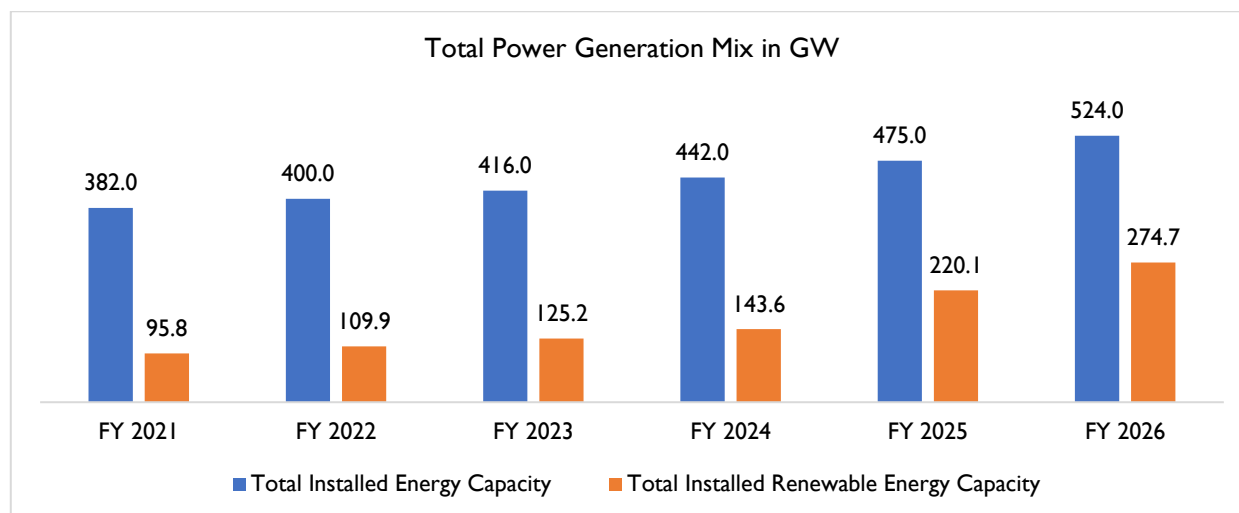
The graph shows a steady increase in India's electricity demand, indicating the country's growing power needs over the next decade. Starting from 1,766 Billion Units (BU) in FY 2026, the requirement is projected to rise to 2,021 BU by FY 2028F and further to 2,473 BU by FY 2032. This progression reflects rising demand driven by industrial growth, urbanisation, increased household electrification, and the adoption of new electricity-intensive sectors such as electric mobility and green hydrogen. Over this period, the CAGR from FY 2026 to FY 2032 is 5.8%, indicating a healthy, sustained growth in energy consumption.

Expected Change in Power Generation Mix: Focus on the Expected Growth in Renewable Power

India's installed power capacity mix is undergoing a steady transition toward renewable energy, supported by policy initiatives and continued capacity additions across solar, wind and other clean sources. Total installed power capacity increased from **382 GW in FY 2021** to **524 GW by FY 2026**, reflecting sustained expansion in both conventional and renewable segments. Over the same period, installed renewable capacity



(including large hydro) rose more rapidly from **95.8 GW in FY 2021 to 274 GW by FY 2026** indicating a clear structural shift toward cleaner energy sources. This growth aligns with India's broader energy transition strategy and its long-term target of expanding non-fossil fuel capacity in the overall generation mix.



Source: Ministry of New and Renewable Energy & NITI Aayog

The chart highlights a consistent year-on-year rise in renewable capacity additions, particularly from FY2023 onward, with a sharper jump between FY2024 and FY2026 as new solar and wind projects were commissioned. Renewable capacity (including large hydro) grew from 220.10 GW as of March 31, 2025 to 274.68 GW as of March 31, 2026, outpacing the growth in total installed capacity. As a result, renewables' share in the total installed base has expanded meaningfully over the period, reflecting increasing investment, competitive tariff discovery through auctions, grid expansion, and supportive policy mechanisms such as transmission waivers and renewable purchase obligations. Overall, the data indicates that incremental capacity additions in India are increasingly being driven by renewable energy sources, reinforcing their rising importance in the country's future power generation mix.

Annual Renewable Energy Capacity Additions by Source in India (GW), FY2021–FY2026

Year	Solar Power	Wind Power	Biomass (Bagasse) Cogeneration	Small Hydro Power	Biomass (Non-bagasse) Cogeneration	Waste to Energy (Off grid)	Waste to Energy	Total
FY 2021	5.63	1.50	0.17	0.10	0.10	0.02	0.02	7.55
FY 2022	12.76	1.11	0.06	0.06	-	0.03	0.05	14.08
FY 2023	12.78	2.28	-	0.10	0.04	0.05	0.03	15.27
FY 2024	15.03	3.25	-	0.06	0.11	0.03	0.00	18.48
FY 2025	23.83	4.15	0.39	0.10	-	0.19	0.06	28.72



FY 2026	44.61	6.05	-	0.07	0.13	0.02	0.01	50.90
CAGR %	51.3%	32.2%	-	-6.9%	5.4%	0.0%	-12.9%	46.5%

Source: Ministry of New and Renewable Energy

India's renewable capacity additions (excluding large hydro) have demonstrated a **clear and sustained growth trajectory from FY2021 to FY2025**, with total annual additions increasing from **7.55 GW in FY2021** to **28.72 GW in FY2025**, reflecting a strong multi-year expansion. This growth has been predominantly driven by **solar power**, which increased significantly from **5.63 GW to 23.83 GW**, consistently accounting for the majority share of new capacity additions. Wind power has also shown a **progressive recovery**, rising from **1.50 GW in FY2021** to **4.15 GW in FY2025**, supporting the overall upward trend, albeit at a slower pace compared to solar. The combined contribution of solar and wind continues to anchor India's renewable energy expansion.

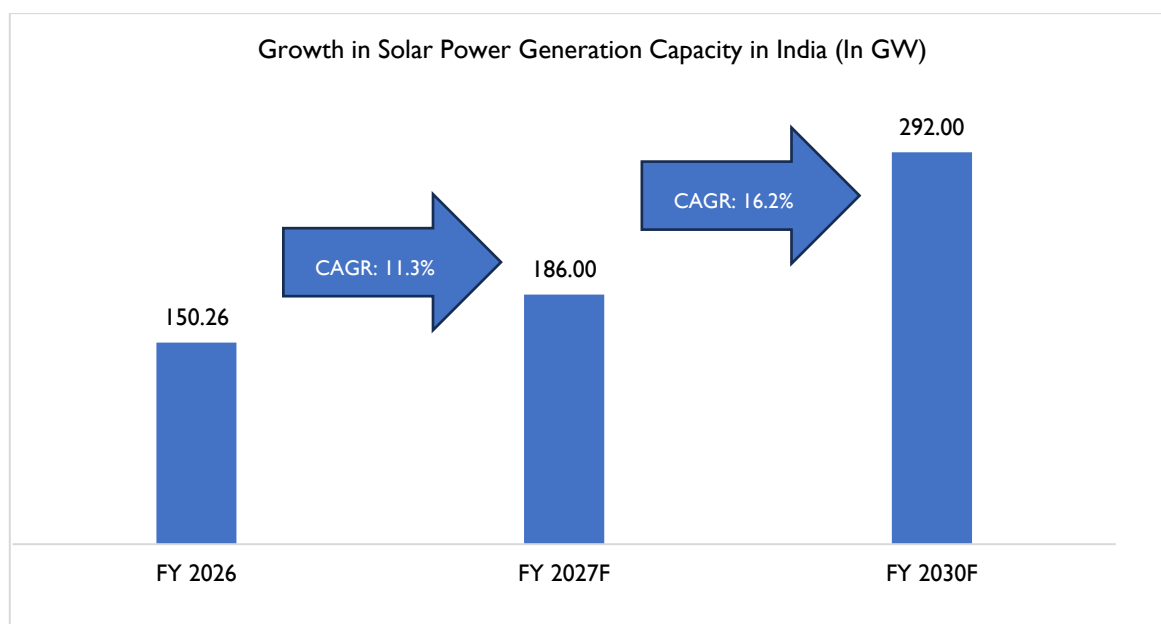
The upward momentum continued in FY2026, with record solar additions of 44.61 GW and record wind additions of 6.05 GW, taking total renewable capacity additions (excluding large hydro) to 50.90 GW. This reflects an accelerated pace of installations, strong project execution and a robust pipeline. This indicates that the growth trend is not only continuing but potentially strengthening, supported by increasing tender activity, open access demand, and large-scale project commissioning.

Other renewable segments, including **biomass, small hydro, and waste-to-energy**, continue to play a **supplementary yet stable role**, with relatively smaller and intermittent additions across years. While these segments show periodic spikes (notably in FY2025), their overall contribution remains limited compared to solar and wind. Overall, the data highlights a **broad-based but solar-led growth trajectory**, with improving wind additions and steady support from other renewables, reinforcing India's ongoing transition towards a diversified and expanding clean energy mix.

Expected Growth in Solar Power Generation Capacity in India

India's solar generation capacity is likely to increase significantly over the next several years as the country continues to expand its renewable energy base and reduce dependence on conventional fuels. National-level programmes aimed at strengthening domestic clean energy capacity, along with ongoing investment from both public and private participants, are expected to support sustained growth in solar installations. Improvements in module efficiency, project execution, and financing structures are also contributing to stronger capacity addition across utility-scale and distributed solar segments.





Source: MNRE, Government of India

Solar capacity increased from about 150.26 GW in FY 2026 to nearly 186 GW by FY 2027, indicating steady near-term expansion supported by project pipelines, policy support, and continued adoption across industrial, commercial, and rooftop segments. Over the medium term, capacity additions are expected to remain strong, with total installed solar capacity potentially reaching around 292 GW by FY 2030. This projected growth reflects a combination of factors, including declining technology costs, expansion of solar park developments, improved transmission connectivity, and rising participation from independent power producers and private investors. As new projects are commissioned, solar power is expected to account for a growing share of incremental generation capacity, reinforcing its importance within India's evolving energy mix.

Ground-mounted / Utility Grade and Rooftop

India's solar roadmap points to a very large build-out by 2030, with cumulative installed solar capacity targeted at around **292 GW**, aligned with the country's broader renewable energy and climate commitments. With installed solar capacity rising to approximately **150.26 GW in FY2026**, a substantial portion of the target has already been achieved, reducing the gap to be bridged over the remaining years of the decade. However, despite this progress, achieving the 2030 target will still require a sustained pace of capacity additions, along with continued improvements in execution efficiency. In practical terms, this necessitates parallel progress across project pipeline development, land and regulatory approvals, transmission infrastructure readiness, and financing availability, ensuring that large-scale solar deployments remain on track and aligned with national energy transition goals.

Within the overall 2030 ambition, the expected capacity is typically discussed across two major segments **rooftop solar** and **ground-mounted (utility-scale) solar**. Rooftop installations are projected to reach **~61 GW by 2030**. Growth in this segment is expected to be led by household adoption, supported by



targeted programmes such as **PM Suryaghar: Muft Bijli Yojana**, which envisages a large push in near-term residential rooftop installations. As penetration increases, rooftop solar can help decentralise generation, reduce distribution losses, and partially offset local feeder loading particularly in demand-dense urban and peri-urban areas.

In contrast, **utility-scale ground-mounted projects** are expected to remain the primary contributor to incremental capacity, with the balance of the 2030 target approximately **~231 GW** linked to large plants and solar parks. The segment continues to benefit from scale advantages, competitive tariffs, and the ability to deliver sizeable blocks of power for grid supply as well as industrial and commercial consumption. Given its role in meeting bulk energy requirements, utility-scale solar is also closely tied to transmission build-out, land availability, and the pace at which storage and flexibility solutions are integrated into the grid.

Round-The-Clock (RTC) Renewable Power Generation Scenario in India

Round-The-Clock (RTC) renewable power refers to the continuous and reliable supply of electricity from renewable energy sources, designed to replicate the firm power characteristics of conventional thermal generation. In India, the concept of RTC renewable energy is gaining traction as the share of variable renewable energy (VRE), particularly solar and wind, increases in the national power mix. To maintain grid stability and ensure predictable power supply, Indian utilities, distribution companies (DISCOMs), and corporate buyers are increasingly exploring RTC renewable procurement models that combine multiple generation technologies and storage solutions.

Government agencies such as the Solar Energy Corporation of India (SECI), NTPC, and state utilities have initiated RTC renewable tenders that mandate assured power delivery using integrated renewable portfolios. These initiatives align with India's broader energy transition objectives, including reducing dependence on fossil fuels, enhancing grid reliability, and supporting long-term decarbonisation targets. RTC renewable power is therefore emerging as a strategic segment within India's renewable energy ecosystem, bridging the gap between intermittent renewable generation and reliable baseload power supply.

Solar photovoltaic (PV) generation integrated with Battery Energy Storage Systems (BESS) is emerging as a key enabler of RTC renewable power in India. Solar-BESS configurations allow excess electricity generated during daytime solar peaks to be stored and dispatched during evening and night-time demand periods, thereby improving power availability and reducing intermittency risks. This integration enhances the dispatchability and reliability of solar power, enabling utilities and corporate consumers to procure firm renewable electricity under long-term power purchase agreements (PPAs).

As India scales up renewable capacity and modernizes its grid infrastructure, Solar BESS installations are expected to play a central role in hybrid renewable projects, utility-scale RTC tenders, and distributed energy solutions. The declining cost of battery technologies, supportive government policies, and increasing



corporate renewable procurement are further accelerating the adoption of Solar BESS systems. Consequently, Solar-BESS integration is positioned as a critical component of India's transition toward reliable, low-carbon, and resilient power systems.

Key Drivers for RTC Renewable Power in India:

- **Grid Stability and Reliability Requirements:** The rapid expansion of solar and wind capacity has increased variability in power generation, creating challenges for grid balancing and frequency management. RTC renewable projects, supported by BESS, enable energy shifting and firm capacity delivery, improving grid stability and reducing reliance on fossil fuel-based peaking plants.
- **Rising Corporate Power Purchase Agreements (PPAs):** Large commercial and industrial (C&I) consumers are increasingly procuring renewable power through long-term PPAs to meet sustainability targets and reduce electricity costs. RTC renewable solutions offer corporates a reliable alternative to conventional power, supporting 24/7 operations while meeting ESG and decarbonisation commitments.
- **DISCOM Procurement and Capacity Replacement Needs:** State DISCOMs are increasingly procuring RTC renewable power to replace aging thermal capacity and meet growing electricity demand. RTC tenders provide utilities with predictable renewable supply profiles, reducing the need for costly balancing power and improving resource planning.
- **Policy Mandates and Government Initiatives:** The Indian government, through agencies such as SECI and MNRE, has introduced RTC and hybrid renewable tenders to promote firm renewable power procurement. Policy frameworks supporting energy storage, hybrid renewable parks, and transmission infrastructure are accelerating the deployment of RTC projects.

Key Technology Combinations Enabling RTC Renewable Power

- **Solar Integrated with Battery Energy Storage Systems (BESS):** Solar power integrated with Battery Energy Storage Systems (BESS) represents one of the most widely deployed configurations for enabling RTC renewable power. In this configuration, solar PV plants generate electricity during daylight hours, while surplus energy is stored in batteries and discharged during periods of low generation or peak demand. This integration helps smooth output variability, enhance capacity utilisation, and provide firm and dispatchable power to the grid. Solar-BESS systems are particularly relevant for utility-scale projects, commercial and industrial (C&I) consumers, and distributed applications where reliability and peak load management are critical. As battery costs continue to decline and grid-scale storage deployments expand, Solar- BESS configurations are increasingly positioned as a cost-effective alternative to conventional peaking power plants, supporting grid stability and enabling higher renewable energy penetration.



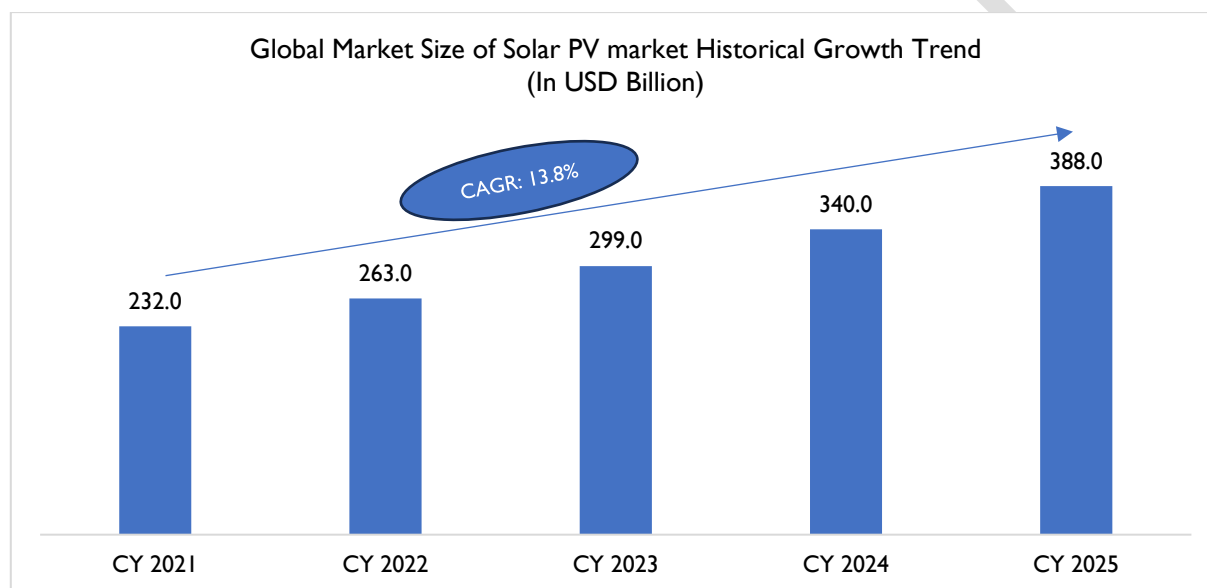
- **Multi-Technology Hybrid Renewable Systems (Wind-Solar-Storage):** Multi-technology hybrid renewable systems combine wind, solar, and Battery Energy Storage Systems (BESS) to deliver continuous and predictable power output across different time periods and seasonal patterns. Solar generation typically peaks during daytime hours, while wind generation often exhibits higher output during night-time and monsoon seasons, making these sources complementary. The addition of BESS further enhances system flexibility by storing excess energy and dispatching it during periods of low generation or high demand. Such hybrid systems are increasingly being developed as large-scale renewable parks and RTC power projects, enabling utilities and corporate off takers to procure firm renewable power under long-term contracts. This configuration is particularly important in markets with high renewable penetration, as it reduces intermittency risks, improves grid balancing, and supports the transition toward fossil fuel-free baseload power.



Solar PV: Market Scenario

Estimated global market size of the solar PV market & historical growth trend (last 5 years)

Solar photovoltaic deployment has expanded across most regions in recent years as countries increase the share of non-fossil power in their energy mix. Rising electricity demand, policy support for cleaner energy sources, and gradual reductions in equipment costs have all contributed to the broader adoption of solar installations. Large utility projects, commercial systems, and residential rooftop installations are being developed in parallel, supporting steady expansion in overall market activity.



Source: D&B Primary Research

The global solar PV sector has expanded at a steady pace in recent years, reflecting continued capacity additions and broader adoption across multiple end-use segments. Market estimates suggest that the sector was valued at roughly USD 232 billion in CY 2021 and increased to around USD 263 billion in CY 2022, before reaching close to USD 299 billion in CY 2023. The growth trend is expected to remain positive, with the market projected to reach approximately USD 340 billion in CY 2024 and about USD 388 billion in CY 2025. Taken together, this indicates an estimated compound annual growth rate of roughly 13–14% between CY 2021 and CY 2025. Ongoing investment in renewable energy infrastructure, continued diversification of electricity generation sources, and expanding deployment of solar installations across both advanced and developing economies are expected to support this upward trajectory.



Global Solar PV Market Segmentation (for the latest year)

By Grid Type	% Share CY 2024
On-Grid	87%
Off-Grid	13%
Total	100%

Source: D&B Primary Research

The global solar PV market in the latest year is overwhelmingly dominated by on-grid systems, which account for 87% of total installations, reflecting their strong integration with national and regional power networks. This dominance is driven by large-scale utility solar projects, commercial and industrial rooftop installations, and supportive grid-connected policies such as feed-in tariffs, net metering, and renewable purchase obligations. On-grid systems benefit from lower upfront costs than off-grid systems because they do not require extensive battery storage, making them the preferred choice in grid-accessible regions.

In contrast, off-grid solar PV systems, which account for 13% of the market, play a crucial role in niche and underserved applications. These systems are primarily deployed in remote, rural, and island regions where grid connectivity is weak or absent, particularly across parts of Africa, Asia, and Latin America. Growth in the off-grid segment is supported by rural electrification programs, falling battery costs, and increasing demand for energy access solutions. While smaller in share, off-grid solar remains strategically important for energy inclusion and decentralised power generation.

By Region (Asia Pacific, North America, Europe, Africa)

By Region	% Share CY 2024
Asia Pacific (Includes China)	58%
Europe	17%
North America	17%
Africa & ROW	8%
Total	100%

Source: D&B Primary Research

The regional segmentation of the global solar PV market in CY 2024 highlights the clear dominance of Asia Pacific, which accounts for 58% of the total market. This leadership is primarily driven by China's large-scale solar manufacturing capacity, aggressive renewable energy targets, and continued investments in utility-scale



solar projects. Other Asia-Pacific countries, such as India, Japan, and Southeast Asian nations, are also contributing to capacity additions, supported by favourable government policies, growing electricity demand, and declining solar costs. The region's strong manufacturing ecosystem and supply-chain integration further reinforce its commanding position in the global solar PV landscape.

Europe and North America, each with a 17% market share, represent mature, steadily expanding solar markets. Growth in these regions is supported by decarbonisation mandates, energy security concerns, and increased focus on reducing dependence on fossil fuels. Europe's expansion is largely policy-driven, while North America benefits from incentives, corporate renewable procurement, and utility-scale solar development. Africa & the Rest of the World (8%), though currently smaller in share, represents a high-growth opportunity due to rising electrification needs, abundant solar resources, and increasing international funding for renewable energy projects. Overall, the segmentation reflects a market led by Asia Pacific, with balanced contributions from developed regions and long-term growth potential in emerging markets.

By End Use Segment (Residential / Commercial & Industrial / Utility)

By End-Use	% Share CY 2024
Utility	60%
Commercial & Industrial	27%
Residential	13%
Total	100%

Source: D&B Desk Research

The global solar PV market in CY 2024 is predominantly driven by the utility-scale segment, which accounts for 60% of total installed capacity, highlighting the continued focus on large-scale solar power plants worldwide. Utility projects benefit from economies of scale, lower levelized cost of electricity (LCOE), and strong policy support through auctions, power purchase agreements (PPAs), and national renewable energy targets. This dominance reflects governments and utilities' preference for large installations to rapidly add clean power capacity and meet decarbonisation goals efficiently.

The commercial & industrial (C&I) segment, with a 27% share, represents a growing adoption of rooftop and on-site solar systems by businesses aiming to reduce energy costs, hedge against electricity price volatility, and meet sustainability commitments. Meanwhile, the residential segment, accounting for 13%, continues to expand steadily, supported by declining system costs, net metering policies, and rising consumer awareness of clean energy solutions. However, its relatively small share indicates higher upfront costs and greater policy



variability than utility-scale projects, reinforcing the current market structure in which large-scale installations remain the primary growth driver.

Rising Global Investment in Renewable Energy and Solar as a Strategic Asset Class:

Rising Global Investment in Renewable Energy

- **Global Energy Transition Investment Scale & Trend:** Global investment in the energy transition which includes renewable energy, grid enhancements, electrified transport, and low-carbon technologies reached a record USD 2.3 trillion in 2025, reflecting an 8 % year-on-year increase. Of this, investments in renewable energy technologies alone were approximately USD 690 billion, underscoring the strong capital flows into clean power infrastructure. This broad global capital deployment highlights growing investor confidence in the future of clean energy markets worldwide, driven by supportive policies and long-term decarbonisation goals.
- **Renewable Power Investment Patterns:** In 2024, renewable energy investment reached USD 807 billion, with nearly 96 % of that funding directed toward power generation rather than transport or heating applications. Solar PV investment in particular hit record levels, capturing nearly half of the total renewable investment in 2024. This demonstrates how capital is increasingly prioritised toward large-scale clean power generation as part of energy transition strategies.
- **Mid-Year Investment Momentum & Regional Shifts:** Investment activity in the first half of 2025 surpassed USD 386 billion for renewable energy projects, marking a 10 % increase compared to the same period in 2024. Despite some regional policy headwinds, investors are shifting capital toward areas with stable regulatory environment. China continued to account for a significant share of investment flows, while Europe showed robust growth, reflecting diversification in regional investor interest and reinforcing renewable energy's financial appeal.
- **Private & Corporate Investment Drivers:** Beyond public and project finance, private and corporate sectors are increasingly participating in renewable investment through corporate offtake agreements, venture equity, and project financing structures. Large corporations are committing capital via long-term power purchase agreements (PPAs) and strategic investments in clean infrastructure, thereby strengthening the linkage between renewable deployment and private capital markets. While exact private investment totals are fragmented across sources, the scale of commitments reflects growing mainstream investor confidence.
- **Diversification & Future-Focus Investment Rationale:** Investor interest in renewable energy is driven not only by environmental mandates but also by portfolio diversification strategies, long-duration cash flows from clean energy assets, and expectations of technological leaps in areas such as battery storage and green hydrogen. This dynamic is amplifying investor willingness to explore innovative financial



instruments tied to renewable assets, signalling that renewables are increasingly seen as attractive, future-oriented investment opportunities.

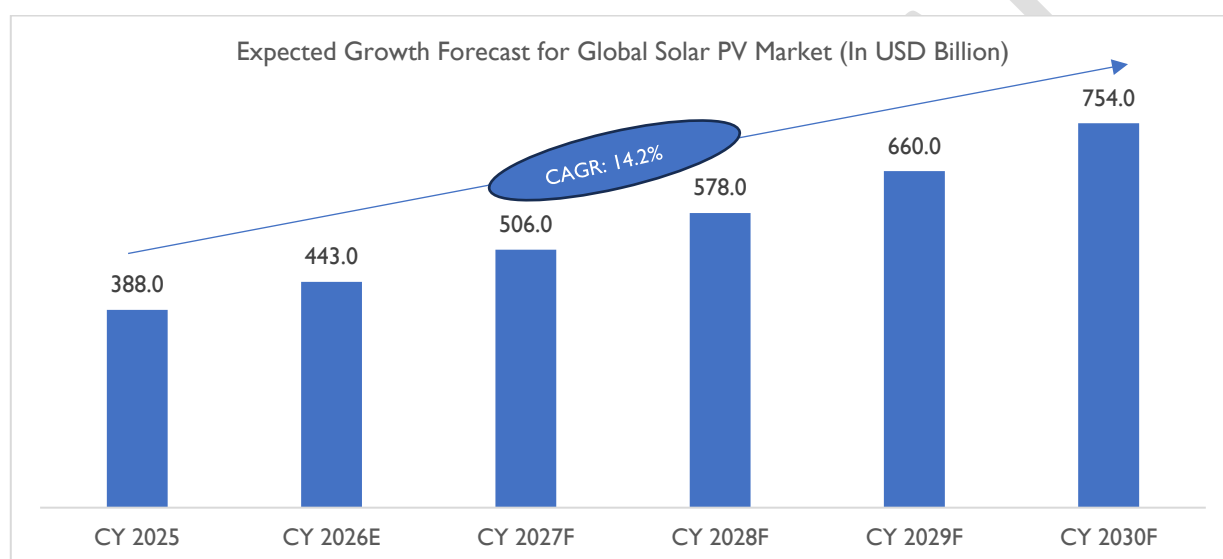
Emerging Financial Instruments in Renewable Energy:

- **Green Bonds:** Green bonds debt securities specifically earmarked for environmentally beneficial projects have gained traction as key financing instruments for renewable energy. For example, Indian companies are issuing green bonds to fund solar and hybrid power assets, helping channel institutional capital into clean energy portfolios at scale.
- **Solar & Renewable Investment Trusts:** Investment trusts and yieldco structures focused on solar and renewable portfolios are emerging as an attractive asset class for mainstream investors who are seeking stable and regular returns from operational assets. Although data on specific trust issuance volumes is still developing, these instruments are increasingly discussed among global infrastructure and energy funds due to predictable cash flows from long-term generation contracts.
- **Fractional & Retail Solar Investments:** Fractional solar investment platforms which allow smaller investors to participate in clean energy asset ownership are expanding access to renewable energy financing. While detailed industry-wide figures are fragmented, platforms offering solar loans and financing solutions have begun scaling rapidly in markets like India, where Solfin - a fintech backed by Waree Group - has disbursed over INR 100 crore in solar loans in just 9 months of operation.
- **Renewable Energy Certificates & Tradable Instruments:** Renewable Energy Certificates (RECs) and similar tradable instruments are being incorporated into carbon markets and corporate sustainability strategies. These certificates enable corporations to claim renewable generation credits and serve as investment proxies when direct project investments are not feasible.
- **Project Debt & Blended Finance Instruments:** Debt financing for renewable infrastructure including green loans, export credit facilities, and blended public-private financing has expanded rapidly. For instance, external credit-enhanced green bonds and international credit lines are being used to support solar and wind projects, demonstrating how structured finance solutions are unlocking capital at favourable terms.



Expected growth forecast of the global solar PV market (next 5 years)

The global solar photovoltaic (PV) industry is expected to continue expanding over the coming five years as energy systems across regions increasingly incorporate renewable sources. Governments and utilities are working to diversify power generation and reduce dependence on conventional fuels, which is encouraging additional solar deployment. At the same time, advances in manufacturing processes, gradual cost reductions, and improvements in project development capabilities are supporting wider installation of solar capacity across markets. As a result, solar PV is likely to remain a major contributor to new power generation capacity added worldwide during the forecast period.



Source: D&B Primary Research, *P=Projected

The global solar PV market is projected to expand from roughly USD 388 billion in CY 2025 to about USD 754 billion by CY 2030F, indicating sustained growth over the forecast period at an estimated CAGR of around 14%. The anticipated increase reflects continued capacity additions, supportive policy environments, investment in large-scale solar infrastructure, and wider adoption across both utility-scale and distributed installations, reinforcing solar PV's expanding role in the global power generation mix.

Global Market Segmentation (at the end of the forecast year)

By Grid Type	% Share CY 2030F
On-Grid	85%
Off-Grid	15%
Total	100%

Source: D&B Primary Research



Grid-connected solar systems are projected to account for the majority of global solar PV installations, with an estimated share of around 85% by 2030. This trend is largely linked to the expansion of utility-scale projects and grid-linked commercial and industrial installations, which typically benefit from scale efficiencies, competitive tariffs, and established grid connectivity. Policy measures such as long-term power purchase agreements, net-metering provisions, and other regulatory support mechanisms in several markets have also encouraged the development of grid-integrated solar capacity.

Off-grid solar systems are expected to represent the remaining share, at roughly 15% of global installations. These systems continue to serve an important role in providing electricity access in locations where grid infrastructure is limited or unreliable, including remote rural areas, island communities, and specific use cases such as telecom infrastructure. Demand for decentralised energy solutions in developing regions supports growth in this segment. However, as grid networks expand and reliability improves in many countries, on-grid solar is likely to remain the primary driver of global solar PV capacity growth through 2030.

By Region (Asia Pacific, North America, Europe, Africa)

By Region	% Share CY 2030F
Asia Pacific (Includes China)	62%
Europe	16%
North America	16%
Africa & ROW	8%
Total	100%

Source: D&B Primary Research

The global solar PV market in CY 2030F is expected to be dominated by the Asia-Pacific region, accounting for 62% of the total market, driven primarily by large-scale capacity additions in China, India, Japan, and Southeast Asia. Strong government support, aggressive renewable energy targets, expanding manufacturing capacity, and declining project costs continue to position Asia Pacific as the global hub for solar deployment. China's leadership in both solar installations and supply chain manufacturing further reinforces the region's dominant share.

Europe and North America, each contributing 16% of the global market, reflect mature and steadily expanding solar markets supported by strong policy frameworks, decarbonisation commitments, and increasing investments in utility-scale and distributed solar projects. Europe's growth is driven by energy security concerns and climate targets, while North America benefits from federal incentives and corporate renewable procurement. Africa & the Rest of the World (8%), though currently smaller in share, represent high long-



term growth potential due to rising electrification needs, improving policy support, and increasing investment in renewable infrastructure across emerging economies.

By End Use Segment (Residential / Commercial & Industrial / Utility)

By End-Use	% Share CY 2030F
Utility	56%
Commercial & Industrial	30%
Residential	14%
Total	100%

Source: D&B Desk Research

The global solar PV market in CY 2030F is expected to remain largely dominated by the utility-scale segment, which is projected to account for 56% of the total market. Although utility installations continue to lead due to economies of scale, favourable auction mechanisms, and long-term power purchase agreements, their share is expected to decline slightly compared with earlier years. This reflects a gradual diversification of solar adoption beyond large, centralised projects toward distributed energy systems.

The commercial & industrial (C&I) segment, with a projected 30% share, is expected to grow notably, driven by corporate sustainability commitments, rising electricity tariffs, and increased adoption of rooftop and captive solar systems. Meanwhile, the residential segment, accounting for 14%, is expected to grow steadily, supported by improved financing options, technological advancements, and favourable net metering policies in key markets. Overall, the segmentation trend highlights a more balanced solar PV market structure by 2030, with increasing participation from decentralised and behind-the-meter installations alongside utility-scale projects.



Regulatory Landscape: Key Regions (European Union, UK, Africa)

➤ European Union

European Green Deal & Clean Energy for All Europeans

The European Green Deal is the EU's overarching climate and energy framework aiming to reduce greenhouse gas emissions by at least 55 % by 2030 and achieve climate neutrality by 2050. It encompasses a suite of legislative initiatives that prioritize renewable energy expansion and energy efficiency as core pillars. Central to solar PV growth, this framework integrates directives, financing mechanisms, and green industrial policies that accelerate transition from fossil fuels.

Revised Renewable Energy Directive

A cornerstone legal instrument, the Revised Renewable Energy Directive (RED II) establishes a binding EU target of at least 42.5 % renewable energy share by 2030 (with ambition to reach 45 %). It also mandates faster and simplified permitting for solar and other renewables, and supports specific sectoral targets (e.g., renewables in buildings and transport).

➤ United Kingdom

Smart Export Guarantee (SEG)

The Smart Export Guarantee (SEG), operational since January 2020, requires licensed electricity suppliers to offer payments for surplus solar energy exported back to the grid. Unlike older feed-in tariffs, SEG pays for exported energy only and energizes small-scale solar adoption, especially rooftop systems under ~5 MW.

Zero-Rate VAT on Solar PV & Related Equipment

The UK government has introduced 0 % VAT on the supply and installation of solar panels and related battery equipment for residential properties (in effect until March 2027). This significantly lowers upfront cost barriers and encourages household and small business adoption of solar PV.

Grant & Social Schemes (ECO4, Warm Homes Plan, Regional Grants)

- Schemes like ECO4 and the Warm Homes Plan provide targeted funding that can fully or partially cover solar installation costs for low-income households and social housing. Additional region-specific grants (e.g., Home Energy Scotland) further reduce cost barriers and enhance equitable access.



➤ **Africa****Competitive Procurement & Auction Mechanisms**

Many African countries have shifted away from traditional feed-in tariffs toward competitive bidding and auction programs to allocate solar PV projects. Auctions enhance transparency, reduce prices, and attract more diverse investment, with countries like Egypt and others tendering large solar capacities under competitive frameworks.

South Africa's Renewable Energy Independent Power Producer Procurement Programme (REIPPPP)

South Africa's REIPPPP has been highly influential: a long-running competitive program that awards solar and other renewable projects to private investors. As of recent rounds, it has delivered substantial capacity (~6.2 GW of awarded projects) and aligned procurement with climate commitments under the Paris Agreement.

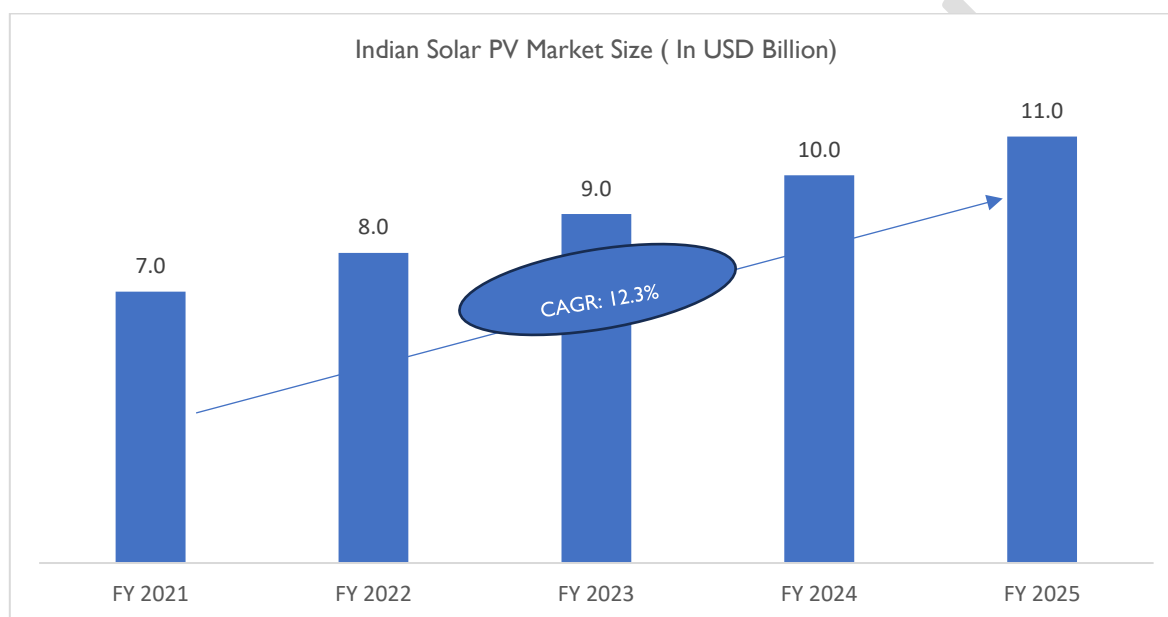
National Renewable Energy Acts & Policy Frameworks

- Several African countries such as Ghana's Renewable Energy Act provide a foundational regulatory structure defining renewable energy development goals, licensing processes, tariff regimes, and institutional roles. These laws set enabling environments for private investment and establish renewable purchase obligations and quality standards.



Indian Solar PV Market size: Current scenario & historical growth trend

The Indian solar PV market has demonstrated steady growth over recent years, supported by strong policy backing and ambitious national renewable energy targets. Increasing investments in utility-scale projects, along with rising adoption of rooftop solar in commercial and industrial segments, have driven market expansion. Improvements in project economics and declining technology costs continue to enhance market attractiveness. Overall, the historical growth trend highlights India's strengthening role as a key global solar PV market.



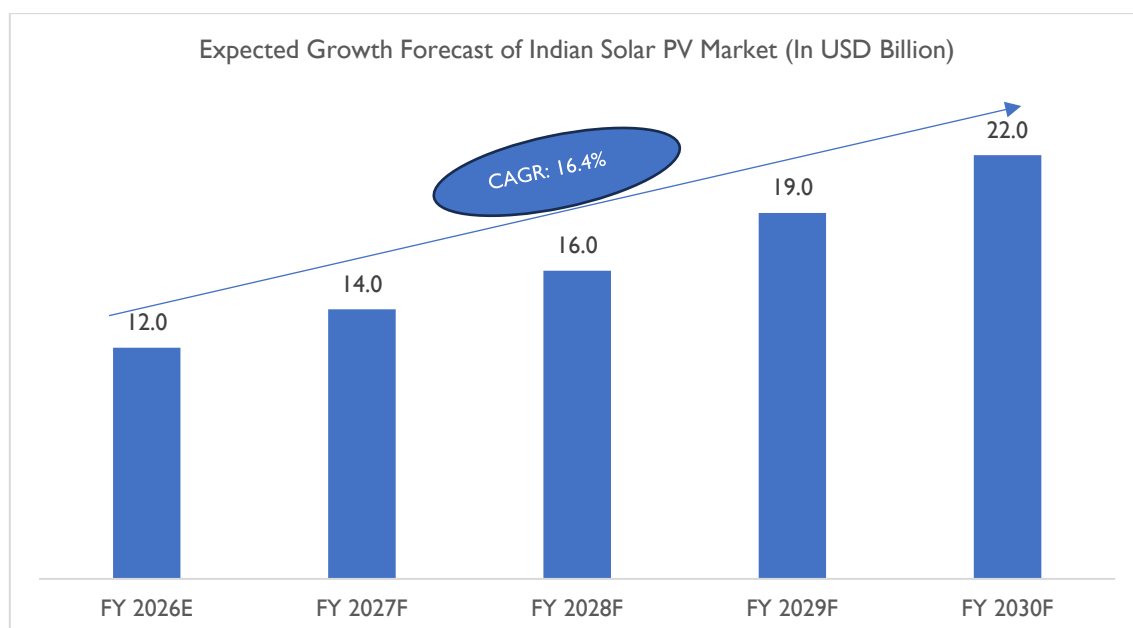
Source: D&B Primary Research

The Indian solar PV market has recorded steady growth between FY 2021 and FY 2025, supported by rising installations and continued policy support for renewable energy. Market size increased from about USD 7 billion in FY 2021 to roughly USD 8 billion in FY 2022 and USD 9 billion in FY 2023, with further expansion to around USD 10 billion in FY 2024 and an estimated USD 11 billion by FY 2025. Over this period, the sector is projected to grow at a CAGR of about 12.3%. The expansion reflects ongoing investments in solar capacity, increased utility-scale and rooftop adoption, and sustained emphasis on strengthening renewable energy infrastructure in India.

Expected growth forecast of the Indian solar PV market

The Indian Solar PV market is witnessing sustained qualitative growth, driven by strong policy backing and long-term renewable energy commitments. Increasing participation from private developers and institutional investors is improving market maturity and execution capability. Technological advancements and cost efficiencies across modules, inverters, and EPC services are enhancing project viability. Rising power demand from commercial, industrial, and utility-scale segments continues to support capacity additions. Overall, the sector is transitioning from policy-led expansion to a structurally resilient, investment-driven growth phase.





Source: D&B Desk Research

The graph indicates a strong and consistent growth trajectory for the Indian Solar PV market, with market size expanding from USD 12.0 billion in FY2026E to USD 22.0 billion by FY2030F. This near-doubling over four years reflects a robust CAGR of 16.4%, highlighting sustained momentum in solar capacity additions and associated value-chain activities, including EPC services, module manufacturing, and balance-of-system components. The steady year-on-year increase suggests that growth is not driven by a single surge year, but rather by a structurally strengthening market supported by long-term demand fundamentals.

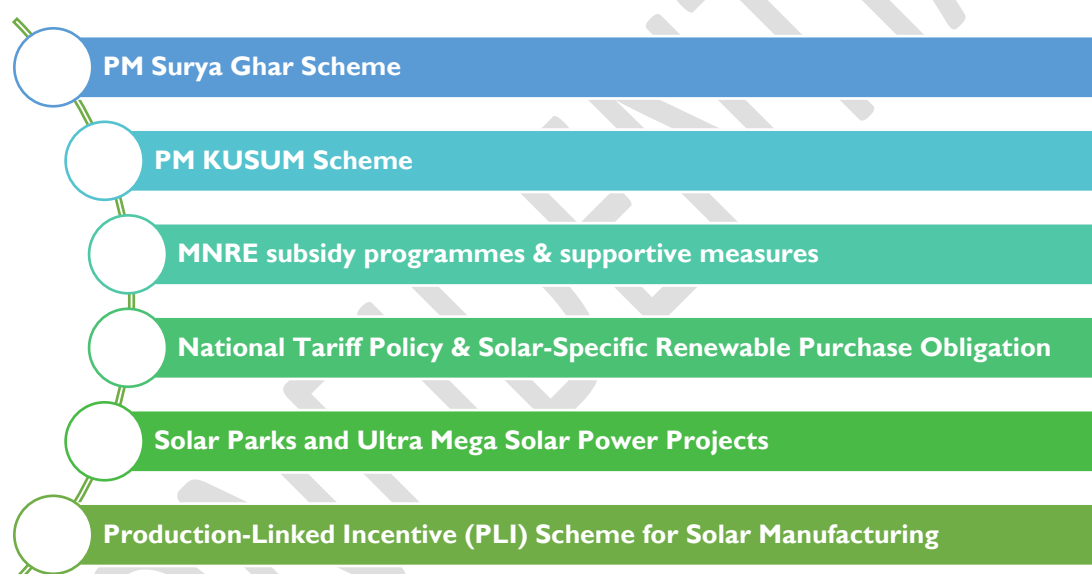
This projected expansion is underpinned by supportive government policies, ambitious renewable energy targets, declining solar technology costs, and rising power demand driven by industrialisation and electrification. Increased investments in utility-scale solar projects, along with accelerating adoption of rooftop and distributed solar across commercial and industrial segments, are likely to contribute to this growth. Additionally, grid modernisation efforts, solar-plus-storage deployments, and the push for domestic manufacturing under initiatives such as “Make in India” are expected to deepen the market, reinforcing India’s position as one of the fastest-growing solar PV markets globally over the forecast period.



Regulatory Landscape- India

India's solar power sector operates in a dynamic regulatory environment, with central and state-level policies aimed at accelerating renewable energy adoption. The government, through the Ministry of New and Renewable Energy (MNRE) and allied agencies, has introduced a mix of subsidy programmes, tariff regulations, renewable purchase obligations, and infrastructure initiatives to drive growth across rooftop, distributed, and utility-scale solar projects. Flagship schemes such as PM Suryaghar and PM-KUSUM have created significant opportunities for EPC players, while measures such as the National Tariff Policy, the RPO framework, solar parks, and the Production Linked Incentive scheme are reshaping market structures and supply chains. Together, these policies not only stimulate demand but also influence project viability, execution models, and risk allocation for EPC contractors.

Analysis of key Regulatory Policies/Programs that have an Impact on the Functioning of the Industry



- PM Suryaghar Scheme:** The PM Suryaghar initiative, introduced in February 2024 with an estimated allocation of about **INR 75,021 crore**, is aimed at expanding residential rooftop solar adoption through **FY 2026–27**. The scheme provides financial support to households installing rooftop systems, offering assistance for smaller installations and additional support for capacity up to a defined limit. By encouraging households to generate part of their own electricity, the programme seeks to reduce dependence on grid supply and promote decentralised energy use. The initiative is expected to expand rooftop installations across the country and create opportunities for installation, servicing, and long-term maintenance activities in the residential segment.
- PM KUSUM Scheme:** The PM-KUSUM programme focuses on expanding solar-based energy solutions in rural and agricultural areas, including solar-powered irrigation pumps and feeder-level solar plants. The scheme is scheduled to continue through **FY 2027**. It supports farmers and rural communities in



generating electricity locally, helping to reduce reliance on conventional energy sources. Implementation of the programme has generated demand for decentralised solar infrastructure, including installation and maintenance of solar pumps and small-scale plants, thereby supporting activity in rural solar deployment and related services.

- **MNRE subsidy programmes & supportive measures:** Through the **Grid-Connected Rooftop Solar Programme Phase II**, the government has set a target of installing **40,000 MW** of rooftop solar capacity by **March 2026**. The programme provides central financial assistance to residential consumers and performance-based incentives to distribution companies for facilitating rooftop installations of up to **18,000 MW**. Clarifications regarding subsidy eligibility under **virtual net metering** arrangements have widened access to support for certain consumers. These measures are expected to maintain momentum in rooftop solar deployment and support continued growth in distributed solar installations across residential and small commercial segments.
- **National Tariff Policy & Solar-Specific Renewable Purchase Obligation (RPO) / REC Framework:** The Tariff Policy under the Electricity Act, 2003 (first notified in January 2006 and revised on January 28, 2016) provides for Renewable Purchase Obligations that require distribution companies and specified consumers to source a portion of electricity from renewable energy. The solar-specific obligation followed a phased trajectory, rising from **0.25% in 2012 to 3% by 2022**. The Renewable Energy Certificate (REC) system was introduced to enable compliance by allowing entities to purchase certificates representing renewable generation. As of **2025**, India's renewable energy capacity has expanded substantially, and the country continues to work toward its long-term objective of achieving **500 GW of non-fossil fuel-based capacity by 2030**. This framework has supported renewable energy procurement and encouraged further investment in clean energy projects. State-level RPO targets have since been subsumed within the unified Renewable Consumption Obligation (RCO) framework notified by the Ministry of Power under the Energy Conservation Act, 2001.
- **Solar Parks and Ultra Mega Solar Power Projects:** To accelerate large-scale solar deployment, the government has promoted the development of solar parks and ultra-mega solar projects that provide ready infrastructure for project developers. As of **February 2025**, a total of **55 solar parks** had been approved across multiple states, representing about **39,958 MW** of capacity, with around **12,804 MW** already commissioned across **24 parks**. These projects offer pre-arranged land, transmission connectivity, and regulatory clearances, which help reduce development timelines and execution risks. Large solar parks continue to support capacity additions and provide opportunities for project development and long-term operations.
- **Production-Linked Incentive (PLI) Scheme for Solar Manufacturing:** The government's **Production-Linked Incentive (PLI)** scheme for high-efficiency solar PV modules aims to strengthen domestic manufacturing across the solar value chain. The programme has an allocation of approximately



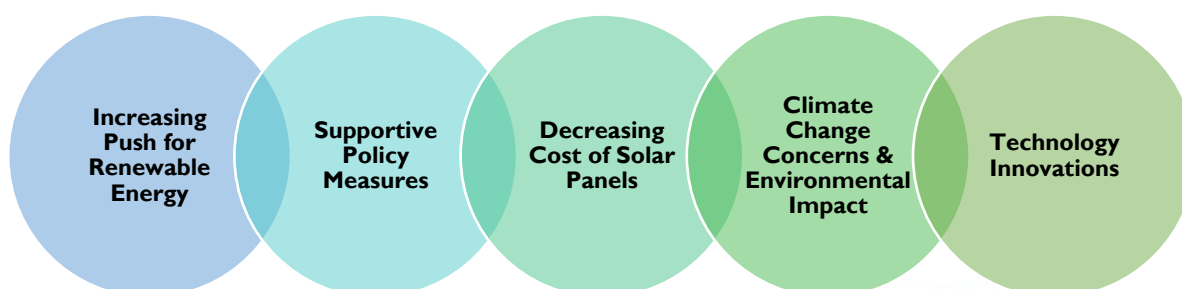
INR 19,500 crore for the period **FY 2022–27** and covers manufacturing of modules, cells, and associated components. By encouraging domestic production, the scheme is expected to improve supply-chain stability, reduce reliance on imports, and support the timely execution of solar projects. The initiative aligns with India's broader objective of expanding installed solar capacity toward **280 GW by 2030**, contributing to the country's wider renewable energy targets.

State-Level Regulatory Policy Frameworks' Impact on EPCs

State	Policy Framework / Regulatory Body	Key Features
Maharashtra	Maharashtra Energy Department / MSEDCL	- Promotion of solar rooftop and ground-mounted projects - Net metering policy - Incentives for solar generation
Rajasthan	Rajasthan Renewable Energy Corporation Limited (RRECL) / RIPS	- Large-scale solar parks & rooftop projects - Fiscal incentives under Rajasthan Investment Promotion Scheme - Solar policy targets aligned with national renewable energy goals
Gujarat	Gujarat Energy Development Agency (GEDA) / Gujarat Renewable Energy Policy 2023	- Development of solar parks & distributed solar projects - Subsidy schemes & capital incentives - Renewable energy targets for state & private sector

Demand Scenario: Global & India

Demand Drivers- Global & Key region



- **Increasing Push for Renewable Energy:** Governments worldwide are accelerating the transition away from non-renewable energy sources to reduce dependence on fossil fuels and enhance long-term energy sustainability. Solar PV has emerged as a cornerstone technology due to its scalability and wide applicability across utility-scale, commercial, and residential segments. Growing renewable energy targets and decarbonisation commitments are sustaining strong global demand for solar installations.
- **Supportive Policy Measures:** Policy frameworks such as renewable purchase obligations, auctions, feed-in tariffs, tax incentives, and net-metering schemes continue to underpin solar PV adoption globally. These measures reduce investment risks, improve project bankability, and encourage private sector participation. Long-term policy visibility in major markets has been a key enabler of sustained solar capacity additions.
- **Decreasing Cost of Solar Panels:** Significant declines in PV module prices, driven by manufacturing scale-up, technological improvements, and supply chain optimisation, have improved the cost competitiveness of solar power. Lower balance-of-system costs and declining levelized cost of electricity (LCOE) have positioned solar PV as one of the most economical power generation options. Cost parity with conventional sources is accelerating adoption across both mature and emerging markets.
- **Climate Change Concerns & Environmental Impact:** Rising awareness of climate change impacts has intensified the push toward low-carbon energy solutions. Solar PV offers a clean alternative with minimal operational emissions, aligning well with national climate strategies and corporate ESG commitments. Increasing pressure from regulators, investors, and consumers is reinforcing demand for solar-based power generation.
- **Technology Innovations:** Advancements such as high-efficiency modules, bifacial panels, improved inverters, and digital monitoring systems have enhanced solar plant performance and reliability. These innovations improve energy yields and reduce lifecycle costs, making solar projects more attractive to developers and utilities. Continuous R&D is expanding solar PV's applicability across diverse climatic and grid conditions.
- **Rising AI Adoption and Data Centre Expansion as Structural Drivers of Global Energy Demand:**
 - **AI and Data Centres as Emerging Structural Drivers of Power Demand:** The increasing adoption of Artificial Intelligence (AI), cloud computing, and digital services is driving rapid expansion in global data centre infrastructure. Data centres are energy-intensive facilities requiring continuous power supply for computing operations and cooling systems. The scaling of AI workloads is expected to structurally increase global electricity consumption over the medium to long term.
 - **Growth in Global Data Centre Capacity and AI Adoption:** Global demand for data centre capacity is expected to grow significantly over the next decade, with annual demand projected to increase from around **60 GW currently to approximately 170- 220 GW by 2030**. This growth

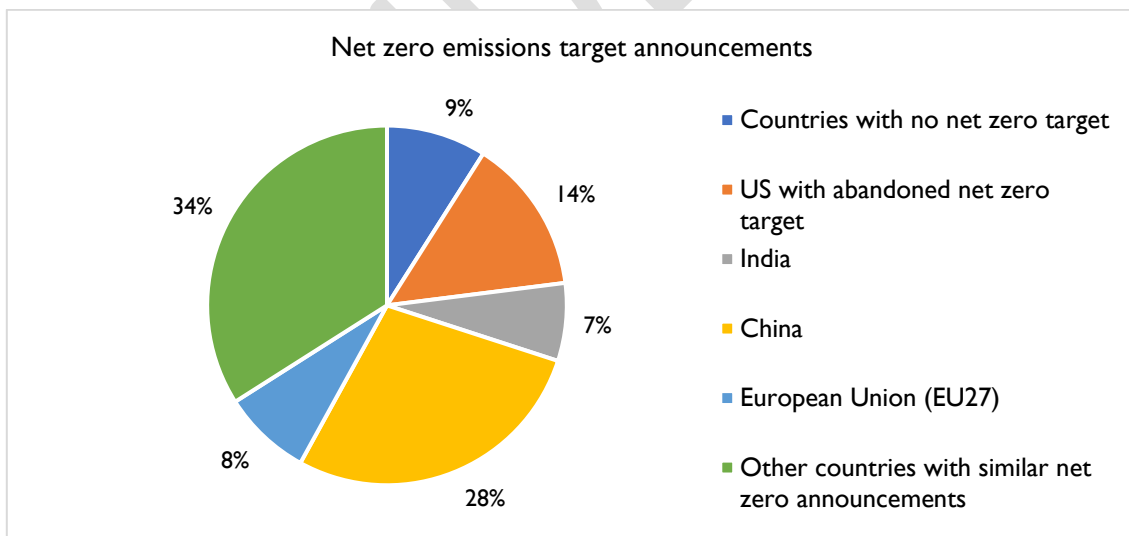


is driven by rising cloud adoption, digital transformation, and the increasing deployment of AI applications across industries such as financial services, healthcare, manufacturing, telecommunications, and e-commerce.

- **Implications for Global Electricity Consumption:** The expansion of data centre infrastructure and AI-driven computing workloads is expected to result in substantial incremental electricity demand globally. AI model training and inference require high-density computing infrastructure and advanced cooling systems, significantly increasing power consumption per unit of data processing. As a result, data centres are expected to emerge as one of the fastest-growing sources of electricity demand globally over the next decade.
- **Role of Renewable Energy in Meeting Incremental Data Centre Power Demand:** The rising electricity demand from data centres is occurring alongside increasing regulatory and corporate focus on decarbonisation. Data centre operators are increasingly procuring renewable power through long-term power purchase agreements and captive renewable generation. Solar power, due to its scalability and declining cost of generation, is expected to play a key role in meeting incremental electricity demand from data centres.

Global Decarbonisation Targets Supporting Solar and Clean Energy Growth

- **Global Net-Zero Commitments & Targets:**



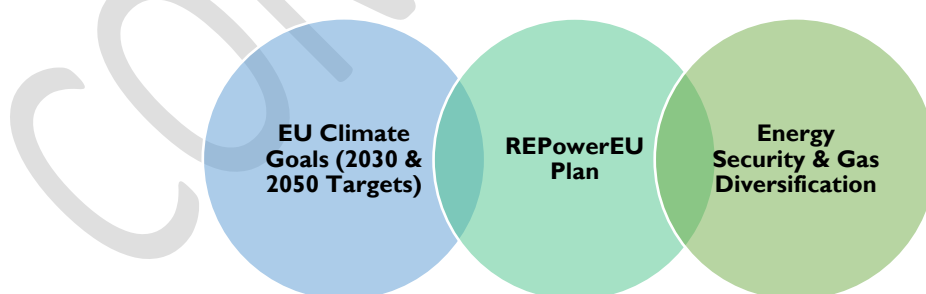
Source: D&B Primary Research

Many countries around the world have committed to achieving **net-zero carbon emissions by mid-century (typically 2050)** as part of their long-term climate strategies to meet the Paris Agreement's goal of limiting warming to 1.5 °C. According to global trackers, **around 145 countries covering ~77-90% of global greenhouse gas emissions** has announced or are considering net-zero targets, reflecting a growing global consensus on climate action.



- **Paris Agreement & Energy Sector Pathway:** The **International Energy Agency (IEA)** Net Zero by 2050 Roadmap highlights that the energy sector which is the source of roughly **75% of all greenhouse gas emissions must rapidly transition to renewables and cleaner technologies** to reach net-zero emissions globally by the specified timeline. This requires scaling up **renewable energy, energy efficiency gains, and electrification** across sectors.
- **Renewable Energy's Role in Global Net Zero:** In a net-zero pathway, renewables like **solar, wind, hydro, geothermal, and others must increase from ~6% of global energy supply today to around 16% by 2030**. Solar PV alone accounted for a majority of renewable electricity growth recently and is the only renewable technology currently on track with the IEA's net-zero scenario.
- **Scale of Global Renewable Expansion:** Global renewable power capacity has grown significantly where **582GW of new renewable capacity was added in 2024**, bringing total global installed capacity to **4.44 terawatts (TW)**, with solar PV leading additions (accounting for ~78% of growth). To align with net-zero pathways, renewables deployment must continue expanding at high annual rates and triple by 2030.
- **Economic & Emission Impacts:** Transitioning to net zero globally is expected to create jobs and **reduce greenhouse gas emissions significantly**, but it also requires a systemic shift in how electricity is generated, transmitted, and consumed essentially moving away from fossil fuels toward renewables, electrification, and energy storage technologies in every major economy.
- **Challenges & Progress Gaps:** Despite the rapid uptake of renewables, global progress is uneven. Analysis suggest that many nations remain off track to triple renewable energy capacity by 2030 an objective seen as critical to net-zero pathways with global capacity needing to reach over **11 TW by 2030** under this ambition.

➤ **European Union (EU) Demand Drivers**

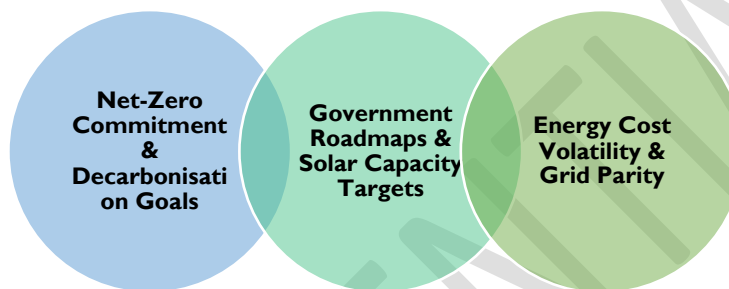


- **EU Climate Goals (2030 & 2050 Targets):** The EU's ambitious climate agenda, including enhanced 2030 renewable energy targets and climate neutrality by 2050, places solar PV at the centre of its energy transition. Solar is viewed as a scalable and rapidly deployable solution to meet interim decarbonisation milestones. These long-term targets provide structural demand support for PV installations across member states.



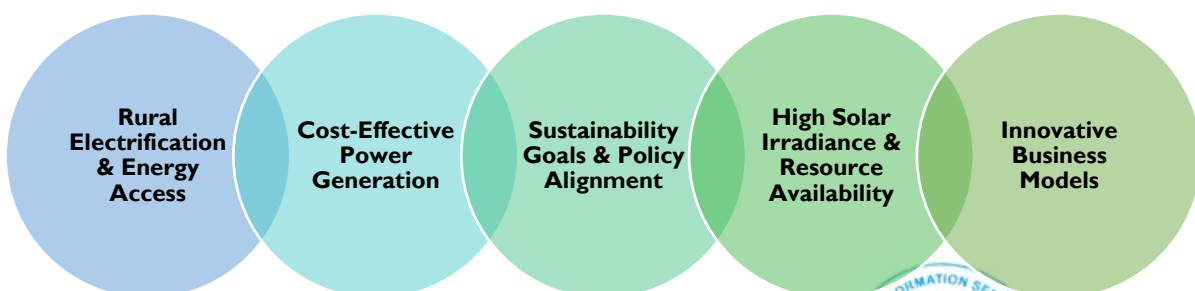
- **REPowerEU Plan:** The REPowerEU plan has accelerated renewable energy deployment to reduce reliance on imported fossil fuels and strengthen energy sovereignty. Solar PV is a priority technology due to its short development timelines and distributed generation potential. Streamlined permitting and rooftop solar mandates under this initiative are driving near- to medium-term demand.
- **Energy Security & Gas Diversification:** Geopolitical disruptions have highlighted the EU's vulnerability to external gas supplies, particularly from Russia. Solar PV helps diversify the energy mix by increasing domestic power generation capacity. This strategic shift toward energy independence is reinforcing investment momentum in both utility-scale and distributed solar systems.

➤ **United Kingdom (UK) Demand Drivers**



- **Net-Zero Commitment & Decarbonisation Goals:** The UK's legally binding net-zero target by 2050 is a primary driver of solar PV demand. Solar energy plays a critical role in decarbonising electricity generation and reducing reliance on fossil-fuel-based power. Policy alignment with broader climate objectives continues to support steady solar deployment.
- **Government Roadmaps & Solar Capacity Targets:** National solar roadmaps and capacity expansion plans provide a structured pathway for scaling installations across rooftop and ground-mounted segments. Clear targets improve investor confidence and encourage long-term project development. These initiatives are supporting consistent growth in the UK solar market.
- **Energy Cost Volatility & Grid Parity:** Rising electricity prices and market volatility have improved the economic attractiveness of solar PV for households and businesses. Grid-parity economics enable consumers to hedge against energy price fluctuations. As a result, demand for rooftop and commercial solar systems is gaining momentum.

➤ **Africa Demand Drivers**



- **Expanding Electricity Access in Underserved Areas:** In many parts of Africa, extending conventional grid infrastructure to remote or sparsely populated regions remains costly and time intensive. Solar PV systems, particularly off-grid and mini-grid solutions, provide an alternative that can be deployed more quickly and with lower upfront infrastructure requirements. As a result, solar has become an important tool for improving electricity access in rural and remote communities across the continent.
- **Improving Cost Competitiveness:** Falling prices for solar modules and related components have made solar power more affordable in several African markets. In locations that rely heavily on diesel generators, solar systems can offer a lower long-term cost of electricity, especially in off-grid or hybrid configurations. This relative cost advantage is encouraging adoption among households, small enterprises, and community-scale installations.
- **Alignment with Energy and Climate Priorities:** Many African countries are incorporating renewable energy into national development and energy planning frameworks. Solar power is being adopted to support emissions reduction objectives while also improving energy access and supporting local economic activity. Financial and technical assistance from international institutions and development agencies is also contributing to the growth of solar projects across the region.
- **Strong Solar Resource Availability:** Many parts of Africa receive high levels of solar radiation throughout the year, providing favourable conditions for solar electricity generation. This natural resource availability improves generation potential and enhances the viability of solar projects. As a result, solar PV is often viewed as one of the most suitable renewable options for large areas of the continent.
- **Emerging Financing and Delivery Models:** New business approaches, including pay-as-you-go arrangements, leasing structures, and service-based models, are helping to make solar systems more accessible to consumers who may not be able to afford upfront costs. These models allow users to pay in smaller instalments over time, expanding access among lower-income households and off-grid communities. Innovations in financing and distribution continue to play an important role in supporting solar adoption in African markets.



Demand Drivers- India Scenario

Solar power demand in India is being supported by a combination of rising electricity consumption, policy initiatives, and improvements in technology and financing. Rapid urbanisation, industrial activity, and higher household energy use continue to increase power requirements across the country. At the same time, solar energy is being positioned as a scalable and cost-competitive option within India's broader energy mix, supporting long-term supply security and emission-reduction goals.



➤ **Surge in Electricity Demand:**

Electricity consumption has expanded steadily in India over the past decade, reflecting structural growth in economic activity and rising electrification levels. Per capita consumption increased from about 957 kWh in FY 2014 to approximately 1,538 kWh in FY 2025, representing an increase of over 60% during the period. In FY 2025, India recorded a peak power demand of around 250 GW, indicating higher electricity usage across residential, commercial, and industrial segments. Continued growth in manufacturing output, services activity, infrastructure development, and cooling demand has contributed to rising electricity needs, reinforcing the requirement for additional generation capacity, including renewable and conventional power sources, to support long-term demand expansion.

➤ **Government Initiatives and Policy Support:**

Policy measures have played a significant role in supporting solar deployment. The National Solar Mission, launched in 2010, initially targeted 20 GW of solar capacity and was later expanded to 100 GW by 2022



(including 40 GW rooftop and 60 GW utility-scale). By early 2025, cumulative installed solar capacity had approached ~100 GW.

In 2024, the PM Suryaghar: Muft Bijli Yojana was introduced to support residential rooftop installations, targeting solar adoption across one crore households. The Production Linked Incentive (PLI) scheme for high-efficiency modules, with a financial allocation of INR 19,500 crore, aims to strengthen domestic manufacturing capacity and reduce import dependence. These initiatives collectively support continued solar capacity addition across segments.

➤ **Insight into evolving technologies & their impact:**

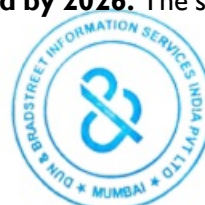
Advances in technology have improved performance and reduced costs within the solar sector. Solar module efficiencies have reached about **24–25%** in recent installations, while the cost of utility-scale solar power has declined by nearly **90% over the past decade**. Installed solar capacity stood at approximately **97.86 GW in 2025**, reflecting steady commissioning of new projects.

- New technologies such as bifacial modules, floating solar plants, and battery storage systems are improving generation output and enabling better land use. Government-supported programmes have also accelerated distributed solar adoption, with more than **700,000 rooftop installations** reported within a short implementation period under recent schemes. The sector has generated employment as well, with an estimated **238,000 jobs in grid-connected solar** and about **80,000 jobs in off-grid solar** as of 2023.
- Declining Cost of Solar Modules and Financing Support:**

Falling module prices, competitive bidding in solar auctions, and improvements in project execution have reduced the cost of solar power generation in India. Financing support mechanisms, including concessional lending through agencies such as **IREDA**, viability gap funding, accelerated depreciation benefits, and tax provisions such as **Section 80-IA**, have improved project economics. These measures have encouraged investment from private developers and supported continued expansion of both utility-scale and rooftop solar installations across the country.

➤ **Structural Impact of AI-Led Data Centre Growth on India's Power Demand:**

- **Expansion of AI and Data Centre Infrastructure in India:** India is witnessing rapid expansion in digital services, cloud adoption, and AI-driven applications, which is driving growth in domestic data centre infrastructure and associated electricity demand. Data centres require uninterrupted power for computing and cooling operations, resulting in high and stable electricity demand profiles.
- **Growth in Domestic Data Centre Capacity and AI Applications:** India's data centre Installed capacity is expected to increase from approximately **853 MW in 2023 to ~1,645 MW by 2026**, with **~791 MW of additional capacity expected to be added by 2026**. The sector is expected



to continue expanding, supported by cloud adoption, digital public infrastructure, and AI-driven computing demand.

- **Implications for India's Electricity Demand Profile:** The expansion of data centre infrastructure and AI-driven workloads is expected to materially increase electricity consumption in India. AI-driven data centres could consume approximately **40- 50 TWh of electricity annually by 2030**, representing a significant incremental demand on the national power system. Data centres operate on a 24x7 basis and require significant power for IT infrastructure and cooling systems, resulting in high base-load electricity demand.
- **Role of Solar and Renewable Energy in Supporting Data Centre Power Requirements:** The increasing electricity demand from data centres aligns with India's policy focus on renewable energy and decarbonisation. Data centre operators are increasingly exploring renewable power procurement through open-access power purchase agreements and captive solar installations to manage energy costs and meet sustainability commitments. Solar power is expected to play an important role in meeting incremental electricity demand from data centres, supporting long-term renewable capacity additions in India.

India Net-Zero Carbon Goals:

- **India's Net-Zero Target & Climate Commitments:** India has officially pledged to achieve **net-zero greenhouse gas emissions by 2070** while pursuing its developmental goals. This long-term target was formalized during the **UN climate negotiations** and aligns with India's Paris Agreement commitments.
- **Renewable Capacity Growth & Current Status:** India's renewable energy expansion has accelerated: as of late 2025, non-fossil fuel capacity (including solar, wind, hydro, and nuclear) crossed **~259 GW**, achieving a **50% share of total installed electricity capacity ahead of the 2030 target**. Solar PV forms a significant part of this mix.
- **Renewable & Power Sector Expansion Needed for Net Zero:** According to a recent **NITI Aayog report**, India will require **cumulative investments of about USD 14.23 trillion in the power sector alone by 2070** to enable a net-zero scenario. This includes large expansions in renewables, storage, transmission, and electrification infrastructure.
- **Renewable Energy as the Backbone of Transition:** Under the net-zero pathway, India's installed renewable energy capacity mix could grow enormously with solar PV projected to reach **3,250-5,500 GW** by 2070, and wind capacity exceeding **1,000 GW** making renewables the structural backbone of India's energy system.
- **Electricity Demand & Grid Transformation:** Electrification will play a central role: by 2070, electricity's share in final energy consumption could rise to around **60%** from about 21% today, driven by electric mobility, cooling demand, and industrial electrification. This underscores the need for grid upgrades and flexibility to integrate high shares of renewables.



- **Policy & Investment Landscape:** India's rapid renewable additions including record solar capacity growth reflect strong policy support and market momentum. Meeting future net-zero goals will require continued policy focus, financing mechanisms, and deployment of grid technologies to support variable renewable integration.

Solar Power EPC Segment

The Solar Power Engineering, Procurement, and Construction (EPC) sector serves as the backbone of solar energy deployment, handling the complete execution of projects, from system design and component procurement to construction and commissioning. The industry's growth has been fuelled by rising adoption of renewable energy, favourable government policies, and declining costs of solar modules and associated balance-of-system components. Today, EPC companies are viewed as key partners by utilities, commercial and industrial clients, and government bodies working to achieve ambitious renewable energy targets.

The sector is also witnessing evolution in its project delivery and business models. EPC firms are increasingly adopting flexible approaches, offering solutions that range from full turnkey projects to hybrid models tailored to specific client needs. At the same time, understanding the difference between Capex-driven projects, where the client invests upfront, and Opex-focused models like RESCO, where the developer bears the initial investment, has become crucial for assessing risk, returns, and operational responsibilities. By managing project execution and optimising design, EPC players not only ensure timely implementation but also play a critical role in enhancing the efficiency, economics, and scalability of solar power projects.

Insight into the key services provided under the solar EPC segment

- **Engineering and System Design:** Solar EPC providers typically begin with a technical assessment of the project site, evaluating parameters such as solar resource availability, shading conditions, terrain characteristics, and structural feasibility. Based on this analysis, they prepare system layouts and detailed electrical and structural drawings aimed at optimising generation output. The engineering stage also involves ensuring compliance with applicable building standards, safety norms, and regulatory approvals required for project execution.
- **Procurement of Equipment and Components:** EPC firms are responsible for sourcing major project components, including solar modules, inverters, mounting structures, and other balance-of-system equipment. Vendor selection is carried out with a focus on quality, cost efficiency, and delivery timelines. Contractors also manage logistics, inventory coordination, and transportation to ensure materials reach the project site in line with construction schedules. Efficient procurement helps maintain project timelines and quality benchmarks.
- **Construction and Installation Activities:** The construction phase covers civil works, structural installation, electrical cabling, and integration of system components. Activities include site preparation,



foundation work, mounting of modules, inverter installation, and connection to the electrical system. EPC contractors typically conduct stage-wise quality checks to confirm that installation aligns with design specifications and operational requirements.

- **Testing and Commissioning:** After installation, the system undergoes performance testing and operational checks to confirm that all components function as intended. EPC teams verify output levels, system stability, and safety parameters before final handover. Clients are generally provided with guidance on system monitoring, basic maintenance requirements, and operational procedures to support smooth functioning post-commissioning.
- **Operations and Maintenance (O&M) Support:** Many EPC providers offer post-installation services aimed at maintaining system performance over its lifecycle. These services may include routine inspections, cleaning of modules, preventive maintenance, repair of components, and performance tracking through monitoring systems. Ongoing maintenance helps ensure consistent generation and reduces the likelihood of system downtime.

Project Coordination and Execution Management:

EPC contractors oversee the project from initial planning through commissioning, managing schedules, budgets, and coordination among stakeholders. This involves working with clients, suppliers, and subcontractors to address technical and logistical requirements. Effective project management helps reduce execution risks, control costs, and

EPC Business Model	Description	Advantages	Considerations
Turnkey EPC Model	A single EPC contractor manages the entire project lifecycle, from design and procurement to construction and commissioning. The client receives a fully operational system upon completion.	Simplifies project management with a single point of contact; ensures accountability and streamlined communication.	Limited client involvement in design and procurement phases.
Split EPC Model	The project is divided into separate contracts for different components or phases. For example, one contractor handles design/procurement, another handles construction/commissioning.	Allows specialization and potentially better pricing by engaging experts for each phase.	Requires effective coordination between contractors to ensure alignment and timely completion.



Owner's Engineer Model	The client hires an independent engineering firm to oversee the project, providing technical expertise, monitoring progress, and ensuring quality and specifications are met.	Provides greater client control and assurance over technical aspects.	May increase project costs due to the additional oversight layer.
EPC Hybrid Model	Combines elements of turnkey and split models. The client may engage an EPC contractor for certain phases while handling others internally or via separate contracts.	Offers flexibility and can be tailored to client-specific needs and capabilities.	Requires careful planning and coordination to ensure seamless integration.
Design-Bid-Build Model	The client separately hires a designer to create project plans/specifications, then bids out construction work to contractors.	Encourages competitive bidding and potentially lower construction costs.	Can lead to longer timelines and coordination challenges between design and construction teams.
Design-Build Model	A single entity handles both the design and construction phases of the project.	Streamlines communication and can result in faster project delivery.	Client has less control over the design process and fewer customization options.

Comparative Analysis: Opex (RESCO) and Capex (EPC) Model

Aspect	Capex (EPC) Model	Opex (RESCO) Model
Investment & Ownership	The customer makes the full upfront investment for the solar project, covering design, procurement, and installation. The asset is fully owned by the customer from day one, giving complete control over its usage and long-term benefits.	No upfront investment is required from the customer. The RESCO finances, installs, owns, and operates the system. Customers only pay for the electricity generated through a Power Purchase Agreement (PPA), typically spread over 10-25 years.



Risk & Responsibility	All risks, technical, operational, and financial, are borne by the customer. This includes responsibility for operations, maintenance, downtime, and ensuring the system performs as expected.	Most risks are transferred to the RESCO. The service provider manages financing, operations, performance, and maintenance, ensuring guaranteed output while minimizing customer involvement.
Financial Impact	Though the upfront cost is high, the payback period is usually 2-4 years depending on project size and incentives. After this period, power generation is almost free except for maintenance, making it highly cost-effective in the long run. Customers can also claim benefits like accelerated depreciation and tax credits.	Customers begin saving from day one without investing capital. Tariffs are usually lower than grid electricity, but long-term cumulative payments under the PPA may exceed the savings achievable under the Capex model. Tax incentives and subsidies are retained by the RESCO, not the customer.
Operational Aspects	Customers must take care of system monitoring, O&M, and replacement of faulty components. This requires technical expertise or additional contracts with O&M providers.	The RESCO handles all operational aspects, including regular maintenance, performance monitoring, and component replacement, often backed by service guarantees. Customers only focus on using the generated electricity.
Suitability	Best suited for large corporates, industries, or institutions with strong balance sheets, sufficient capital, and long-term commitment to sustainability. It offers ownership, higher savings, and fiscal benefits.	Suitable for customers with limited capital, smaller institutions, or businesses that prefer predictable electricity costs with minimal risk and no management burden. Particularly attractive for clients looking for hassle-free adoption.

Analysis of the role of EPC players in solar energy

EPC companies are the backbone of solar energy development, bearing full responsibility for transforming project blueprints into operating solar facilities. Their duty begins with technical design and engineering, which includes assessing site feasibility, designing system layouts, and ensuring safety and regulatory compliance. This is followed by procurement of equipment and materials, in which EPCs use global and domestic supply



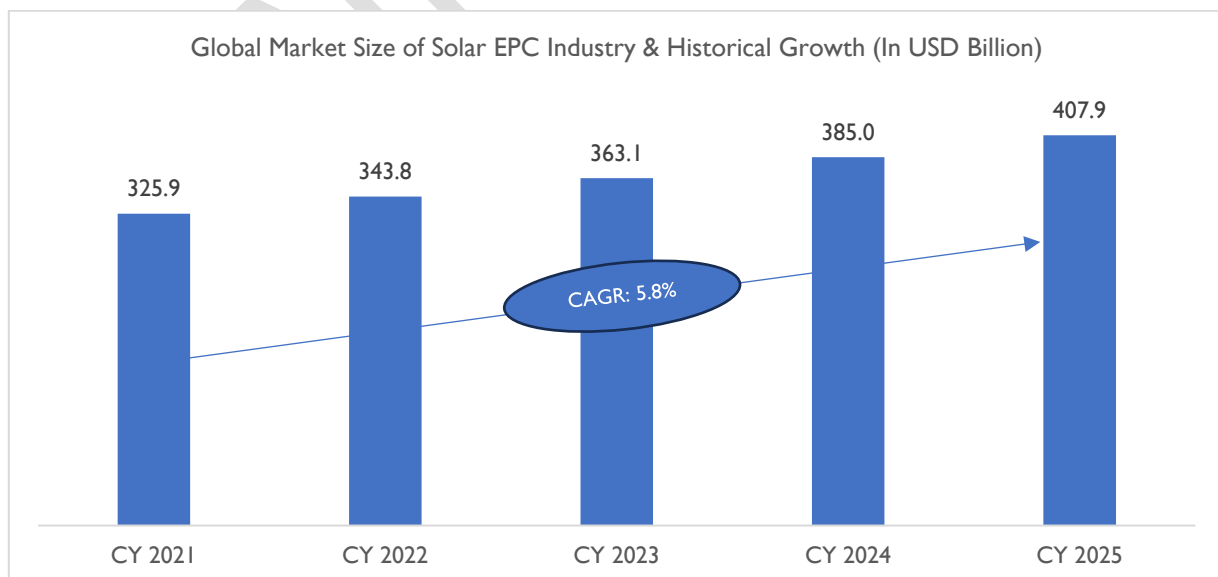
chains to acquire high-quality solar modules, inverters, and other balance-of-system components at competitive prices. Finally, through building and commissioning, EPC businesses provide fully functional solar projects on time, reducing delays and assuring reliable grid connectivity.

Beyond execution, EPC players have a strategic impact on project costs and performance. Their engineering skill has a direct impact on plant efficiency, energy yield, and long-term reliability, whilst their procurement strength decides the final project cost. By providing turnkey solutions, EPC firms lower risks for investors and developers, making solar projects more financially viable. They are also increasingly providing operations and maintenance (O&M) services, which ensure that solar plants continue to work properly throughout their lifespans. Furthermore, EPC players promote innovation and scalability by implementing modern technologies such as tracking systems, hybrid solar-storage designs, and digital monitoring platforms. In this approach, they not only complete projects, but also reduce costs, improve reliability, and expedite the whole shift to renewable energy.

Market Scenario

Global market size of solar EPC industry & historical growth trends

The global Solar EPC market demonstrates stable, resilient growth, supported by ongoing solar capacity additions worldwide. The increasing scale of utility-scale projects and the expansion of commercial and distributed solar are sustaining EPC demand. Standardisation of project design and execution has improved delivery efficiency across regions. The growing integration of storage, grid connectivity, and digital monitoring is expanding the scope of EPC services. Overall, the sector remains a critical backbone for global solar energy deployment.



Source: D&B Primary Research

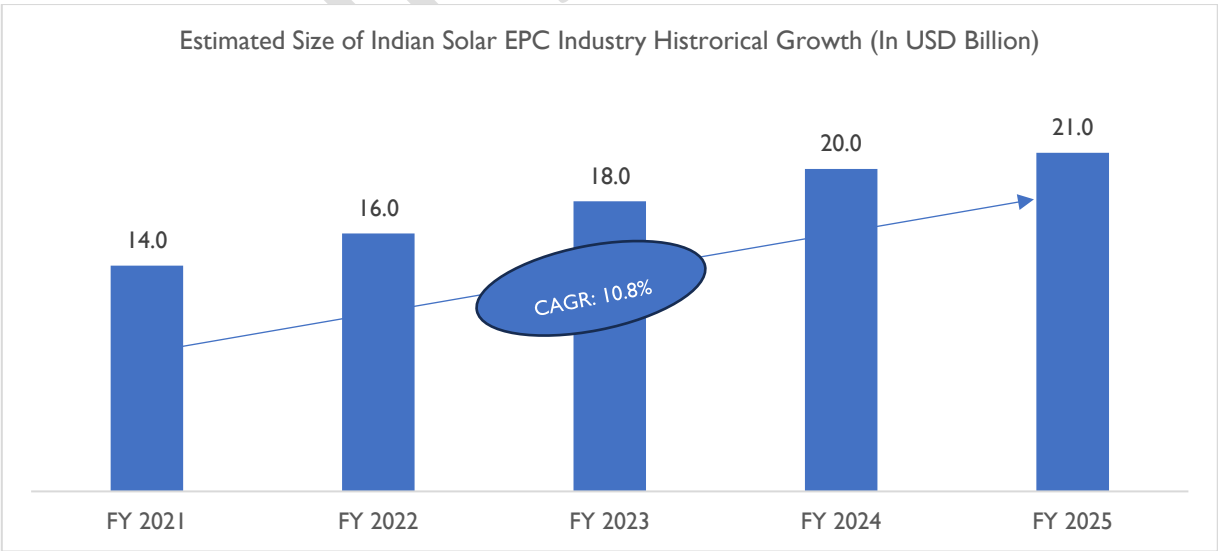


The graph illustrates steady historical growth in the global Solar EPC market, with market size increasing from USD 325.9 billion in CY2021 to an estimated USD 407.9 billion by CY2025. This expansion reflects a moderate but stable CAGR of 5.8%, indicating consistent project execution activity across utility-scale, commercial, and distributed solar installations worldwide. The year-on-year rise in market value suggests sustained demand for EPC services, supported by ongoing renewable capacity additions across both developed and emerging economies.

This growth trend is driven by global decarbonisation commitments, rising investments in large-scale solar parks, and accelerated energy transition initiatives across regions such as Asia-Pacific, Europe, and the Middle East. While supply chain disruptions and cost volatility affected timelines in earlier years, the market has demonstrated resilience through improved project standardisation and contracting frameworks. Looking ahead, continued expansion of solar capacity, increasing project complexity, and integration with energy storage and grid infrastructure are expected to keep EPC demand stable, reinforcing the sector's role as a critical enabler of global solar deployment.

Estimated size of the Indian market for the solar EPC industry & historical growth trends

The Indian Solar EPC industry is experiencing strong, sustained growth, driven by accelerating solar capacity additions nationwide. Rising utility-scale projects and increasing participation from commercial and industrial consumers are driving EPC demand. Improved policy clarity and streamlined tendering processes have enhanced visibility into project execution. Growing focus on solar parks, hybrid projects, and storage integration is increasing the complexity and value of EPC services. Overall, the sector is evolving into a mature and execution-driven market.



Source: D&B Primary Research

The graph highlights a strong, consistent expansion in the Indian Solar EPC market, with industry size increasing from USD 14.0 billion in FY2021 to an estimated USD 21.0 billion by FY2025. This growth



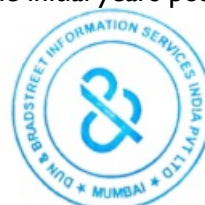
translates into a robust CAGR of 10.8% over FY2021- FY2025, underscoring the accelerating pace of solar project execution across the country. The steady year-on-year rise reflects sustained tendering activity, timely project awards, and improving execution capabilities among EPC players.

This upward trend is primarily driven by India's aggressive renewable energy targets, large-scale utility solar deployments, and rising adoption of solar across commercial and industrial segments. Policy support, availability of project financing, and declining system costs have further strengthened EPC demand. Additionally, increased focus on grid-scale solar parks, hybrid projects, and integration with energy storage is expanding the scope of EPC services, positioning the Indian Solar EPC industry for continued growth beyond FY2025.

Brief insight into solar O&M contracts in India

In India's fast-growing solar sector, **Operations & Maintenance (O&M) contracts** have become a critical element for ensuring long-term performance and reliability of solar assets. Since solar projects typically have a lifespan of 20-25 years, O&M contracts define how the plant will be monitored, serviced, and optimised during this period. These agreements clarify service providers' responsibilities, performance expectations, and cost allocations, thereby safeguarding both investors and developers.

- **Key Inclusions in O&M Contracts:** Solar O&M contracts in India typically encompass a broad range of technical, operational, and financial aspects. These include:
 - **Plant performance guarantees** such as minimum performance ratio (PR) and guaranteed energy yield, with penalties for underperformance.
 - **Preventive and corrective maintenance**, covering periodic inspections, module cleaning, inverter servicing, replacement of faulty components, and electrical safety checks.
 - **Remote monitoring services** for real-time data on energy generation, system efficiency, and fault detection.
 - **Spare parts management**, ensuring critical components are available on-site or procured quickly to minimise downtime.
 - **Reporting obligations**, including monthly and annual performance reports to project owners and financiers.
 - **Warranty management**, where the O&M provider coordinates with equipment manufacturers for claims and replacements.
- **Key Stakeholders**
 - **Project Developers / Asset Owners** – responsible for financing and overall ownership; they engage O&M contractors to ensure reliable operation.
 - **EPC Contractors** – often provide bundled O&M services for the initial years post-commissioning.



- **Specialised O&M Service Providers** – independent firms with dedicated expertise in solar plant operations, sometimes engaged after the initial EPC warranty period.
- **Lenders/Investors** require strong O&M contracts to ensure projects meet revenue expectations, as repayment depends on consistent energy generation.
- **Equipment Suppliers / OEMs** – play a role in warranty enforcement and supply of spare parts under contractual obligations.
- **Structure of O&M Contracts:** Solar O&M contracts in India are typically structured as **long-term service agreements** (5-25 years) or **short-term renewable contracts** (1-5 years, extendable). The key structures include:
 - **Comprehensive O&M Contracts** – covering all services, including manpower, equipment replacement, monitoring, and performance guarantees.
 - **Non-Comprehensive Contracts** – limited in scope, where the service provider handles only preventive and corrective maintenance; spare parts and major replacements are billed separately.
 - **Performance-linked Contracts** – increasingly common, where O&M payments are tied to energy generation levels, aligning the contractor's incentives with the owner's returns.

These contracts also specify **scope of work, service timelines, liability clauses, escalation mechanisms, and termination conditions**, ensuring accountability between asset owners and service providers. With India's growing solar capacity, over 123 GW as of August 2025, robust O&M contracting has become essential not just for sustaining generation levels but also for attracting long-term institutional investment into the sector.



Advantage of specialized solar EPC player

Technical Expertise and Specialized Knowledge

- Solar EPC players have highly skilled teams dedicated to system design, electrical engineering, structural planning, and regulatory compliance. Unlike in-house teams, which may have limited exposure, EPC firms have worked on diverse projects and bring proven best practices, leading to efficient layouts, higher generation, and lower operational risks.

Efficient Procurement and Supply Chain Management

- Specialized EPC firms maintain long-standing relationships with module, inverter, and equipment suppliers. This allows them to negotiate bulk procurement at lower costs, ensure timely delivery, and guarantee quality certifications. In contrast, in-house execution often struggles with fragmented supply chains and higher costs.

End-to-End Project Accountability

- With an EPC partner, clients have a single point of responsibility for timelines, cost management, and performance guarantees. EPCs often back their work with warranties and guaranteed output commitments, providing banks and investors greater confidence in the project's long-term viability.

Innovation and Technology Integration

- Leading EPC firms constantly adopt the latest technologies such as bifacial modules, single-axis trackers, hybrid solar-plus-storage systems, and AI-based monitoring platforms. This enhances generation efficiency and improves overall return on investment, which may not be feasible through in-house approaches due to limited technical exposure.

Execution Experience and Risk Mitigation

- Having implemented projects in varied geographies and climates, EPCs are better equipped to deal with ground realities such as land contour challenges, extreme weather, and grid interconnection delays. Their experience helps anticipate and mitigate risks, ensuring projects are delivered within time and budget.

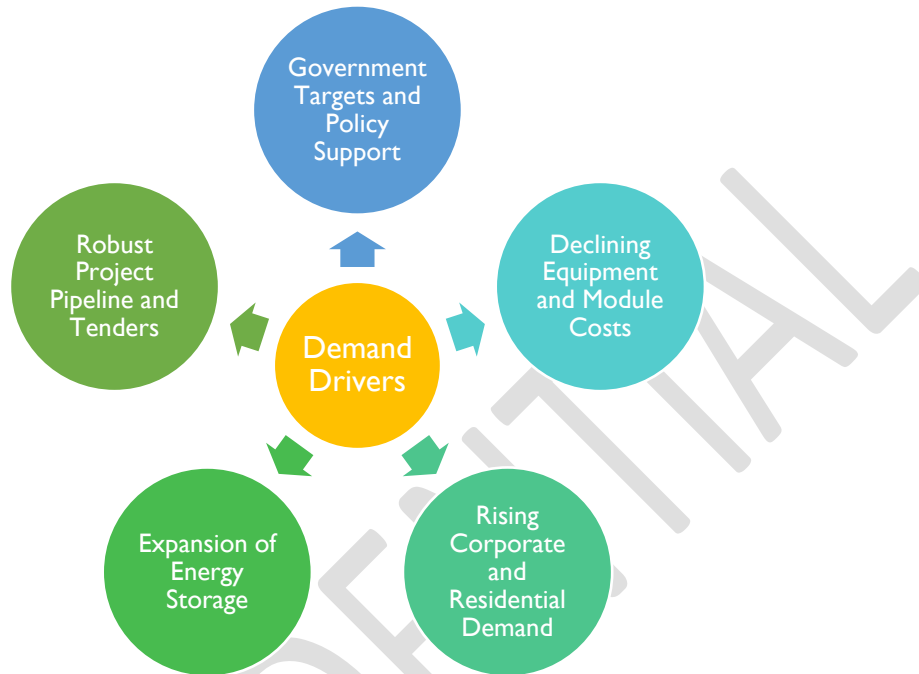
Scalability and Faster Deployment

- Specialized EPC players are structured to mobilize resources quickly and manage multiple large-scale projects simultaneously. This enables clients to scale capacity faster and capture market opportunities without being slowed down by internal capacity constraints.



Demand Dynamics

Key Growth Drivers: Analysis of Factors Driving the Growth in India.



➤ Government Targets and Policy Support

Government Targets and Policy Support **have been major drivers of growth in India's solar EPC segment**. India's ambitious renewable energy goals, including achieving **500 GW** of non-fossil fuel capacity by FY 2030, with **280 GW from solar**, have created a robust project pipeline for EPC players. As of August 2025, the Ministry of New and Renewable Energy mentioned that the country's cumulative solar capacity reached **123.13 GW**, comprising **93.90 GW** from ground-mounted plants and **20.85 GW** from rooftop installations.

The government has reinforced this growth through initiatives like the **Pradhan Mantri Suryaghar Muft Bijli Yojana**, which has significantly increased rooftop solar adoption. Supportive measures such as **Viability Gap Funding (VGF)**, **Accelerated Depreciation (AD)**, and **Production Linked Incentives (PLI)** for domestic module manufacturing have further improved project viability, reduced financial risks, and encouraged both private and institutional investments, directly benefiting EPC companies by creating a steady demand for design, procurement, and construction services.

➤ Declining Equipment and Module Costs



One of the most significant drivers for the expansion of India's solar EPC market is the steady decline in solar module and equipment costs. Over the past decade, module prices have fallen dramatically, from **over INR 200 per watt in FY 2010** to under **INR 9 per watt in FY 2024**, making solar installations more financially viable for residential, commercial, and industrial users. Simultaneously, domestic solar module manufacturing capacity has expanded to about 172 GW as on March 31, 2026, from about 74 GW in FY 2025, supported by initiatives like the **Production Linked Incentive (PLI)** scheme and the **Approved List of Models and Manufacturers (ALMM)**. This expansion has reduced dependence on imports, strengthened the supply chain, and enabled EPC companies to source high-quality components reliably.

The combination of falling equipment costs and stronger domestic manufacturing has made EPC projects more cost-competitive, improved project bankability, and expanded the overall addressable market for solar EPC players. By reducing capital expenditures and ensuring timely material availability, this driver continues to fuel growth and attract new investment in India's solar sector.

➤ **Rising Corporate and Residential Demand**

The adoption of rooftop solar systems is accelerating across both residential and corporate sectors, creating strong growth opportunities for India's solar EPC market. In FY 2024, India added approximately **3.2 GW** of rooftop solar capacity, an **88%** increase compared to the previous year. Residential consumers contributed about **74%** of this capacity, while industrial, commercial, and government installations accounted for roughly **19%, 6%, and 1%**, respectively. Government initiatives such as the **Pradhan Mantri Suryaghar Muft Bijli Yojana** have made solar installations more accessible to households by reducing upfront costs and providing incentives.

Corporate demand is also rising sharply, driven not only by cost savings but increasingly by **ESG compliance requirements for large companies, including Fortune 100 and Fortune 500 firms**. These companies are mandated to report on their environmental impact, making renewable energy adoption, such as rooftop solar, a strategic and regulatory priority. Additionally, the draft **Carbon Credits Bill in India** is expected to further incentivize solar adoption, as companies can earn carbon credits or offset emissions through renewable energy projects.

The combined demand from households and corporations has created a substantial and diversified project pipeline for EPC companies. This environment, supported by government policies, financial incentives, and increasing corporate sustainability obligations, continues to make solar energy an attractive and compelling solution for a wide range of stakeholders, driving sustained growth in the EPC segment.

➤ **Expansion of Energy Storage**

The rapid deployment of Battery Energy Storage Systems (BESS) in India is becoming a major growth driver for the solar EPC segment. Installed BESS capacity has grown sharply, from just 51 MWh in FY 2023 to 341



MWh in FY 2024, and further to 506 MWh (205 MW) in FY 2025, representing a **tenfold increase** in only two years. This surge reflects the growing need to integrate storage with solar projects to address intermittency, enhance grid stability, and optimize power dispatch.

Large-scale projects, such as Delhi's 10 MW/10 MWh BESS, Karnataka's 75 MW/150 MWh system under SECI, and Chhattisgarh's 40 MW/120 MWh BESS, alongside smaller installations in remote areas like Kavaratti's 1.4 MWh system, illustrate both the scale and geographic diversity of storage adoption. Looking forward, India currently has about 3,300 MW of BESS in the pipeline, expected to deliver 8,500 MWh over the next two years, with an additional 12,500 MW (~42,000 MWh) under tender. By FY 2032, total BESS capacity is projected to reach 74 GW (~296,000 MWh), according to the Central Electricity Authority.

For solar EPC companies, this trend opens up significant opportunities to design, integrate, and execute hybrid solar-plus-storage projects. EPC players capable of delivering end-to-end solutions, including system design, storage integration, and grid connectivity, are well positioned to meet the growing demand for reliable, round-the-clock renewable energy.

➤ **Robust Project Pipeline and Tenders**

The growth of India's solar EPC market is being strongly supported by a robust project pipeline and increasing tender activity. In FY 2024, rooftop solar tenders alone totalled **2.8 GW**, reflecting a significant rise compared to previous years. As of early FY 2025, the country had over **84.10 GW of solar capacity under implementation** and around **47.49 GW in the tendering pipeline**, according to the **Ministry of New and Renewable Energy (MNRE)**.

This steady flow of ongoing projects and tenders provides EPC players with **consistent business opportunities**, allowing them to plan resources efficiently, optimise project execution, and scale operations effectively. Additionally, competitive bidding processes contribute to **cost efficiency, improved project timelines, and enhanced execution quality**. The combination of a healthy project pipeline and structured tendering mechanisms positions the EPC sector for sustained growth and stability in India's solar market.

Key Success Factors for EPC Companies

The success of solar EPC companies depends on a combination of technical expertise, operational efficiency, financial strength, and innovation. Companies that excel in these areas can deliver high-quality projects, optimize performance, and maintain a competitive edge in India's growing solar market.

- **Technical Expertise and Engineering Capabilities:** EPC companies must have strong design and engineering skills to optimise solar system performance, ensure compliance with technical and safety standards, and integrate advanced technologies such as battery storage or hybrid solar-plus-storage



solutions. Superior engineering capabilities enable higher efficiency, reliability, and long-term operational success for solar projects.

- **Project Management and Execution Efficiency:** Efficient planning, resource allocation, and execution are essential for delivering projects on time and within budget. Companies capable of managing multiple large-scale projects simultaneously, coordinating across different geographies, and addressing unforeseen challenges demonstrate operational excellence and gain client trust.
- **Supply Chain and Vendor Management:** Reliable procurement of high-quality modules, inverters, and other components at competitive prices is crucial. EPC companies with strong vendor relationships and a resilient supply chain can ensure timely deliveries, reduce costs, and avoid project delays, which is particularly important in large-scale or tender-driven projects.
- **Financial Strength and Risk Management:** Adequate capital and effective risk management enable EPC firms to manage working capital, secure project financing, and navigate uncertainties such as regulatory changes, project delays, and price fluctuations. Strong financial health ensures stability and the ability to undertake multiple projects concurrently.
- **Innovation and Adaptability:** EPC companies that adopt innovative technologies, implement smart O&M solutions, and offer hybrid solar-plus-storage systems can differentiate themselves in a competitive market. Adaptable companies can respond quickly to evolving client requirements and policy changes, enhancing their overall value proposition.

Challenges Faced by EPC Players

- **High Capital Intensity and Financing Constraints:** EPC projects, especially in renewable energy and large infrastructure, require substantial upfront investment. Securing financing can be challenging due to fluctuating interest rates, limited availability of concessional loans, and lenders' risk perceptions. Delays in fund disbursement often impact project timelines. Additionally, smaller EPC firms struggle to compete with larger players who have easier access to credit. This financial pressure can also affect the ability to procure advanced technology or skilled labour on time.
- **Project Execution and Time Overruns:** Managing project schedules is a critical challenge, as delays can lead to cost overruns and penalties. Factors such as logistical constraints, raw material unavailability, or unforeseen site conditions often disrupt timelines. Coordination across multiple vendors and subcontractors adds complexity. EPC firms, even minor delays in high-value projects can cascade, affecting both profitability and client trust.
- **Regulatory and Policy Uncertainty:** EPC players operate in environments where policies, tariffs, and environmental regulations frequently evolve. Delays in approvals, unclear permitting processes, or sudden regulatory changes can disrupt project planning. For instance, shifts in renewable energy incentives or local land-use regulations directly impact project feasibility. Firms must constantly adapt to maintain



compliance, which increases administrative burden and project costs. Navigating these uncertainties requires close engagement with regulators and proactive risk assessment.

- **Supply Chain and Equipment Challenges:** Global and domestic supply chain disruptions can significantly affect EPC execution. Shortages of critical components, fluctuations in raw material costs, and delays in importing specialised equipment can stall projects. EPC companies need strong vendor networks and contingency plans to mitigate supply risks. Additionally, currency fluctuations for imported equipment can escalate costs. Efficient logistics and procurement strategies are crucial for timely project delivery and maintaining budgetary control.
- **Skilled Labour Shortage and Workforce Management:** EPC projects demand highly skilled engineers, technicians, and project managers. Recruiting and retaining talent, especially in remote locations, is challenging. Workforce shortages can delay construction, affect quality, and increase operational risks. Training and upskilling initiatives are necessary but often add to project costs. Moreover, labour laws and safety regulations require strict adherence, and non-compliance can result in legal and financial penalties, further complicating workforce management.
- **Intense Competition and Margin Pressure:** The EPC sector is highly competitive, with multiple players bidding for similar projects. Aggressive pricing and underbidding can erode profit margins. Large multinational firms with more resources often dominate high-value projects, leaving smaller players with lower-margin work. Cost overruns, penalties, and fluctuating input costs further squeeze profitability. EPC firms must balance competitive pricing with maintaining operational efficiency and high-quality standards to sustain long-term business growth.

Outlook for the EPC Market

The outlook for India's solar EPC market remains **highly positive**, underpinned by robust government targets, rising demand across residential, commercial, and industrial segments, and increasing adoption of hybrid solar-plus-storage solutions. With India aiming for **500 GW of non-fossil fuel capacity by 2030**, including **280 GW from solar**, the EPC segment is expected to benefit from a strong pipeline of utility-scale, rooftop, and distributed solar projects.

Emerging trends such as **energy storage integration, smart monitoring, and advanced O&M solutions** are creating opportunities for EPC players to offer higher-value services and differentiate themselves in a competitive market. While challenges such as financing constraints, regulatory changes, and supply chain volatility persist, companies with **technical expertise, operational efficiency, and innovative solutions** are well-positioned to thrive. Overall, the solar EPC sector is poised for **sustained growth, greater competitiveness, and strategic importance** in India's renewable energy transition.



Emerging Innovation & Trends

Analysis of Emerging Technologies & Trends in the Solar EPC Space

- **Digitalisation of Site Assessment and Engineering Processes:** Solar EPC companies are progressively integrating digital workflows into early-stage project planning. Instead of relying solely on conventional surveys, firms now deploy tools such as 3D modelling software, satellite-based mapping, and unmanned aerial inspections to analyse site characteristics. These technologies improve the precision of terrain evaluation, structural positioning, and shading estimation. By enabling more accurate system configuration at the design stage, digital planning reduces rework during construction and enhances overall project efficiency.
- **Mechanisation and Process Optimisation in Project Execution:** Large-scale solar installations are increasingly incorporating mechanised installation practices to enhance consistency and speed. Specialised installation equipment supports improved module alignment and structural assembly, particularly in expansive utility projects. In the operational phase, automated cleaning mechanisms are being introduced to maintain panel efficiency in regions prone to dust accumulation. Such systems contribute to stable energy output while reducing dependence on manual intervention and lowering long-term operational expenditure.
- **Data-Driven Monitoring and Predictive Asset Management:** The integration of connected sensors and advanced analytics is reshaping how solar plants are monitored and maintained. Continuous data streams from inverters, modules, and environmental sensors allow operators to assess performance conditions in real time. Analytical systems evaluate this data to detect deviations from expected output levels and flag potential technical issues. By identifying early warning signals, operators can undertake preventive actions that limit downtime and support sustained generation performance.
- **Lifecycle Optimisation through Virtual Modelling:** Digital plant replicas often referred to as virtual performance models are gaining relevance in solar asset management. These tools simulate plant behaviour under different environmental and load conditions, enabling scenario analysis without physical intervention. Through such simulations, operators can evaluate performance strategies, assess system upgrades, and enhance operational planning across the plant's lifecycle. This capability strengthens long-term performance management and decision-making.
- **Competitive Differentiation through Transparency and Technology Adoption:** As the solar EPC landscape becomes more competitive, firms are increasingly leveraging technology to enhance transparency and client engagement. Real-time progress tracking systems and performance dashboards provide stakeholders with visibility into project milestones and operational metrics. Companies that adopt structured digital systems, data reporting mechanisms, and efficiency-driven execution models are better positioned to deliver predictable outcomes and maintain credibility in a rapidly evolving market environment.



Threats & Challenges



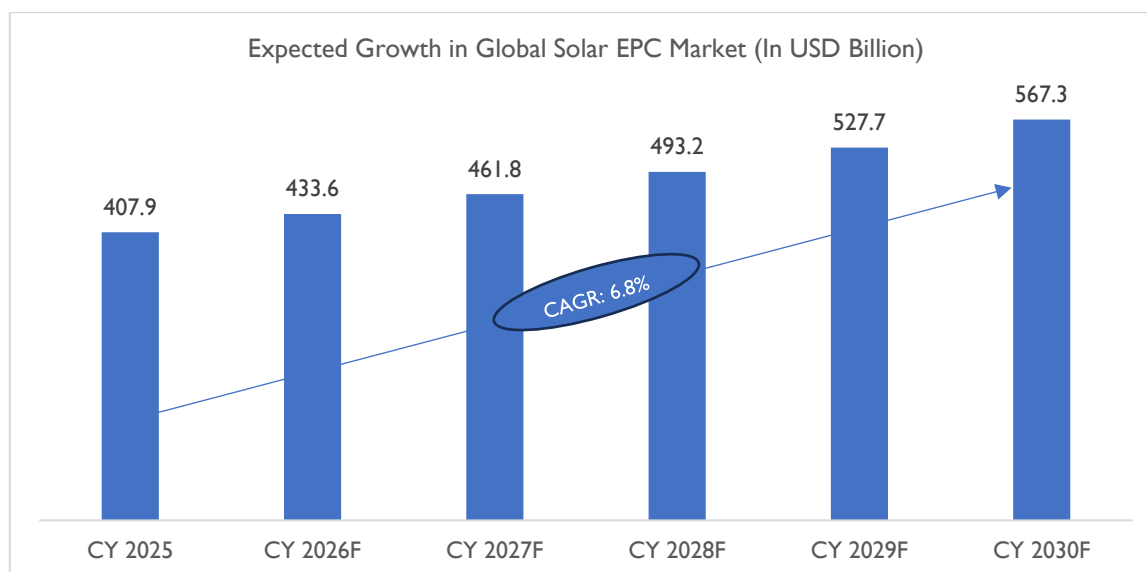
Growth Forecast

Expected growth in the global solar EPC market

The global market for solar engineering, procurement, and construction (EPC) services is projected to grow steadily over the coming years, supported by continued expansion of solar capacity and rising investment in renewable energy infrastructure. Increasing development of large-scale solar projects across multiple regions, along with cross-border investment flows into clean energy, is expected to sustain demand for EPC services. At the same time, the addition of storage systems, hybrid renewable configurations, and grid integration requirements is broadening the scope of solar project execution, creating more complex and higher-value



EPC assignments. Improvements in supply chain reliability and greater standardisation in system design are also contributing to more efficient project delivery.



Source: D&B Primary Research

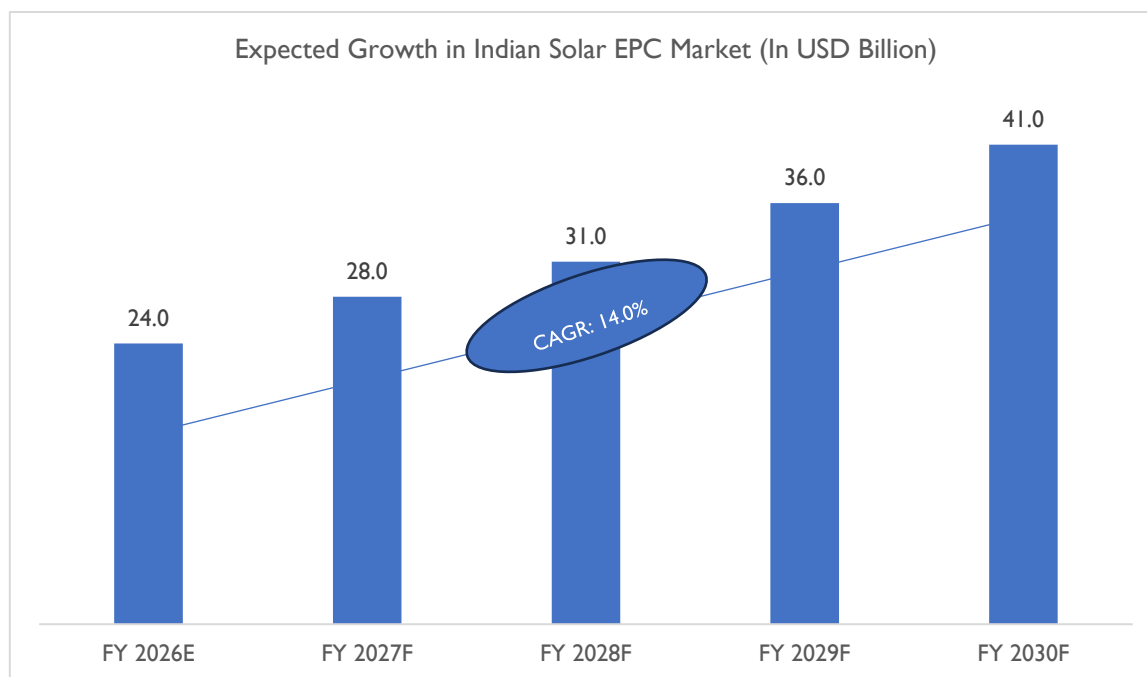
Industry estimates indicate that the global solar EPC market could increase from about USD 407.9 billion in CY 2025 to approximately USD 567.3 billion by CY 2030F, reflecting 6.8% CAGR over the forecast period. This projected expansion suggests continued growth in solar project development across utility-scale, commercial, and distributed segments. The upward trajectory is linked to ongoing capacity additions in key markets and sustained policy emphasis on renewable energy deployment.

Growth over the medium term is expected to be supported by long-term emission reduction targets, rising capital allocation toward renewable energy projects, and continued construction of large solar installations across regions such as Asia-Pacific, Europe, the Middle East, and the Americas. The increasing integration of energy storage, hybrid renewable systems, and grid modernisation initiatives is also expanding the size and complexity of EPC contracts. As project pipelines grow and systems become more sophisticated, EPC contractors are likely to remain central to the delivery of new solar capacity across global markets.



Expected growth in the Indian solar EPC market

The Indian solar EPC market is set for strong growth, driven by government renewable energy targets, policy support, and rising numbers of utility-scale and rooftop projects. Mid-teens CAGR is expected, with integrated and quality-focused EPC players likely to gain the most. Expansion in grid-linked and hybrid solutions will further support the sector.



Source: D&B Primary Research

The graph indicates a strong, sustained expansion in the Indian Solar EPC market, with market size projected to grow from **USD 21.0 billion in FY2025 to USD 41.0 billion by FY2030F**. This near-doubling over five years reflects robust project pipelines across utility-scale, commercial & industrial (C&I), and rooftop solar segments. The consistent year-on-year increase highlights improving execution capabilities of EPC players, rising tender activity by central and state agencies, and continued momentum in large solar park developments. Supportive government policies, declining solar module prices over the medium term, and increasing private sector participation are further reinforcing market growth.

Overall, the market is projected to grow at a **CAGR of 14.0% during FY2025- FY2030F**, underlining solar EPC as one of the fastest-growing segments within India's renewable energy ecosystem. Growth is also being driven by India's long-term renewable targets, grid-scale solar additions aligned with energy transition goals, and increasing integration of hybrid projects combining solar with storage. As capacity additions accelerate and project sizes increase, EPC contractors with strong balance sheets, technological expertise, and execution track records are expected to capture a larger share of this expanding market.



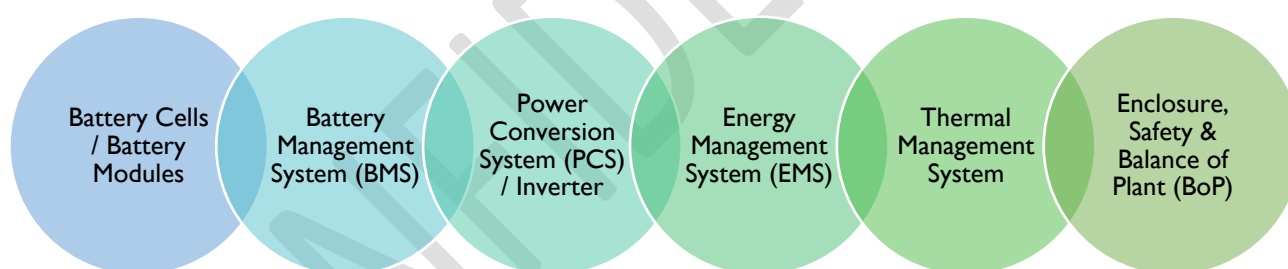
Battery Energy Storage System (BESS) Landscape: Global & India

Concept of BESS, a brief insight into its functioning, and major components in BESS

A Battery Energy Storage System (BESS) is an integrated system that stores electrical energy in chemical form using rechargeable batteries and then converts it back to electricity when needed. BESS plays an important role in modern power systems by balancing supply and demand, enhancing grid stability, and allowing for greater use of renewable energy sources like solar and wind. Globally, BESS is increasingly seen as a critical enabler of the energy transition, facilitating peak shaving, frequency management, backup power, and energy arbitrage.

In operation, the BESS charges when excess electricity is available, such as during periods of high renewable generation or low demand, and discharges when demand is high or generation is low. Power electronics convert AC grid power to DC for battery charging and back to AC for discharge. Advanced control systems continuously monitor battery health, state of charge, temperature, and grid conditions to ensure safe, efficient, and dependable operation across a wide range of use cases, including utility-scale installations, commercial and industrial applications.

Major Components of a BESS



- **Battery Cells / Battery Modules**

Battery cells are the fundamental energy-storage units that store electrical energy chemically. Cells are assembled into modules, then into battery packs, to achieve the desired voltage and capacity. Common chemistries include lithium-ion (LFP, NMC), lead-acid, sodium-ion, and flow batteries, with lithium-ion dominating globally and in India. The choice of chemistry affects energy density, cycle life, safety, cost, and operating temperature range. Proper cell selection is critical for performance, longevity, and compliance with safety standards.

- **Battery Management System (BMS)**

The BMS is the “brain” of the battery system, responsible for monitoring and protecting the battery. It continuously measures parameters such as voltage, current, temperature, and state of charge of each cell or



module. The BMS prevents unsafe conditions like overcharging, deep discharging, overheating, and short circuits. It also balances cells to ensure uniform performance and extends battery life. Advanced BMS solutions enable predictive maintenance and real-time diagnostics, which are essential for large-scale BESS deployments.

- **Power Conversion System (PCS) / Inverter**

The PCS converts electrical energy between AC and DC, enabling interaction with the battery, the grid, or the load. During charging, it converts AC power from the grid or a renewable source into DC power for the batteries. During discharging, it converts DC power back into AC at the required voltage and frequency. The PCS also controls active and reactive power, supports grid services like frequency regulation, and ensures compliance with grid codes. Its efficiency and response time significantly influence overall system performance.

- **Energy Management System (EMS)**

The EMS is the supervisory control layer that optimises the BESS's overall operation. It decides when to charge or discharge the batteries based on electricity prices, load demand, renewable generation forecasts, and grid signals. The EMS integrates with utility SCADA systems, renewable plants, and market platforms to maximise economic and operational benefits. In India, EMS plays a vital role in managing peak demand and improving renewable integration. It also generates reports and analytics for performance tracking and regulatory compliance.

- **Thermal Management System**

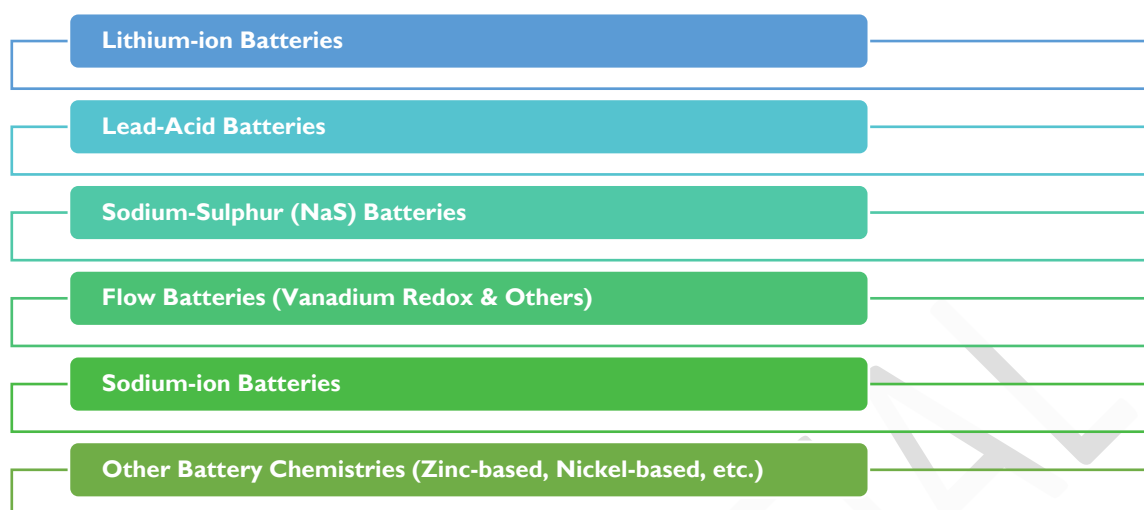
Batteries are highly sensitive to temperature, making thermal management essential for safety and longevity. This system maintains batteries within an optimal temperature range using air, liquid, or hybrid cooling. Effective thermal management prevents overheating, reduces degradation, and minimises the risk of thermal runaway. It also ensures consistent performance across varying ambient conditions, which is particularly important in India's hot climate. Proper design of this system directly impacts battery life and system reliability.

- **Enclosure, Safety & Balance of Plant (BoP)**

The enclosure houses batteries, electronics, and auxiliary systems, protecting them from environmental factors such as dust, humidity, and extreme temperatures. Safety systems include fire detection and suppression, gas detection, insulation monitoring, and emergency shutdown mechanisms. Balance of Plant components, such as transformers, switchgear, cabling, and grounding systems, enable safe and reliable grid interconnection. Robust enclosure and safety design are critical to meeting international standards and ensuring safe operation throughout the system's lifecycle.



Types of battery chemistry (Lithium-ion, Lead-Acid, Sodium-Sulphur, others)



➤ **Lithium-ion Batteries**

Lithium-ion batteries are the most widely used battery chemistry in modern BESS applications globally and in India. They offer high energy density, fast response times, and high round-trip efficiency, making them ideal for grid-scale, commercial, and renewable integration projects. Common variants include Lithium Iron Phosphate (LFP) and Nickel Manganese Cobalt (NMC), with LFP increasingly preferred due to better thermal stability and longer cycle life. Lithium-ion batteries support frequent charge–discharge cycles and advanced control through BMS. However, they require sophisticated safety and thermal management systems and entail higher upfront costs than some alternatives.

➤ **Lead-Acid Batteries**

Lead-acid batteries are one of the oldest and most established energy storage technologies. They are known for low upfront costs, high reliability, and ease of recycling, supported by a well-established supply chain. These batteries are commonly used in backup power, telecom towers, and small-scale stationary storage applications. However, lead-acid batteries have low energy density, shorter cycle life, and limited depth of discharge compared to lithium-ion batteries. They are less suitable for high-cycling or large-scale grid applications, but still relevant for cost-sensitive and standby use cases.

➤ **Sodium-Sulphur (NaS) Batteries**

Sodium-sulphur batteries are high-temperature batteries that operate at around 300–350°C and are mainly used for large-scale, long-duration energy storage. They offer high energy density, long cycle life, and good efficiency for multi-hour discharge applications. NaS batteries are particularly well-suited for grid stabilisation, load levelling, and smoothing renewable energy. However, their high operating temperature requires robust



thermal insulation and safety systems. Due to safety concerns and complex operations, their deployment is limited and largely concentrated in utility-scale projects, especially in countries such as Japan.

➤ **Flow Batteries (Vanadium Redox & Others)**

Flow batteries store energy in liquid electrolytes contained in external tanks, allowing independent scaling of power and energy capacity. Vanadium Redox Flow Batteries (VRFB) are the most mature type and are well-suited for long-duration storage applications (4-10+ hours). They offer long cycle life, deep discharge capability, and high safety with minimal fire risk. However, flow batteries have lower energy density and higher initial capital costs, and they require more space. They are gaining interest for grid-scale and renewable firming applications, including pilot projects in India.

➤ **Sodium-ion Batteries**

Sodium-ion batteries are an emerging alternative to lithium-ion batteries, using abundant and low-cost sodium instead of lithium. They offer improved safety, good performance at high temperatures, and reduced dependence on critical minerals. While energy density is lower than that of lithium-ion batteries, sodium-ion batteries are promising for stationary storage where space and weight are less critical. The technology is still in early commercialisation, but it holds strong potential for India given local resource availability and supply chain advantages.

➤ **Other Battery Chemistries (Zinc-based, Nickel-based, etc.)**

Other battery chemistries, such as zinc-air, zinc-bromine, and nickel-cadmium, are used in niche applications. Zinc-based batteries offer strong safety and long-term storage potential but remain under development. Nickel-based batteries are robust and perform well in extreme temperatures but are expensive and less energy-dense. These chemistries are generally selected for specific industrial, defence, or remote-area applications rather than mainstream grid-scale BESS.

Type of BESS (Front-of-the-meter & Behind-the-meter)

➤ **Front-of-the-Meter (FTM) BESS**

Front-of-the-Meter BESS refers to energy storage systems that are installed on the utility side of the electricity meter, directly connected to the transmission or distribution network. These systems are typically owned and operated by utilities, independent power producers, or system operators. FTM BESS is primarily used to provide grid-level services, including frequency regulation, peak load management, renewable energy integration, and transmission congestion relief. In both global and Indian power systems, FTM BESS is emerging as a critical asset for enhancing grid flexibility and reliability, particularly as renewable penetration increases.



FTM BESS participates in wholesale electricity markets or utility contracts and is often dispatched based on grid requirements rather than end-user demand. These systems are typically large-scale, ranging from several megawatts to hundreds of megawatts, with discharge durations of one to multiple hours. In India, FTM BESS is being deployed alongside solar and wind projects and as standalone storage assets under government tenders to support peak power and reduce reliance on fossil fuel-based peaking plants.

Key Characteristics of FTM BESS:

- Connected to the transmission or distribution grid
- Provides grid services and market-based functions
- Utility-scale capacity (MW- GWh range)
- Supports renewable energy integration and grid stability

➤ Behind-the-Meter (BTM) BESS

Behind-the-Meter BESS is installed on the consumer side of the electricity meter, typically at residential, commercial, or industrial facilities. These systems are designed to manage on-site energy consumption, reduce electricity bills, and provide backup power during outages. BTM BESS is commonly paired with rooftop solar PV systems to store excess generation for later use. In India, BTM storage is gaining traction in commercial and industrial (C&I) sectors due to high demand charges, unreliable grid supply in some regions, and the need for energy cost optimisation.

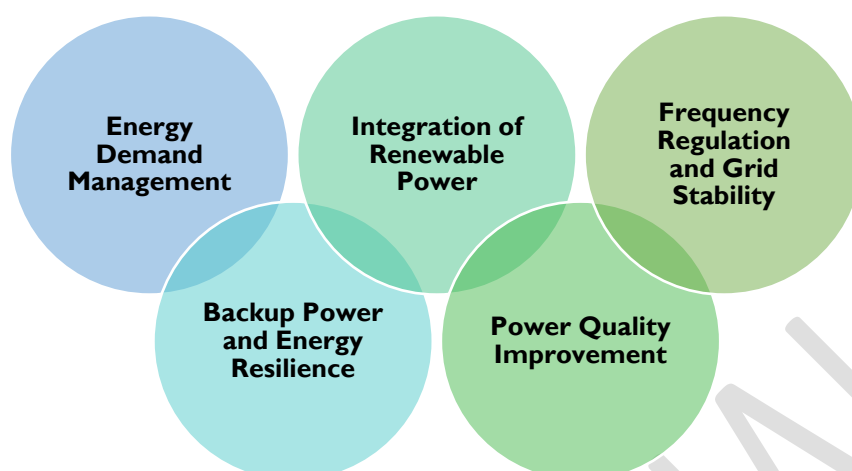
BTM BESS operates primarily based on the end-user's load profile and electricity tariff structure rather than grid-level signals. Applications include peak shaving, demand charge reduction, power quality improvement, and energy resilience. These systems are typically smaller than FTM BESS, ranging from a few kilowatt-hours to several megawatt-hours. With falling battery costs and supportive policies, BTM BESS is expected to grow rapidly in urban, industrial, and renewable-rich regions.

Key Characteristics of BTM BESS:

- Installed at customer premises
- Optimizes energy costs and provides backup power
- Often paired with rooftop solar or DG sets
- Small to medium scale (kW- MWh range)



Key applications



- **Energy Demand Management:** Energy demand management is one of the most important applications of BESS, particularly for utilities and commercial & industrial (C&I) consumers. BESS enables peak shaving by discharging stored energy during high-demand periods, thereby reducing peak load on the grid and lowering demand charges for consumers. It also supports load shifting, where energy is stored during off-peak, low-cost periods and used during peak, high-cost periods. In India, this application is especially valuable due to time-of-day tariffs, rising peak demand, and stressed distribution networks. By flattening demand curves, BESS reduces the need for expensive peaking power plants and defers investments in grid infrastructure upgrades.
- **Integration of Renewable Power:** BESS plays a critical role in enabling large-scale integration of intermittent renewable energy sources such as solar and wind. Since renewable generation is variable and weather-dependent, BESS stores excess power during periods of high generation and releases it when generation drops or demand increases. This helps in smoothing output, firming renewable power, and reducing curtailment. In India, where solar generation peaks during daytime while demand often peaks in the evening, BESS bridges this mismatch effectively. Globally, renewable-plus-storage projects are increasingly replacing conventional thermal power for meeting peak and reliability requirements.
- **Frequency Regulation and Grid Stability:** Frequency regulation is a fast-response grid service where BESS adjusts power output within milliseconds to maintain grid frequency within permissible limits. Unlike conventional generators, batteries can respond almost instantaneously to frequency deviations, making them highly effective for stabilizing power systems. BESS can absorb excess power during over-frequency conditions and inject power during under-frequency events. This capability is becoming increasingly important as renewable penetration rises and conventional rotating inertia decreases. In India, BESS is being evaluated and deployed to support grid stability and reduce reliance on thermal plants for ancillary services.



- **Backup Power and Energy Resilience:** BESS provides reliable backup power during grid outages, ensuring continuity of operations for critical infrastructure such as hospitals, data centres, telecom networks, and industrial facilities. Unlike diesel generators, batteries offer instant power without emissions, noise, or fuel logistics. BESS can operate independently or in hybrid configurations with solar PV and DG sets, forming microgrids. In regions with grid reliability issues or frequent outages, BESS significantly enhances energy resilience. This application is increasingly relevant in India's commercial and industrial sectors and remote or islanded grids.
- **Power Quality Improvement:** BESS helps improve power quality by mitigating voltage fluctuations, flicker, and harmonics in distribution networks. It provides fast reactive power support and voltage regulation, especially in areas with high renewable penetration or sensitive industrial loads. For industries such as manufacturing, pharmaceuticals, and IT services, maintaining power quality is critical to avoid equipment damage and production losses. BESS-based solutions are increasingly used as an alternative to traditional power quality equipment, offering multifunctional benefits in a single system.

BESS usage areas



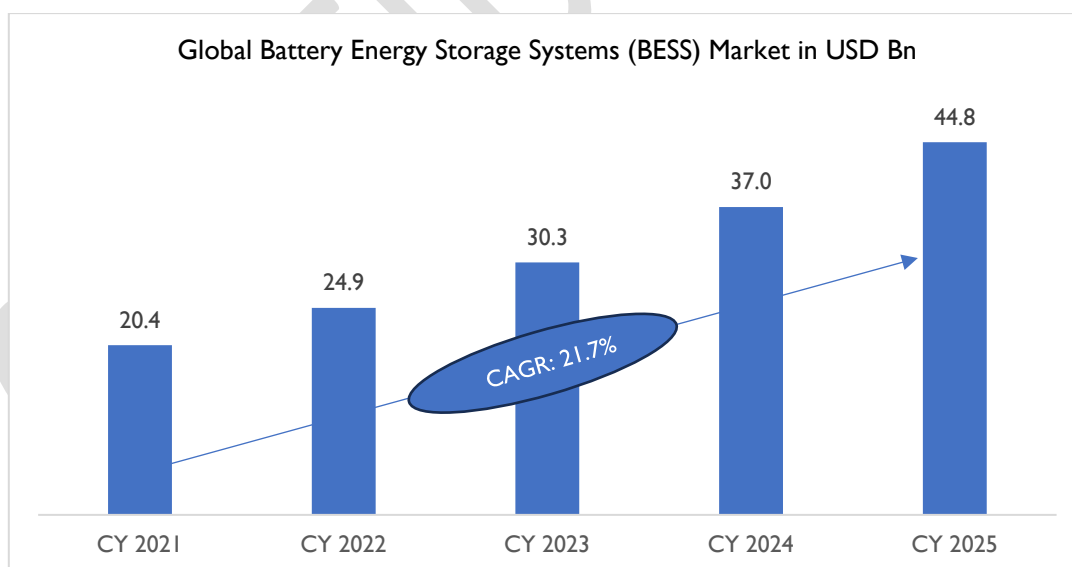
- **Residential & Commercial Applications:** In residential and commercial sectors, BESS is primarily used to reduce electricity costs, improve energy reliability, and maximize the use of rooftop solar systems. Homeowners and commercial building operators store excess solar energy generated during the day and use it during evening peak hours or power outages. This reduces dependence on the grid and lowers electricity bills under time-of-day tariffs. In commercial establishments such as offices, malls, hospitals, and educational institutions, BESS supports peak shaving, backup power, and power quality improvement. In India, adoption is growing due to increasing rooftop solar installations, rising tariffs, and the need for uninterrupted power supply.
- **Utility Grid Applications:** Utility-scale BESS is deployed on transmission and distribution networks to support grid stability, reliability, and flexibility. These systems help manage peak demand, provide frequency regulation, and balance supply demand fluctuations caused by renewable energy integration. Utility grids use BESS for energy arbitrage, congestion management, and transmission deferral. In India, large-scale BESS projects are being implemented alongside solar and wind power plants and as standalone storage assets under government-led tenders. Globally, utility BESS is becoming a key alternative to conventional peaking power plants.



- **Industrial Applications:** In industrial facilities, BESS is used to ensure operational continuity, optimize energy costs, and improve power quality. Industries with high energy consumption and sensitive equipment such as manufacturing, steel, cement, chemicals, and data centres use BESS for peak demand management and voltage stabilization. BESS also provides seamless backup power, reducing reliance on diesel generators and lowering emissions. In India, industrial users are increasingly adopting BESS to mitigate grid unreliability, manage demand charges, and comply with sustainability goals.
- **Transportation & Mobility Applications:** BESS plays a critical role in electrifying transportation, particularly for electric vehicles (EVs) and charging infrastructure. Stationary BESS is deployed at EV charging stations to manage peak loads, reduce grid stress, and enable fast charging without costly grid upgrades. In railways, metros, and electric bus depots, BESS stores regenerative braking energy and provides backup power. In India, as EV adoption accelerates, BESS is becoming an essential component of charging infrastructure and public transport electrification. This application supports grid-friendly mobility and enhances overall energy efficiency.

Estimated global market size of the BESS market & historical growth trend

The chart illustrates the steady and accelerating expansion of the global Battery Energy Storage Systems (BESS) market from CY 2021 to CY 2024. Market size increased from USD 20.4 billion in CY 2021 to USD 37.0 billion in CY 2024, reflecting strong momentum supported by an estimated CAGR of 21.7%. This growth trajectory highlights the rising strategic importance of energy storage in the global energy transition.



Source: D&B Primary Research

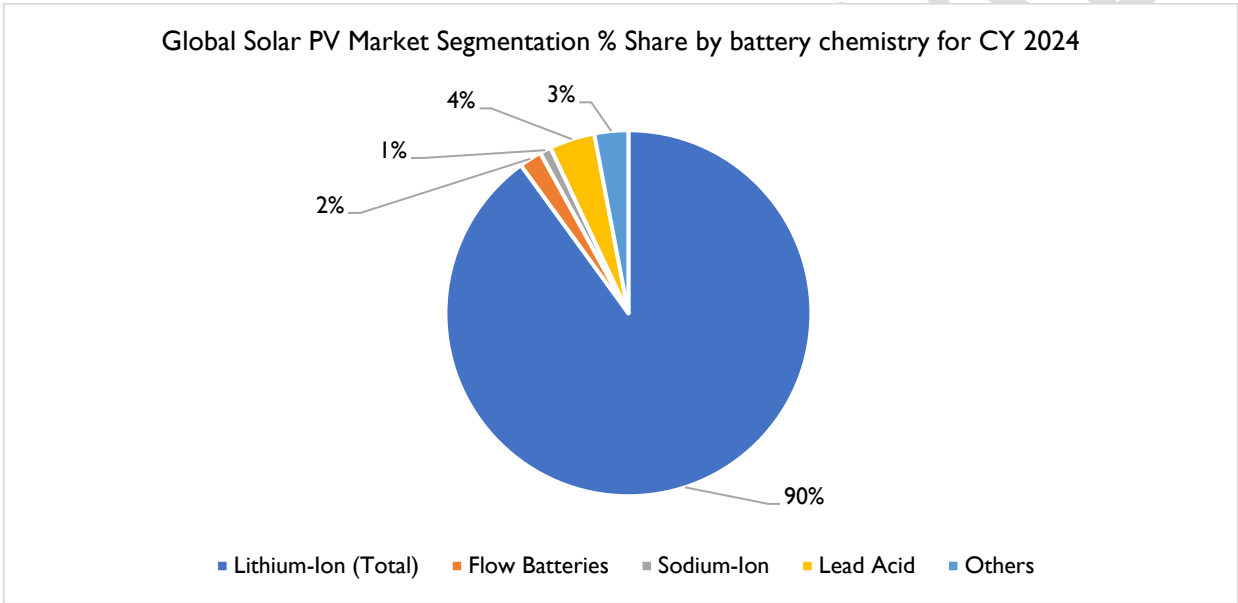
Between CY 2021 and CY 2022, the BESS market grew from USD 20.4 billion to USD 24.9 billion, indicating early acceleration driven by increasing renewable energy integration and declining lithium-ion battery costs. Growth further accelerated in CY 2023, with the market reaching USD 30.3 billion, driven by large-scale



deployment of grid-connected storage, rising investments in solar and wind power, and growing demand for peak-load management and grid-stability solutions.

By CY 2024, the market had expanded to USD 37.0 billion, underscoring BESS's transition from a niche supporting technology to a core component of modern power infrastructure. Policy supports for clean energy, increasing electrification of transport and industry, and the need for resilient and flexible power systems are sustaining high growth rates. The consistent upward trend suggests continued expansion in the medium term, with BESS playing a critical role in enabling renewable penetration, energy security, and decarbonisation objectives globally.

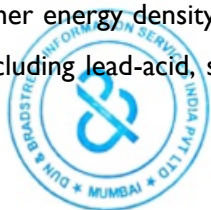
Global market segmentation: By Battery Chemistry



Source: D&B Primary Research

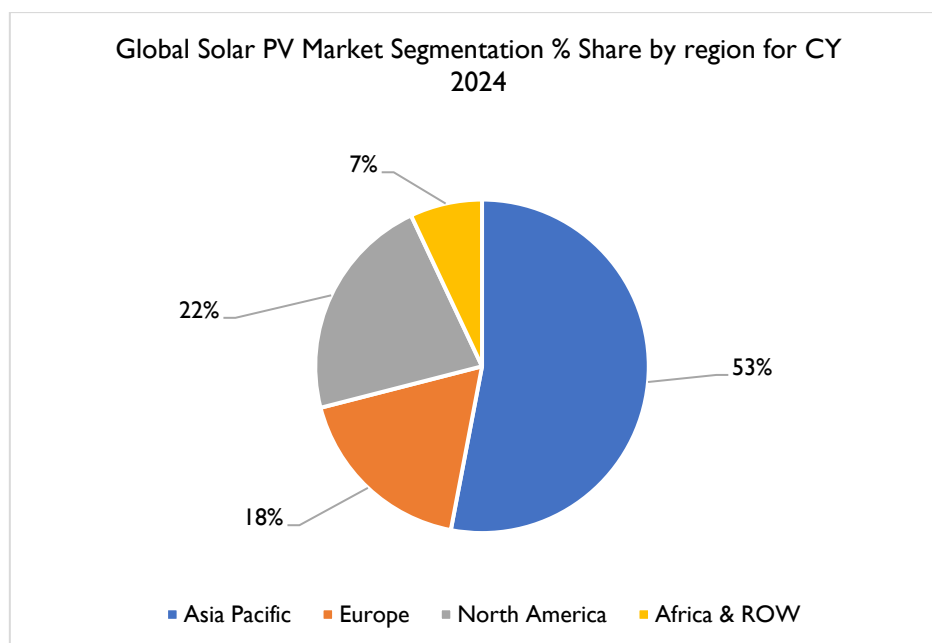
The global solar PV-linked energy storage market in CY 2024 is overwhelmingly dominated by lithium-ion battery technologies, which together account for around 90% of total installations. This strong dominance is driven by lithium-ion batteries' superior energy density, rapidly declining costs, high round-trip efficiency, and well-established global supply chains. The widespread deployment of utility-scale solar projects, coupled with increasing requirements for grid balancing, peak shaving, and renewable integration, has further reinforced lithium-ion's position as the preferred storage technology across both grid-scale and commercial applications.

Within the lithium-ion segment, Lithium Iron Phosphate (LFP) batteries represent approximately 60% of lithium-ion deployments, equivalent to about 54% of the overall market, reflecting their growing preference in stationary energy storage due to longer cycle life, enhanced safety, and lower cost compared to cobalt-based chemistries. Nickel Manganese Cobalt (NMC) batteries account for the remaining 40% of the lithium-ion segment, or roughly 36% of the total market, supported by their higher energy density and established adoption in space-constrained applications. Non-lithium technologies, including lead-acid, sodium-ion, flow



batteries, and others, collectively hold a marginal share, indicating that while alternative chemistries are emerging for niche and long-duration use cases, lithium-ion is expected to remain the backbone of solar energy storage systems in the near to medium term.

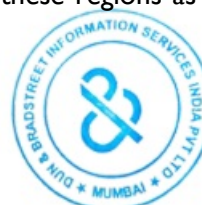
Global market segmentation: By region



Source: D&B Primary Research

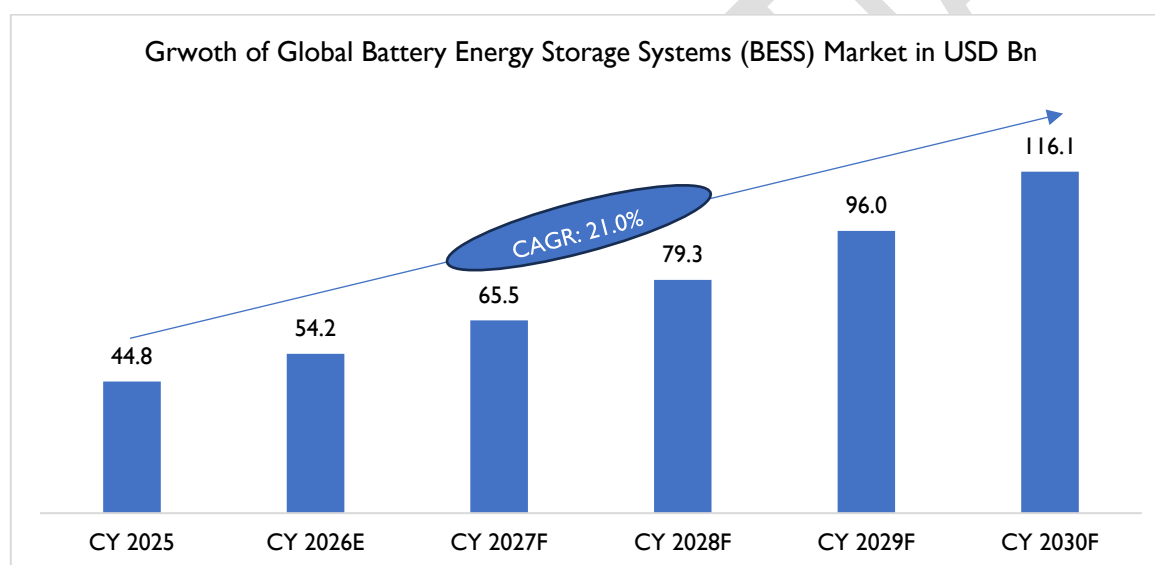
The global solar PV market in CY 2024 is led by the Asia-Pacific region, accounting for approximately 53% of the total market. This dominance is driven by large-scale solar capacity additions across China, India, Southeast Asia, and other emerging economies, supported by strong government policy frameworks, competitive project economics, and rapid industrial and urban growth. The region's leadership is further reinforced by its position as a global manufacturing hub for solar modules, inverters, and balance-of-system components, enabling cost efficiencies and faster deployment timelines.

Europe and North America together account for a substantial share of the market, contributing approximately 18% and 22%, respectively. Growth in these regions is supported by decarbonisation targets, grid modernisation initiatives, and policy incentives aimed at accelerating renewable energy adoption. Europe's expansion is closely linked to energy security concerns and net-zero commitments, while North America benefits from long-term incentives, corporate renewable procurement, and investments in solar-plus-storage projects. Africa and the rest of the world collectively account for about 7% of the market, reflecting relatively early-stage adoption; however, improving access to financing, rising electricity demand, and increasing focus on distributed and off-grid solar solutions position these regions as emerging growth opportunities over the medium to long term.



Expected growth in the global BESS market size

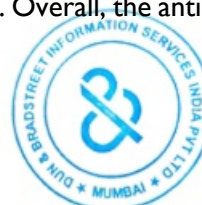
The global market for Battery Energy Storage Systems (BESS) increased significantly, demonstrating storage technologies' growing significance in supporting developing power systems, between CY 2021 and CY 2024. During this time, the market grew from around USD 20.4 billion in CY 2021 to nearly USD 37.0 billion in CY 2024, representing a compound annual growth rate of approximately 21.7%. This development emphasizes the growing importance of energy storage in facilitating renewable energy adoption and boosting grid flexibility.



Source: D&B Primary Research

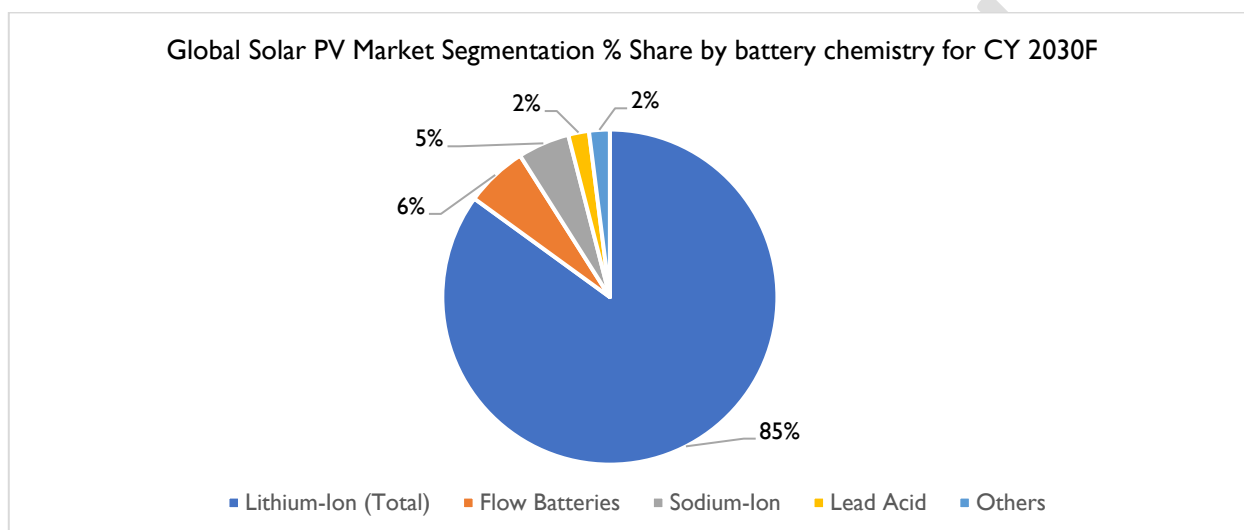
The continuous year-on-year increase in market size from USD 54.2 billion in CY 2026E to USD 79.3 billion in CY 2028F demonstrates the continued investment momentum in utility-scale, commercial, and industrial storage applications. Rapid expansion of solar and wind capacity, an increasing demand for grid balancing and peak load control and falling battery costs due to technological advancements and economies of scale are all key growth drivers. Furthermore, supportive policy frameworks, storage capacity auctions, and sustainable energy infrastructure incentives are driving large-scale BESS deployments in major countries.

By CY2030F, the market is expected to exceed reach USD 116.1 billion, indicating BESS's evolution into a critical component of modern power systems. The expanding adoption of solar-plus-storage and wind-plus-storage projects, the increasing electrification of transportation and industry, and the necessity for resilient decentralized energy infrastructure are all projected to drive rapid growth. Overall, the anticipated trajectory



shows solid long-term fundamentals for the BESS market, establishing it as a key component of global energy transition and decarbonisation initiatives.

Global market segmentation: By battery chemistry



Source: D&B Desk Research

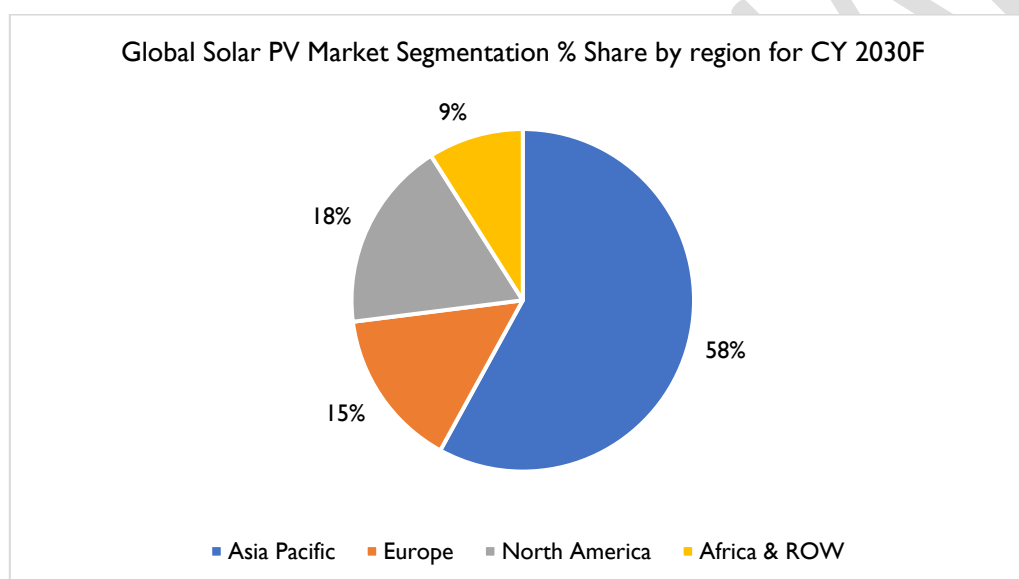
The chart highlights the projected battery chemistry mix for the global solar PV–linked energy storage market in CY 2030. While lithium-ion batteries are expected to retain a dominant position, their overall share is projected to moderate to around 85%, reflecting gradual diversification toward alternative battery chemistries as storage requirements evolve and new technologies mature. Lithium-ion’s continued leadership is underpinned by its proven performance, declining costs, and entrenched manufacturing ecosystem, particularly for grid-scale and commercial solar-plus-storage installations. However, the slight reduction in market share compared to earlier years indicates increasing adoption of non-lithium technologies for specific use cases.

Flow batteries are projected to account for approximately 6% of the market by CY 2030, owing to their suitability for long-duration storage and applications requiring high cycling stability. Sodium-ion batteries are expected to capture approximately 5% of the market, driven by cost advantages, raw material availability, and growing interest in reducing reliance on lithium supply chains. Lead-acid and other emerging technologies together account for the remaining share, reflecting their continued relevance in niche, cost-sensitive, and distributed applications. Overall, the evolving chemistry mix suggests a gradual shift toward a more diversified



energy storage landscape, while lithium-ion remains the backbone of solar energy storage systems in the medium term.

Global market segmentation: By region



Source: D&B Desk Research

The chart presents the projected regional distribution of the global solar PV market for CY 2030. Asia-Pacific is expected to further consolidate its leadership position, accounting for approximately 58% of the global market share, reflecting sustained capacity additions, large-scale manufacturing capabilities, and strong policy support across key countries in the region. Asia Pacific's growing dominance is driven by the continued expansion of solar installations in China, India, and Southeast Asia, supported by cost competitiveness, rapid urbanisation, and government-led renewable energy targets. The region's integrated solar value chain from module manufacturing to project development continues to enable faster deployment and lower system costs. In contrast, Europe's share is projected to moderate to around 15% by CY 2030, as mature markets stabilise despite ongoing investments driven by decarbonisation commitments and energy security considerations.

North America is expected to maintain a significant presence with an estimated 18% share, supported by long-term policy incentives, corporate renewable procurement, and growth in solar-plus-storage projects.



Africa and the rest of the world are projected to increase their combined share to approximately 9%, indicating gradual but steady adoption of solar PV, driven by rising electricity demand, improved access to financing, and the expansion of distributed and off-grid solar solutions. Overall, the regional outlook highlights a continued shift of global solar PV growth toward emerging and high-growth markets, with Asia Pacific remaining the primary engine of expansion through 2030.

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Global Regulatory Landscape

➤ **Inflation Reduction Act (IRA) & Federal Energy Storage Policies - United States (2022 onwards)**

The United States has established one of the most comprehensive regulatory frameworks for energy storage through the Inflation Reduction Act (IRA) and related federal policies. A key provision of the IRA is the extension of the Investment Tax Credit (ITC) to standalone energy storage systems, allowing developers to claim up to 30% tax credit on project costs. This marked a significant regulatory shift, as earlier incentives were primarily limited to storage paired with renewable energy. The inclusion of standalone BESS has expanded deployment across utility-scale, commercial, and residential segments.

In addition to tax incentives, the U.S. government has introduced multiple funding and policy initiatives through the Department of Energy (DOE), including the Energy Storage Grand Challenge (ESGC), which focuses on technology innovation, domestic manufacturing, and large-scale deployment. Federal laws such as the Infrastructure Investment and Jobs Act have allocated billions of dollars toward energy storage demonstration projects and supply chain development. Further regulatory support is provided by the Federal Energy Regulatory Commission (FERC), particularly through Orders 841 and 2222, which enable energy storage systems to participate in wholesale electricity markets and ancillary services. These reforms remove market entry barriers and create multiple revenue streams for BESS, making the U.S. one of the most advanced and mature regulatory environments for energy storage globally.

➤ **Electricity Market Design Reform & Storage Integration - European Union (2023- 2024)**

The European Union has introduced significant reforms under its Electricity Market Design framework to support renewable integration and energy storage deployment. A key regulatory development is the formal recognition of energy storage as a separate asset class within electricity markets, which helps eliminate issues such as double charging for grid usage. This regulatory clarity allows BESS operators to participate in multiple market segments, including energy trading, balancing markets, and capacity mechanisms. The EU framework also promotes long-term contracting mechanisms such as Contracts for Difference (CfDs), which provide revenue stability for renewable and storage projects. Additionally, member states are encouraged to develop flexibility markets and incentivise grid-scale storage deployment to support increasing renewable penetration. These reforms are aligned with the EU's broader Energy Union strategy, which emphasises decarbonisation, grid resilience, and energy security.



Moreover, EU policies focus on integrating storage with renewable energy systems to reduce curtailment and improve system efficiency. Regulatory measures also support research, innovation, and deployment of advanced storage technologies. Overall, the EU regulatory landscape is evolving toward a market-based approach, enabling storage systems to monetise multiple value streams while ensuring grid stability in a high-renewable energy system.

India Regulatory Landscape:

➤ **Viability Gap Funding (VGF) Scheme for BESS- (2024 & 2025)**

The Government of India has introduced Viability Gap Funding (VGF) schemes to accelerate the deployment of Battery Energy Storage Systems (BESS), particularly in the early stages where project economics remain challenging. Under this scheme, the government provides financial support (up to a certain percentage of project cost) to make BESS projects commercially viable. In 2024, the Ministry of Power launched operational guidelines for VGF support targeting grid-scale BESS deployment, followed by an expanded scheme in 2025 with a significantly higher capacity target and budgetary allocation. The scheme aims to catalyse large-scale adoption by reducing upfront capital costs, which are a key barrier in BESS projects. It also promotes competitive bidding through agencies such as SECI, ensuring price discovery and cost efficiency. Additionally, the VGF framework includes provisions for domestic value addition, encouraging local manufacturing and reducing dependence on imports. This policy is critical in building early-stage market momentum and attracting private sector investment into storage infrastructure.

➤ **National Framework for Energy Storage Systems & Resource Adequacy Guidelines- India (2023 onwards)**

The Government of India introduced a comprehensive National Framework for Energy Storage Systems in 2023, positioning storage as a core component of the power system. This framework integrates BESS into long-term power planning through Resource Adequacy Plans, requiring utilities to consider storage alongside generation and transmission resources. The policy recognizes storage as essential for managing peak demand, ensuring grid reliability, and enabling large-scale renewable integration. In addition, energy storage has been formally incorporated into the National Electricity Plan and planning frameworks issued by the Central Electricity Authority (CEA). These guidelines mandate utilities to plan for sufficient storage capacity to meet future demand reliably. By embedding BESS into national planning processes, the policy ensures structural demand creation for storage systems and provides long-term visibility to investors and developers.



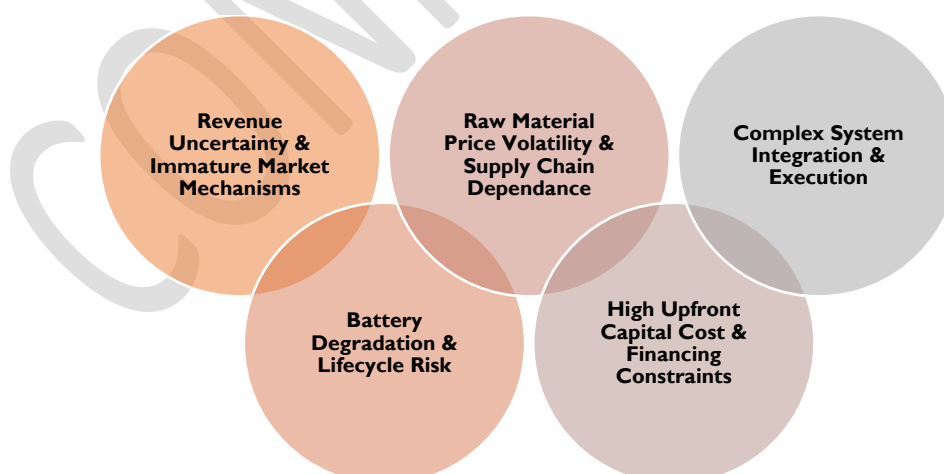
➤ **Energy Storage Obligations (ESO) & ISTS Waiver**

The Ministry of Power has introduced Energy Storage Obligations (ESO), requiring distribution companies and obligated entities to procure a certain percentage of their energy from storage systems. The ESO starts at around 1% and is expected to increase progressively to 4% by FY 2029- 30, creating a mandated demand for energy storage deployment across the power sector. Complementing this, the government has provided financial incentives such as waivers on Inter-State Transmission System (ISTS) charges for BESS projects, particularly those co-located with renewable energy plants. These waivers significantly reduce operational costs and improve project viability. Together, ESO and ISTS waivers act as both demand-side and cost-side enablers, accelerating the adoption of solar-plus-storage and standalone BESS projects in India.

➤ **Electricity Rules Amendments & Market Participation - (2022- 2025 updates)**

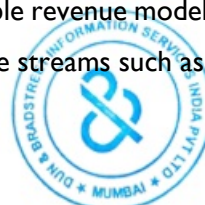
The Government of India has undertaken key regulatory reforms by amending Electricity Rules to formally recognise Energy Storage Systems (ESS), including BESS, as an integral part of the power system. These amendments allow storage systems to participate across generation, transmission, and distribution segments, significantly expanding their role in the electricity value chain. Further reforms in 2025 enabled flexible ownership models, allowing BESS to be developed, owned, leased, or operated by utilities, private developers, or even consumers. Storage systems have also been made eligible to provide ancillary services such as frequency regulation and reserve support under CERC regulations. These measures create new revenue streams for BESS operators and enhance the commercial viability of storage projects in India.

Key Threats & Challenges



• **Revenue Uncertainty & Immature Market Mechanisms**

One of the most critical risks in BESS is the lack of fully developed and stable revenue models across markets. While storage systems can theoretically generate income through multiple streams such as energy arbitrage,



ancillary services, and capacity payments, many markets do not yet have mature frameworks to support seamless revenue stacking. This creates uncertainty in cash flow visibility and makes it difficult for developers and investors to accurately assess long-term project returns, impacting financing and investment decisions.

- **Battery Degradation & Lifecycle Risk**

Battery performance degrades over time due to charge-discharge cycles, temperature conditions, and usage patterns, directly affecting system efficiency and output. If degradation rates or augmentation requirements are miscalculated during project planning or bidding, it can lead to higher-than-expected replacement costs and failure to meet contractual performance guarantees. This poses a significant risk of margin erosion over the lifecycle of the project, especially in long-term contracts such as firm or dispatchable power agreements.

- **Raw Material Price Volatility & Supply Chain Dependence**

BESS relies heavily on critical minerals such as lithium, cobalt, and nickel, which are subject to global supply-demand imbalances and geopolitical dynamics. Price volatility in these materials can significantly impact battery costs, leading to fluctuations in overall project capex. Additionally, concentrated supply chains and dependence on a few geographies increase the risk of disruptions, delays, and cost escalations, affecting both project timelines and financial viability.

- **High Upfront Capital Cost & Financing Constraints**

BESS projects require substantial upfront investment, with battery systems accounting for a major share of total project costs. Despite declining prices, storage remains capital-intensive compared to conventional power assets. At the same time, evolving business models and uncertain revenue streams make lenders cautious, limiting access to affordable financing. This creates barriers to large-scale deployment, particularly in emerging markets where financial ecosystems for storage are still developing.

- **Complex System Integration & Execution**

Deploying BESS involves integrating multiple components, including battery packs, inverters, energy management systems (EMS), and thermal management solutions, with existing grid infrastructure. This multi-layered integration increases technical complexity and execution risk, requiring specialized expertise and robust project management. Any gaps in design, coordination, or system compatibility can lead to delays, performance issues, or increased operational costs, making execution a key challenge for developers and EPC players.



India Market Scenario

BESS Manufacturing Scenario in India

India is emerging as a high-potential BESS market, supported by rapid renewable-energy expansion, rising electricity demand and the increasing requirement for grid flexibility. The latest official data from the Ministry of Power show that, as of 30 June 2026, India had 15,754 MW / 42,530 MWh of BESS³¹ capacity under construction, while 11,747 MW / 38,425 MWh had been awarded and a further 19,192 MW / 67,574 MWh was at the tendering stage.³² The Ministry of Power's July 2026 update further states that the National Electricity Plan projects India's BESS requirement at 8.68 GW / 34 GWh by 2026–27 and 47.24 GW / 236 GWh by 2031–32, with estimated investment of approximately INR 3.49 lakh crore by 2031–32³³.

India's policy framework is also supporting BESS deployment through competitive procurement, energy-storage requirements, transmission-charge incentives and other regulatory measures. The Government has extended a 100% waiver of ISTS charges for co-located BESS projects commissioned up to June 2028, supporting the economics of renewable-plus-storage projects. The Central Electricity Authority's BESS status page, last updated in July/August 2026, currently identifies 30 June 2026 as the latest quantitative BESS status report. Therefore, the June 2026 figures above should be treated as the latest verified official BESS deployment pipeline data, rather than assuming that newer August quantitative figures are available.

Against this expanding deployment pipeline, India's BESS manufacturing ecosystem is gradually developing across battery modules and packs, battery management systems, energy management systems, power electronics, thermal-management systems, enclosures and other balance-of-system components. Domestic manufacturers are increasingly establishing capabilities for battery-pack production and associated electronics, while the level of localisation varies across components depending on technology availability, manufacturing scale, supply-chain maturity and project requirements.

The manufacturing process involves multiple stages, beginning with the inspection and qualification of battery cells and other components and extending to module and pack production, electrical integration and quality testing. In addition to battery manufacturing, capabilities in BMS, EMS and inverter PCB production support the development of integrated BESS solutions. The adoption of automated inspection, welding, testing and traceability systems is also supporting improvements in manufacturing consistency and scalability..

³¹ https://cea.nic.in/wp-content/uploads/2021/03/Status_of_development_and_deployment_of_BESS_projects_in_India_as_on_30.06.2026.pdf

³² <https://www.pib.gov.in/newsite/erecontent.aspx>

³³ <https://www.pib.gov.in/PressReleasePage.aspx>



Key Manufacturing Processes:

- **Raw Material Inward & Quality Inspection:** Lithium-ion cells, busbars, BMS boards, wiring harnesses, connectors, cooling plates, enclosure components and insulation materials are received and subjected to Incoming Quality Control (IQC). Dimensions, appearance and electrical characteristics are verified before materials are released for production.
- **Cell Sorting, Matching & Compression:** Cells are evaluated for Open Circuit Voltage (OCV) and Internal Resistance (IR) and matched according to their electrical characteristics. Selected cells are then arranged in the required series-parallel configuration and compressed using dedicated fixtures, with insulation sheets and spacers added for mechanical stability and electrical protection.
- **Vision Inspection, Laser Cleaning & Welding:** CCD/vision systems verify cell orientation, alignment and spacing before welding. Cell terminals and busbar contact surfaces are laser-cleaned to remove contaminants, followed by precision laser welding to establish reliable, low-resistance electrical connections.
- **Post-Welding Inspection & Electrical Testing:** Welds are checked through visual and vision-based inspection, while ACIR testing is conducted to verify electrical continuity and internal resistance. Non-conforming modules are identified for troubleshooting, rework or rejection.
- **Module-to-Pack Integration:** Battery modules are installed into prepared enclosures along with mounting components, insulation materials and cooling plates. Thermal or structural adhesive may be applied to improve module fixation, vibration resistance and thermal conductivity.
- **Busbar, Harness & BMS Integration:** Series busbars are connected between modules, while voltage-sensing wires, temperature sensors, communication harnesses and BMS connectors are installed. Proper routing and secure connections are verified to minimise electrical and operational risks.
- **Pack Testing, Aging & Final Inspection:** Completed packs undergo insulation-resistance, ACIR, IP and functional testing, followed by controlled charging and discharging during battery aging. Voltage, current, temperature behaviour and BMS functionality are monitored before final quality inspection and dispatch.
- **BMS, EMS & Inverter PCB Manufacturing:** SMT-based production can be used for BMS, EMS and inverter PCBs, covering automatic PCB loading, solder-paste printing, pick-and-place component mounting and nitrogen-based reflow soldering. AOI, functional testing and communication validation are subsequently conducted to verify PCB quality and performance.

The BESS manufacturing process in India is progressively incorporating controlled production, automated inspection, precision welding and electrical testing across the battery value chain. The integration of battery



module and pack manufacturing with BMS, EMS and inverter PCB capabilities supports greater control over product quality and system performance. As domestic manufacturing capabilities expand, process automation, traceability and quality-control systems are expected to become increasingly important for scaling BESS production.

BESS Assembly Industry in India

The BESS assembly industry in India focuses on integrating battery cells or modules with electrical, thermal, control and protection systems to develop application-specific energy-storage units. Assembly activities can range from cell-to-module and module-to-pack integration to the incorporation of BMS, cooling systems, electrical connections and protective enclosures, depending on the configuration and requirements of the storage project.

The assembly process requires controlled handling of battery components along with multiple quality and safety checks throughout production. Automated and semi-automated equipment, including compression fixtures, vision inspection systems, laser-welding equipment and electrical testing stations, can be used to improve assembly accuracy and product consistency. The completed battery packs are subjected to testing and aging before final inspection, documentation and dispatch.

Key Assembly Processes:

- **Cell Selection, Sorting & Module Formation:** Incoming cells are checked for OCV and IR and grouped according to their electrical performance. The matched cells are arranged in the required configuration, compressed and insulated before proceeding to inspection and welding.
- **CCD Inspection, Terminal Cleaning & Laser Welding:** Vision systems check cell positioning, alignment and spacing, while laser cleaning prepares cell terminals and busbar contact areas. Laser welding then establishes electrical connections between cells and busbars with controlled precision.
- **Module Inspection & Pack Preparation:** Weld quality is verified through visual inspection, vision systems and ACIR testing. Approved modules are then grouped according to the required pack configuration, with their polarity, identification and electrical characteristics verified before installation.
- **Enclosure, Cooling Plate & Adhesive Assembly:** The lower casing is prepared with mounting supports and insulation, while cooling plates are tested for airtightness or leakage. Thermal or structural adhesive is applied where required before the modules are positioned within the enclosure.
- **Module Placement, Busbar & Harness Connection:** Modules are fitted into the enclosure and mechanically secured before series busbars are connected. Voltage-sensing wires, temperature sensors, communication harnesses and BMS connections are then installed and properly routed.

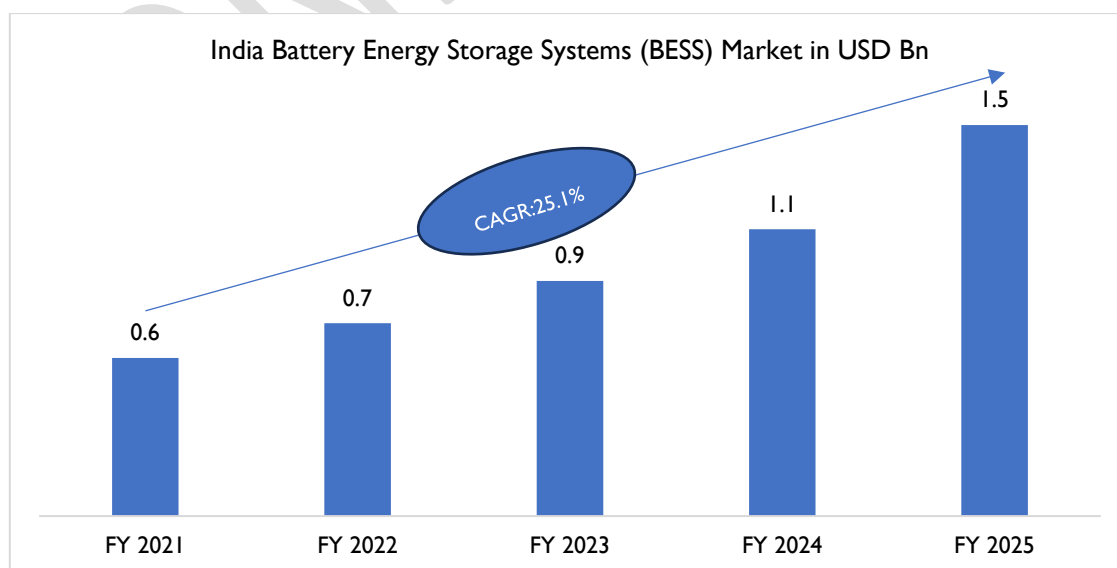


- **Electrical Safety & End-of-Line Testing:** Insulation-resistance and ACIR tests are conducted to verify electrical isolation, continuity and internal resistance. The top cover is subsequently fitted and the enclosure is sealed before ingress-protection testing.
- **IP Testing & Battery Aging:** The assembled pack undergoes IP testing to validate enclosure protection against dust and water ingress. Controlled charging and discharging during aging helps monitor voltage stability, current flow, temperature behaviour and BMS functionality.
- **Final Quality Control, Traceability & Dispatch:** Final inspection and pre-dispatch checks cover the physical condition, dimensions, BMS functionality, wiring and safety parameters of the completed pack. Barcode/serial-number labelling and production/testing documentation are maintained before approved packs are transferred for dispatch.

The BESS assembly process involves the systematic integration of battery modules, thermal-management systems, electrical connections, BMS and protective enclosures, supported by multiple inspection and testing stages. Processes such as module matching, laser welding, insulation testing, IP testing and battery aging help ensure the reliability and safety of assembled systems. Increasing assembly capabilities in India can support the development of application-specific storage solutions and facilitate the scaling of domestic BESS deployment.

Estimated market size of the Indian BESS market & historical growth trend

The chart illustrates the growth of the Indian Battery Energy Storage Systems (BESS) market from FY 2021 to FY 2025. The market expanded steadily from USD 0.6 billion in FY 2021 to USD 1.5 billion by FY 2025, reflecting rising adoption of energy storage solutions as India accelerates its renewable energy deployment and grid modernisation efforts.



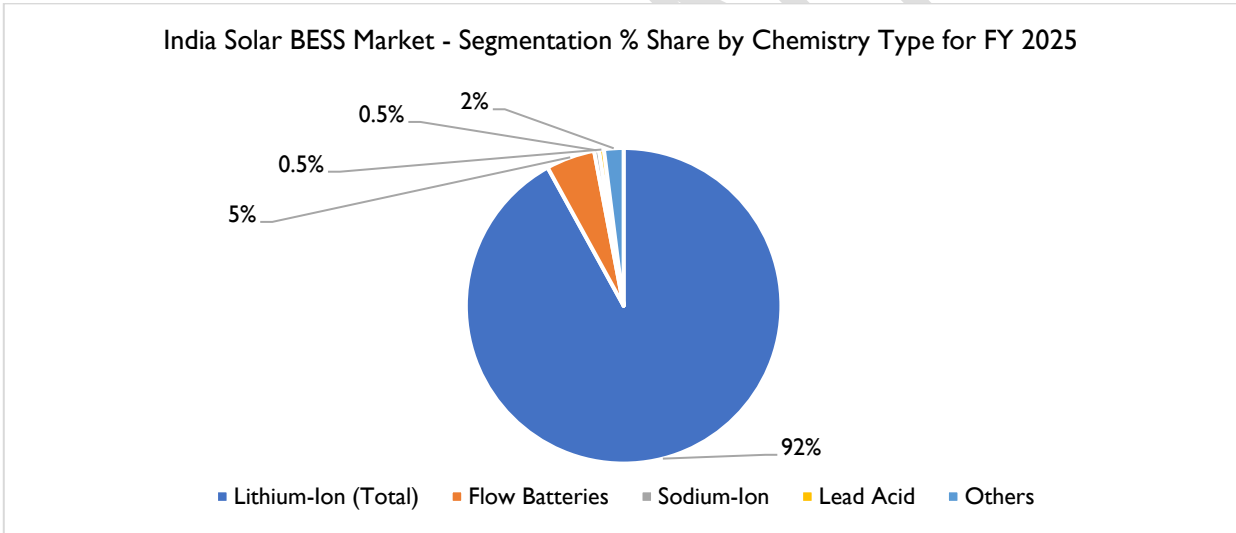
Source: D&B Primary Research



(Note: The India Battery Energy Storage System (BESS) market size is estimated on a Total Addressable Market (TAM) basis, capturing capital expenditure across the broader energy ecosystem beyond utility grid projects. The market comprises three key demand segments—Utility Grid (~70%), Commercial & Industrial (~20%), and Telecom/Off-Grid (~10%). The valuation includes the full value chain covering hardware (cells and battery packs), balance-of-system components (inverters, containers), and software and services (EMS and O&M), reflecting a market currently driven by equipment deployment and infrastructure build-out.)

Between FY 2021 and FY 2023, the BESS market grew from USD 0.6 billion to USD 0.9 billion, supported by increasing solar and wind capacity additions, pilot storage projects, and early-stage deployments across grid-scale and commercial applications. Growth accelerated further in FY 2024 and FY 2025, with the market reaching USD 1.1 billion and USD 1.5 billion, respectively. This acceleration is driven by government initiatives such as renewable-plus-storage tenders, emphasis on round-the-clock (RTC) power supply, and rising demand for grid balancing and peak power management. Overall, the upward trend indicates that BESS is transitioning from a nascent segment to a critical component of India’s power infrastructure, with strong growth potential as policy clarity improves and large-scale storage deployments gain momentum.

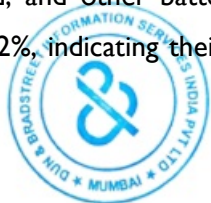
Market segmentation based on battery chemistry



Source: D&B Primary Research

The chart depicts the chemistry-wise segmentation of the Indian solar-linked Battery Energy Storage Systems (BESS) market for FY 2025. The market is overwhelmingly dominated by lithium-ion batteries, which account for approximately 92% of total installations, underscoring their central role in supporting India’s rapidly expanding solar power capacity.

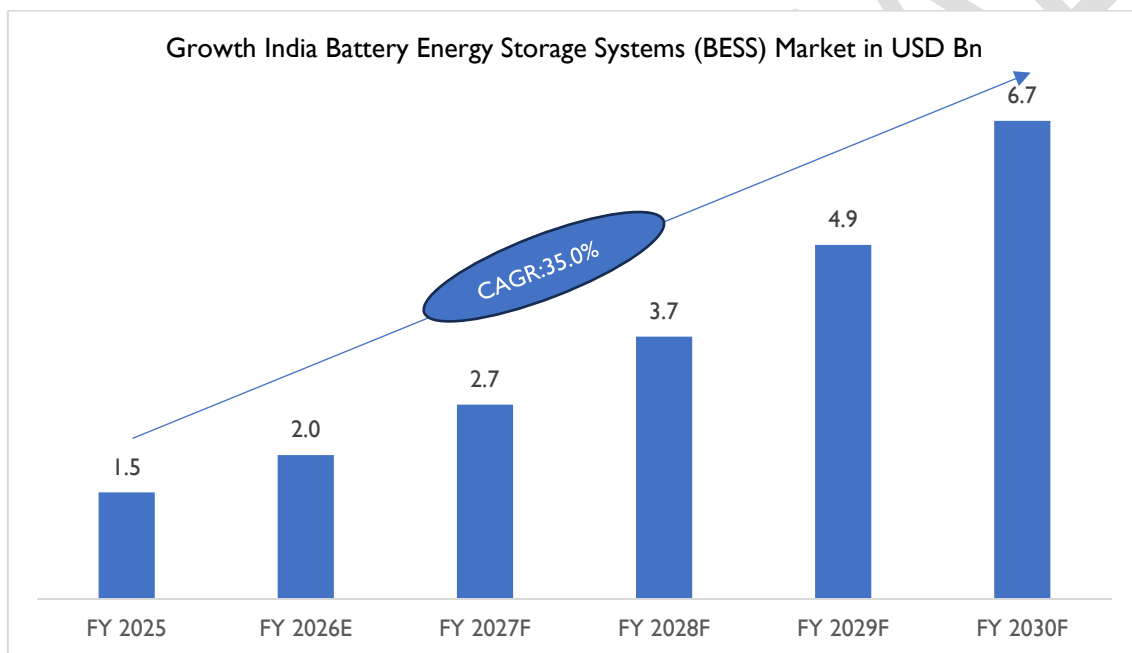
Lithium-ion batteries’ dominance is driven by their high efficiency, declining costs, proven performance, and suitability for both grid-scale and commercial solar applications. Flow batteries account for around 5% of the market, reflecting limited but growing adoption in long-duration storage and pilot projects where extended discharge duration and high cycle life are critical. Sodium-ion, lead-acid, and other battery technologies together account for a marginal share of the market, each at or below 2%, indicating their current use in



niche, cost-sensitive, or demonstration-level deployments. Overall, the chemistry mixes highlights that while alternative storage technologies are emerging in India, lithium-ion batteries remain the preferred and most commercially viable solution for solar energy storage in the near term.

Expected growth in the BESS market in India

The chart illustrates the projected growth of the Indian Battery Energy Storage Systems (BESS) market from FY 2025 to FY 2030F. The market is expected to expand rapidly, from USD 1.5 billion in FY 2025 to approximately USD 6.7 billion by FY 2030F, reflecting a CAGR of approximately 35%. This sharp growth trajectory reflects the accelerating role of energy storage in supporting India's renewable energy ambitions and power sector transformation.



Source: D&B Primary Research

The steady year-on-year expansion from USD 2.0 billion in FY 2026E to USD 3.7 billion in FY 2028F highlights increasing momentum in large-scale BESS deployments across utility-scale, commercial, and industrial segments. Growth is being driven by rising solar and wind capacity additions, increasing focus on round-the-clock (RTC) renewable power supply, and the introduction of storage-backed renewable tenders by central and state agencies. By FY 2029F- FY 2030F, the market is projected to accelerate further, reaching USD 4.9 billion and USD 6.7 billion, respectively, supported by improved regulatory clarity, declining battery costs, and increased participation by private developers and investors. Overall, the outlook indicates that BESS will become a core component of India's power infrastructure, enabling grid stability, peak-demand management, and deeper integration of renewable energy over the medium to long term.



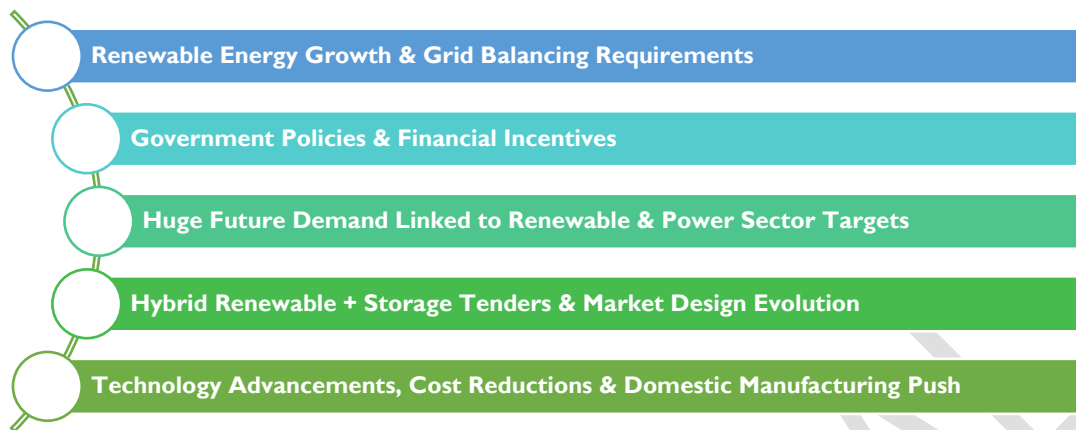
Demand Drivers

Analysis of key factors driving the demand for BESS

- **Renewable Energy Integration & Grid Flexibility Needs:** According to the International Energy Agency (IEA), global battery storage capacity was ~85 GW in 2023 after deploying more than 42 GW in a single year, making battery storage one of the fastest-growing energy technologies globally. Batteries are critical to managing the variability of wind and solar by providing short-term grid balancing and flexibility services. The IEA projects that installed grid-scale battery storage capacity must expand to approximately 970 GW by 2030 (a ~35-fold increase from 2022 levels) under its Net Zero Scenario to support high renewable penetration. As renewables such as solar and wind rapidly increase their share of electricity generation (e.g., IRENA reports 582 GW of new renewable capacity added in 2024, representing nearly 86% of new power capacity), storage is increasingly indispensable for maintaining grid stability and enabling high renewable uptake.
- **Rapid Deployment Fuelled by Policy & Incentives:** The G7 countries and energy ministers have endorsed targets to expand global electricity storage capacity from ~230 GW in 2022 to ~1,500 GW by 2030, a nearly six-fold increase aligned with COP28 climate goals. This ambition underscores how government policy frameworks and international climate commitments explicitly drive global storage demand. Government auctions and regulatory reforms, such as Italy's awarding of storage capacity through formal tenders and revenue-stabilising mechanisms, are providing revenue certainty and driving investor confidence in storage deployment.
- **Cost Reductions and Manufacturing Scaling:** Battery costs have fallen by approximately 90% since 2010, driven by technological improvements, economies of scale, and policy-supported manufacturing scaling. Such dramatic cost declines help expand storage beyond early adopters into mainstream grid and commercial markets. Cheaper batteries significantly improve the economics of pairing storage with renewable generation, enabling solar-plus-storage and peak-shaving projects to be cost-competitive with traditional fossil fuel power plants in many regions.
- **Market Participation:** About 65% of battery capacity additions are utility-scale, while behind-the-meter systems (residential, commercial) contribute ~35% of annual growth on average, showing diversified demand across segments. This diversification means that storage demand is supported not only by utilities for grid services but also by consumers especially in markets with time-varying tariffs or unreliable grids.



Analysis of key factors driving the BESS market in India



➤ Renewable Energy Growth & Grid Balancing Requirements

India's ambitious renewable energy target of 500 GW by 2030 is pushing the grid toward higher shares of solar and wind, which are intermittent. BESS is critical for balancing these variable generation patterns, storing excess energy during periods of high renewable output and discharging it during periods of high demand, thereby enhancing grid stability and reducing curtailment risk. According to Mercom India, the cumulative installed BESS capacity was ~219 MWh as of March 2024 and is increasing as renewable deployment accelerates. Policy measures, such as grid connectivity regulations and ancillary services requirements, strengthen the case for energy storage as a necessary component of the grid.

➤ Government Policies & Financial Incentives

The Government of India has introduced several *enabling policies* to stimulate BESS deployment, including inter-state transmission charge waivers (extended until June 2028) for energy storage projects and viability gap funding (VGF) schemes specifically for BESS. The Ministry of New & Renewable Energy (MNRE) provides operational guidelines and funding support to build investor confidence and accelerate the adoption of storage technologies. These policy levers reduce project costs and support revenue stabilisation, making storage projects more bankable.

➤ Huge Future Demand Linked to Renewable & Power Sector Targets

India's power planning reflects a massive future storage requirement: the Central Electricity Authority (CEA) estimates energy storage needs of ~411 GWh by 2031-32, including significant BESS capacity to support rapid renewable integration. Independent forecasts from industry reports also highlight that BESS demand could grow *several times* between 2026 and 2032, potentially reaching tens of gigawatts of capacity as distribution utilities and grid planners incorporate storage into expansion plans. This projected demand scale underscores storage as a long-term growth market.

➤ Hybrid Renewable + Storage Tenders & Market Design Evolution



India is increasingly awarding hybrid tenders that embed storage requirements with solar and wind auctions. Between 2022 and mid-2025, around 12.8 GWh of BESS capacity was auctioned, a clear indicator of market readiness and developer interest. Hybrid solutions (solar + storage) help manage the “duck curve” problem by ensuring firm renewable supply and aligning generation with demand profiles. These evolving market structures are stimulating participation from utilities, developers, and investors.

➤ **Technology Advancements, Cost Reductions & Domestic Manufacturing Push**

Advances in lithium-ion battery technology and cost reductions (both global and India-specific) are making storage more financially viable. Government-led initiatives such as the Production Linked Incentive (PLI) for Advanced Chemistry Cell manufacturing, aim to build domestic battery production capacity (e.g., targeting 55 GWh of ACC capacity) to reduce import dependence and lower costs. Local manufacturing incentives are catalysing investment in the battery supply chain, which is crucial for scaling large-scale BESS deployments nationwide.



Competitive Landscape (Focus: Solar EPC Segment)

The Solar EPC segment in India has evolved into a highly competitive and execution-driven market, increasingly converging with Battery Energy Storage Systems (BESS) as part of integrated renewable infrastructure solutions. Established EPC players such as Sterling & Wilson Renewable Energy, Tata Power Solar, and Larsen & Toubro continue to dominate large-scale solar project execution, supported by strong engineering capabilities, financial strength, and proven track records in utility-scale deployments. Competition remains intense, with aggressive bidding practices keeping margins under pressure, particularly in government tenders and large developer-led projects.

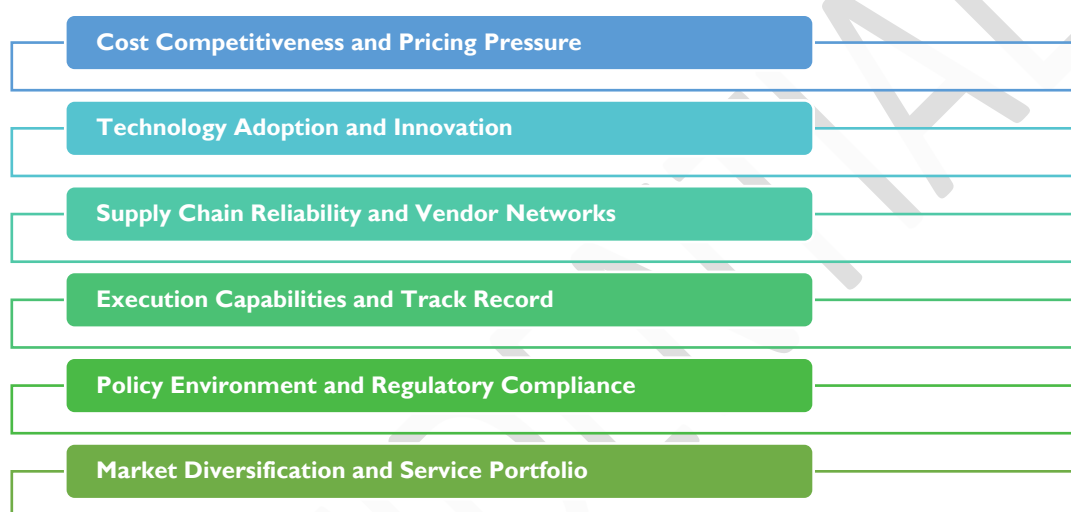
The inclusion of BESS within solar EPC scope is reshaping the competitive dynamics. EPC players are now expected to deliver integrated solar-plus-storage solutions, especially for grid stability, peak load management, and round-the-clock (RTC) renewable power projects. This has increased the technical complexity of projects, favoring companies with capabilities in system integration, energy management systems (EMS), and battery technology partnerships. Firms that have established collaborations with global battery suppliers or possess in-house expertise in storage integration are gaining a competitive edge in emerging hybrid and RTC project tenders. Differentiation in the Solar EPC and BESS segment is increasingly driven by technological capabilities and execution efficiency. Advanced project design tools, digital twin technologies, and real-time monitoring systems are being leveraged to optimise plant performance and storage utilisation. Additionally, companies with robust procurement strategies and diversified supplier networks are better positioned to manage risks related to battery sourcing, raw material price volatility (such as lithium), and import dependencies. Execution timelines and reliability remain critical, particularly as storage-linked projects often involve stricter performance guarantees and contractual obligations.

The competitive landscape is also witnessing the emergence of specialised players focusing on BESS deployment, either independently or in partnership with EPC contractors. These players bring expertise in battery system design, integration, and lifecycle management, complementing traditional EPC capabilities. As a result, strategic alliances between EPC firms and storage technology providers are becoming increasingly common, enabling participation in complex tenders such as hybrid renewable projects and ancillary grid services. Another key trend is the growing integration of EPC and asset ownership capabilities in solar-plus-storage projects. Companies that can both execute and invest in projects are better positioned to optimise lifecycle costs, secure financing, and offer turnkey solutions to clients. This integrated approach creates higher entry barriers for smaller or standalone EPC firms, particularly in BESS-linked projects where capital intensity and technical expertise requirements are significantly higher.



Overall, the Solar EPC and BESS segment is transitioning toward a more technology-intensive and capital-intensive competitive environment. While established EPC players continue to dominate large-scale and complex projects, mid-sized firms are increasingly focusing on niche opportunities such as commercial and industrial (C&I) solar-plus-storage solutions and microgrid applications. Going forward, the market is expected to witness consolidation and strategic partnerships, as success will depend on the ability to deliver integrated, cost-efficient, and technologically advanced solar-plus-storage solutions in an increasingly competitive bidding environment.

Analysis of key factor shaping competition in the sector



➤ **Cost Competitiveness and Pricing Pressure:**

One of the biggest determinants of competition in the solar EPC market is the ability to deliver projects at competitive costs. Developers often award contracts to EPC firms to optimise procurement and reduce balance-of-system costs while maintaining quality. With solar tariffs in India and other markets hitting record lows, EPC players face shrinking margins. This puts pressure on contractors to improve operational efficiency and adopt low-cost procurement strategies. As a result, cost leadership often becomes the deciding factor in winning large-scale bids.

➤ **Technology Adoption and Innovation:**

The pace at which EPC firms adopt advanced solar technologies such as bifacial modules, single-axis trackers, and smart inverters significantly influences their competitive positioning. Companies that leverage automation, AI-driven design, and digital twins in project execution achieve greater efficiency and reduce downtime. Innovation in storage integration and hybrid projects (solar, wind, and storage) is also reshaping the market. Firms unable to keep up with evolving technologies risk losing relevance. Thus, technological edge often becomes a major differentiator.



➤ **Supply Chain Reliability and Vendor Networks:**

Given the dependence on imported modules, inverters, and other components, supply chain resilience is a critical competitive factor. EPC players with strong vendor relationships, diversified sourcing, and long-term procurement contracts can ensure timely project execution. The government's push for domestic manufacturing through schemes such as PLI also influences supply-side strategies. Firms that can balance cost with supply assurance enjoy a strong edge in a market often affected by import duties and geopolitical fluctuations.

➤ **Execution Capabilities and Track Record:**

Large utility-scale projects demand proven expertise in on-time, on-budget delivery. EPC firms with a strong track record of successfully executed MW- and GW-scale projects command greater credibility with developers and financiers. Their ability to handle complex terrains, grid integration challenges, and quality control sets them apart. As tender sizes increase, execution capacity and workforce management become decisive in securing repeat business. Players with weak execution records often struggle to compete for large contracts.

➤ **Policy Environment and Regulatory Compliance:**

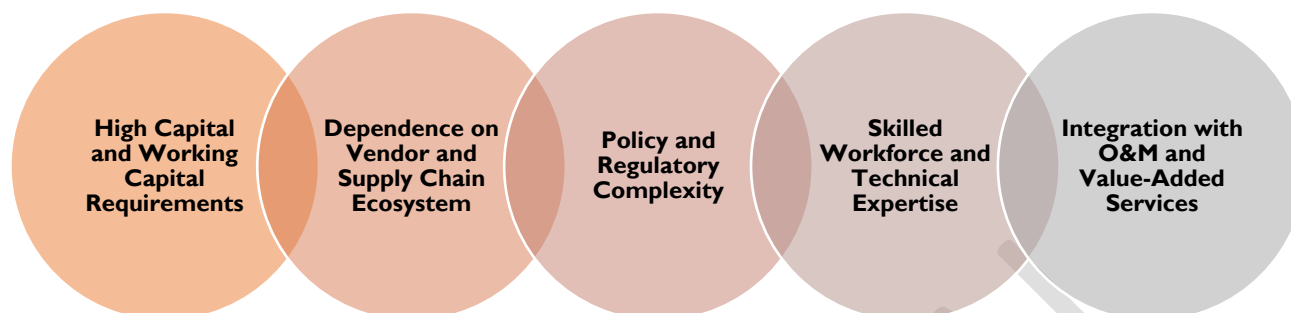
Government policies, import duties, safeguard tariffs, and renewable purchase obligations directly affect the competitive dynamics in the EPC sector. Firms with strong regulatory know-how and compliance mechanisms gain an advantage in navigating complex approval processes. Policy support for localisation and renewable integration also favours players aligned with government objectives. On the other hand, frequent policy changes and tariff uncertainties create volatility, thereby forcing EPCs to continuously adapt their strategies.

➤ **Market Diversification and Service Portfolio:**

EPC players expanding beyond traditional utility-scale projects into rooftop solar, hybrid plants, and O&M services enjoy more stable revenue streams. Diversification reduces dependency on price-sensitive competitive bidding. Firms offering end-to-end solutions from design and construction to operations and asset management differentiate themselves by providing long-term value. This broader service portfolio not only ensures recurring business but also strengthens customer stickiness in a highly competitive market.



Analysis of entry barriers / other factors



➤ **High Capital and Working Capital Requirements:**

Solar EPC projects demand significant upfront investments for procurement, manpower mobilisation, and logistics. In addition, firms are required to furnish bank guarantees, bid security, and performance guarantees, which create financial strain. These requirements act as barriers for smaller firms with limited financial depth. Only well-capitalised companies or those backed by strong parent groups can sustain operations in the highly competitive EPC landscape.

➤ **Dependence on Vendor and Supply Chain Ecosystem:**

The EPC segment is highly dependent on the timely availability of critical components like modules, inverters, and mounting structures. Global supply chain volatility, import duties, and currency fluctuations add complexity. Established players with strong vendor networks and bulk procurement agreements have a competitive edge. New entrants often lack bargaining power with suppliers, leading to higher costs and project delays, thereby limiting their competitiveness.

➤ **Policy and Regulatory Complexity:**

Solar EPC firms must navigate multiple clearances, environmental approvals, land-use permissions, and grid connectivity, all of which require strong regulatory expertise. Frequent policy changes, such as safeguard duties or localisation mandates, add uncertainty. Larger EPCs with dedicated compliance teams can adapt quickly, while smaller firms often find regulatory hurdles daunting. This creates an additional barrier to smooth entry and expansion for new players.

➤ **Skilled Workforce and Technical Expertise:**

Solar EPC requires specialised skills in engineering design, grid integration, project management, and safety compliance. Building and retaining such a workforce demands investment in training and HR systems, which can be challenging for smaller firms. Large players with established teams can execute projects more quickly



and with higher efficiency. New entrants may struggle to access talent pools, particularly in regions with high levels of renewable energy activity.

➤ **Integration with O&M and Value-Added Services:**

Many leading EPC firms now provide end-to-end solutions, including operations and maintenance (O&M) and hybrid project integration. This enhances their long-term client relationships and provides recurring revenue streams. New entrants focusing solely on EPC services may be at a disadvantage relative to integrated service providers. Without diversification into value-added services, survival in a competitive ecosystem becomes more difficult.

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Industry SWOT Analysis

Strengths

- Strong government support through renewable targets, auctions, and policy incentives ensures long-term project visibility.
- Mature EPC capabilities offering end-to-end engineering, procurement, and construction reduce execution risk for developers.
- Rapid growth in utility-scale and distributed solar drives a steady pipeline of EPC contracts
- Falling solar module and balance-of-system costs improve project economics and EPC scalability
- Large and competitive EPC ecosystem enhances cost efficiency and regional execution capability.
- Integration of BESS with solar enables dispatchable renewable energy and improves grid reliability.
- Ability to offer integrated solar-plus-storage solutions enhances competitiveness in complex and RTC projects.

Weaknesses

- High capital intensity and working-capital requirements strain cash flows, especially for mid-sized EPC players.
- Thin operating margins due to aggressive competitive bidding and price-based tendering.
- Dependence on global supply chains exposes projects to logistics delays and price volatility.
- Execution challenges such as land acquisition, permitting, and grid connectivity delays.
- Skill gaps and limited availability of specialized technical manpower in complex projects.
- High capital expenditure for BESS increases overall project cost and financing burden.
- Dependence on imported battery technologies and components exposes projects to supply risks.

Opportunities

- Expansion of large-scale solar parks and hybrid renewable-plus-storage projects increases EPC scope and value addition.
- Growing rooftop and C&I solar demand diversifies EPC revenue beyond utility-scale projects.
- Emerging markets and cross-border solar projects open new geographic growth avenues.
- Integration of digital tools, automation, and smart monitoring improves project efficiency and lifecycle services.
- Domestic manufacturing initiatives and localization policies strengthen procurement resilience.
- Rising demand for solar-plus-storage and round-the-clock (RTC) renewable energy solutions.
- Increasing use of BESS for peak shaving, grid balancing, and ancillary services creates new revenue streams.

Threats

- Policy changes, delays in auctions, or renegotiation risks can disrupt EPC order books.
- Volatile prices of key raw materials such as polysilicon, steel, and aluminum affect project costs.
- Intensifying competition from large integrated energy players pressures pricing and margins.
- Trade barriers, import duties, and geopolitical disruptions impact equipment availability.
- Extreme weather events and climate risks can delay construction and increase execution costs.
- Fluctuations in battery raw material prices (lithium, cobalt) impacting cost structures.
- Evolving regulatory frameworks and lack of standardized policies for BESS deployment may delay adoption.



Company Profiling: Soleos Energy Ltd.

Company Overview:

Founded in 2017 and headquartered in Ahmedabad, Gujarat, Soleos Energy Limited operates in the solar energy sector as an engineering, procurement, and construction (EPC) solutions provider. The company is engaged in the development and execution of solar power projects, supporting clients across utility-scale as well as commercial and industrial segments. Soleos undertakes activities spanning project design, engineering, procurement, construction, commissioning, and associated regulatory support for solar installations.

The company reports a cumulative commissioned solar capacity exceeding 100 megawatts (MW), with an additional 400+ MW under construction across various stages. Its project portfolio includes rooftop solar systems, ground-mounted solar plants, utility-scale solar power projects, and customised solar applications designed to address site-specific and operational requirements of customers. Soleos Energy provides end-to-end EPC services supported by in-house engineering and project management teams. In addition to EPC execution, the company also operates across captive, group captive, and Independent Power Producer (IPP) models supported by long-term power purchase agreements (PPAs) and open-access arrangements.

The company **positions itself** as among the few solar energy companies in India that offers an **integrated solar energy platform** encompassing **in-house** project development, financing coordination, EPC execution, long-term asset management, and an **in-house Battery Energy Storage System (BESS) manufacturing facility**. The Company is positioned across integrated solar energy applications, including solar-plus-storage solutions catering to hybrid, round-the-clock (RTC), and firm solar energy requirements.

Through its research and development efforts, Soleos has developed its own proprietary solar tracker technology, referred to as the AI-Enabled Solar Tracker with Dynamic Self-adjusting Tilt (SAT) Model and also developed Solar Power Generation System With Seasonal Tilt Function To Improve Production Efficiency, which is designed to keep photovoltaic modules optimally oriented toward the sun throughout the day using a tilted single-axis geometry and the company has filed its patent applications.

As part of its integrated solar energy platform expansion initiatives during 2024, the company highlighted developments including Portugal community solar projects, launch of group captive offerings, and utility-scale solar in Africa. **Soleos is the only Indian energy company** to have developed and commissioned a community solar project in **Coimbra, Portugal**, demonstrating its international presence in community-based renewable energy infrastructure. The company also offers operations and maintenance (O&M) services aimed at ensuring system uptime and performance over the operating life of solar assets. Its solutions are deployed across diverse end-use applications, including industrial facilities, commercial establishments, and utility-connected projects.



Beyond India, Soleos Energy has established a presence in multiple international markets, including Portugal, Zimbabwe, the Democratic Republic of the Congo (DRC), and Uganda. The **Company is developing one of the largest** publicly identifiable **utility-scale solar and battery storage infrastructure** projects by an Indian renewable energy company in the **Democratic Republic of the Congo (DRC)**, comprising **248 MW (DC) of solar power capacity**. Further, the Company is among the early Indian renewable energy companies undertaking utility-scale solar power development initiatives in collaboration with the Government of Zimbabwe under the Independent Power Producer (IPP) model. In addition, the Company is developing a 15 MW utility-scale solar power project in collaboration with the Government of Nagaland, reflecting its participation in emerging renewable energy infrastructure development initiatives in the state. These international and domestic projects reflect the company's focus on expanding its renewable energy development footprint across multiple geographies and project categories.

Further, soleos has ventured into vertical integration of its business by expanding into the manufacturing of Battery Energy Storage Systems (BESS) for utility scale projects with a total capacity of 100MWh and further it intend to expand the facility with a total capacity of up to 2.2 GWh including SMT (Surface Mount Technology) production line deigned for manufacturing of BMS (Battery Management System) PCBs (Printed Circuit Boards).

Product & Services Offered:

Segments	Subsegments
Products	• Supply of Solar Module • Supply of Solar Inverters • BESS • Other related equipment and accessories
Solutions	• Rooftop Solar • Ground Mount Solar
Models	• Captive Solar • Group Captive Solar • Third Party Sale
Services	• Solar Engineering, Procurement and Construction Services • Project Development and Consultancy Services • Total Asset Management



Key Customer Segments Served:

- **Commercial and Industrial Enterprises:** Soleos serves commercial and industrial clients looking to adopt solar power systems such as rooftop installations and ground-mount projects. These customers typically include manufacturing units, large facilities, and corporate campuses that require customised solar energy solutions to reduce grid dependency and manage energy costs. The company offers end-to-end solar EPC services tailored to business energy demand profiles.
- **Utility-Scale Solar Project Developers:** The company engages with developers undertaking large solar parks and utility-scale photovoltaic (PV) installations, offering design, procurement, and installation support. These customers require scalable solutions for high-capacity energy generation, including solar park projects in India and international markets. Soleos's portfolio of solar parks reflects its capabilities in handling complex, large-scale projects.
- **Institutional and Government-Linked Customers:** The company's services are suited to institutional customers such as public sector organisations and government-linked projects that involve solar infrastructure development. These customers often require compliance with policy frameworks and long-term performance, which Soleos supports through its turnkey project execution and ongoing operations and maintenance services.
- **Distributed Generation and Rooftop Solar Users:** Soleos also serves customers seeking distributed solar energy solutions, including rooftop systems for commercial and residential sector facilities. These clients benefit from tailored designs, module selection, and installation services that optimise energy generation at the point of use, supported by service and performance monitoring commitments.

Key Strengths:

- **Integrated Renewable Energy Business Model:** The company operates across multiple stages of the renewable energy value chain, including project development, financing coordination, EPC execution, operations & maintenance, asset management, and emerging energy storage solutions, enabling a comprehensive service offering for customers.
- **Diversified Project Execution Capabilities:** Soleos has experience in executing rooftop solar, ground-mounted solar, solar parks, and utility-scale solar projects, allowing the company to cater to varied customer requirements across commercial, industrial, and utility segments.
- **Presence Across Multiple Business Models:** The company operates across EPC, captive, group captive, and Independent Power Producer (IPP) models, providing flexibility in addressing different customer ownership structures, financing requirements, and power procurement strategies.



- **Growing Solar-Plus-Storage Capabilities:** The company has expanded its focus beyond conventional solar EPC services into solar-plus-storage solutions, positioning itself to participate in hybrid, round-the-clock (RTC), and firm renewable energy opportunities.
- **Domestic and International Project Development Experience:** Soleos has developed project execution capabilities across multiple domestic and international markets, enabling exposure to diverse regulatory environments, project structures, and customer requirements.
- **Large Development Pipeline:** The company reports a development pipeline across various stages, supported by ongoing projects under construction and a portfolio spanning both Indian and international markets.

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Peers Profiling

Company Name	Overview
Oriana Power Limited	Oriana Power Limited, incorporated in 2013 and headquartered in Noida, Uttar Pradesh, is an India-based renewable energy solutions provider engaged in the development and execution of solar power projects. The company provides engineering, procurement, and construction (EPC) services for rooftop and ground-mounted solar installations for commercial and industrial consumers. Its service portfolio includes project design, engineering, procurement of photovoltaic modules and balance-of-system components, installation and commissioning of solar energy systems, along with operations and maintenance services for solar plants. The company also provides solutions such as floating solar installations, solar parks, carport solar systems, hybrid renewable systems, and battery energy storage systems (BESS), and undertakes solar projects under EPC as well as renewable energy service company (RESCO) business models to support renewable energy adoption across industrial and commercial sectors.
Bondada Engineering Limited	Bondada Engineering Limited, incorporated on 29th March 2012 and headquartered in Hyderabad, Telangana, is an India-based diversified infrastructure EPC company providing engineering, procurement and construction (EPC) and operations and maintenance (O&M) services across renewable energy, telecommunications, Indian Railways, Battery Energy Storage Systems (BESS), data centres, and defence sectors. The company is ISO 9001:2015 certified. In the renewable energy segment, the company provides end-to-end solar EPC services covering site survey, land preparation, system design, civil and electrical installation, commissioning, performance monitoring, and long-term O&M for utility-scale ground-mounted solar projects. The company also executes solar projects under the Independent Power Producer (IPP) model supported by long-term power purchase arrangements. Beyond solar EPC, the company offers passive telecom infrastructure services, railway Kavach signalling infrastructure, and BESS under the Build-Own-Operate (BOO) model. It operates in-house manufacturing facilities in Telangana and Andhra Pradesh, producing solar module mounting structures, telecom towers, and fabricated steel structures through its subsidiaries. Its client base includes NTPC Green Energy, NLC India Renewables, MAHAGENCO, Adani Group, AP TRANSCO,



	Tamil Nadu Green Energy Corporation Limited, BSNL, and Reliance Jio, among others. As of March 2026, the company reports cumulative solar commissioning of approximately 1.3 GWp with approximately 7.8 GW under execution and an order book of approximately INR 7,148 crore.
Zodiac Energy Ltd	Established in 1992 and headquartered in Ahmedabad, Gujarat, India, Zodiac Energy Limited operates in the renewable energy sector, focusing on the development and implementation of clean energy solutions. Its operations cover key stages such as engineering, design, project execution, and installation. Over the years, the company has developed a portfolio of more than 500 MWp of renewable energy projects and has served over 16,000 customers across regions including Asia, Africa, and North America. Zodiac Energy Limited continues to expand its geographic presence while focusing on addressing evolving energy requirements through renewable technologies, supported by a team with technical expertise in project management and execution within the energy domain. The company is ISO 9001:2015 and ISO 14001:2015 certified and has also installed over 150 MW of diesel and gas-based captive co-generation plants. Offerings: • Ground mounted solar solutions • Rooftop Solar Solutions (Commercial & Industrial) • Residential Rooftop Solar Solutions • Hybrid Solutions (Solar+wind+DG+Battery+ Grid) • BESS(Battery Energy Storage System)
Solarworld Energy	Established in 2014 and headquartered in Noida, Uttar Pradesh, Solarworld Energy operates in India's renewable energy sector, focusing on solar power development and related solutions. The company provides end-to-end engineering, procurement, and construction (EPC) services, along with solar park development and execution of rooftop and ground-mounted solar projects across different customer segments. It is also engaged in solar module



manufacturing, with an annual production capacity of around **1.55 GW** at its **facility in Roorkee.**

In addition to project execution, Company is **currently developing a 650 MWh battery storage project and over 900 MW of solar power projects.** Solarworld Energy is involved in developing energy storage systems, including containerized solutions aimed at supporting grid stability. The company also operates as an independent power producer (IPP), with activities spanning the development of solar and battery storage projects. Over the years, it has built a project portfolio exceeding 1 GW, supported by experience in delivering integrated renewable energy solutions. The company provides end-to-end Solar EPC services, along with solar park development and execution of rooftop and ground-mounted solar projects, offering tailored energy solutions for government bodies, industries, commercial enterprises, and institutions. It has worked with organizations such as NTPC, SJVN, RVPNL, GUVNL, Haldiram's, Coca-Cola Bottlers, and KRBL, delivering large-scale energy projects.

- PV Module Manufacturing Capacity: **1.55 GW**
- Solar Roof Top and Ground Mounted: **1.1 GW**
- Solar Utility Under Execution: **650 MW**
- Asset Management Solar Projects: **250+ MW**
- BESS Annual Production Capacity: **3.6 GWh**



Financials KPI

Particular	Unit	Oriana Power Limited			Bondada Engineering Limited			Zodiac Energy Limited			Solarworld Energy Solutions Limited		
		As at end for Fiscal			As at end for Fiscal			As at end for Fiscal			As at end for Fiscal		
		Fiscal 2026	Fiscal 2025	Fiscal 2024	Fiscal 2026	Fiscal 2025	Fiscal 2024	Fiscal 2026	Fiscal 2025	Fiscal 2024	Fiscal 2026	Fiscal 2025	Fiscal 2024
Total Revenue	₹ in Lakhs	1,84,101.69	99,806.71	38,579.52	2,85,109.90	1,58,013.67	80,372.22	54,598.00	40,966.79	22,102.73	1,41,606.60	55,108.50	50,550.20
Revenue From Operations	₹ in Lakhs	1,81,367.23	98,716.60	38,287.49	2,84,280.50	1,57,095.68	80,072.23	54,352.00	40,777.72	22,006.11	1,37,615.60	54,476.50	50,101.60
EBITDA	₹ in Lakhs	39,802.25	23,449.23	8,077.60	32,661.15	17,074.45	6,847.74	5,578.00	3,703.66	1,896.23	14,703.50	10,674.70	7,109.30
EBITDA Margin	in %	21.95%	23.75%	21.10%	11.49%	10.87%	8.55%	10.26%	9.08%	8.62%	10.68%	19.60%	14.19%
PAT	₹ in Lakhs	25,204.45	15,855.37	5,428.00	21,107.91	11,317.13	4,630.80	2,099.00	1,996.98	1,097.20	12,047.40	7,704.80	5,169.10
PAT Margin	in %	13.90%	16.06%	14.18%	7.43%	7.20%	5.78%	3.86%	4.90%	4.99%	8.75%	14.14%	10.32%
Operating Cash Flow	₹ in Lakhs	33,703.54	25,089.31	269.82	12,456.58	-14,093.09	4,401.00	1,627.00	-4,884.09	1,597.32	-4,950.60	5,389.80	717.50
Net Worth	₹ in Lakhs	77,121.10	51,762.16	14,866.07	73,252.36	47,614.01	16,791.75	11,684.00	9,656.40	4,757.41	84,779.70	30,906.60	7,359.50
Debt Equity Ratio	In Times	0.66	0.52	1.23	0.38	0.38	0.43	1.96	1.63	0.80	0.30	0.37	0.83
Return on Equity	in %	32.68%	30.63%	36.52%	28.82%	23.77%	27.58%	17.96%	20.68%	23.06%	14.21%	24.93%	70.24%
Return on Capital Employed	in %	32.01%	30.05%	24.58%	32.29%	26.36%	29.33%	13.96%	14.26%	22.33%	16.47%	26.64%	55.79%
Return of Assets	in %	9.83%	12.02%	13.23%	10.34%	9.44%	9.17%	4.35%	5.90%	9.49%	7.14%	12.88%	33.34%
Key Operating Cost	₹ in Lakhs	1,43,141.32	76,116.44	30,419.73	2,52,570.33	1,40,677.63	73,319.80	49,769.00	37,342.83	20,188.00	1,23,339.50	43,574.50	43,258.50
Interest Coverage Ratio	In Times	6.07	9.22	13.07	7.78	7.81	7.62	2.37	3.94	4.12	6.87	17.09	10.42
Order Book	₹ in Lakhs	NA	NA	NA	7,14,750.00	5,28,200.00	1,74,700.00	NA	NA	NA	2,81,304.20	1,70,055.10	81,304.10

Note: We used consolidated financial Statements



Formula Table

Parameter	Formula
Total Revenue	Total Income includes Revenue from Operations and Other income.
Revenue From Operations	Revenue from operations means the revenue from operations as appearing in the restated statement of profit & loss for the relevant year/period.
EBITDA	EBITDA is calculated as Profit before tax for the year, plus finance costs and depreciation and amortisation expenses, less other income.
EBITDA Margin (%)	EBITDA Margin (%) is calculated as EBITDA divided by Revenue from Operations
Profit after tax (PAT)	Profit after tax (PAT) refers to -Profit/(Loss) for the year from Continuing Operations
PAT Margin (%)	PAT Margin (%) is calculated as Profit for the year as a percentage of Revenue from Operations
Operating Cash Flow	Operating Cash Flow represents the net cash generated from or used in operating activities during the year, as reported in the Company's Statement of Cash Flows.
Net Worth	Net Worth is calculated as Total Assets minus Total Liabilities as at the end of the relevant fiscal/year.
Debt to Equity Ratio	Debt to Equity Ratio is calculated as Total Borrowings divided by Shareholders' Equity as at the end of the year.
Return on Equity (ROE)	ROE is calculated as - Profit attributable to owners of the Company divided by Equity for the year.
Return on Capital Employed (ROCE)	RoCE is calculated as Earnings before interest and taxes (EBIT) divided by Capital Employed. EBIT is calculated as Profit before tax plus finance costs.
Return on Asset (ROA)	Return on Assets (ROA) is calculated as - Profit attributable to owners of the Company divided by the Total Assets for the year.
Key Operating Cost	Key Operating Cost is calculated as total expenses less finance costs for the relevant Fiscal.
Interest Coverage Ratio	Interest Coverage Ratio is calculated as EBIT divided by finance costs for the relevant Fiscal, where EBIT is calculated as EBITDA less amortization.
Order Book	Order Book values are the value of outstanding executable orders as disclosed by the respective companies in their annual reports, investor presentations, or other publicly available disclosures for the relevant fiscal year.

