Industry Report Power T&D and Transformer Components

July 2025

Disclaimer

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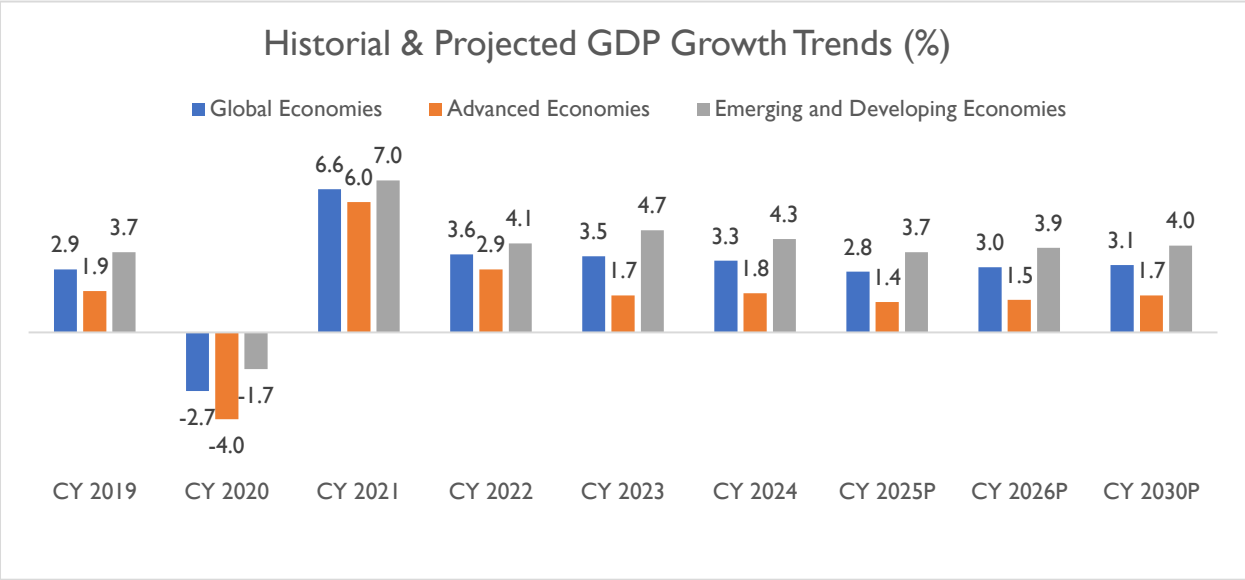
Global Economic Overview

The global economy, which recorded GDP growth at 3.3% in CY 2024, is expected to show resilience at 2.8% in CY 2025. This marks the slowest expansion since 2020 and reflects a -0.5%point downgrade from January 2025 forecast. Moreover, the projection for CY 2026 has also reduced to 3.0%. This slowdown is majorly attributed due to numerous factors such as high inflation in many economies despite central bank effort to curb inflation, continuing energy market volatility driven by geopolitical tensions particularly in Ukraine and Middle East, and the re-election of Donald Trump as US President extended uncertainty around the trade policies as well as overall global economic growth. High inflation and rising borrowing costs affected the private consumption on one hand while fiscal consolidation impacted the government consumption on the other hand. As a result, global GDP growth is estimated to moderation by 2.8% in CY 2025 as compared to 3.3% in CY 2024.

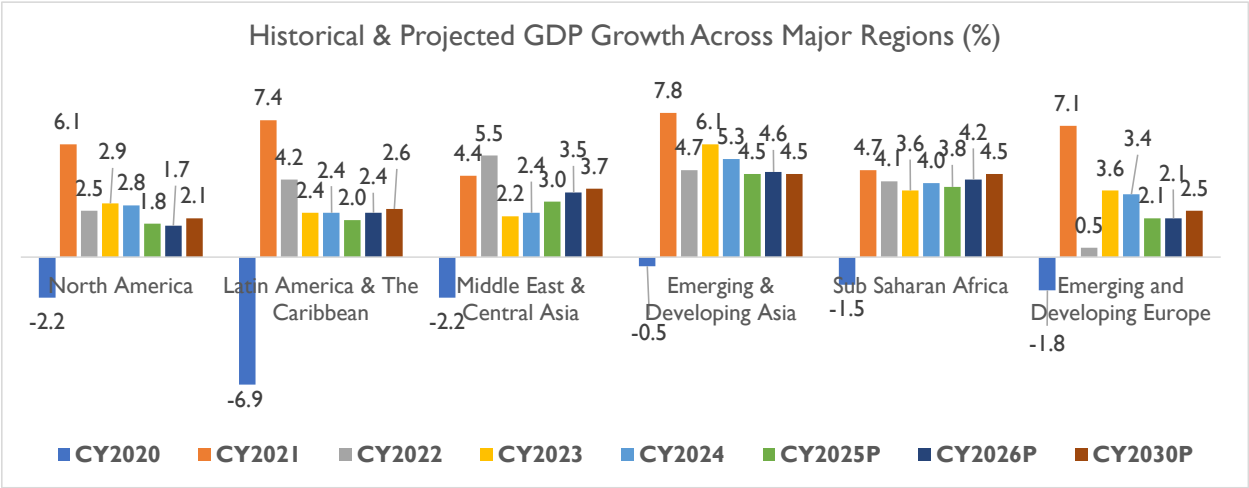


Source – IMF Global GDP Forecast Release April 2025

Note: Advanced Economies and Emerging & Developing Economies are as per the classification of the World Economic Outlook (WEO). This classification is not based on strict criteria, economic or otherwise, and it has evolved over time. It comprises of 40 countries under the Advanced Economies including the G7 (the United States, Japan, Germany, France, Italy, the United Kingdom, and Canada) and selected countries from the Euro Zone (Germany, Italy, France etc.). The group of emerging market and developing economies (156) includes all those that are not classified as Advanced Economies (India, China, Brazil, Malaysia etc.)

Historical and Projected GDP Growth

GDP growth across major regions exhibited a mixed trend between 2022-23, with GDP growth in many regions including North America, Emerging and Developing Asia, and Emerging and Developing Europe slowing further in 2024. In 2025, GDP growth rate in Emerging and Developing Asia (India, China, Indonesia, Malaysia, etc.) is expected to moderate further to 4.5% from 5.3% in the previous year, while in the North America, it is expected to moderate to 1.8% in CY 2025 from 2.8% in CY 2024.



Source-IMF World Economic Outlook April 2025 update.

Except Middle East & Central Asia, all other regions like Emerging and Developing Asia, Emerging and Developing Europe, Latin America & The Caribbean, Sub Saharan Africa and North America, are expected to record a moderation in GDP growth rate in CY 2025 as compared to CY 2024. Further, growth in the United States is expected to come down at 2.71% in CY 2025 from 2.80% in CY 2024 due to lagged effects of monetary policy tightening, gradual fiscal tightening, and a softening in labour markets slowing aggregate demand.

Global Economic Outlook

The global economy is navigating a period of exceptional uncertainty. Policy shifts, particularly those reshaping trade, have alarmed financial markets and bruised business sentiment. The U.S.'s reciprocal tariffs, which represent additional costs for businesses from almost all countries with which the U.S. trades, charge trade partners an import duty at a discounted rate of approximately half the rate that the trade partner currently imposes on the U.S. According to U.S. President Donald Trump, reciprocal tariffs, ranging from 10% to 50%, are meant to address trade barriers limiting U.S. exports. The *effective* tariff rate includes other tariffs imposed at an earlier date and cumulatively may now be higher than duties charged on U.S. imports. It is unclear whether the reciprocal tariffs represent a negotiating tool, and may therefore be temporary, or form part of broader long-term protectionist measures and industrial strategy.

Responses to reciprocal tariffs have been varied, with some economies promising swift countermeasures. More than 50 markets have sought negotiations with the US. While Malaysia is seeking a united response across ASEAN, the Chinese Mainland has retaliated with duties on all imports from the U.S., declaring it will "fight to the end". In early April 2025, the U.S. confirmed the most aggressive steps yet, with a cumulative 145% tariff on some products imported from the Chinese Mainland. Brazil has readied itself by passing a bill allowing for retaliation, Australia has ruled out retaliatory levies, and the EU remains open to negotiation while preparing a package of countermeasures.

Tariffs and their unpredictable application have weighed on consumer and business sentiment, sunk global stock markets, raised recession risks, and made a global slowdown more likely. Our latest Global Business Optimism Insights report indicates a further decline in business optimism as firms continue to grapple with trade-related policy uncertainty and its broader economic implications. Export-driven sectors reported sharp declines in optimism. Financial risk perceptions remain elevated as businesses contend with high borrowing costs and persistent inflation expectations. More broadly, the uncertainty is reflected in delayed capital expenditure and a pullback in hiring.

Tariffs have begun to exert pressure on central banks by contributing to inflationary pressures and increasing financial market volatility. Central banks are adjusting forward guidance and policy frameworks and may begin to consider the likelihood of softer growth being a bigger priority than high inflation by starting to cut interest rates to support economies. For businesses, this uncertainty translates into unpredictable cost structures, fluctuating credit availability, and the management of operational costs through diversified supply networks.

The latest Dun & Bradstreet Global Business Optimism Insights report reveals a further decline in business optimism, though at a more moderate pace than in the prior quarter, as businesses continued to grapple with trade-related policy uncertainty and its broader economic implications. Export-driven sectors such as automotives, electricals, and metals saw sharp declines in optimism, particularly in the U.S., Mexico, South Korea, and Japan, where rising tariffs and shifting trade policies have fueled cost pressures and demand volatility. Financial risk perceptions remain elevated.

Global Growth Projection

At broader level, the global economy is expected to experience a slowdown in 2025, with GDP growth projected to decline to 2.8%, down from 3.3% in 2024. This deceleration reflects persistent inflationary pressure, geopolitical uncertainties and tightened monetary policies. However, a sightly recovery is anticipated in 2026, with growth projected to improve to 3.0%. Global inflation is expected to decline steadily, to 4.3% in 2025 and to 3.6% in 2026. Inflation is projected to converge back to the target earlier in advanced economies, reaching 2.2% in 2026, whereas in emerging market and developing economies, it is anticipated to decrease to 4.6% during the same period. Trade tariffs function as a supply shock for the countries imposing them, leading to a decrease in productivity and an increase in unit costs. Countries subject to tariffs experience a negative demand shock as export demand declines, placing downward pressure on prices. In each scenario, trade uncertainty introduces an additional layer of demand shock since businesses and households react by delaying investment and spending, and this impact could be intensified by stricter financial conditions and heightened exchange rate volatility. Moreover, Global trade growth is expected to slow down in 2025 to 1.7%. This forecast reflects increased tariff restrictions affecting trade flows and, to a lesser extent, the waning effects of cyclical factors that have underpinned the recent rise in goods trade.

Geopolitical tensions as seen in the past such as the wars in Ukraine and the Middle East could exacerbate inflation volatility, particularly in energy and agricultural commodities.

India Macroeconomic Analysis

India emerged as one of the fastest growth economies amongst the leading advanced economies and emerging economies. In CY 2024, even amidst geopolitical uncertainties, particularly those affecting global energy and commodity markets, India continues to remain one of the fastest growing economies in the world and is expected to grow by 6.2% in CY 2025 and 6.3% in CY 2026.

Country	CY 2020	CY 2021	CY 2022	CY 2023	CY 2024	CY 2025	CY 2026 P	CY 2030 P
India	–5.8%	9.7%	7.6%	9.2%	6.5%	6.2%	6.3%	6.5%
China	2.3%	8.6%	3.1%	5.4%	5.0%	4.0%	4.0%	3.4%
United States	-2.2%	6.1%	2.5%	2.9%	2.8%	1.8%	1.7%	2.1%
Japan	-4.2%	2.7%	0.9%	1.5%	0.1%	0.6%	0.6%	0.5%
United Kingdom	-10.3%	8.6%	4.8%	0.4%	1.1%	1.1%	1.4%	1.4%
Russia	-2.7%	5.9%	-1.4%	4.1%	4.1%	1.5%	0.9%	1.2%

Source: World Economic Outlook, April 2025

The Government stepped spending on infrastructure projects to boost the economic growth had a positive impact on economic growth. The capital expenditure of the central government increased by average 26.52% during FY 2023-24 which slowed to 7.27% in FY 2025 which is expected to translate in moderating GDP growth of 6.5% in 2024. In the Union Budget 2025-2026, the government announced INR 11.21 trillion capex on infrastructure (10.12% higher than previous year revised estimates) coupled with INR 1.5 trillion in interest-free loans to states. This has provided much-needed confidence to the private sector, and in turn, expected to attract the private investment.

India's Sovereign Debt Outlook and Credit Rating

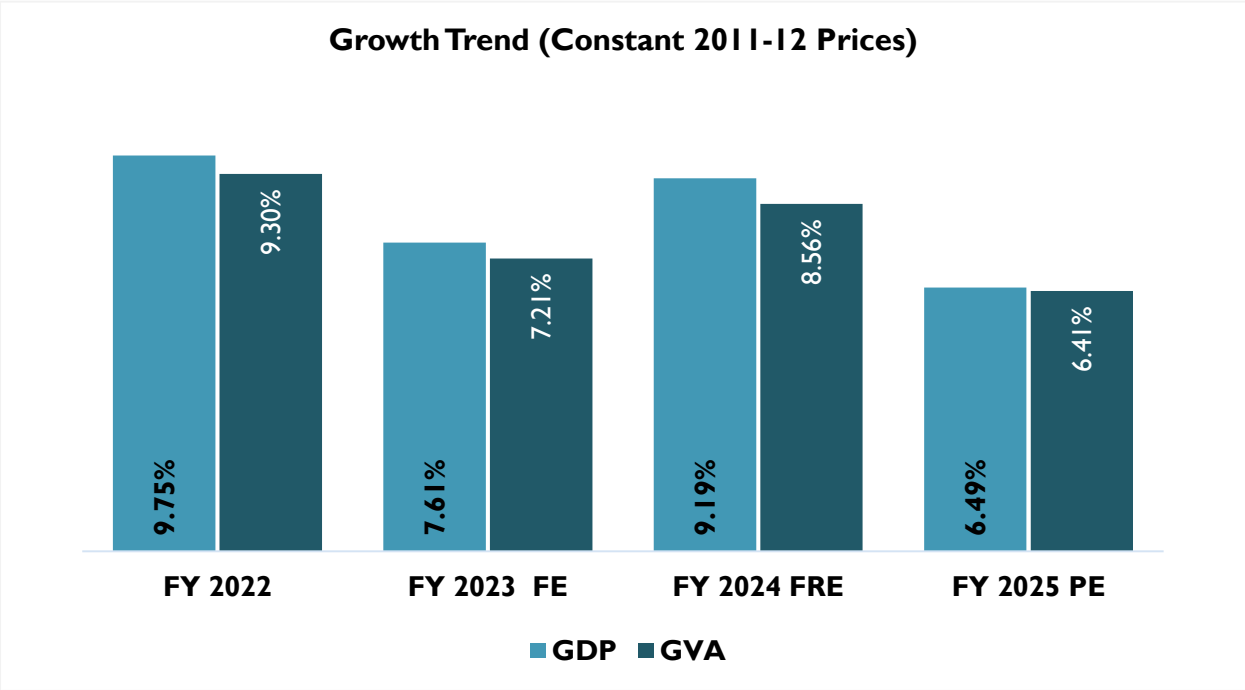
India's sovereign debt has been on an upward trajectory, reflecting the government's continued investment in infrastructure, welfare schemes, and economic stimulus measures. The debt stood at INR 171.78 lakh crore in FY 2024 and is projected to rise to INR 181.74 lakh crore in FY 2025, with further expansion to INR 196.78 lakh crore anticipated by FY 2026. While the growing debt levels raise concerns over fiscal pressure, they remain largely within sustainable limits when viewed in the context of India's nominal GDP growth, strong domestic demand, and the government's adherence to medium-term fiscal consolidation targets. India's ability to manage a high debt burden is further supported by a relatively low share of external debt and a deep, well-regulated domestic financial market that absorbs a significant portion of government borrowings.

Despite the increase in sovereign debt, international rating agencies have taken a more positive view of India's fiscal and economic outlook. In a notable development, Morningstar DBRS upgraded India's Long-Term

Foreign and Local Currency – Issuer Ratings from BBB (low) to BBB, maintaining a Stable trend. The agency also upgraded the Short-Term Foreign and Local Currency Issuer Ratings from R-2 (middle) to R-2 (high), again with a Stable outlook. These upgrades reflect global investor confidence in India's economic resilience, consistent policy direction, and macroeconomic stability, even amid global uncertainties. The improved ratings enhance India's credit profile and can positively impact the cost of international borrowing, foreign investment flows, and overall perception of India as a stable and growing economy.

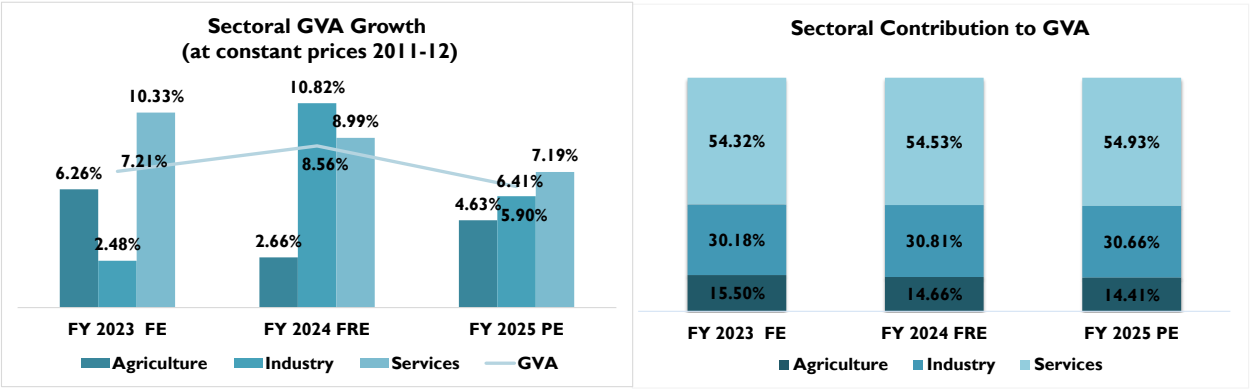
Historical GDP and GVA Growth trend

As per the latest estimates, India's GDP at constant prices is estimated to grow to INR 187.96 trillion in FY 2025 (Provisional Estimates) with the real GDP growth rates estimated to be 6.5% for FY 2025. Similarly, real Gross Value Added (GVA) growth stood is estimated to have moderated to 6.4% in FY 2025. Even amidst global economic uncertainties, India's economy exhibited resilience supported by robust consumption and government spending.



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

Sectoral Contribution to GVA and annual growth trend



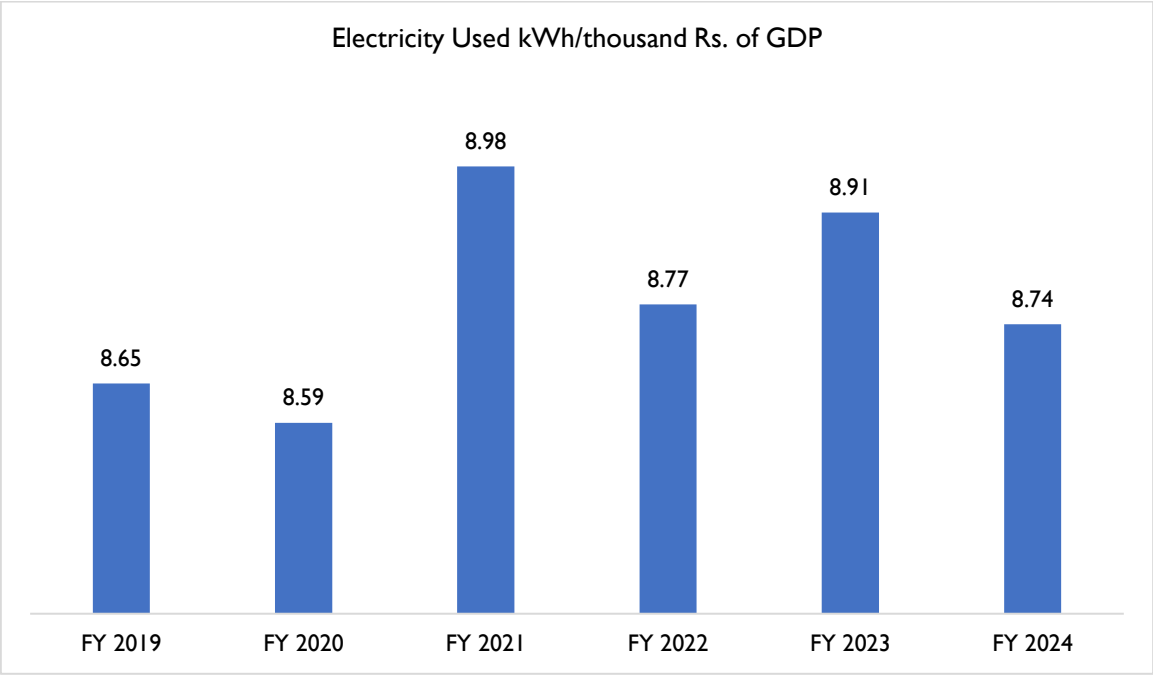
Source: Ministry of Statistics & Programme Implementation (MOSPI)
FE is Final Estimates, FRE is First Revised Estimate and PE is Provisional Estimates

Sectoral analysis of GVA reveals that the industrial sector experienced a moderation in FY 2025, recording a 5.90% y-o-y growth against 10.82% year-on-year growth in FY 2024. Within the industrial sector, growth moderated across sub sector with mining, manufacturing, and construction activities growing by 2.69%, 4.52%, and 9.35% respectively in FY 2025, compared to 3.21%, 12.30%, and 10.41% in FY 2024. Growth in the utilities sector too moderated to 6.03% in FY 2025 from 8.64% in the previous year. The industrial sector's contribution to GVA moderated marginally from 30.81% in FY 2024 to 30.66% in FY 2025.

The services sector continued to be the main driver of economic growth, although its pace moderated. It expanded by 7.19% in FY 2025 from 8.99% in FY 2024. The services sector retained its position as the largest contributor to GVA, rising from 54.32% in FY 2023 to 54.53% in FY 2024, with a further increase to 54.93% in FY 2025.

The agriculture sector saw an acceleration, with growth increasing from 2.66% in FY 2024 to 4.63% in FY 2025. However, its contribution to GVA declined marginally from 14.66% in FY 2024 to 14.41% in FY 2025. Overall, Gross Value Added (GVA) growth moderated to 6.41% in FY 2025 from 8.56% in FY 2024.

Electricity Efficiency in Economic Production



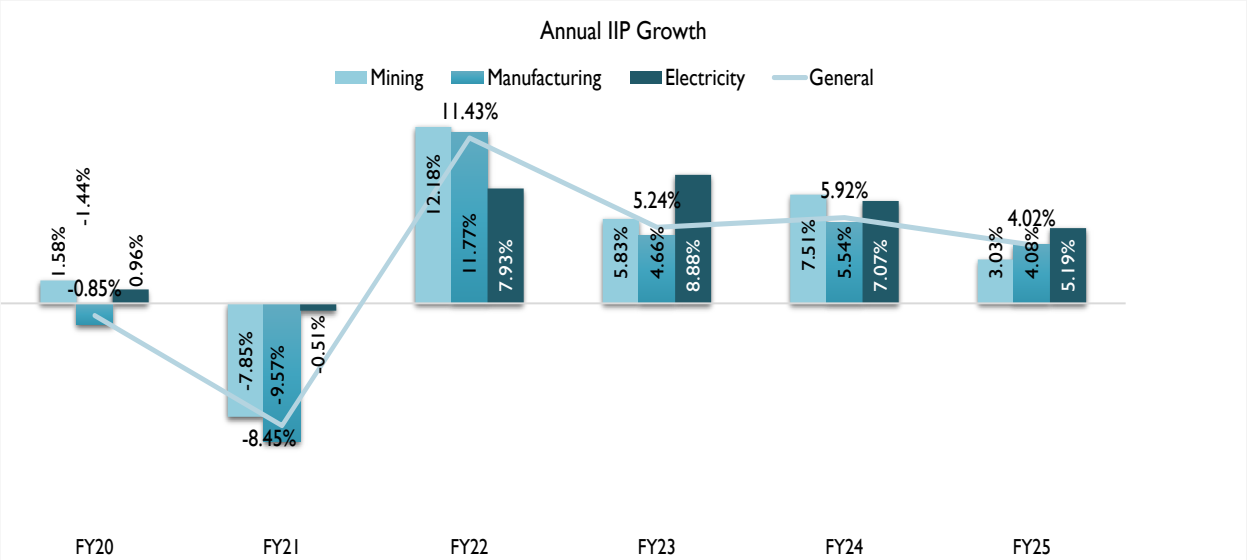
Source: Ministry of Statistics & Programme Implementation (MOSPI) [1]

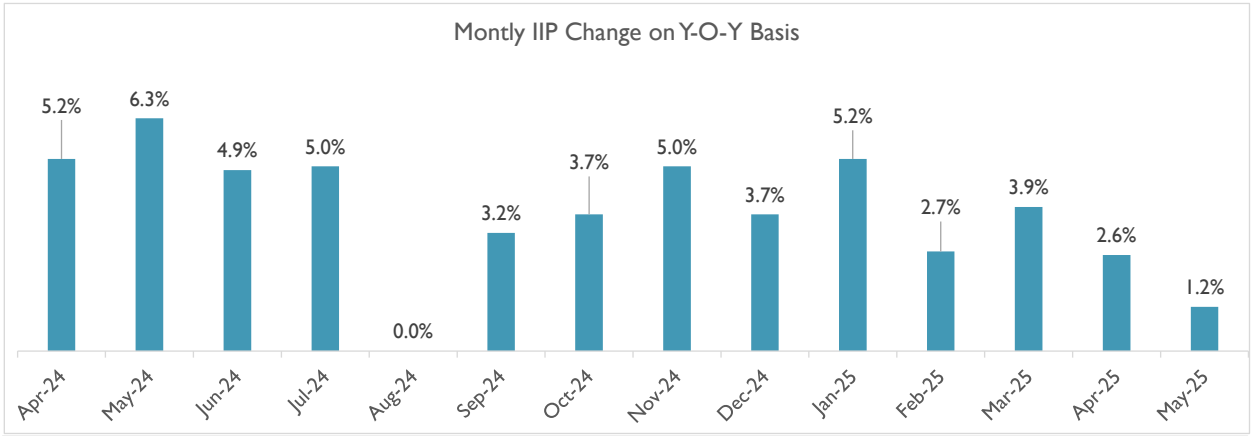
India's electricity intensity measured as electricity used (kWh) per thousand rupees of GDP has remained relatively stable over the period from FY 2019 to FY 2024, fluctuating within a narrow range of 8.59 to 8.98. In FY 2020, the ratio dipped slightly to 8.59, primarily due to reduced industrial and commercial activity during the COVID-19 lockdown. However, it rose again to 8.98 in FY 2021 as electricity demand rebounded faster than economic output. In recent years, the intensity has moderated slightly, reaching 8.74 in FY 2024, indicating marginal improvements in energy efficiency. This trend shows that while India has made progress in increasing renewable energy adoption and deploying efficient technologies, significant gains in energy efficiency are still needed. Reducing electricity intensity further will require a focused push on energy-efficient infrastructure, clean technology deployment, and a shift toward less energy-intensive sectors such as digital services and low-carbon industries.

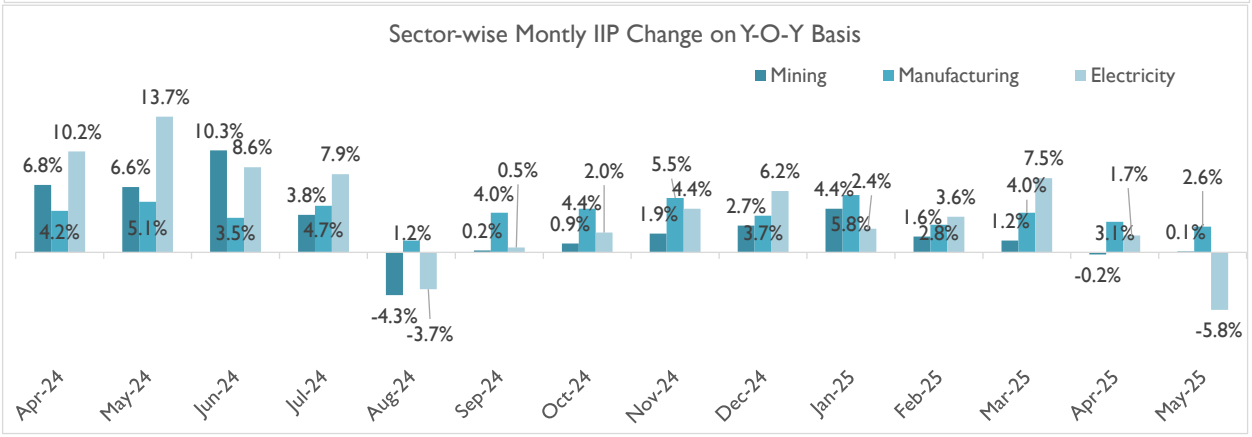
Annual & Monthly IIP Growth

Industrial sector performance as measured by IIP index exhibited moderation in FY 2025, recording a 4.02% y-o-y growth against 5.92% increase in the previous year. The manufacturing index showed moderation and grew by 4.08% in FY 2025 against 5.54% in FY 2024. Mining sector index too moderated and exhibited a growth of 3.03% in FY 2025 against 7.51% in the previous years while the Electricity sector Index, also witnessed moderation of 5.19% in FY 2024 against 7.07% in the previous year.

[1] This is as per the latest data available on MOSPI





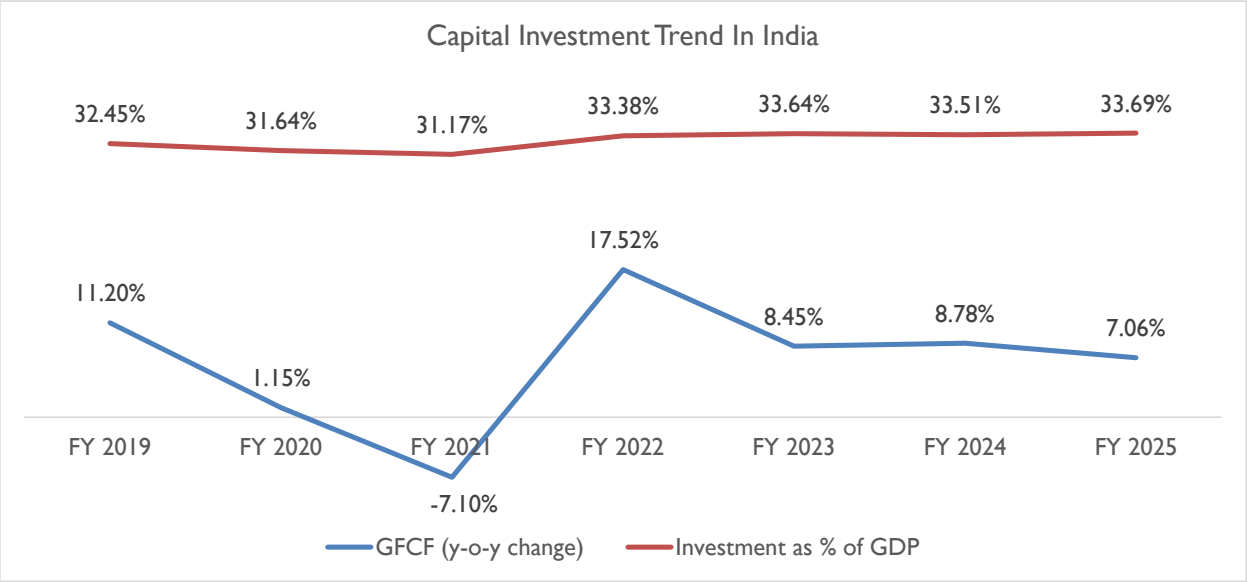


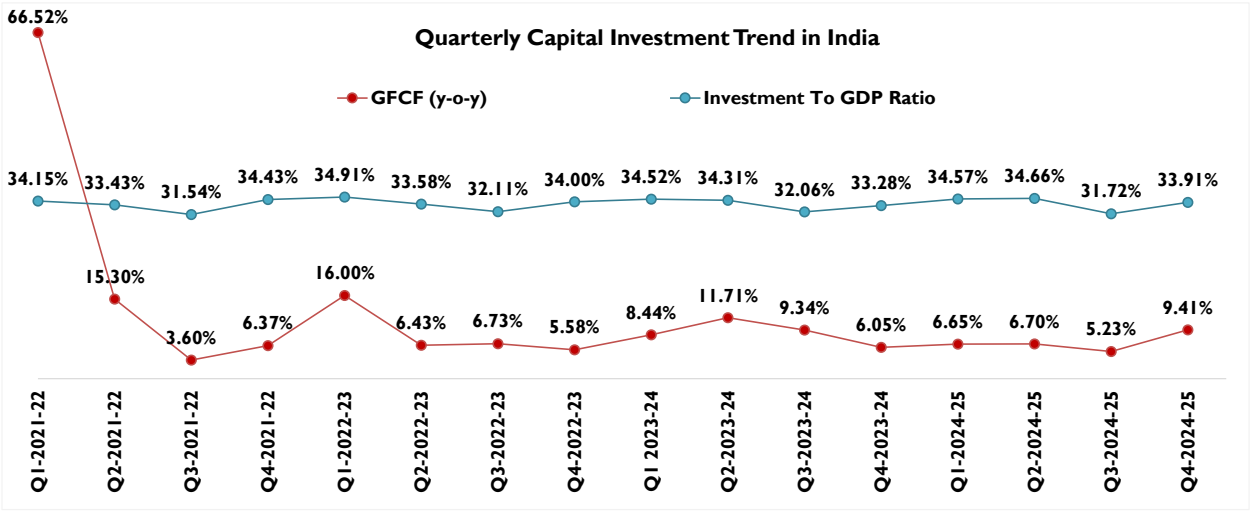
Source: Ministry of Statistics & Programme Implementation (MOSPI)

The IIP growth rate for the month of May 2025 is 1.2% which was 2.6% in the month of April 2025. The growth rates of the three sectors, Mining, Manufacturing and Electricity for the month of May 2025 are (-)0.1%, 2.6% and (-)5.8% respectively.

Annual and Quarterly: Investment & Consumption Scenario

Other major indicators such as Gross fixed capital formation (GFCF), a measure of investments, has shown fluctuation during FY 2025 as it registered 7.06% year-on-year growth against 8.78% yearly growth in FY 2024, taking the GFCF to GDP ratio measured to 33.69%.

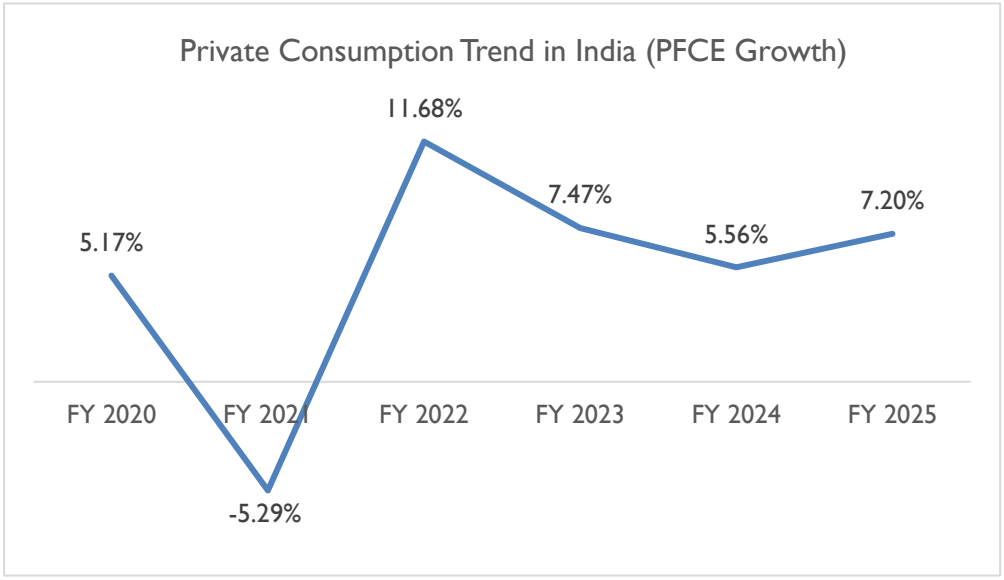


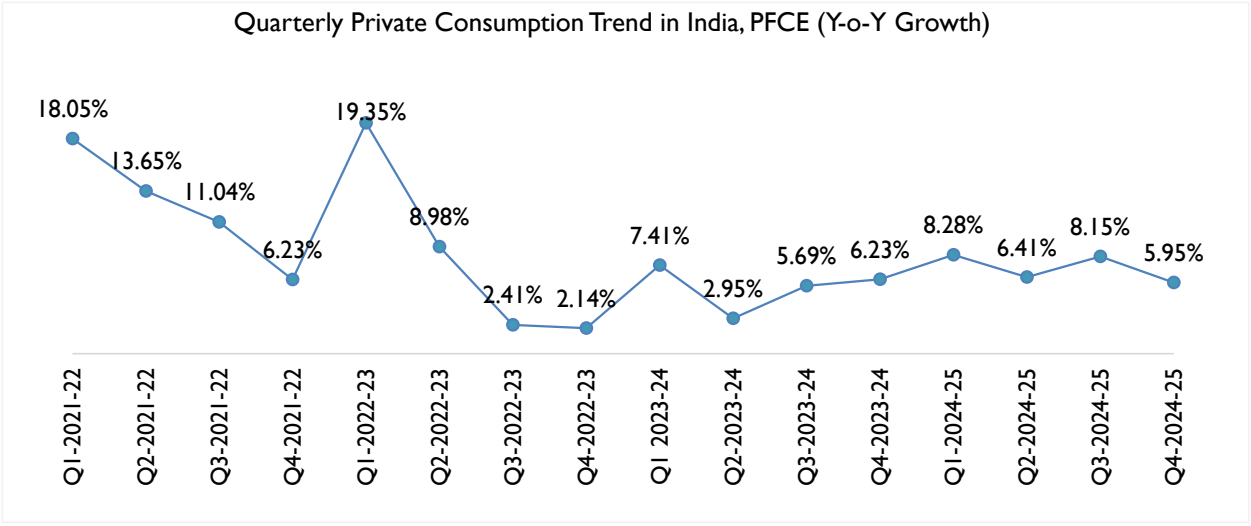


Source: Ministry of Statistics & Programme Implementation (MOSPI)

On quarterly basis, GFCF exhibited a fluctuating trend in quarterly growth over the previous year same quarter. In FY 2024, the growth rate moderated to 6.05% in March quarter against the previous two quarter as government went slow on capital spending amidst the 2024 general election while it observed an improvement in Q1 FY 2025 by growing at 6.65% against 6.05% in the previous quarter and moderated in the subsequent two quarter. On yearly basis, the growth rate remained lower compared to the same quarter in the previous year during FY 2025. The GFCF to GDP ratio measured 33.91% in Q4 FY 2025.

Private Consumption Scenario





Sources: MOSPI

Private Final Expenditure (PFCE) a realistic proxy to gauge household spending, observed growth in FY 2025 as compared to FY 2024. However, quarterly data indicated some improvement in the current fiscal as the growth rate improved over the corresponding period in the last fiscal.

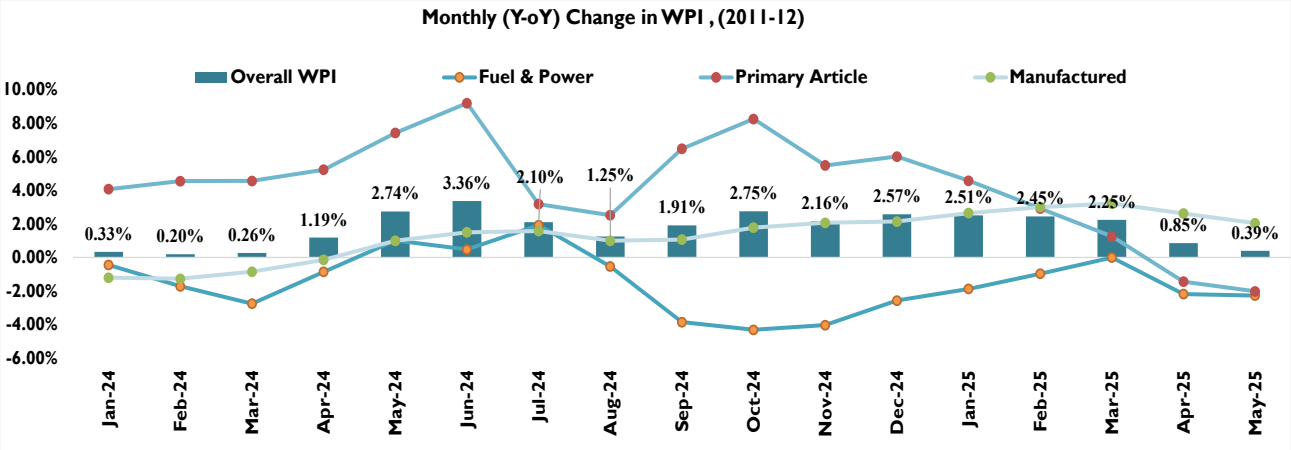
Inflation Scenario

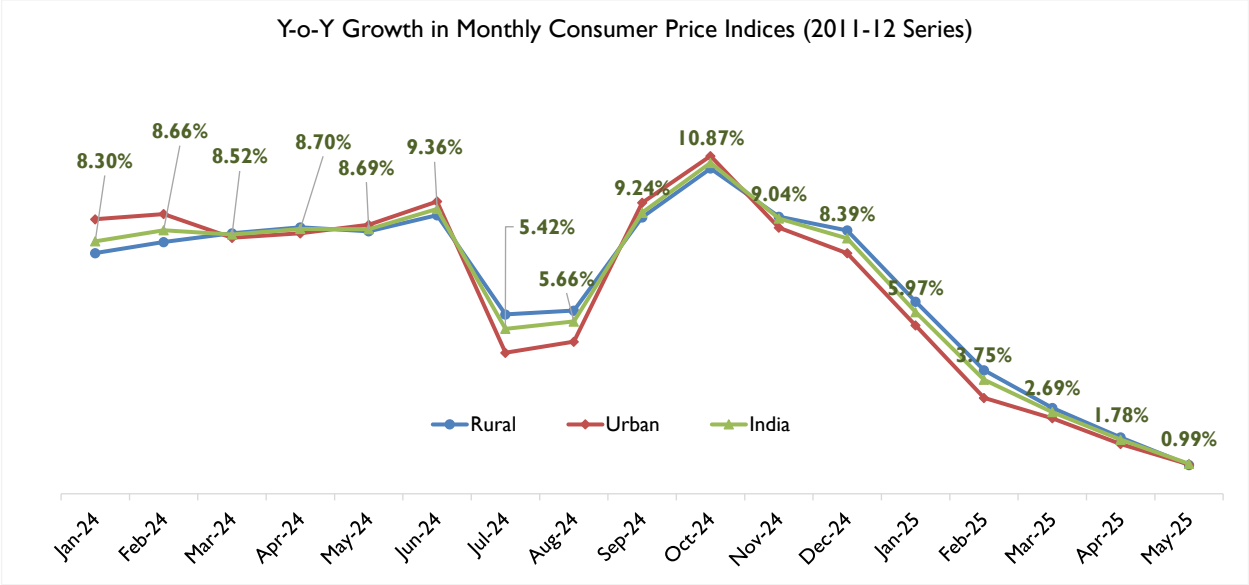
The inflation rate based on India's Wholesale Price Index (WPI) exhibited significant fluctuations across different sectors from January 2024 to May 2025. The annual rate of inflation based on All India Wholesale Price Index (WPI) number is 0.39% (provisional) for the month of May 2025 (over May 2024). Positive rate of inflation in May 2025 is primarily due to increase in prices of manufacture of food products, electricity, other manufacturing, chemicals and chemical products, manufacture of other transport equipment and non-food articles etc.

By May 2025, Primary Articles (Weight 22.62%), The index for this major group decreased by 0.05 % to 184.3 (provisional) in May 2025 from 184.4 (provisional) for the month of April 2025. Price of minerals (-7.16%) and non-food articles (-0.63%) decreased in May 2025 as compared to April 2025. The price of food articles (0.56%) increased in May 2025 as compared to April 2025.

Moreover, power & fuel, the index for this major group declined by 0.95% to 146.7 (provisional) in May 2025 from 148.1 (provisional) for the month of April 2025. Price of mineral oils (-2.06%) decreased in May 2025 as compared to April 2025. The price of coal (0.81%) and electricity (0.80%) increased in May 2025 as compared to April 2025.

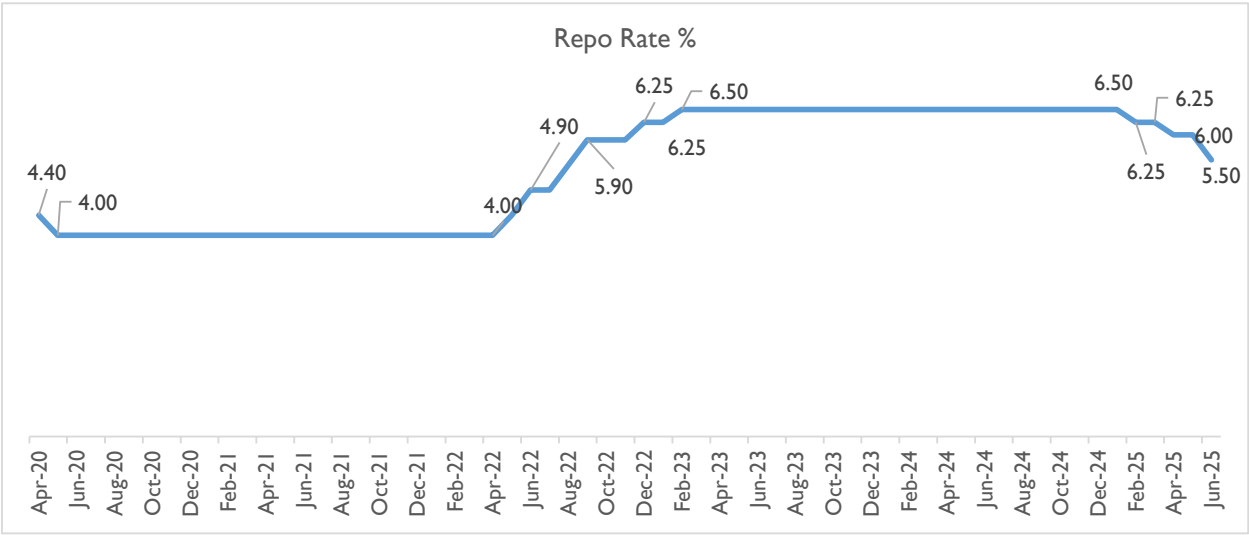
Furthermore, Manufactured Products (Weight 64.23%), The index for this major group remained unchanged at 144.9 (Provisional) in May 2025. Out of the 22 NIC two-digit groups for manufactured products, 10 groups witnessed an increase in prices, 9 groups witnessed a decrease in prices and 3 groups witnessed no change in prices. Some of the important groups that showed month-over-month increase in prices were other manufacturing; manufacture of other non-metallic mineral products; computer, electronic and optical products; pharmaceuticals, medicinal chemical and botanical products and textiles etc. Some of the groups that witnessed a decrease in prices were manufacture of food products, basic metals; rubber and plastics products, chemical and chemical products and electrical equipment etc. in May 2025 as compared to April 2025.





Source: MOSPI, Office of Economic Advisor

Retail inflation rate (as measured by the Consumer Price Index) in India showed notable fluctuations between January 2024 and May 2025. Overall, the national CPI inflation rate moderated to 0.99% by May 2025, indicating a gradual easing of inflationary pressures across both rural and urban areas. Rural CPI inflation peaked at 10.69% in October 2024, declining to 0.95 % in May 2025. Urban CPI inflation followed a similar trend, rising to 11.09% in October 2024 and then dropping to 0.96% in May 2025. CPI measured above 6.00% tolerance limit of the central bank since July 2023. As a part of an anti-inflationary measure, the RBI has hiked the repo rate by 250 bps since May 2022 and 8 Feb 2023 while it held the rate steady at 6.50 % till January 2025. On 6th June 2025, RBI reduced the repo rate by 50 basis points which currently stands at 5.50%.



Sources: CMIE Economic Outlook

Growth Outlook

The Union Budget 2025-26 has laid the foundation for sustained growth by balancing demand stimulation, investment promotion and inclusive development. Inflation level is reaching within the central bank's target; the RBI may pursue further monetary easing that will support growth. The medium-term outlook is bright,

fuelled by the emphasis on physical and digital infrastructure spending. With a focus on stimulating demand, driving investment and ensuring inclusive development, the budget introduces measures such as tax relief, increased infrastructure spending and incentives for manufacturing and clean energy. These initiatives aim to accelerate growth while maintaining fiscal discipline, reinforcing India's long-term economic resilience. The expansion of tax relief i.e zero tax liability for individuals earning up to INR 12 lacs annually under the new tax regime is expected to strengthen household finances and, consequently, boost consumption.

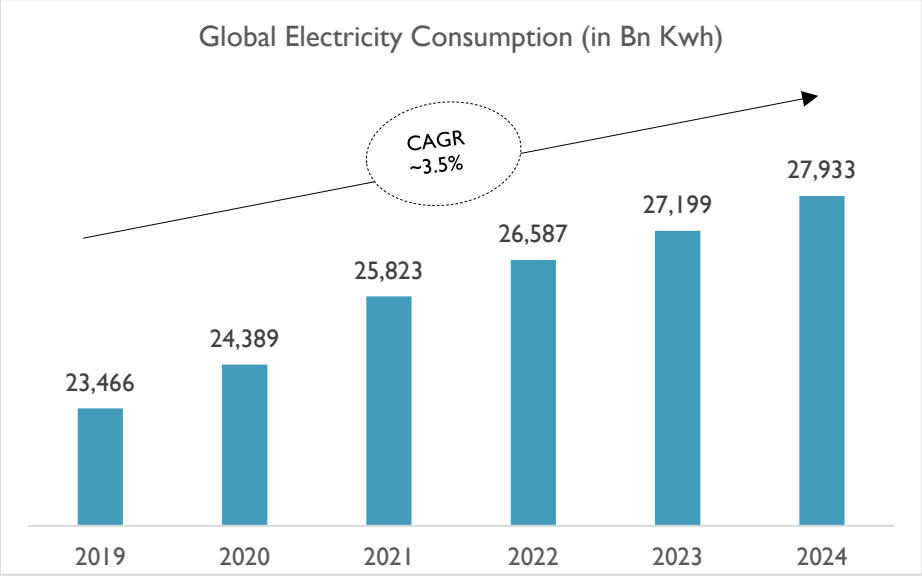
The external sector remains resilient, and key external vulnerability indicators continue to improve. However, tariff-related uncertainty is likely to weigh on exports and investment, prompting us to cut our FY26 GDP growth forecast to 6.3%.

Electricity Landscape

Per Capita Electricity Consumption

Global Electricity Consumption Landscape

Globally, electricity consumption per person varies widely across regions, with developed economies consuming significantly more than developing ones. The disparity reflects differences in economic development, industrialization, and access to energy. In developed economies such as the U.S. and Canada, high per capita electricity consumption is driven by energy-intensive lifestyles, industrial activities, and the increasing adoption of electric vehicles. Emerging economies like China have experienced a significant rise in consumption due to rapid industrialization, urbanization, and technological advancements. Meanwhile, several European countries, despite having high consumption levels, are prioritizing renewable energy sources and energy efficiency to minimize the environmental impact of their electricity usage.



Source: Energy Information Administration, D&B Desk Research[2]

The global electricity consumption has shown consistent growth from 2019 to 2024. In 2019, total consumption stood at 23,466 billion kilowatt-hours (kWh), which increased to 24,389 billion kWh in 2020, reflecting a slight rise despite the global slowdown due to the pandemic. The recovery in 2021 is more pronounced, with consumption jumping to 25,823 billion kWh, driven by renewed economic activities and industrial demand. By 2022, the global electricity consumption further climbed to 26,587 billion kWh, indicating steady growth at a Compound Annual Growth Rate (CAGR) of approximately 3.5% over the

[2] This is as per the latest data available on Energy Information Administration

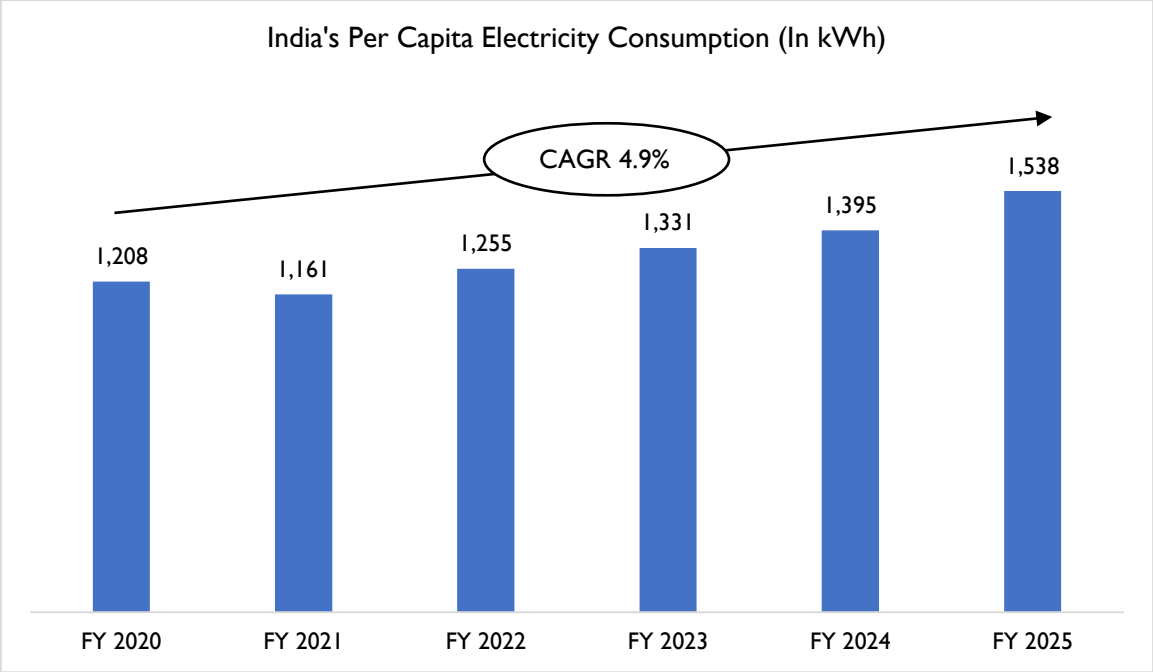
period. This upward trend is expected to continue, with consumption forecasted to reach 27,199 billion kWh in 2023 and 27,933 billion kWh by 2024.

This growth is primarily attributed to rising energy demand from both developed and emerging economies, increased electrification, and industrial expansion. Moreover, the increasing integration of electric vehicles, technological advancements, and growing urbanization contribute significantly to the surge in electricity consumption. However, this steady rise also underscores the need for greater adoption of renewable energy sources and energy-efficient technologies to ensure sustainable energy usage globally.

India's Per Capita Electricity Consumption

India's per capita electricity consumption has been steadily increasing over the years, reflecting its rapid industrialization, urbanization, 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 includes extensive rural electrification efforts through initiatives such as 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 urbanization, along with increasing appliance ownership and evolving consumption patterns, has further driven higher electricity usage in residential sectors. 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, D&B Desk Research

India has demonstrated a notable upward trend in per capita electricity consumption over recent fiscal years, reflecting a broader expansion in energy use among its population. The per capita consumption, measured in kilowatt-hours kWh, exhibited a consistent increase from FY 2020 to FY 2025, with an overall CAGR of 4.9%. This growth trajectory signifies an ongoing rise in electricity demand, likely driven by economic development, increased industrial activity, and improving access to electricity across various regions.

In FY 2020, per capita consumption was 1,208 kWh, which dipped slightly to 1,161 kWh in FY 2021, likely due to pandemic-related disruptions. However, consumption rebounded in FY 2022 to 1,255 kWh, followed by continued growth to 1,331 kWh in FY 2023. The positive trajectory persisted into FY 2024, with consumption rising to 1,395 kWh, and further to 1,538 kWh in FY 2025. This consistent increase underscores India's ongoing efforts to improve electricity access, support industrial growth, and enhance living standards across urban and rural areas.

This steady increase in per capita consumption underscores India's expanding energy needs. The CAGR of 4.9% suggests a sustained growth in electricity consumption, which can be attributed to several factors. These include a growing population, urbanization, industrialization, and improvements in living standards. The rise in consumption also reflects the ongoing efforts to enhance electricity access and infrastructure across the country.

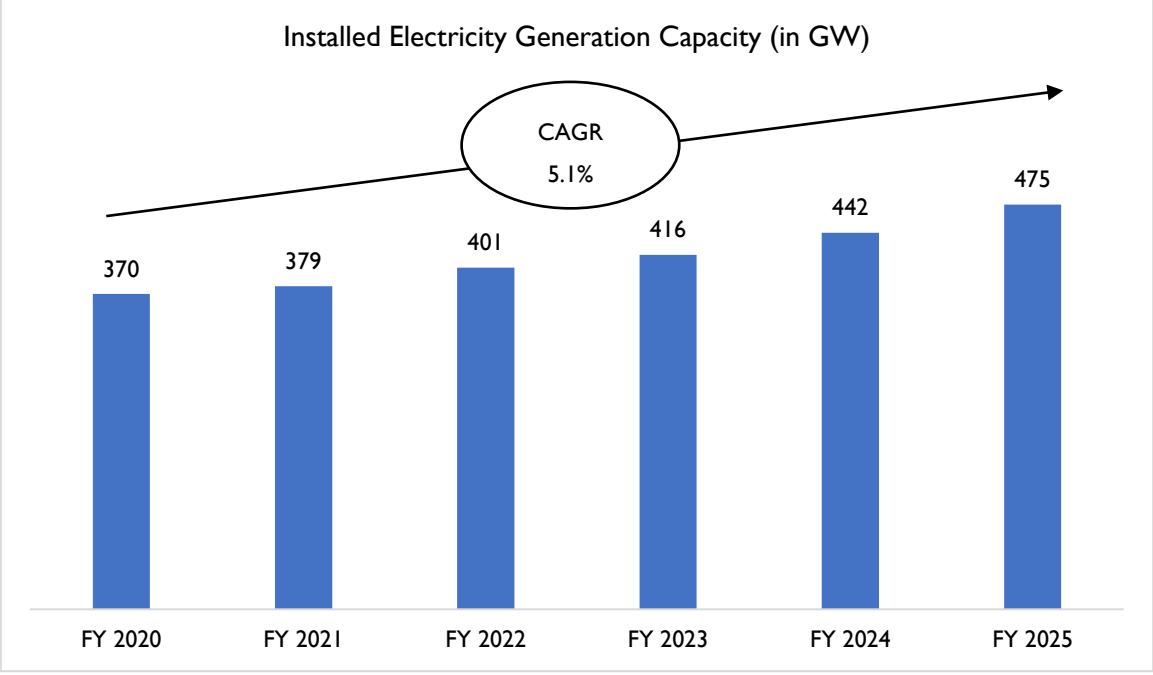
Installed Capacity and Generating Capacity

Electricity demand in India has grown exponentially on the back of rapid urbanization, and large-scale industrialization. The two factors have increased the pool of consumers, as well as increased the per head unit consumption. This developing demand landscape have led to a rapid scale up in generation sector- with capacity addition happening across thermal, hydroelectric, nuclear, and renewable energy.

Installed Capacity

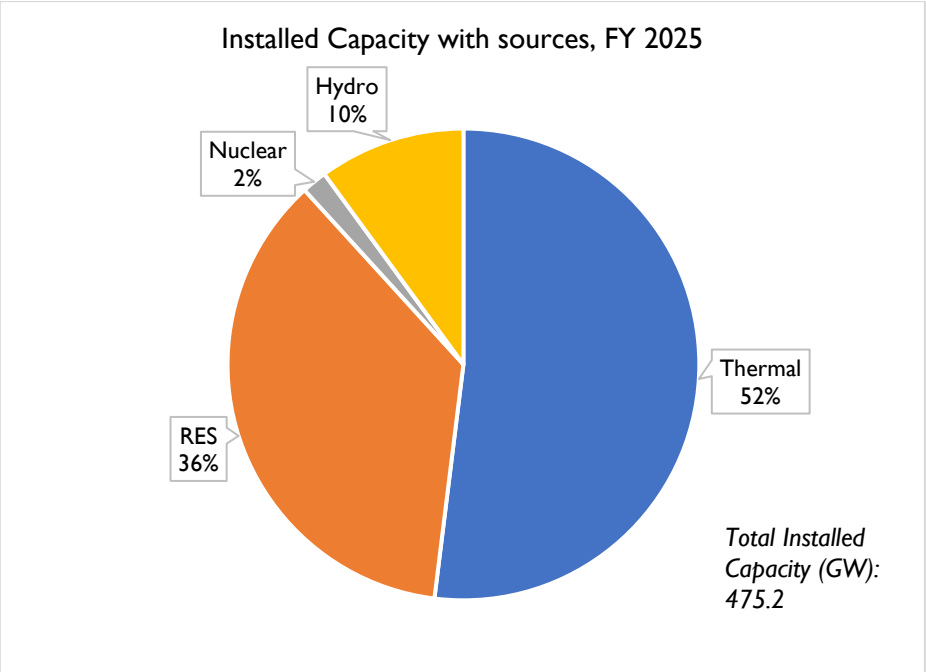
India's installed electricity generation capacity has shown consistent growth over the past five years, increasing from 370 GW in FY 2020 to 475 GW in FY 2025. This expansion represents a CAGR of 5.1%, underscoring the country's sustained efforts to enhance its power infrastructure in response to rising energy demand. Year-on-year additions have been steady, with capacity rising to 379 GW in FY 2021, 401 GW in FY 2022, and further to 416 GW in FY 2023. This upward trend reflects India's proactive approach to ensuring energy availability for industrial, commercial, and residential sectors.

The acceleration in capacity addition is driven by significant investments in both conventional and renewable energy sources. From 416 GW in FY 2023, the installed capacity reached 442 GW in FY 2024 and further climbed to 475 GW in FY 2025, indicating a strong push toward energy diversification and sustainability. This growth not only supports India's economic expansion but also aligns with national objectives of improving energy access, reducing dependence on imports, and transitioning to a cleaner, more resilient energy system..



Source: Central Electricity Authority, Ministry of Power

As of FY 2025, India's total installed electricity generation capacity stands at 475.2 GW, reflecting a well-diversified energy mix. The composition of this capacity highlights the country's ongoing efforts to balance energy security, affordability, and sustainability in its power sector strategy.



Source: Central Electricity Authority

Thermal power continues to dominate the energy landscape, accounting for 52% of the total installed capacity, or 246.93 GW. This includes coal, lignite, gas, and diesel-based generation. Despite growing environmental concerns, thermal power remains the backbone of India's electricity supply due to its ability to provide consistent base-load power and support grid stability, particularly in regions with high demand and limited renewable penetration.

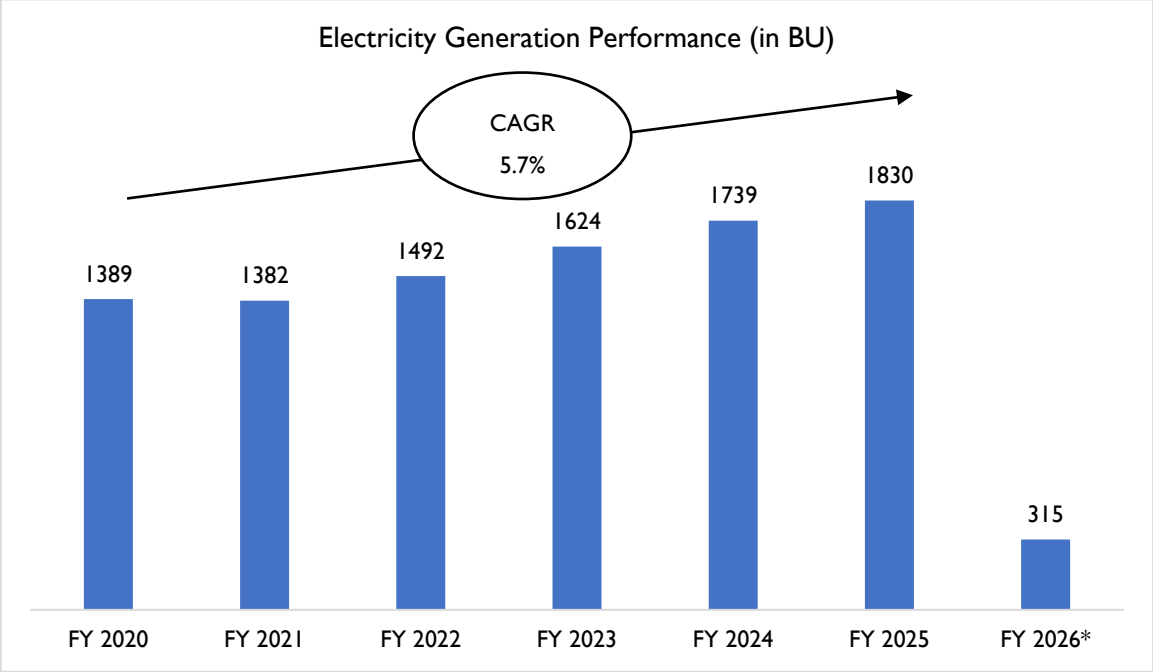
Renewable Energy Sources (RES), comprising solar, wind, biomass, and small hydro, make up 36% of the installed capacity, totalling 172.36 GW. This significant share reflects India's strong commitment to clean energy, driven by ambitious government targets, favourable policy frameworks, and increased private sector participation. Solar and wind energy, in particular, have seen rapid growth due to falling technology costs and large-scale project implementation under national missions.

Hydropower contributes 10% of the capacity (47.72 GW), reinforcing its role as a flexible and dispatchable renewable source. Hydropower not only aids in peak load management but also supports grid balancing, especially with the growing share of intermittent renewables like solar and wind. Meanwhile, nuclear energy, with a capacity of 8.18 GW (or 2%), provides a stable, low-emission base-load alternative and continues to play a supporting role in India's clean energy ambitions.

This distribution of capacity in FY 2025 reflects India's multi-pronged approach to energy planning, maintaining reliable conventional generation while accelerating the shift toward greener and more sustainable energy solutions.

Generation Capacity

India's electricity generation performance has shown a steady upward trend over recent years, reflecting both an expansion in installed capacity and a growing demand for power across sectors. Measured in billion units (BU), total electricity generation increased from 1,389 BU in FY 2020 to 1,830 BU in FY 2025, registering a CAGR of approximately 5.7% during this five-year period. This sustained growth highlights the country's continued investments in power infrastructure and its ability to respond to the evolving energy requirements of a growing economy.



Source: Central Electricity Authority

* Note: FY 2026 figures are up to May 2025

After a marginal decline from 1,389 BU in FY 2020 to 1,382 BU in FY 2021, largely due to lower industrial and commercial activity during the pandemic, electricity generation rebounded strongly in subsequent years. Generation rose to 1,492 BU in FY 2022, followed by 1,624 BU in FY 2023, and 1,739 BU in FY 2024, reflecting the recovery of economic activity, increased electrification of rural areas, and growing consumption from sectors like manufacturing, data centers, metro rail systems, and electric mobility. The output further increased to 1,830 BU in FY 2025, driven by higher peak demand and improved availability of generation assets. Preliminary data for FY 2026, based on figures available up to May 2025, indicates that 315 BU have already been generated in the first two months, suggesting that the country is on track to surpass or match the previous year's performance, provided seasonal trends hold. The electricity generation target for FY 2026 has been set at 2,000 BU[3], comprising contributions from thermal, hydro, nuclear, imports from Bhutan, and

[3] Central Electricity Authority

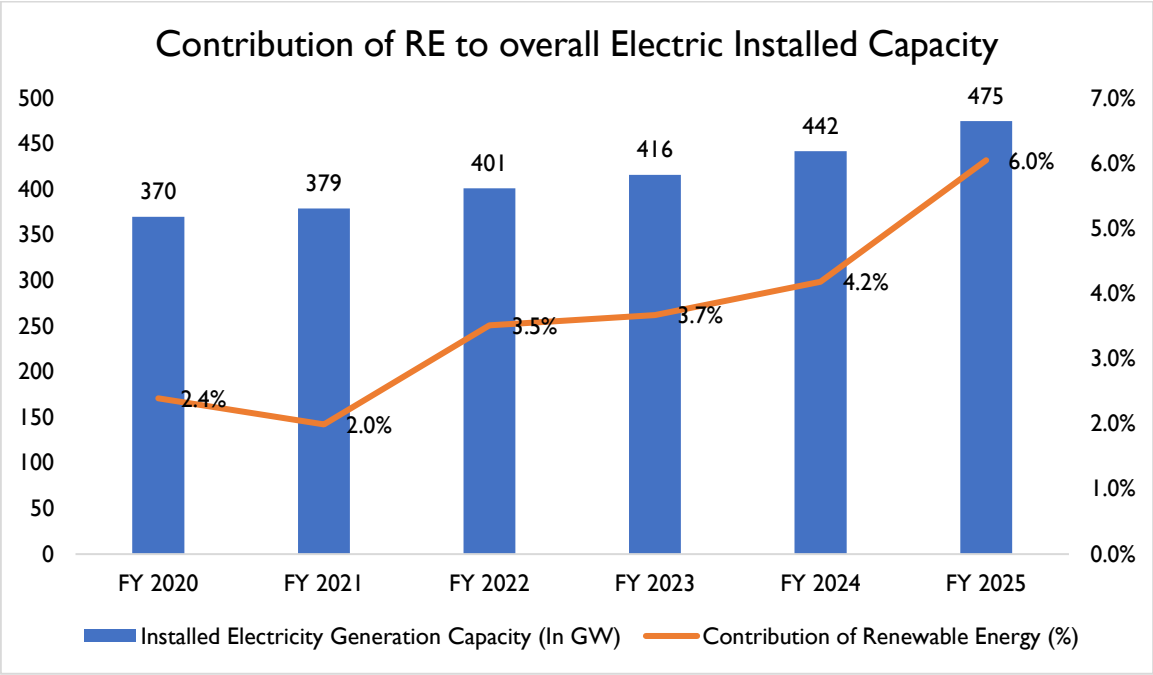
renewable energy sources (excluding large hydro), indicating the government's expectations for continued growth in demand and generation output.

This upward momentum is also supported by improved operational performance, particularly in thermal power plants, where plant load factors have shown a notable increase. The combination of robust electricity demand and the intermittent nature of renewable generation has reinforced the importance of stable base-load capacity, enabling better utilization of existing thermal assets. At the same time, solar and wind energy have continued to expand their role in the energy mix, supported by favourable policy frameworks and strong investment flows. The growing contribution of renewables reflects India's progress in transitioning to a cleaner energy system and integrating variable power sources more effectively into the national grid.

As India advances toward its clean energy and electrification goals, the positive generation trend reinforces the sector's growing efficiency, adaptability, and readiness to support long-term economic development and sustainability objectives. Continued capacity augmentation, grid modernization, and digitalization of distribution networks are expected to further bolster electricity generation and delivery in the years ahead.

Contribution of RE to Overall Installed Capacity

India's installed electricity generation capacity has demonstrated consistent growth, rising from 370 GW in FY 2020 to an estimated 475 GW in FY 2025, reflecting the country's ongoing efforts to expand and modernize its power infrastructure. This growth is largely driven by the rising energy needs of an increasingly industrialized and urbanized economy, alongside policy-driven investments in both conventional and renewable energy segments. The capacity expansion has accelerated particularly in recent years, with a notable jump from 401 GW in FY 2022 to 442 GW in FY 2024, and further to 475 GW in FY 2025, aligning with India's broader goals of ensuring energy security and meeting its developmental demands.

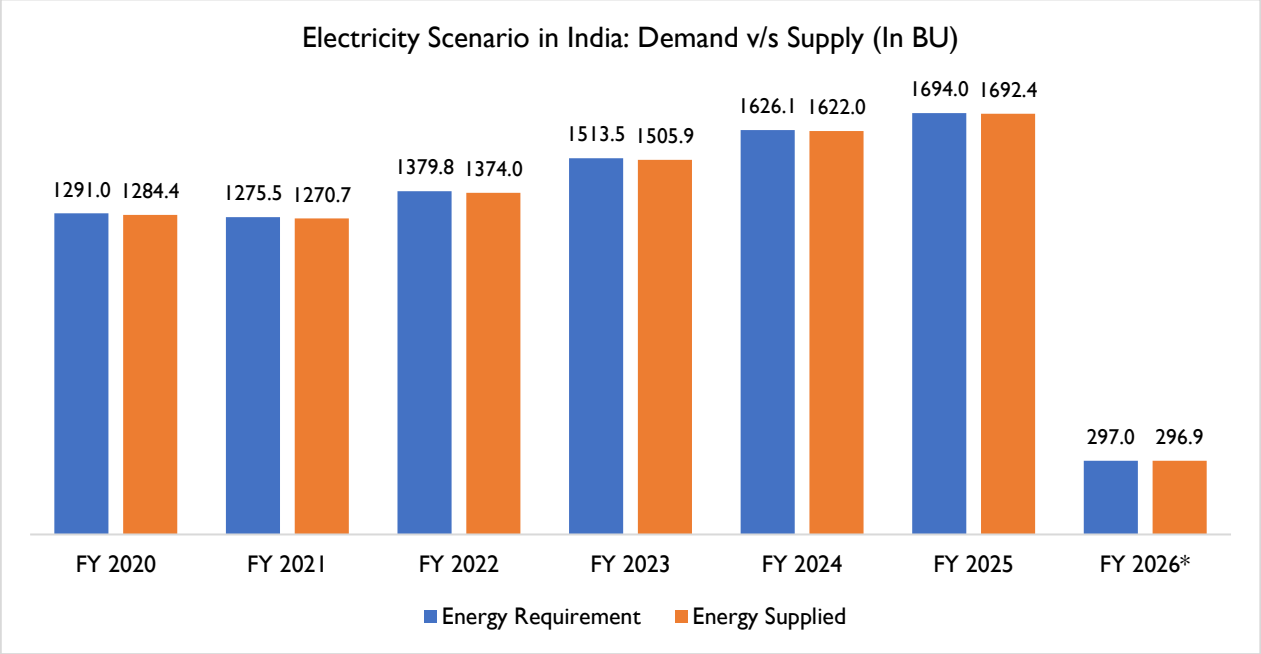


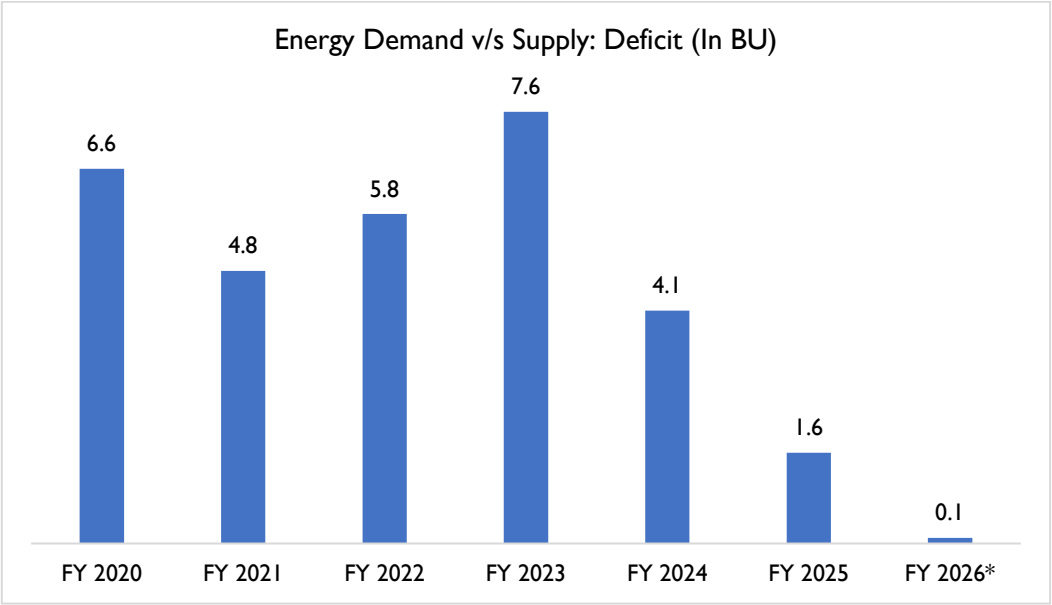
Source: MNRE and CEA, D&B analysis

At the same time, the contribution of renewable energy to total electricity generation has seen a significant uptrend, despite initial fluctuations. After a dip to 2.0% in FY 2021, the renewable share recovered steadily, rising to 3.5% in FY 2022, 4.2% in FY 2024, and reaching 6.0% in FY 2025. This upward trajectory highlights India's reinforced commitment to clean energy transition and climate resilience. The increase in renewable contribution, particularly between FY 2022 and FY 2025, signifies the country's strategic push toward decarbonization and its efforts to reduce reliance on fossil fuels while fostering sustainable development through solar, wind, and other green energy sources.

Electricity Demand

India's electricity demand has grown steadily over recent years, reflecting increased industrial activity, urbanization, and rural electrification. Between FY 2020 and FY 2025, the total energy requirement rose from 1,291 BU to 1,694 BU, registering a CAGR of 5.6%. This consistent rise highlights the expanding energy needs of the country's growing economy. In parallel, electricity supply has kept pace, improving significantly in both volume and reliability. For instance, while the supply in FY 2020 was 1,284.4 BU, it increased to 1,692.4 BU by FY 2025, resulting in a sharp decline in the power deficit from 6.6 BU to just 1.6 BU over the same period.



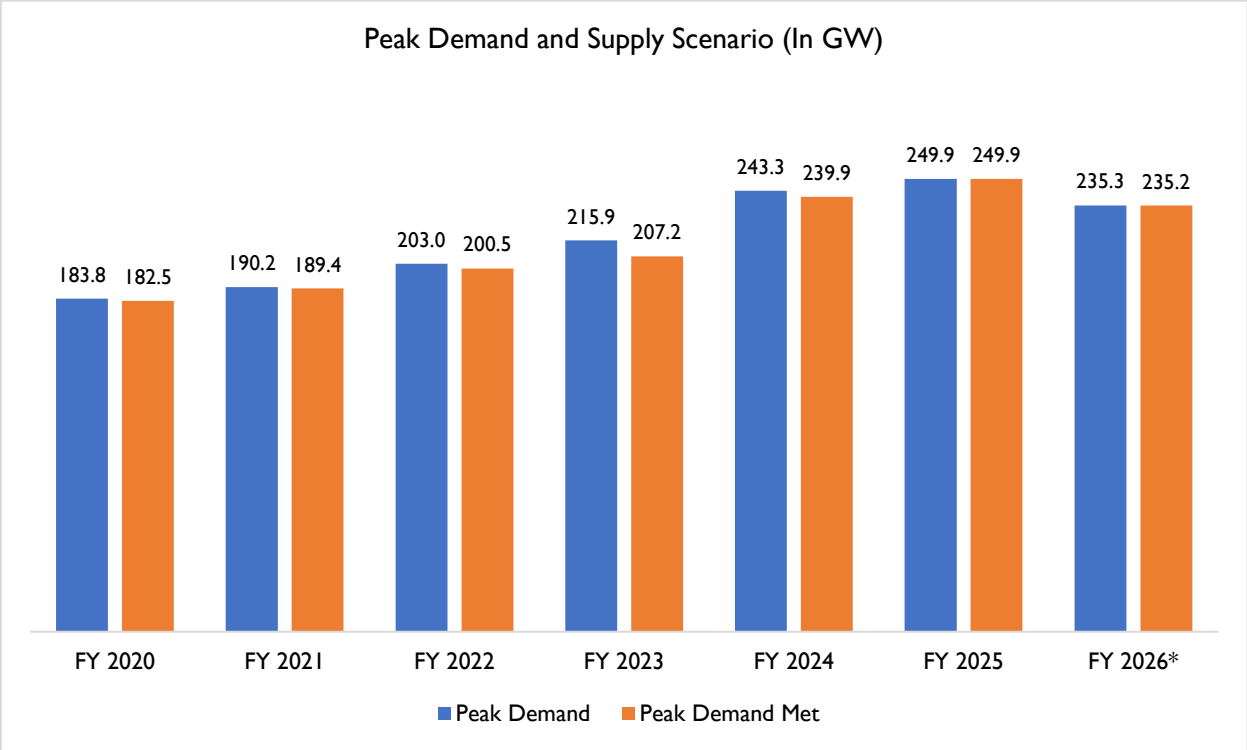


Source: Central Electricity Authority, Ministry of Power

*Note: For FY 2026, the figures are up to May 2025

The narrowing gap between demand and supply over these years indicates improvements in generation capacity, grid infrastructure, and operational efficiency. Even as demand surged year after year, the shortfall remained marginal and continued to shrink. Notably, in FY 2026 (up to May), the deficit stood at just 0.1 BU, pointing to a near-balanced power scenario. This performance underscores India's progress toward achieving energy adequacy, ensuring uninterrupted supply, and reducing regional and seasonal shortages. It reflects the success of sustained investments in power generation, particularly in renewables, along with better demand forecasting and grid management.

India's peak electricity demand has seen a steady upward trajectory in recent years, driven by rising consumption across residential, industrial, and commercial sectors. From 183.8 GW in FY 2020, the country's peak demand increased to 249.9 GW in FY 2025, reflecting a CAGR of 6.3% over the five-year period. This robust growth mirrors the country's broader economic expansion, increased electrification, and higher appliance and cooling loads, especially during summer months.



Source: Central Electricity Authority, Ministry of Power

*Note: For FY 2026, the figures are up to May 2025

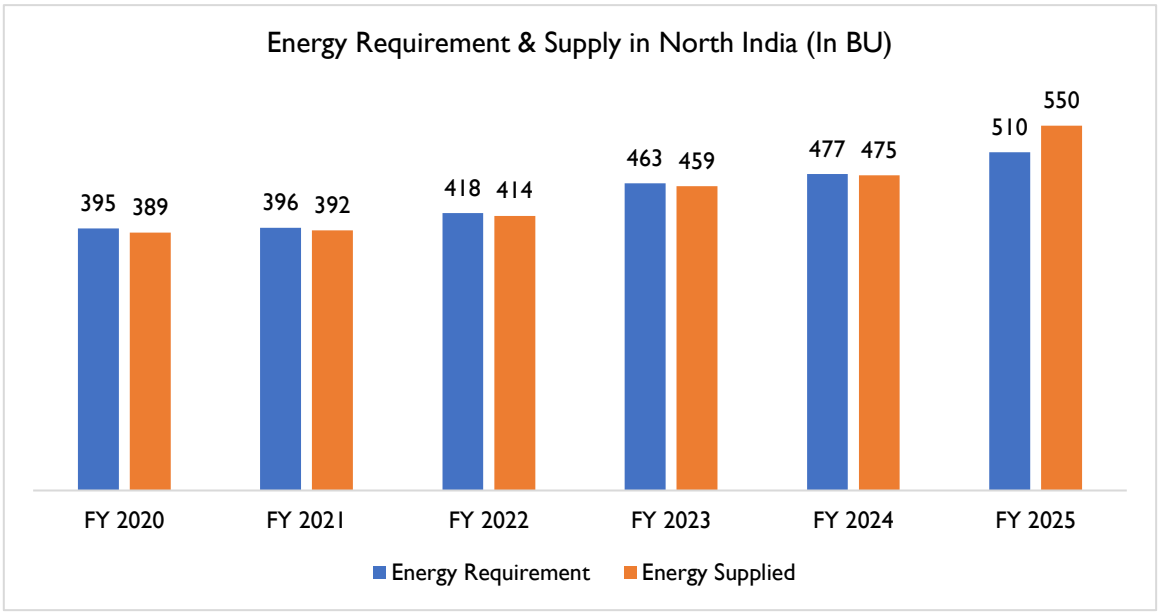
Alongside rising demand, the country has significantly improved its ability to meet peak load requirements. While in earlier years there were minor gaps, such as a shortfall of 1.3 GW in FY 2020 and 8.7 GW in FY 2023, India achieved full demand met in FY 2025, with supply matching peak demand at 249.9 GW. This milestone highlights improvements in power system reliability, better grid resilience, and enhanced coordination between generation and transmission infrastructure.

For FY 2026, provisional figures up to May 2025 indicate a peak demand of 235.3 GW, with a marginal shortfall of 0.1 GW. While these values may increase as the year progresses, especially during peak summer, early data suggests continued strength in India's ability to handle peak load situations. Overall, the trend points to a power sector that is becoming more responsive and resilient, capable of keeping pace with rising demand while maintaining grid stability and supply adequacy.

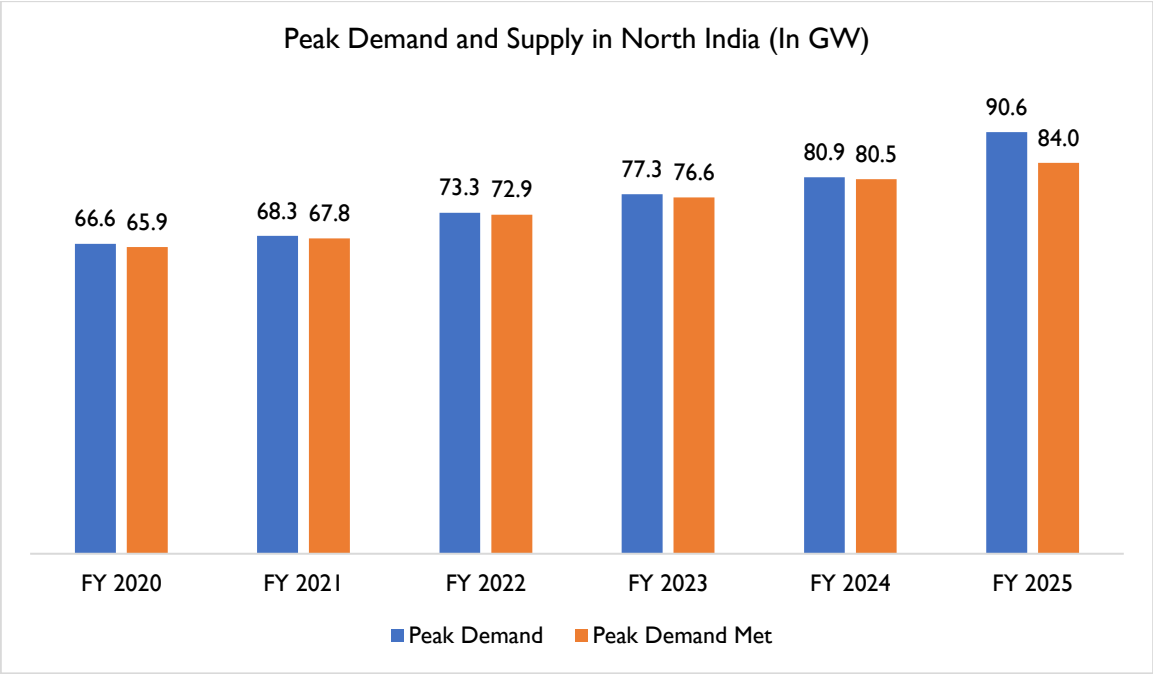
Scenario in North India

As one of the most populous regions in the country, North India, comprising states such as Uttar Pradesh, Rajasthan, Punjab, Haryana, Delhi, Himachal Pradesh, Uttarakhand, Jammu & Kashmir & Ladakh, and the union territory of Chandigarh, plays a critical role in the national electricity landscape due to its large population, diverse geography, and dynamic economic activities. The region spans densely populated urban centers, industrial hubs, agricultural belts, and mountainous terrains, resulting in varied and seasonally sensitive electricity demands.

Driven by urbanization, expanding manufacturing zones, agricultural irrigation loads, and increasing residential consumption, the energy requirement in North India has grown significantly over the years. From 395 BU in FY 2020 to 510 BU in FY 2025, the region witnessed a CAGR of approximately 5.3%, reflecting steady and sustained demand expansion. Correspondingly, energy supplied increased from 389 BU to 550 BU during this period, supported by ongoing capacity additions, transmission system strengthening, and enhanced inter-state power exchange mechanisms. Despite this strong supply growth, minor deficits persisted in some years, typically in the range of 1 to 4 BU, largely due to seasonal imbalances or unexpected peak loads. However, FY 2025 is anticipated to have recorded a net surplus, according to Central Electricity Authority (CEA) estimates, signalling a notable improvement in the region's power adequacy and resilience.



Source: Load Generation Balance Report, CEA



Source: Load Generation Balance Report, CEA

**Note: For FY 2025, Energy Supplied and Peak Demand Met both figures are anticipated by CEA*

The peak power scenario in North India has followed a similar upward trajectory. The region's peak electricity demand rose from 66.6 GW in FY 2020 to 90.6 GW in FY 2025, registering a CAGR of approximately 6.3%. This growth has been largely driven by rising commercial and residential cooling loads, the expansion of metro rail networks, and increased electrification in rural and semi-urban areas. On the supply side, maximum demand met improved from 65.9 GW to 84 GW over the same period, reflecting enhancements in generation availability and grid responsiveness. However, a modest peak shortfall of around 6.6 GW remained in FY 2025, highlighting the persistent challenge of meeting instantaneous demand, particularly during high-load seasons such as summer. While the region has made strong progress in bridging the annual energy gap, the peak demand pressures underscore the need for improved peaking capacity, demand-side management, and grid flexibility to ensure uninterrupted power delivery during critical periods.

Among the contributors, Uttar Pradesh, as the most populous state, accounts for a major share of both demand and supply, followed by Rajasthan and Delhi. Meanwhile, Himachal Pradesh and Uttarakhand contribute significantly to hydro-based generation, and Punjab and Haryana are critical for agricultural electricity loads. Chandigarh and Delhi, being largely urbanized, experience high per capita consumption, especially in the commercial and service sectors.

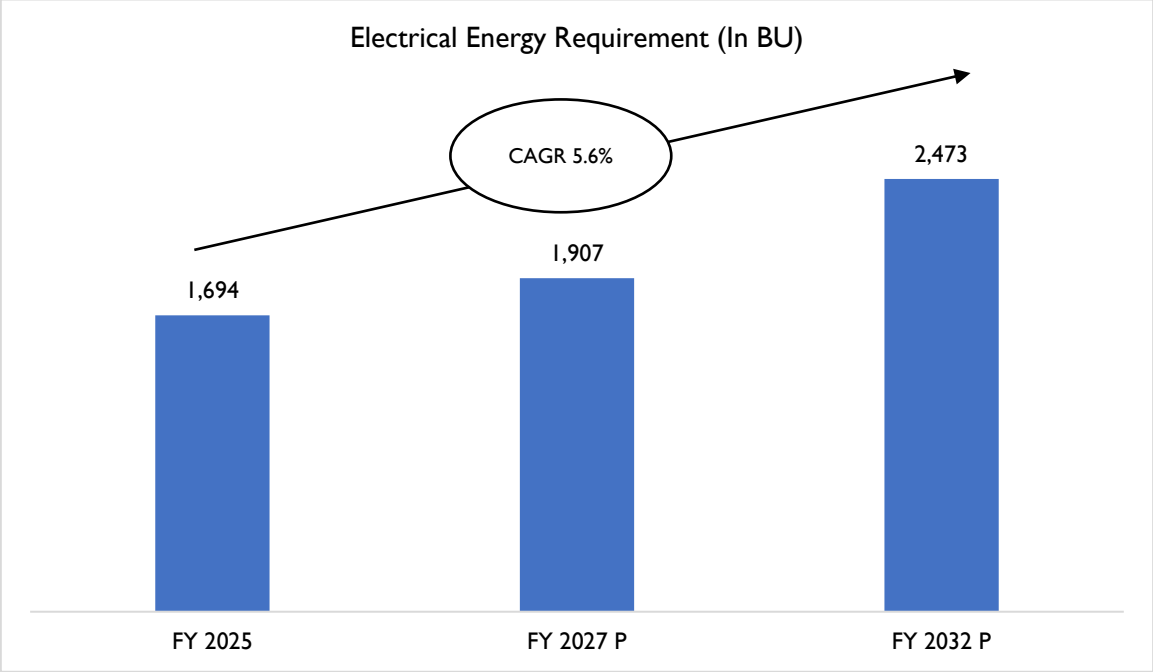
Despite the improvements, managing peak demand and regional imbalances remains a challenge. The deficit in peak demand met, especially in recent years, points to the need for peaking power capacity, energy storage integration, and demand-side management strategies. Strengthening intra-state and inter-state transmission

corridors, along with diversified renewable energy deployment, particularly solar and hydro, will be essential in ensuring uninterrupted power supply across North India's varied terrain and seasonal needs.

Growth Forecast

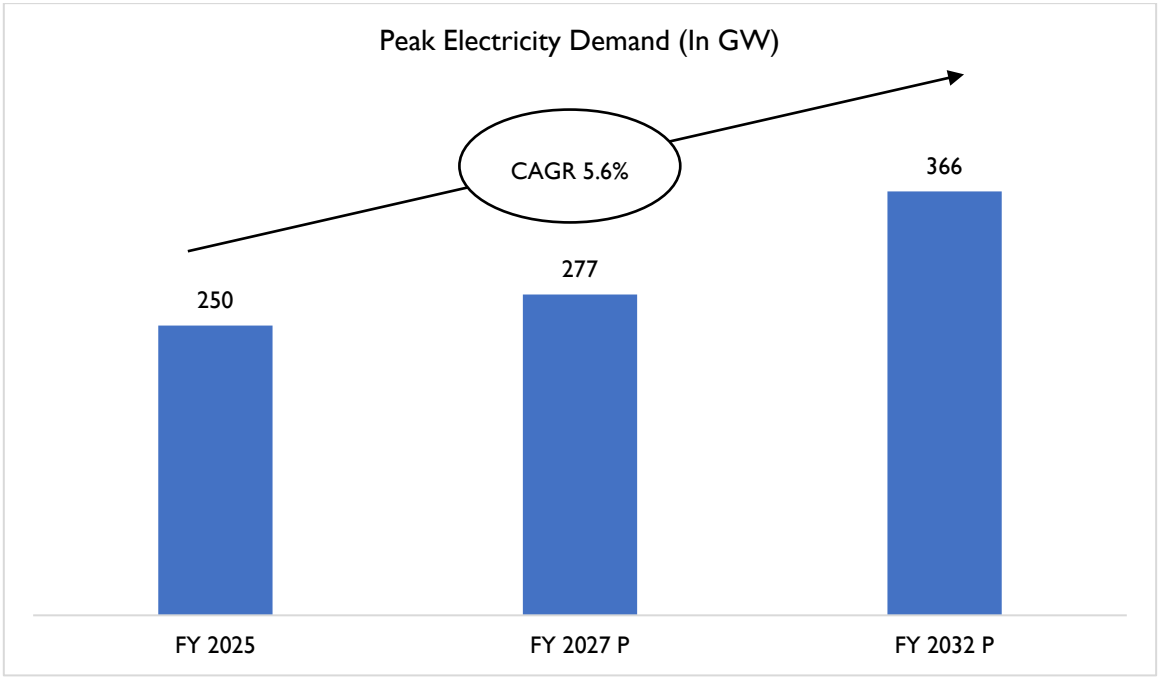
Growth in Electricity Demand

India continues to witness a robust and sustained increase in electricity demand, driven by ongoing urbanization, population growth, industrial expansion, and greater electrification across sectors. According to projections, the country's electrical energy requirement is expected to grow at a CAGR of approximately 5.6% from 1,694 BU in FY 2025 to 1,907 BU by FY 2027, and further to 2,473 BU by FY 2032. This projected rise underscores the growing dependence on reliable power supply to support residential consumption, commercial activity, transportation, digital infrastructure, and industrial output.



Sources: National Electricity Plan, CEA, Ministry of Power

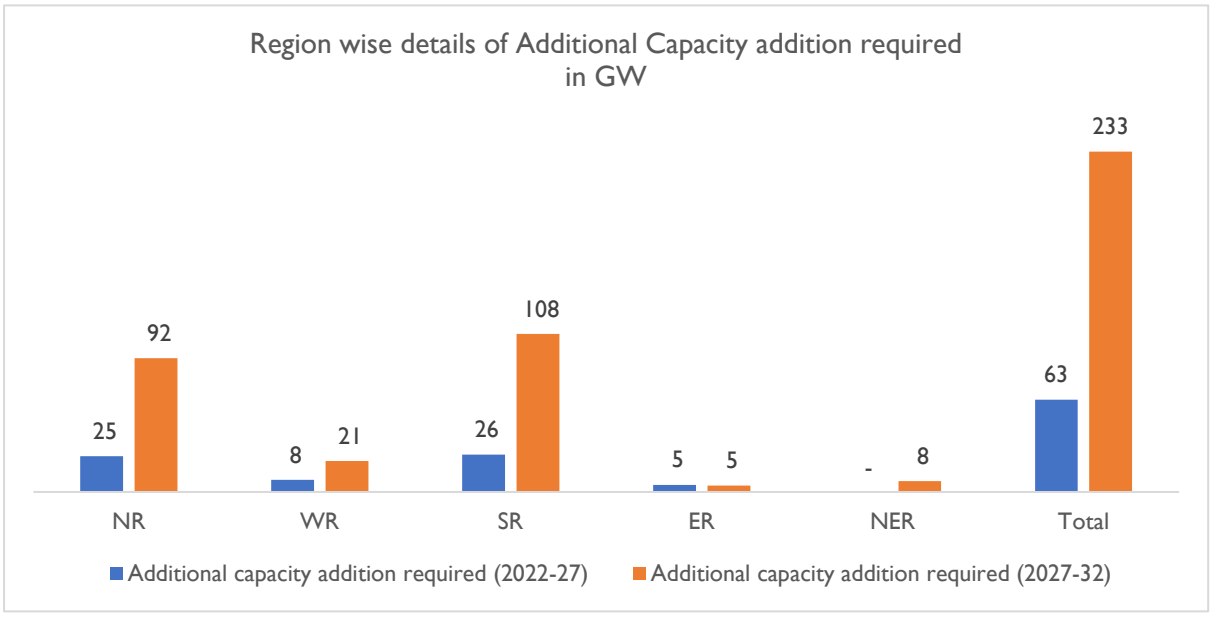
In parallel, India's peak electricity demand is also expected to grow at a similar pace, increasing from 250 GW in FY 2025 to 277 GW in FY 2027, and reaching 366 GW by FY 2032, again reflecting a 5.6% CAGR over this period. The anticipated surge in peak demand highlights the need for enhanced generation capacity, grid modernization, and flexible energy systems capable of handling instantaneous load spikes. As India moves toward becoming a USD 5 trillion economy, this forecasted growth in electricity demand underscores the strategic importance of timely infrastructure investments to ensure energy security and resilience.



Sources: National Electricity Plan, CEA, Ministry of Power

These projections highlight the need for robust infrastructure development, energy conservation measures, and sustainable energy sources to meet the escalating power requirements while ensuring uninterrupted and reliable access to electricity for all segments of society.

To add to it, apart from capacity already under-construction, it is estimated that a total of 63 GW of additional capacity will be required between FY 2022 and 2027 while nearly 233 GW of additional capacity would be required between FY 2027- 32, if the expected demand growth is to be met.

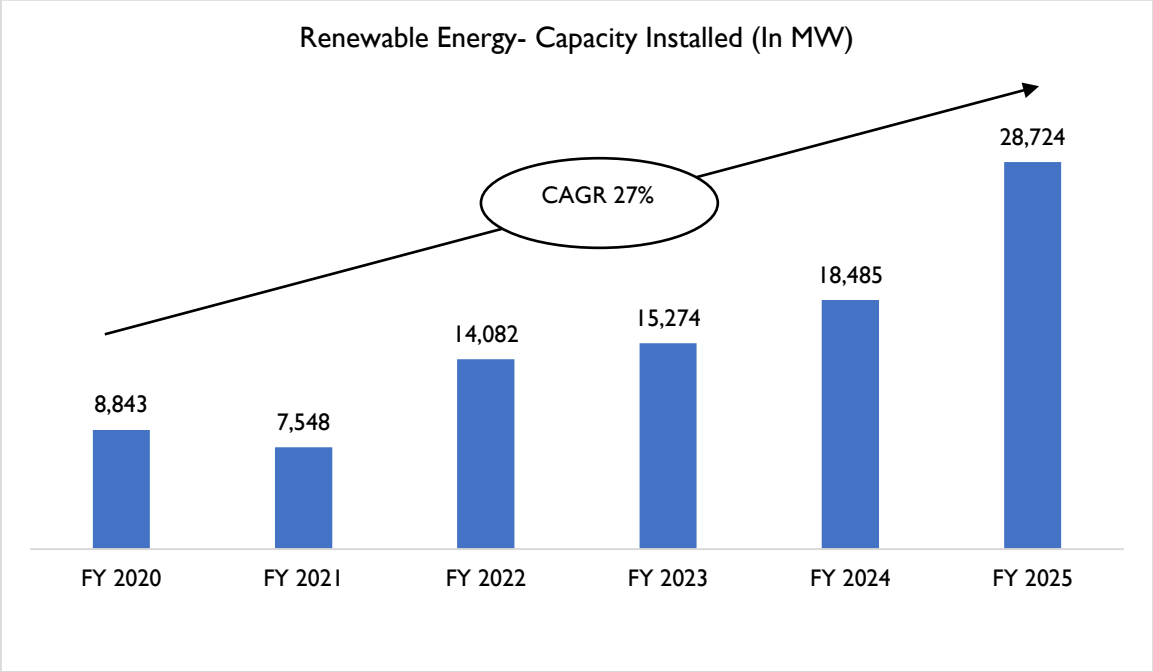


Source: National Electricity Plan 2022

Renewable Energy

Installed Capacity in India

India has made remarkable strides in expanding its renewable energy installed capacity, demonstrating a clear commitment to sustainability and a greener energy future. Over recent years, the country has aggressively pursued the development of clean energy sources, such as solar, wind, and biomass, leading to a significant transformation in its power sector. This push toward renewable energy reflects not only environmental concerns but also strategic goals of enhancing energy security and diversifying the electricity mix.



Source: Ministry of New and Renewable Energy

Note: Renewable Energy Capacity does not include Large Hydro Power

The installed renewable energy capacity in India has shown exceptional growth between FY 2020 and FY 2025, increasing from 8,843 megawatts (MW) to 28,724 MW, reflecting a robust CAGR of approximately 27%. After a temporary dip in FY 2021, where additions declined to 7,548 MW likely due to COVID-19-related disruptions and logistical constraints, the sector rebounded strongly. Capacity additions rose sharply to 14,082 MW in FY 2022, followed by 15,274 MW in FY 2023, and a further increase to 18,485 MW in FY 2024. The latest figures for FY 2025 reflect an impressive jump, underscoring renewed momentum driven by strong policy support, investor confidence, and advancements in renewable technology.

This growth trajectory highlights the effectiveness of India's renewable energy strategies, such as competitive bidding, viability gap funding, production-linked incentives, and state-specific targets. Solar power has been at the forefront of this expansion, with large-scale solar parks, rooftop systems, and hybrid models contributing significantly. Wind energy has also retained its relevance, especially in high-potential coastal and inland regions.

Meanwhile, biomass, small hydro, and emerging technologies such as green hydrogen and storage-backed renewables are increasingly gaining ground.

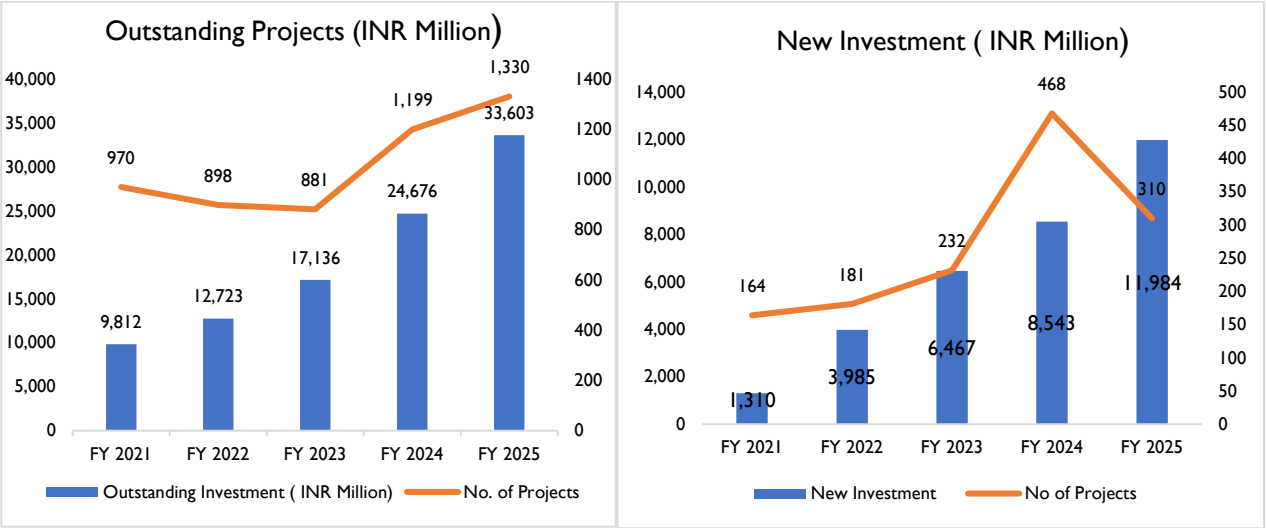
The rapid increase in renewable capacity brings multiple socioeconomic and environmental benefits. It reduces dependence on fossil fuels, curbs greenhouse gas emissions, and contributes significantly to climate mitigation goals. Additionally, it stimulates job creation, drives innovation, and promotes inclusive development by improving electricity access in underserved regions, particularly in rural and remote areas.

Looking ahead, India is well-positioned to sustain this momentum. With its ambitious target of achieving 500 GW of non-fossil fuel capacity by 2030, the government continues to roll out supportive policies, while the private sector remains a strong partner in driving capacity growth. Continued investments in grid modernization, battery storage, and hybrid projects are expected to accelerate the energy transition, further reinforcing India's global leadership in clean energy development. The growth in renewable energy installed capacity between FY 2020 and FY 2025 is not just a quantitative milestone but a clear indicator of India's unwavering commitment to building a resilient, low-carbon, and future-ready energy ecosystem.

Capital Expenditure Capex on Renewable Electricity in India

India's renewable electricity sector continued its strong upward trajectory in FY 2025, demonstrating not only sustained momentum but also a clear deepening of investor confidence. The value of outstanding investments rose significantly to INR 33,603 million, building on successive annual increases over the past five years. This marks a continued expansion in committed capital, reflecting robust pipeline activity and the country's strategic focus on scaling up clean energy infrastructure.

Simultaneously, new investments surged to INR 11,984 million in FY 2025, up from INR 8,543 million in FY 2024, indicating fresh capital infusion into upcoming renewable projects. While the number of new projects moderated slightly to 310 (down from 468 in FY 2024), the higher average investment per project suggests a trend toward larger-scale and possibly more technologically advanced projects. This shift aligns with national targets emphasizing utility-scale solar parks, wind corridors, hybrid systems, and storage integration.



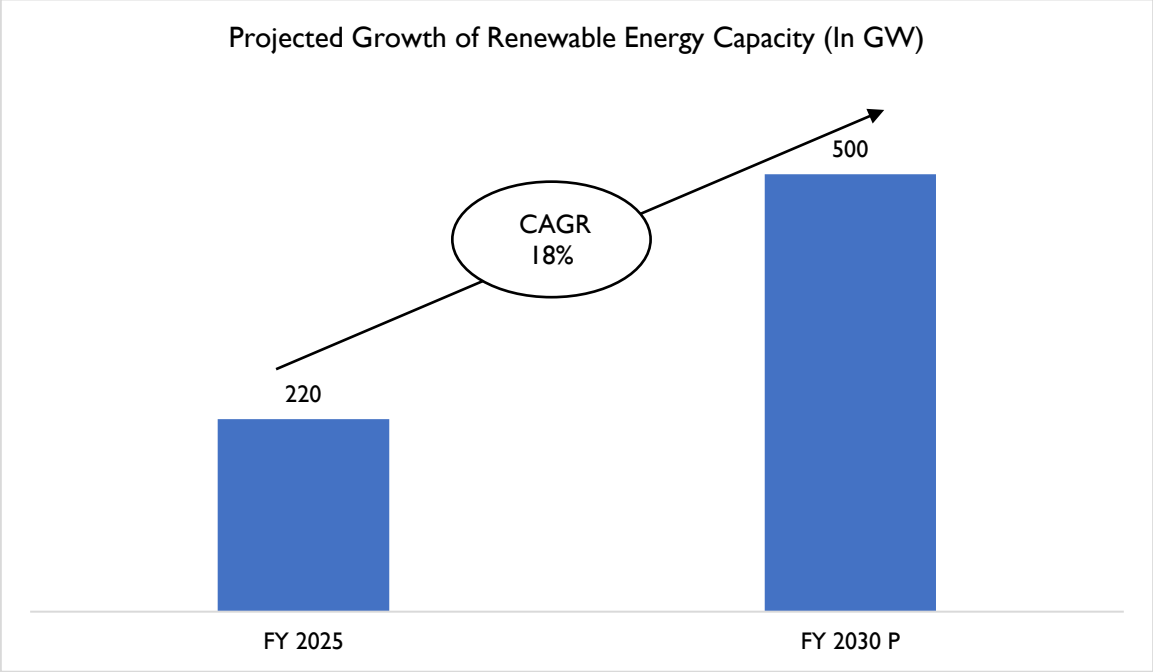
Source: CMIE

On the other hand, outstanding projects reached 1,330, continuing the growth pattern seen in recent years. This rise demonstrates not only a healthy project pipeline but also improved project clearances, better execution confidence, and growing developer interest. The increasing count also signals the deepening penetration of renewables beyond traditional strongholds, with more diversified geographical uptake.

In summary, FY 2025 reinforces India's position as a rapidly evolving renewable energy market. The substantial rise in cumulative and new investments reflects a maturing sector that is now drawing consistent capital flows. While challenges such as grid integration, cost rationalization, and timely implementation remain, the current investment patterns point toward a steady transformation of India's energy landscape with stronger scale, broader participation, and increasing global relevance.

Growth Forecast

India has reached a significant milestone in its renewable energy journey, with the country's total renewable energy installed capacity surpassing 220 GW by FY 2025, accounting for approximately 46% of the nation's total installed electricity generation capacity of 475 GW. This includes 106 GW of solar power, 50 GW of wind energy, and 53 GW of hydro capacity, encompassing both large and small hydro projects. This achievement not only reflects India's accelerating shift toward clean energy but also underscores the success of sustained policy efforts and public-private collaboration in transforming the energy landscape.



Source: Central Electricity Authority

Note: Renewable Energy Capacity includes Large Hydro: 47.73 GW

States such as Rajasthan, Gujarat, Tamil Nadu, and Karnataka have emerged as leaders in renewable energy deployment, contributing significantly to India's growing green portfolio. The Central Electricity Authority (CEA) and the Ministry of New and Renewable Energy (MNRE) continue to support this momentum through a host of enabling initiatives. Key programs like the National Green Hydrogen Mission, PM-KUSUM, and the PLI Scheme for High-Efficiency Solar PV Modules have spurred large-scale capacity additions and domestic manufacturing.

Looking ahead, India has set an ambitious target of achieving 500 GW of non-fossil fuel-based installed capacity by FY 2030, which would require scaling renewables at a CAGR of around 18% from current levels. This goal is being supported by a structured bidding trajectory of 50 GW per year, 100% FDI allowance, and incentives for manufacturing and grid integration. Additional measures such as waivers on inter-state transmission system (ISTS) charges for solar and wind projects and the planned development of offshore wind projects along the coasts of Gujarat and Tamil Nadu further reinforce India's commitment to its green transition.

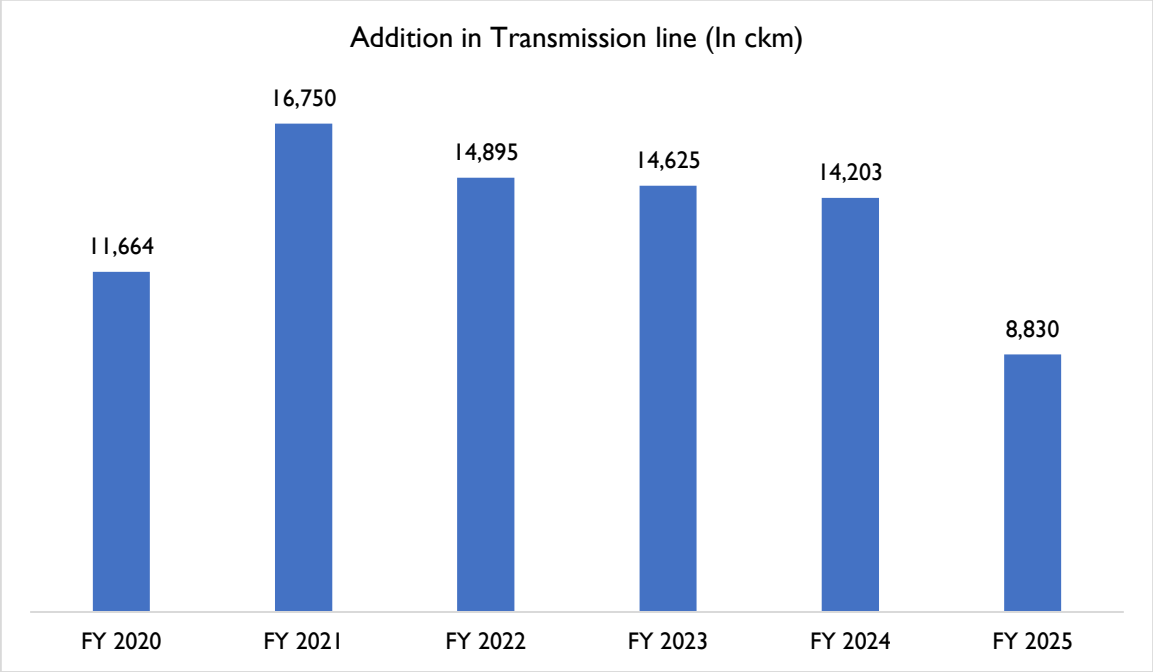
This growth not only contributes to India's climate goals under the Paris Agreement but also enhances energy security, boosts rural employment, and creates a robust foundation for the low-carbon economy of the future. With strong policy backing and private sector participation, India is well-positioned to lead the global clean energy transition.

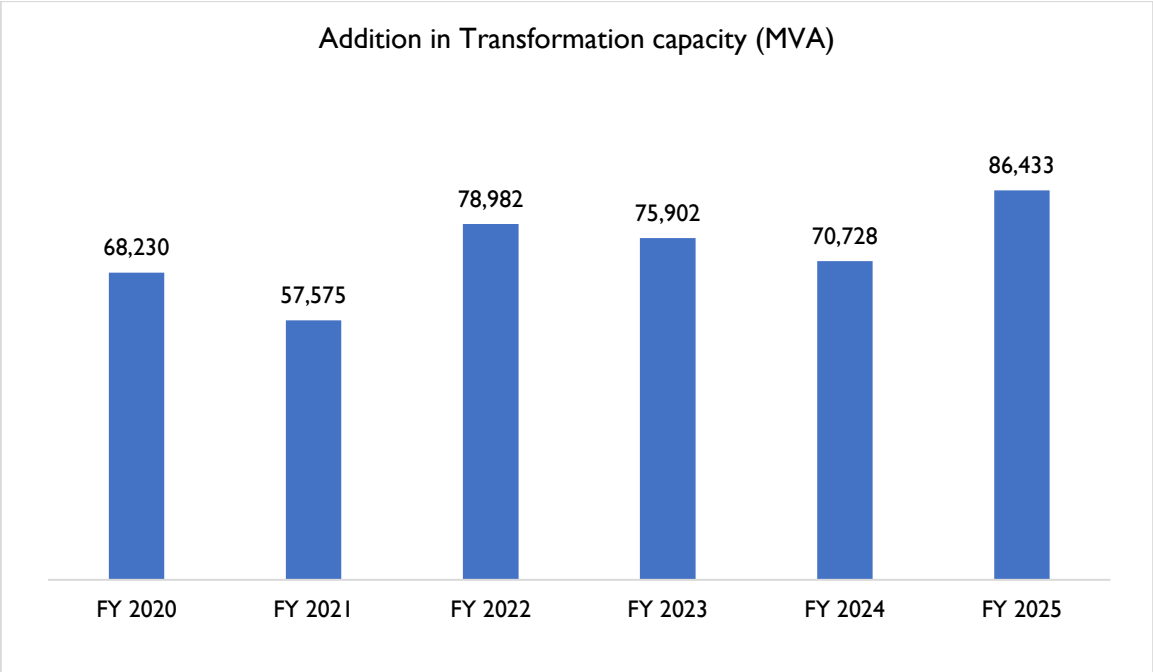
Electricity Transmission & Distribution Infrastructure in India

The power transmission and distribution infrastructure of India is a critical component of the country's electricity sector. The transmission infrastructure consists of high-voltage transmission lines and substations that transmit electricity over long distances from power plants to various regional grids. India has a vast network of transmission lines, including Extra High Voltage (EHV) and Ultra High Voltage (UHV) lines, which facilitate the bulk transfer of electricity.

With high energy demand and last-mile electrification goals, India has made significant progress in expanding and modernizing its transmission and distribution networks in recent years. In FY 2025, the country added 8,830 circuit kilometres (ckm) of transmission lines and enhanced its transformation capacity by 86,433 MVA. Over the last five years (FY 2020- FY 2024), India added an average of 14,827 ckm of transmission lines and 70,683 MVA of transformation capacity annually.

This sustained capacity addition has positioned India among the countries with the largest synchronous electricity grids in the world. As of April 30, 2025, India's transmission network has expanded to approximately 494,732 ckm of transmission lines and 1,350,953 MVA of transformation capacity.





Source: Central Electricity Authority, Ministry of Power

From FY 2020 to FY 2025, India witnessed a consistent expansion in its power transmission infrastructure, with notable additions in both transmission lines (ckm) and transformation capacity (MVA). For instance, in FY 2020, an addition of 11,664 ckms was accompanied by 68,230 MVA of transformation capacity, whereas in FY 2025, 8,830 ckms supported a capacity increase of 86,433 MVA. Over this six-year period, the cumulative additions totalled 80,967 ckms and 437,850 MVA, indicating a strong correlation between infrastructure development and electricity transformation capacity enhancement.

The average ratio across this period suggests that one kms of transmission line supports approximately 5.4 MVA of transformation capacity. This relationship serves as a key planning metric for future grid expansion. For example, to double the transformation capacity equivalent to FY 2025 levels 86,433 MVA reaching 172,866 MVA the system would require proportionate transmission infrastructure. Based on the established ratio, this would necessitate the addition of around 32,014 ckms of transmission lines to effectively support the increased capacity.

Energy Demand vs. Transmission: Analysing the Disparity

Despite a significant increase in energy demand over the past few years and projections for continued growth, the power transmission and transformer industry has not experienced corresponding growth in transmission line additions and production. This discrepancy can be attributed to several factors. First, while energy consumption has surged, the rate of new transmission line construction has stagnated. For instance, in FY 2025, only 8,830 ckm of transmission lines were added, reflecting a slowdown compared to previous years. Various challenges have impeded the timely execution of transmission projects, including land acquisition issues, regulatory hurdles, and implementation delays, which have caused significant postponements in project

completions. Furthermore, the government's emphasis on integrating renewable energy sources into the grid has created a pressing need for an expanded transmission network. However, the development of this infrastructure has not kept pace with the growing renewable capacity, expected to reach 500 GW by 2030. Current planning indicates a vision for a more robust transmission system by 2032, aiming for 648,000 ckm of lines, yet existing investments and expansions have yet to translate into immediate growth in the sector. Additionally, market dynamics, such as a current focus on thermal capacity to meet base load requirements, may shift attention away from necessary investments in transmission infrastructure. Thus, while energy demand continues to rise, the power transmission and transformer industry faces significant barriers that hinder its growth, illustrating a disconnect between demand and actual capacity expansion.

Growth Forecast

Transmission & Distribution Scenario

Based on the projected increase in electrical energy requirements and peak electricity demand in India, there is a clear need for substantial growth in power transmission and distribution infrastructure. To meet the rising demand, significant investments and advancements in the power sector are being made. It is expected that the transmission and distribution infrastructure will experience a substantial expansion to accommodate the growing electricity requirements.

To support the projected energy demand of 1,907 BU in FY 2027 and 2,472 BU in FY 2032 and the expected increase in peak electricity demand from 250 GW in FY 2025 to 277 GW in FY 2027 and 366 GW in FY 2032, the power transmission and distribution network will need to be strengthened and expanded with significant augmentation of the distribution infrastructure. This will involve the construction of new transmission lines, substations, and transformers, as well as upgrades to existing distribution networks to enhance the capacity and efficiency of the grid. Additionally, the deployment of advanced technologies such as smart grids and grid automation will be necessary to ensure optimal power flow and monitoring.

Furthermore, the expected increase in additional capacity requirement will also require a transformation in the power transmission and distribution network with the installation of new transformers, distribution lines, and metering systems to handle the higher loads and ensure reliable power supply to consumers. Thus, growth in power transmission and distribution infrastructure in India is essential to meet the steadily increasing demand for electricity. The expansion of these networks will enable the efficient and reliable supply of power, supporting the nation's economic growth, industrial development, and achieving all power and energy goals.

Key Demand Drivers

India, with its vast population, rapid urbanization, and thriving industrial and commercial sectors, is experiencing a significant surge in the demand for electricity. The increased demand has enforced government to support commissioned power plants to sell electricity even in the absence of valid Power Purchase Agreement (PPA). Several factors are driving this increasing appetite for power. The major factors driving the growth of the sector are increasing urbanization, rising disposable income witnessing a lifestyle shift thereby, having an increasing consumption of electricity. To meet this burgeoning demand, it becomes imperative to bolster the transmission and distribution infrastructure across the nation.

Population Growth

India, with a population comprising approximately 17.2% of the global total, is experiencing significant demographic changes, as it became the most populous country in 2023, reaching around 1.428 billion individuals. Despite a noticeable slowdown in population growth over recent years, the country continues to witness an upward trend in its population. This growth necessitates a substantial increase in housing and residential units, thereby driving demand for electricity.

To accommodate the increasing population and the subsequent rise in housing demand, India must enhance its transmission and distribution (T&D) infrastructure. The current T&D framework may prove inadequate for supplying electricity to densely populated urban areas and remote rural regions with limited connectivity. Therefore, it is crucial to upgrade and expand the transmission and distribution networks to ensure a reliable and uninterrupted power supply, effectively addressing the challenges posed by the burgeoning population.

Urbanization

The increasing population in India is projected to create substantial demand for residential units, particularly in urban areas, serving as a significant driver for transmission and distribution (T&D) infrastructure. According to the Handbook of Urban Statistics 2022, the urban population has been steadily rising, with over 469 million urban dwellers in 2021, expected to exceed 558 million by 2031 and surpass 600 million by 2036. This rapid urbanization reflects a transformation within Indian cities, as millions migrate to urban centers in search of better opportunities and living standards. The growing number of nuclear families and evolving consumer preferences will further amplify the demand for housing, necessitating enhanced T&D capabilities to support this expansion. As urban areas require robust electricity infrastructure for residential, commercial, and industrial needs, the surge in housing development will significantly increase the demand for T&D services. To meet these requirements, India must upgrade and expand its T&D networks, ensuring they can adequately supply electricity to densely populated regions and newly established urban locales, thus guaranteeing reliable and uninterrupted power distribution.

Growth in demand from Industrial & Commercial Consumers

India is witnessing significant industrial and commercial growth across various sectors, positioning itself as a potential global manufacturing hub with increasing investments throughout the value chain. Key industries, including manufacturing, construction, information technology, and services, demand substantial electricity for their operations, while the rise of commercial establishments such as shopping malls, hotels, and offices further amplifies the need for robust transmission and distribution (T&D) infrastructure. The industrial sector accounts for approximately 32% of total power consumption in FY 2024[4] and per capita energy consumption has shown a CAGR of 4.9% from FY 2020 to FY 2025. This industrial expansion, coupled with rising per capita income, is driving increased electrification and per capita usage. From April 2024 to March 2025, power consumption reached 1,694 billion units (BU), exceeding the 1626.1 BU recorded for the entire FY 2024. Additionally, the government's focus on infrastructure development to meet the demands of the growing population will further contribute to the sector's overall growth. To support this industrial and commercial expansion, there is an urgent need to reinforce the T&D infrastructure, as high-capacity power connections will be essential for industries and commercial entities. The current infrastructure presents an opportunity for enhancement to effectively manage the anticipated increase in load in the coming years. This underscores the importance of expanding and upgrading T&D networks to proactively meet the evolving demands of these sectors.

Growth in demand from retail consumers

With rising incomes and improving living standards, there is a growing demand for transmission and distribution (T&D) infrastructure to support increasing household electricity consumption. Households rely on electricity for lighting, cooking, heating, cooling, and operating various appliances and electronics. As more households gain access to electricity or upgrade to higher-powered appliances, the overall demand for T&D services rises. To effectively address this scenario, India must enhance its T&D infrastructure at the local level to accommodate the rising household consumption. This entails strengthening distribution networks, upgrading transformers, and installing additional distribution substations to ensure a reliable supply of electricity, particularly in rural and semi-urban areas. Such improvements will be essential to meet the evolving needs of households and support the country's ongoing development.

Infrastructure Development

India is heavily investing in massive infrastructure projects. This substantial increase in infrastructure development spending in India, as highlighted in the Budget 2025-26, is set to drive the demand for transmission and distribution of power in the country. With the government nearly tripling its infrastructure

[4] Institute for Energy Economics and Financial Analysis, CEA

spending to INR11.21 lakh crore, equivalent to approximately 3.1% of GDP, compared to previous years, there will be a significant boost in the construction of highways, railways, airports, and smart cities. [5]

Furthermore, the scheme for providing 50-year interest-free loans to state governments for capital investment has been extended for another year, with an enhanced outlay of INR 1.5 lakh crore. This continuation not only supports infrastructure development at the state level but also incentivizes states to implement complementary reforms and policy measures aligned with national development goals. In addition, the establishment of the Urban Infrastructure Development Fund (UIDF), utilizing the priority sector lending shortfall to create urban infrastructure in Tier 2 and Tier 3 cities, with an annual outlay of INR 10,000 crore, further contributes to the demand for electricity.

As a result of the increased infrastructure spending and the implementation of various initiatives, there will be a surge in the demand for transmission and distribution infrastructure across the country. Upgrading and expanding the transmission lines, transformers, and distribution networks will be essential to ensure that the power generated from these new infrastructure projects can be effectively distributed to the end-users. The reinforcement of the transmission and distribution infrastructure will enable the reliable and efficient supply of electricity, meeting the increased demands arising from the country's infrastructure development endeavours.

Increasing Demand from Agriculture

Agriculture is a vital sector in India, employing a significant portion of the population and driving the demand for robust transmission and distribution (T&D) infrastructure. As farmers increasingly adopt modern irrigation techniques, such as electric pumps, the need for T&D services in the agricultural sector intensifies. Furthermore, electricity plays a critical role in post-harvest processing and storage of agricultural produce, further contributing to the demand for reliable T&D solutions. To effectively address these needs, strengthening the distribution infrastructure in rural areas is essential. This includes expanding the network to reach remote agricultural regions, installing dedicated agricultural feeders, and ensuring a dependable electricity supply for irrigation and agro-processing units. Government initiatives like the Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY) and the Revamped Distribution Sector Scheme (RDSS) are already addressing these challenges, highlighting the importance of enhancing T&D capabilities to support the agricultural sector's growth and modernization.

Government Initiatives

The Indian government has been actively implementing various schemes and initiatives, such as the Pradhan Mantri Sahaj Bijli Har Ghar Yojana (Saubhagya), Deen Dayal Upadhyaya Gram Jyoti Yojana, and the Revamped Distribution Sector Scheme, to provide electricity access to all citizens. These initiatives focus on electrifying rural areas and households that currently lack electricity access, thereby significantly increasing the demand

[5] Budget 2025-26, Government of India

for robust transmission and distribution (T&D) infrastructure, particularly in rural regions. To achieve the government's electrification goals, it is essential to enhance T&D infrastructure by extending transmission lines, establishing new substations, and strengthening distribution networks. This proactive approach will ensure that the growing demand for T&D services is met effectively, facilitating the delivery of electricity to underserved communities and supporting broader economic development.

Strengthening the Grid for Renewable Energy Integration

The increasing installed capacity of renewable energy (RE) sources, such as wind and solar, necessitates the development of a more robust grid network to effectively manage and distribute the growing electricity generated from these variable sources. To support this demand, the Indian government aims to significantly expand its power transmission network, targeting a total of 648,000 ckm by 2032 to accommodate a peak electricity demand of 458 GW. The anticipated addition of 280 GW of variable renewable energy by 2030 highlights the need for upgraded transmission infrastructure to ensure efficient power evacuation and maintain grid stability. Furthermore, the integration of renewable energy sources requires enhanced inter-regional transfer capacities and the implementation of High Voltage Direct Current (HVDC) lines, which are essential for managing the fluctuating nature of renewable energy generation. This growing reliance on renewable energy sources directly drives the demand for improvements in Transmission and Distribution (T&D) infrastructure, underscoring the necessity for a stronger grid network to support India's ambitious energy transition goals.

Government Regulations

Deen Dayal Upadhyaya Gram Jyoti Yojana

The Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY), launched in December 2014, is a government scheme in India aimed at providing uninterrupted power supply to rural areas. It has three components under its umbrella:

1. **Separation of agriculture and non-agriculture feeders:** The main objective of this component is to separate the feeders in order to provide regulated supply of power to agricultural consumers and continuous power supply to non-agricultural consumers in rural areas.
2. **Strengthening and augmentation of sub-transmission & distribution (ST&D) infrastructure in rural areas**: The requirement for electricity in rural regions is growing steadily because of the expanding customer base and shifts in lifestyle and consumption habits. Consequently, it is important to enhance and reinforce the sub-transmission and distribution infrastructure to guarantee dependable and high-quality electricity provision in rural areas.
3. **Rural electrification**: The previous Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY) program, which aimed to electrify villages and establish electricity distribution infrastructure in rural areas, has now been incorporated into the DDUGJY scheme.

The scheme had a total budget of INR 75,893 crores. Out of this, components (1) and (2) with a cost of Rs. 43,033 crores received a budgetary support of Rs. 33,453 crores from the Indian Government throughout the implementation period. The third component of the scheme had an approved cost of Rs. 39,275 crores, including a budgetary support of Rs. 35,447 crores.

The Ministry of Power provided guidance for the scheme, while the Rural Electrification Corporation Limited was responsible for its implementation. Initially, the government allocated 60% of the project cost to most states and reserved 85% for special states. Additional funding of 15% was granted by the government when the first milestones were achieved, with 5% of that amount being reserved for special states.

Achievements under DDUGJY RE:

Under the previous Rural Electrification (RE) program, as of December 31, 2021, a total of 1,365 projects with a combined budget of Rs. 66,380 crore were approved. The Government of India (GoI) released a grant of Rs. 53,414 crore to the states. The progress made in terms of implementation is as follows:

- 2,993 Sub-stations (Incl. augmentation of 2,101 Sub-Stations) commissioned
- 10.14 Lakh Distribution Transformers commissioned
- 7.83 Lakh ckm of LT Lines erected
- 4.73 Lakh ckm 11KV Lines erected
- 0.15 Lakh ckm 33 & 66 KV HT Lines erected
- As reported by the States, all the inhabited un-electrified villages across the country, as per Census 2011, were electrified by 28th April, 2018.

Achievements under DDUGJY New:

By December 31, 2021, a total of 4,404 projects with a budget of Rs. 47,972 crore were approved, including various components. The GoI released a grant of Rs. 22,755 crore to the states. The physical progress achieved so far is as follows:

- 3,958 Sub-stations (including augmentation of 2,093 Sub-stations) commissioned
- 3.95 Lakh Distribution Transformers commissioned
- 1.23 Lakh ckms of new 11 KV line erected
- 2.96 Lakh ckms of LT Lines erected
- 0.28 Lakh ckms of HT Lines (33 & 66 KV Lines) erected
- 1.22 Lakh ckms of 11 KV Feeders segregated
- Energy Meters in 153.80 Lakh consumer premises, 2.53 Lakh Distribution Transformers & 0.13 Lakh 11 KV Feeders installed

Achievement under DDUGJY Addl. Infra

An amount of Rs. 14,179 crore had been sanctioned to 20 states upon their request for the creation of additional infrastructure exclusively for households covered under the Saubhagya scheme. As of December 31, 2021, a cumulative grant of Rs. 7,165.52 crore has been released by the Government of India to the states. The physical progress made is as follows:

- 228 Sub-stations (including augmentation of 220 Sub-stations) commissioned
- 2.19 Lakh Distribution Transformers commissioned
- 0.66 Lakh ckms of new 11 KV line erected
- 1.96 Lakh ckms of LT Lines erected

The scheme stands closed as on 31-03-2022. However, the power reforms and larger goal of rural electrification under DDUGYJ have been taken under RDSS.

Integrated Power Development Scheme

Ministry of Power, Government of India, notified "Integrated Power Development Scheme" (IPDS) on 3rd December, 2014, with the aim to ensure 24×7 Power supplies for consumers, reduction in AT&C (aggregate technical and commercial) losses, and providing access to power to all households. IPDS has the following components under its umbrella:

1. **Strengthening of Sub-transmission and Distribution network in urban areas including provisioning of solar panels on Govt. buildings including Net-metering:** The Indian government has been offering financial assistance to State-owned Discoms/Power Departments through various programs. However, these departments have been unable to keep up with the increasing demand for electricity, resulting in significant gaps and deficiencies in the sub-transmission and distribution network. As a result, the sub-transmission and distribution network has become a hindrance in ensuring reliable and high-quality power supply to consumers.
2. **Metering of feeders / distribution transformers / consumers in urban areas:** The implementation of end-to-end metering is crucial for the power sector. Having effective metering for all consumers ensures accurate accounting, billing, assessment of load patterns, and proper infrastructure planning. It also enables the identification of areas with high losses, prompting corrective measures to reduce those losses.
3. **IT enablement of distribution sector and strengthening of distribution network**: In July 2008, the Ministry of Power, Government of India, launched the Restructured Accelerated Power Development and Reforms Programme (R-APDRP) with the aim of establishing baseline data, promoting accountability, reducing Aggregate Technical and Commercial (AT&C) losses to a level of 15% through strengthening and upgrading the sub-transmission and distribution network, and adopting Information Technology. The R-APDRP has now been integrated into the Integrated Power Development Scheme (IPDS).

The scheme has a total budget of Rs. 76,623 crore. Out of this, the estimated budget for components (1) and (2) is Rs. 32,612 crore, which includes a budgetary support of Rs. 25,354 crore from the Government of India throughout the implementation period.

The R-APDRP scheme, with a cost of Rs. 44,011 crore, including a budgetary support of Rs. 22,727 crore as approved by CCEA, will be carried forward to the new IPDS scheme, in addition to the budget allocation for components (1) and (2) mentioned above.

For the majority of states, the government has allocated 60% of the project cost, while 85% was allocated for special states. Upon achieving the initial milestones, the government provided an additional 15% of funds, with 5% specifically allocated to special states.

According to the February 2022 data from the Ministry of Power and New and Renewable Energy, projects worth Rs. 30,802 Crore [with Government of India (GoI) Grant of Rs. 19,332 Crore] have been sanctioned under IPDS covering project components outlined herein, of which GoI grant of Rs. 16,717 Crore has been released to the States. The distribution system strengthening works have been successfully completed in 544 circles.

The targets set and the achievements under IPDS 2014- 2022 strengthening project for major works are tabulated below

Items (Unit)	Target	Achievement
New Power Sub Station (Nos.)	999	994
HT Lines (ckm)	24,262	23,539
LT Lines (ckm)	10,769	10,409
AB Cable (ckm)	65,029	64,364
UG Cable (ckm)	21,551	21,336
Roof Top Solar Panels (kwp)	46,544	46,107

This scheme has been subsumed under RDSS, to be implemented as per its extant guidelines, and marked closed as of March 2022. No new projects will be sanctioned under this scheme but projects already sanctioned were eligible to receive funds up to 31st March 2022. However, projects sanctioned for Ayodhya, Uttar Pradesh under IPDS were allocated funds till 31st March 2023.

Revamped Distribution Sector Scheme

The Government of India has introduced the Revamped Distribution Sector Scheme (RDSS), which is a comprehensive initiative aimed at transforming the distribution sector. With a significant budget of Rs. 3,03,758 crore and estimated financial assistance of Rs. 97,631 crore from the Central Government over a period of 5 years from FY 2021-22 to FY 2025-26, the scheme focuses on reducing Aggregate Technical & Commercial (AT&C) losses to pan-India levels of 12-15% and eliminating the Average Cost of Supply (ACS)-Average Revenue Realized (ARR) gap by 2024-25.

The primary goal of the RDSS is to improve the operational efficiency and financial sustainability of power distribution companies (DISCOMs). It accomplishes this by providing financial assistance to DISCOMs based on their adherence to pre-qualifying criteria and their achievement of minimum benchmarks. The scheme is divided into two main components:

1. Part 'A' includes financial support for prepaid smart metering, system metering, and the upgradation of distribution infrastructure, while
2. Part 'B' focuses on training, capacity building, and other enabling and supporting activities.

Under the RDSS, DISCOMs must achieve a minimum score of 60% and fulfill specific parameters to be eligible for funding. This encourages DISCOMs to undertake necessary reforms and enhancements in their operations and infrastructure. The scheme also integrates existing power sector reform programs, including the Integrated Power Development Scheme, Deen Dayal Upadhyaya Gram Jyoti Yojana, and Pradhan Mantri Sahaj Bijli Har Ghar Yojana, streamlining efforts under a unified program.

Through the RDSS, the government aims to strengthen the distribution sector, enhance supply infrastructure, and promote the adoption of prepaid smart metering systems. By reducing AT&C losses and closing the ACS-ARR gap, the scheme will improve the financial viability of DISCOMs, ensuring efficient and reliable electricity delivery to consumers. This comprehensive approach will contribute to the overall development and growth of the power distribution sector in India, benefiting both DISCOMs and electricity consumers nationwide.

Achievements

The reform measures implemented under the RDSS, in conjunction with other initiatives by the Ministry, have led to a significant decrease in AT&C losses of DISCOMs from 22.32% in the fiscal year 2021 to 16.44% in the fiscal year 2022. This reduction in AT&C losses has subsequently narrowed the gap between Average Cost of Supply (ACS) and Aggregate Revenue Requirement (ARR) from Rs. 0.69/kWh in FY2021 to Rs. 0.15/kWh in FY2022.

Furthermore, the AT&C losses in the power sector have further decreased to 15.41% (provisional) in FY 22-23. The direct implication of this achievement is a tangible improvement in the ACS-ARR gap, ultimately benefiting end consumers by ensuring the provision of quality power supply.

National Grid: One Nation - One Grid

The "One Nation One Grid" initiative of the Government of India is an ambitious initiative aimed at integrating and unifying the power grids across the country into a single national grid. The policy's objective is to enable the seamless transmission and sharing of electricity across states and regions, ensuring efficient utilization of power resources and promoting grid stability.

Under this policy, the different regional power grids in India, such as the Northern, Western, Eastern, and Southern grids, are interconnected to form a synchronized and interconnected power transmission network. The integration of these grids allows for the transfer of surplus power from one region to another, ensuring a reliable and consistent power supply across the country.

The achievement of this goal was realized with the commissioning of the 765kV S/c Raichur – Sholapur line on December 31, 2013. This milestone paved the way for the integration of the regional grids and laid the foundation for a unified and synchronized power transmission network across the country.

The central agency responsible for the development and strengthening of the transmission network is POWERGRID. Their focus lies in establishing inter-state and inter-regional transmission links to enhance the capacity of the national grid. This proactive approach ensures optimal utilization of India's diverse and unevenly distributed energy resources.

In the FY 2025 alone, the country witnessed the addition of 6,490 MW of inter-regional (IR) transmission capacity. This ongoing expansion of the transmission network has pushed the cumulative inter-regional capacity to 118,740 MW.[6] This continuous expansion of the transmission infrastructure has also resulted in a cumulative transformation capacity of 1,354,103 MVA as of May 2025.[7] These developments reflect the government's sustained commitment to strengthening the national grid and facilitating the seamless, reliable transfer of power across different regions of the country.

The implementation of the National Grid system signifies India's commitment to developing a robust and unified power transmission infrastructure. Through the continuous strengthening of inter-state and inter-regional transmission links, the country aims to achieve optimal utilization of resources, enhance grid stability, and foster competition in the power market. These efforts are vital for meeting the growing electricity demand, promoting renewable energy, and ensuring reliable and affordable power supply for all.

Green Energy Corridor

The Green Energy Corridor initiative in India focuses on the development of transmission corridors and associated infrastructure to facilitate the integration of renewable energy into the power grid. It aims to address the challenges of integrating large-scale renewable energy generation by strengthening the

[6] Network Plan (2024-25), Central Transmission Utility
[7] Industry Source, D&B Desk Research

transmission network by upgrading existing transmission lines, constructing new high-capacity lines, and establishing substations and transformers.

The initiative aims to balance power supply and demand by transmitting surplus renewable energy from regions with high generation potential to areas with high consumption. It also aims to improve grid stability and reliability, minimize transmission losses, and enable open access and market mechanisms for renewable energy trading.

The 12th Plan Period facilitated the integration and transmission of 32,713 MW of renewable energy capacity. The scheme initially estimated a total funding requirement of Rs. 34,141 Crore for the development of transmission infrastructure and control systems in states with abundant renewable resources such as Andhra Pradesh, Gujarat, Himachal Pradesh, Jammu and Kashmir, Karnataka, Maharashtra, Rajasthan, Madhya Pradesh, and Tamil Nadu.

The Green Energy Corridor project requires an estimated cost of Rs. 12,693.94 Crore for intra-state transmission systems and Rs. 15,455 Crore for inter-state transmission systems (revised figures). The funding for intra-state transmission schemes involves 20% equity from the State Government, 40% grant from the National Clean Energy Fund (NCEF), and 40% soft loan. Inter-state transmission schemes, on the other hand, are funded with 30% equity from PGCIL (Power Grid Corporation of India Limited) and 70% soft loan.

To support the funding of green energy corridors, a loan agreement has been signed between PGCIL and KfW Germany for a soft loan of Euro 500 million. Additionally, PGCIL has obtained a loan from ADB (Asian Development Bank) for the implementation of transmission schemes under Green Energy Corridor-Part D. Various states including Tamil Nadu, Rajasthan, Himachal Pradesh, Andhra Pradesh, Gujarat, and Madhya Pradesh have signed loan agreements with KfW Germany for financial assistance in implementing intra-state transmission projects.

Green Energy Corridor (GEC) Phase I

GEC-1, was approved by the Cabinet Committee on Economic Affairs (CCEA) in 2015. This scheme involves the implementation of intra-state transmission lines and sub-stations in eight renewable energy-rich states: Andhra Pradesh, Gujarat, Himachal Pradesh, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan, and Tamil Nadu. The project aims to evacuate approximately 24 GW of renewable energy power, with around 16.4 GW already commissioned and connected to the grid. The project's total cost is Rs. 10,141.68 crore, funded by 40% central grant from MNRE (Rs. 4,056.67 crore), 40% loan from KfW Germany (EUR 500 million), and 20% equity by the State Transmission Utilities (STUs). As of October 31, 2022, 8,651 ckm of transmission lines and 19,558 MVA of substations have been constructed, with Rajasthan, Madhya Pradesh, and Tamil Nadu having completed all their projects. The commissioning timeline for projects under GEC-1 was extended until March 2023.

Green Energy Corridor (GEC) Phase II

GEC-II was approved by the CCEA in January 2022. This scheme targets the implementation of intra-state transmission lines and sub-stations in seven states: Gujarat, Himachal Pradesh, Karnataka, Kerala, Rajasthan, Tamil Nadu, and Uttar Pradesh. The project's objective is to evacuate approximately 20 GW of renewable energy power in these states with addition of 10,753 circuit kilometres (ckm) of transmission lines and 27,546 Mega Volt-Amperes (MVA) capacity of sub-stations. The project cost is Rs. 12,031.33 crore, with 33% central financial assistance from MNRE (Rs. 3,970.34 crore) and the remaining 67% available as a loan from KfW/REC/PFC. The State Transmission Utilities (STUs) in these states are currently preparing the packages and issuing tenders for the project implementation. The scheduled commissioning timeline for projects under GEC-2 is March 2026.

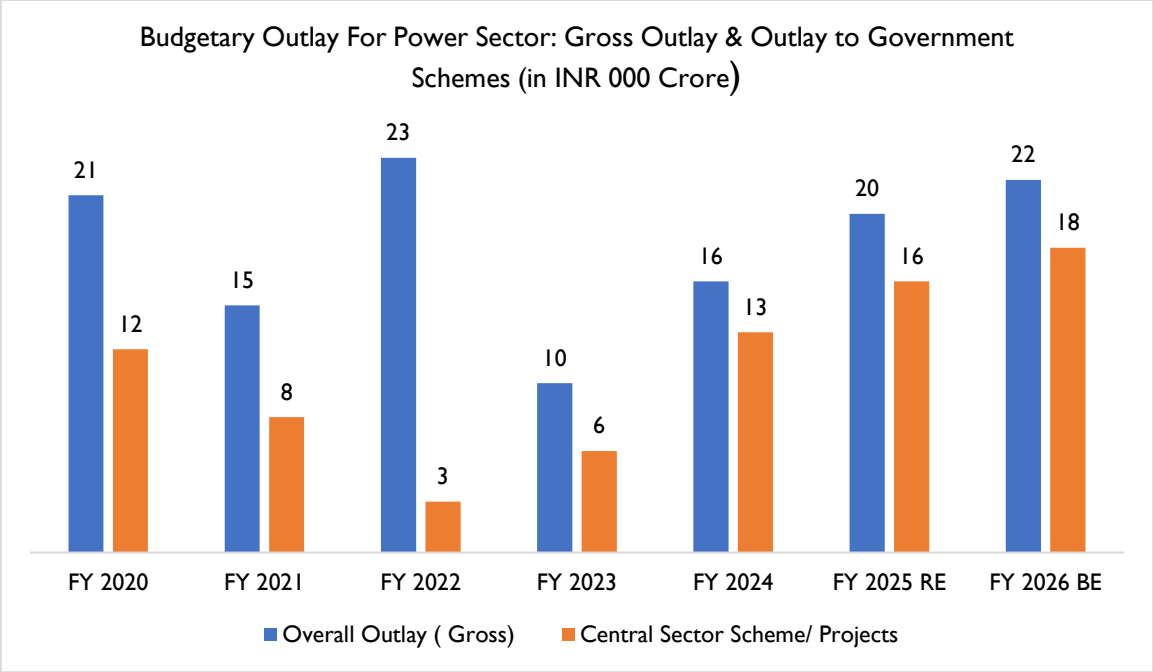
The State-wise brief of the projects under the scheme is as under:

State	Estimated project cost (INR Crore)	Length of transmission lines envisaged (ckm)	Capacity of substations envisaged (MVA)	RE addition envisaged (MW)
Gujarat	3636.73	5138	5880	4000
Himachal Pradesh	489.49	62	761	317
Karnataka	1036.25	938	1225	2639
Kerala	420.32	224	620	452
Rajasthan	880.92	1170	1580	4023
Tamil Nadu	719.76	624	2200	4000
Uttar Pradesh	4847.86	2597	15280	4000
Total	**12,031.33**	**10753**	**27546**	**19431**

Budgetary Outlay for Power Sector

The interim budget for FY 2025 marked a renewed push toward infrastructure and energy sector development, with a notable rise in allocations for ongoing government schemes. Although the power sector has consistently remained a strategic focus, earlier budget cycles particularly in FY 2022 and FY 2023 witnessed a moderation in allocations, with central sector scheme funding dipping to INR 2.8 crore and INR 5.8 crore, respectively. However, this trend has been decisively reversed in the latest budget cycle.

The overall gross budgetary outlay for FY 2025 (RE) rose to INR 19,800 crore, up from INR 16,300 crore in FY 2024, while allocations toward central sector schemes and projects increased to INR 16,300 crore, a significant jump of over 23% compared to the previous year. This upward revision reflects the government's commitment to accelerating economic growth and addressing key sectoral inefficiencies through focused public investment.



Source: Union Budget, Government of India

In particular, the Reform-Linked Distribution Scheme (RDSS) has received special emphasis, recognizing the persistent challenges faced by the transmission and distribution (T&D) segment. The scheme's budget allocation rose to INR 15,700 crore in FY 2025, marking an increase than the Revised Estimate of FY 2024, reaffirming the government's resolve to enhance the operational and financial sustainability of power distribution utilities. These budgetary priorities signal a strategic pivot back to strengthening core infrastructure, ensuring reliable power access, and driving long-term structural reform in the electricity sector.

Engineering, Procurement, and Construction (EPC)

EPC refers to a prominent contracting agreement in the construction industry where a single contractor assumes full responsibility for the project's engineering, procurement, and construction. This model streamlines project execution by transferring substantial risks from the owner to the contractor, making it an attractive option for developers who seek cost certainty and reduced engagement in project management.

EPC contracts typically involve several key characteristics:

- Single Point of Responsibility: The contractor manages all project aspects, simplifying oversight for the client.
- Fixed Price and Cost Certainty: Often structured as a lump sum, these contracts reduce financial risk and enable better budget management.
- Risk Transfer: Significant project risks, including design and construction-related uncertainties, are transferred to the contractor.
- Turnkey Delivery: The contractor delivers a fully operational facility, allowing the client to commence operations without further modifications.
- Performance Guarantees: Contractors commit to meeting specific performance standards, assuring quality and operational efficiency.

Scope of EPC Services in Power Transmission and Distribution

EPC (Engineering, Procurement, and Construction) services in the power transmission and distribution sector encompass a wide range of activities that are crucial for the development and operation of electrical power grids. These services involve the planning, design, construction, and commissioning of various infrastructure components, ensuring a seamless and efficient flow of electricity. Key areas covered by EPC services in power transmission and distribution include:

- ***Substation Construction***: EPC contractors design, build, and commission substations, which are essential for transforming and distributing electricity. This involves the installation of transformers, switchgear, and other electrical equipment.
- ***Transmission Line Construction***: EPC services extend to the construction of high-voltage transmission lines, which transport electricity over long distances. This includes the installation of towers, conductors, and insulators.
- ***Distribution Network Development***: EPC contractors are responsible for designing and building distribution networks, which deliver electricity to end-users. This involves the installation of distribution transformers, feeders, and other components.
- ***Grid Modernization and Expansion***: EPC services are crucial for upgrading existing power grids and expanding their capacity to meet growing demand. This involves the rehabilitation of aging infrastructure, installation of new equipment, and integration of renewable energy sources.

- ***Project Management***: EPC contractors provide comprehensive project management services, overseeing all aspects of the project from planning and design to construction and commissioning. This ensures that projects are completed on time, within budget, and to the required quality standards.

  EPC services play a vital role in ensuring the reliability and efficiency of power transmission and distribution systems. By providing a one-stop solution for all aspects of project development, EPC contractors help to streamline the process and reduce project risks. As the demand for electricity continues to grow, the importance of EPC services in the power sector will only increase.

Construction industry in India

Overview

The construction sector is a key component of the Indian economy with linkages across more than 200+ sub sectors. Construction, the second largest economic activity in India (after agriculture) contributes around ~9.1% to the national GDP. Further, India is poised to become the third-largest construction market in the next 2-3 years on the back of stable economic growth as the real estate sector has emerged to be a critical engine in the country's growth story. As per a Knight Frank report, the construction sector, along with the output generated from real estate services and ownership of dwellings, contributes nearly 18% to the economy's total output.

It is the second largest employment generator in India with nearly 71 million workforce which is expected to cross 100 million by 2030. High employability of the sector is due to chain of backward and forward linkages that the sector has with other sectors of the economy. It provides impetus to other manufacturing sectors like cement, bitumen, iron and steel, chemicals, bricks, paints, tiles among others. A unit increase in expenditure in construction sector has a multiplier effect on other sectors with a capacity to generate income as high as five times in other sectors.

India's construction industry is on a phenomenal growth trajectory, projected to reach a staggering USD 1.4 trillion by 2025, accounting for 8%-10% of India's GDP. This represents a significant leap from its current size of approximately USD 820 billion, showcasing the dynamism and potential of this sector. Cities are a major driver for the construction industry as more than 40% of the population is expected to live in urban India (compared to the current 33%), leading to a demand for 25 million additional mid-end and affordable units by 2030. Further, the Smart Cities Mission targeted at 100 cities is aimed at improving the quality of life through modernized/ technology driven urban planning.

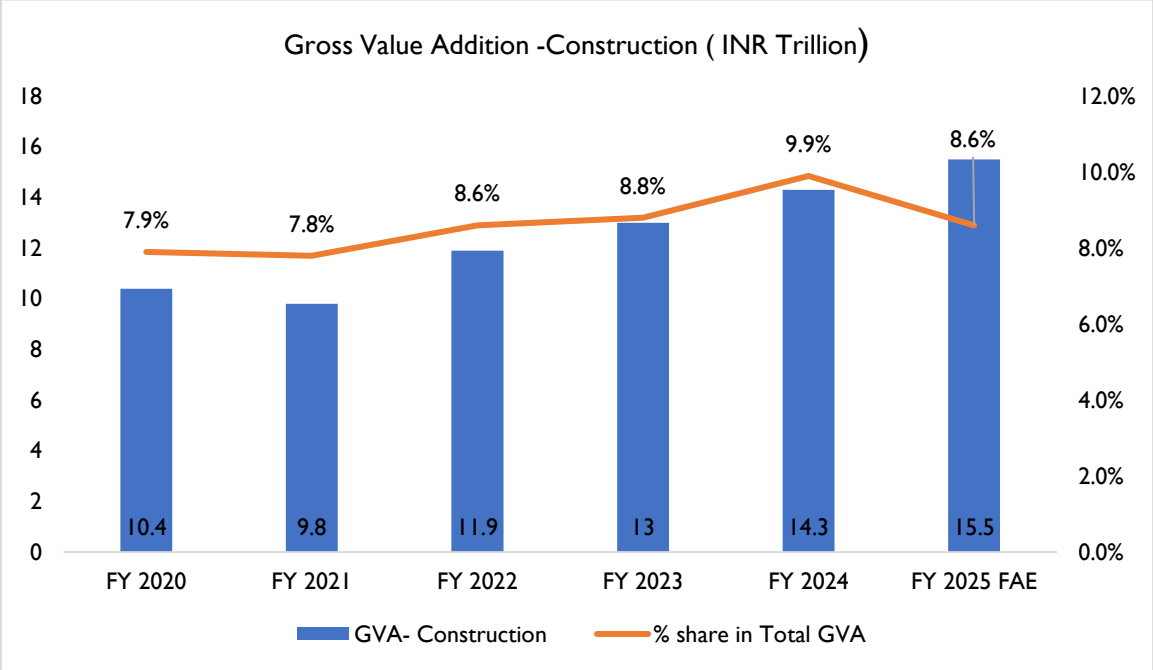
The Indian government's ambitious Gati Shakti National Master Plan plays a pivotal role in propelling the construction industry forward. This comprehensive roadmap aims to seamlessly integrate infrastructure development across various sectors, creating a national logistics network that will boost efficiency and reduce costs.

The Bharatmala Pariyojana initiative complements Gati Shakti by focusing specifically on developing a world-class highway network spanning over 83,000 kilometers. This ambitious project comprises several expressways, ring roads, and economic corridors, aiming to improve connectivity, boost regional development, and facilitate trade. The booming construction industry is a significant job creator, directly employing millions of workers across various disciplines like engineering, construction, architecture, and skilled labor. Additionally, the sector indirectly supports numerous job opportunities in associated industries like manufacturing, transportation, and logistics.

Historical growth trend in construction industry

Contribution to national economy by the construction sector has steady improved over the years, and by FY 2025 it is estimated to account for nearly 8.6% of national Gross Value Added (GVA). In actual terms, the GVA by construction sector reached approximately INR 15.5 trillion in FY 2025.

This positive development is based on increased government spending on infrastructure as well as faster than expected demand growth in the real estate sector. The housing sector especially is seeing stable demand, on the back of low loan rates, deductions in stamp duty announced by several state Governments as well as drop in property price volatility.



Source: Ministry of Statistics & Programme Implementation (base year 2011-12)

The government has identified infrastructure as a priority sector to bolster GDP growth. Various reforms have been introduced from time to time to attract investment in infrastructure. Infrastructure sector was opened to private participation post-liberalization in 1991 and currently up to 100% FDI under automatic route is allowed in most sectors/activities.

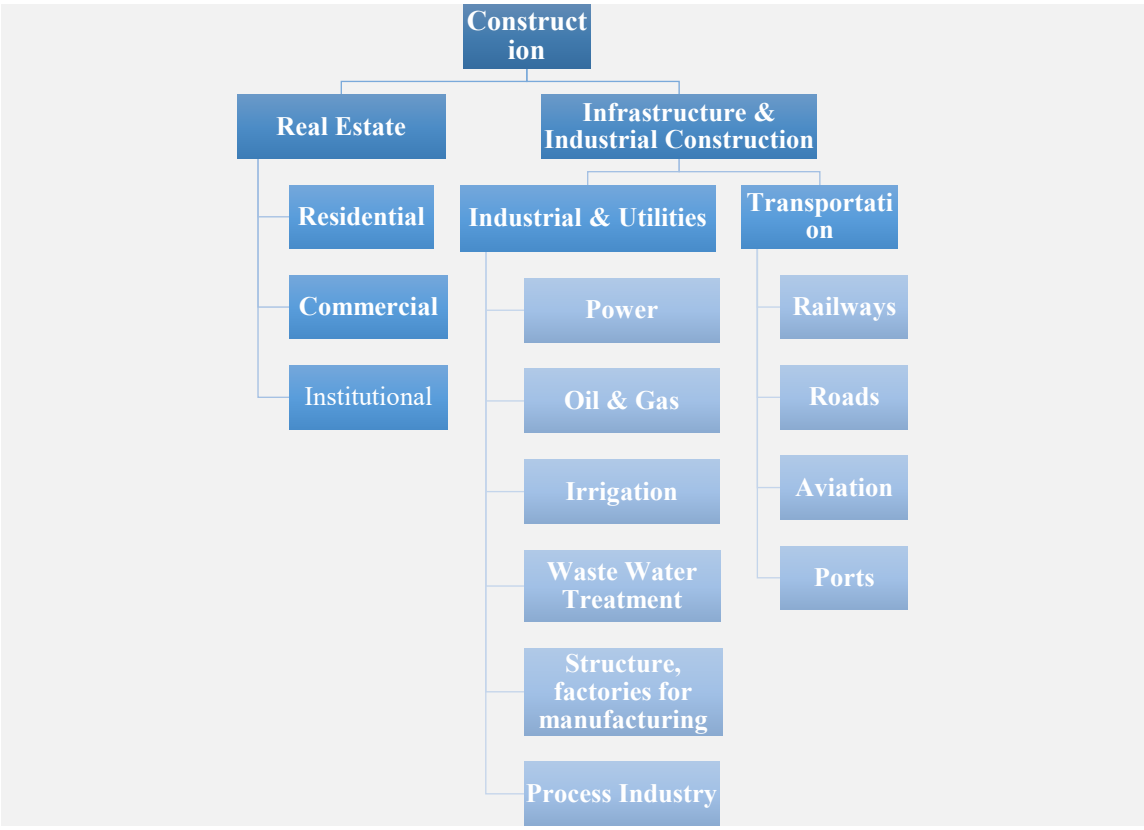
100% FDI under automatic route is allowed in construction-development projects which would include development of townships, construction of residential/commercial premises, roads or bridges, hotels, resorts, hospitals, educational institutions, recreational facilities, city and regional level infrastructure, townships.

India has emerged as a safe investment destination in the last decade. The construction development segment (townships, housing, built-up infrastructure, and construction-development projects) is the seventh largest FDI recipient with its share in total FDI inflows standing at nearly 4% (at the end of March 2025) and cumulatively amounted to INR 1,358.24 billion from Apr 2000 – March 2025.

Segment	FY 2022 INR Bn	FY 2023 INR Bn	FY 2024 INR Bn	FY 2025 INR Bn	Cumulative FDI From April 2000 to March 2025 INR Bn
Construction Development *Townships, housing, built-up infrastructure, and construction-development projects*	9.32	11.96	21.13	45.03	1,358.24
Construction (Infrastructure) Activities	241.78	135.88	350.76	189.62	2,585.16

Key Segments of the Indian Construction Industry

Construction sector includes a broad spectrum of activities including planning & design to actual construction. The sector is broadly divided into two: real estate construction and Industrial & infrastructure construction.



Real Estate

Residential Construction: Building Homes for a Growing Nation

It is the largest Segment, representing approximately 60% of the industry, residential construction plays a dominant role. Rapid urbanization driven by a burgeoning middle class and economic growth fuels demand for new housing units, particularly in Tier 1 and Tier 2 cities. Government initiatives like Pradhan Mantri Awas Yojana (PMAY) aim to bridge the housing gap and provide affordable homes for low-income families.

Preference for smaller apartments, smart homes, and integrated townships with amenities is gaining traction among the residents.

Commercial Construction: Skyrocketing Demand for Office and Retail Space

This segment is fuelled by Economic Growth i.e., Increasing business activity and foreign direct investment drive demand for office space in major cities. Growth of e-commerce and changing consumer preferences necessitate modern retail centres and logistics infrastructure. Emerging trend of Co-working and Coworking Spaces catering to the burgeoning freelance and start-up culture. Green buildings and energy-efficient technologies are gaining traction as environmental consciousness rises.

Infrastructure Construction: Connecting India: Roads & Highways, Railways, Airports, and Ports

The sector bears strategic importance in contributing towards country's economic growth. It is a key driver of economic growth and national development. Infrastructure development can be referred to as a set of basic services, facilities, and physical installations required for smooth functioning of quality life in a country. Growth in infrastructure serves as an indicator of level of urbanization as well as overall development in the country. It encompasses the development and maintenance of essential infrastructure like roads, highways, railways, airports, ports, waterways, etc. This segment plays a crucial role in:

- *Connecting people and places*: Efficient transportation networks facilitate movement of goods and people, boosting trade and commerce.
- *Stimulating economic activity*: Infrastructure projects create jobs, attract investments, and spur development across various sectors.
- *Improving quality of life*: Access to clean water, sanitation, and reliable electricity enhances living standards and promotes overall well-being.

Key Segments of Infrastructure Construction:

Roads & Highways: India has a road network spanning approximately 6.6 million kms, making it the second largest in the world. This network – which comprises of national highways, state highways, district roads, and rural road – carries approximately 65% of country's freight traffic and nearly 90% of passenger traffic. However, it needs significant expansion and upgrades. The government initiatives like Bharatmala Pariyojana and Sagarmala aim to improve connectivity and logistics efficiency.

Railways: The Indian Railways network is the fourth largest globally, undergoing modernization with dedicated freight corridors and high-speed rail projects. The modernization of railway stations in India encompasses a wide range of initiatives aimed at enhancing infrastructure, amenities, and services to provide passengers with a world-class travel experience. This includes the construction of modern waiting halls, waiting rooms, restrooms, and passenger lounges equipped with amenities such as Wi-Fi connectivity, charging points, and digital display boards providing real-time information about train schedules and arrivals.

Additionally, efforts are underway to improve accessibility for passengers with disabilities by installing ramps, elevators, and other facilities to ensure equitable access to railway services.

Airports: Expansion and modernization of airports to cater to growing air traffic and promote regional connectivity. India plans to build and upgrade over 100 airports, expanding air connectivity and catering to growing passenger demand.

Ports: With a coastline of approximately 7,517 km, India's coastline offers immense potential for port development, facilitating international trade and boosting maritime connectivity. India has 12 major ports and approximately 200 minor ports as of July 2024. Indian ports handle 95% of the total international trade volume of the country where the 12 major ports of India handled 53% of the total cargo and the minor ports accounted for 47% of the cargo traffic in FY2024. Various initiatives are being taken by central bodies to improve maritime transport in India by reducing turnaround time, enhance operational efficiency, improve capacity utilization, increase inland waterways, and lower costs. Sagar Mala Project and Maritime India Vision 2030 are few of the largest sector specific policies being implemented across the country aimed at bringing India to the forefront of the global maritime transport.

Global transformer industry

The global transformer industry plays a crucial role in supporting the electrical power infrastructure worldwide. Transformers are indispensable devices that convert voltage levels to enable efficient transmission and distribution of electricity. They are used in various applications, from power generation plants to residential areas, ensuring a reliable and uninterrupted supply of electricity. The industry is driven by several factors, including economic growth, urbanization, and the increasing demand for electricity. As countries develop and cities expand, the need for transformers grows to meet the rising energy consumption. Additionally, the shift towards renewable energy sources and the electrification of transportation are further driving demand for transformers. Major players in the global transformer market include multinational corporations like ABB, Siemens, GE, Schneider Electric, and Mitsubishi Electric, known for their technological expertise and global reach. However, the industry also faces challenges such as rising raw material costs, intense competition from emerging markets, and rapid technological advancements. Despite these challenges, the global transformer industry is expected to continue expanding, driven by the persistent demand for electricity and the need for efficient and reliable power distribution solutions.

Indian Transformer Industry

Transformer along with power transmission lines forms the core of a power transmission & distribution (T&D) infrastructure and an important part of substation infrastructure. A **substation** transforms or regulates voltage levels. It contains various equipment such as Transformers, Switches, Circuit breakers, Large metallic pipe called bus work, Support structures to terminate transmission lines and Communications equipment.

Transformers can be broadly categorized into following based on the output rating.

- **Power transformers:** Power transformers are used in transmission network of higher voltages for step-up and step-down application. It should have a primary voltage rating of 33 kilo volt (kV) and above.
- **Distribution transformers**: Distribution transformers work at lower voltages. A distribution transformer is used to transform power voltage from transmission point to distribution of power to the end user.

Electricity generated at a power plant is transmitted to the nearest grid via step-up transformers and then to the state grid (via step-up or step-down transformers) and then to a power substation via step-down transformers. Finally, distribution transformers are used to transmit power from the sub-transmission point to end consumers.

- There are also specialized types of transformers. These are primarily used for welding, furnace etc. Special Transformers find application in industries like oil & gas, metal, steel for melting, refining, etc.
- Another classification of the transformer comprises current and voltage transformer (defined in unit volume), which together are referred as **instrument transformer**.

Based on application, transformers are also classified as industrial transformers or utility transformers. Based on technology, it can be divided into oil filled transformers and dry transformers.

Market Scenario

The Indian transformer industry is experiencing robust growth, driven by factors such as rapid urbanization, industrialization, and increasing demand for electricity. The estimated market size for FY 2025 is INR 353.9 billion, indicating a significant expansion in recent years. Several key trends are shaping the market landscape:

Infrastructure Development: India's ongoing infrastructure projects, including the construction of power plants, transmission lines, and distribution networks, are driving demand for transformers. The government's focus on smart cities and rural electrification initiatives is further fueling this growth.

Renewable Energy Expansion: The increasing adoption of renewable energy sources, such as solar and wind power, is creating a need for transformers to integrate these sources into the grid. This is contributing to the expansion of the transformer market.

Industrial Growth: India's thriving manufacturing sector, including automotive, electronics, and chemicals, is driving demand for electricity. This, in turn, is leading to increased demand for transformers for industrial applications.

Technological Advancements: Advances in transformer technology, such as the development of more efficient and compact designs, are enabling manufacturers to offer innovative products. This is driving the market towards higher-value products.

Government Policies: The government's focus on improving power infrastructure and promoting energy efficiency is creating a favourable environment for the transformer industry. Policies such as the National Electricity Policy and the National Solar Mission are supporting the growth of the market.

Despite the positive outlook, the Indian transformer industry faces challenges such as intense competition, rising raw material costs, and the need to comply with stringent quality standards. However, with the right strategies and investments, the industry is well-positioned to capitalize on the growing market opportunities and continue its expansion in the coming years.

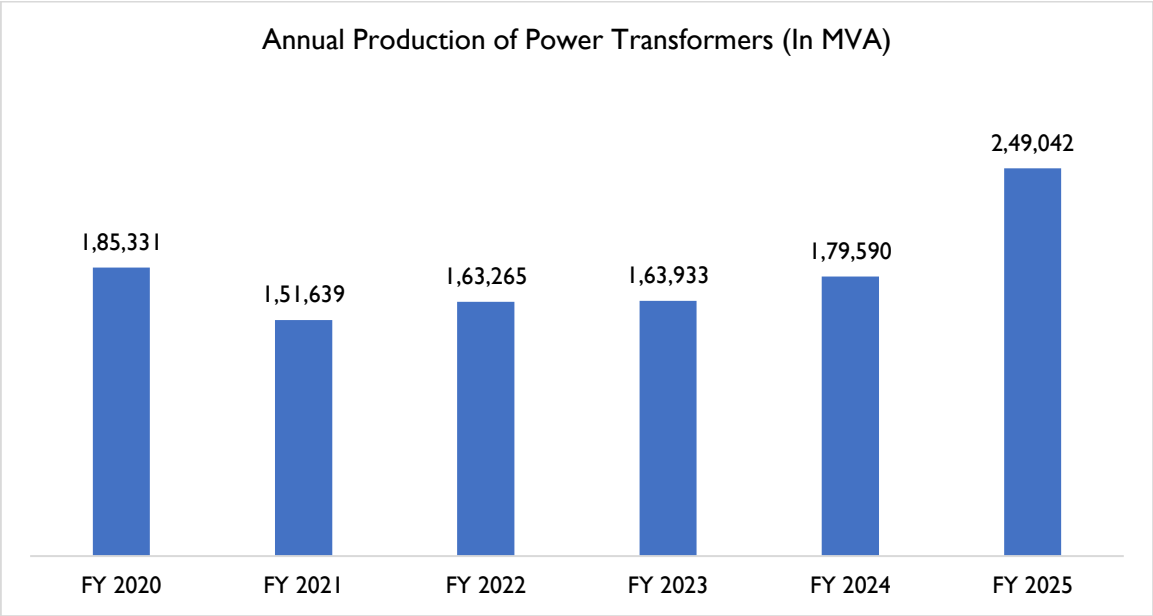
The Indian power transmission sector has seen the highest substation capacity additions in the 220 kV and 400 kV voltage segments, which continue to serve as the backbone for regional and inter-regional transmission. In particular, the 400 kV segment has shown consistent growth, increasing from 30,560 MVA in FY 2019 to 40,540 MVA in FY 2025, underscoring its critical role in high-capacity transmission corridors. The 220 kV level, while traditionally dominant in intra-state networks, has also recorded notable capacity expansions from 21,145 MVA in FY 2019 to 24,893 MVA in FY 2025, indicating continued investment in strengthening state-level grids.

Voltage Level	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025
220 kV	21,145	21,140	21,320	25,096	23,767	20,543	24,893
400 kV	30,560	24,590	24,555	31,386	32,635	32,185	40,540
765 kV	21,000	19,500	7,700	18,500	19,500	18,000	21,000
+/- 320 kV HVDC	-	-	1,000	1,000	-	-	-
+/- 500 kV HVDC	-	-	-		-	-	-
+/- 800 kV HVDC	-	3,000	3,000	3,000	-	-	-
All India	72,705	68,230	56,575	78,982	75,902	70,728	86,433

Source: India Transmission Portal

By contrast, the 765 kV segment has historically seen the lowest annual additions, with a significant dip observed in FY 2021 (only 7,700 MVA), reflecting limited deployment. However, from FY 2022 onward, there has been a clear shift, with capacity additions rebounding to 19,500 MVA in FY 2023 and again reaching 21,000 MVA in FY 2025. This resurgence reflects a strategic shift by power utilities toward ultra-high voltage infrastructure, aimed at enabling bulk power transfer over long distances while minimizing transmission losses and enhancing grid efficiency.

Annual Production of Power Transformers:

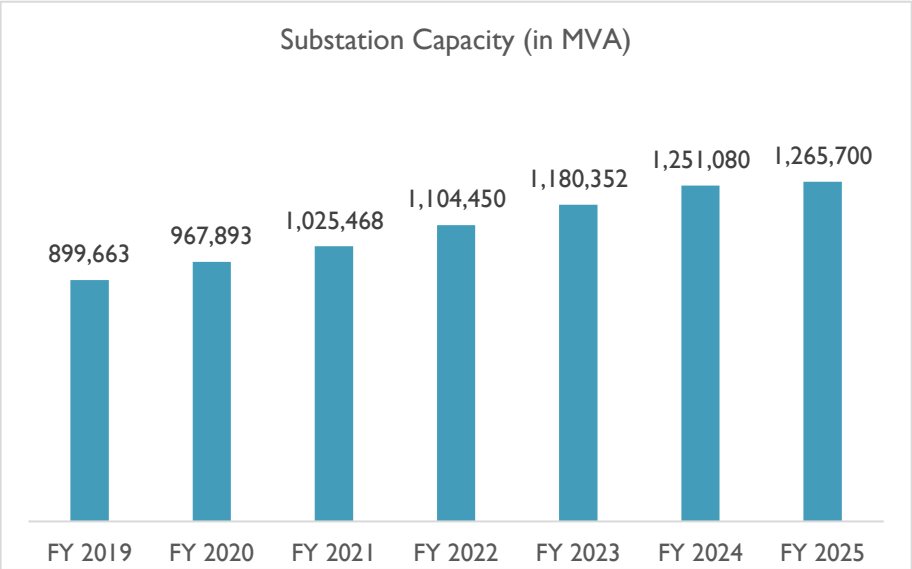


Source: Center for Monitoring Indian Economy (CMIE)

India's annual production of power transformers declined to 1,85,331 MVA in FY 2020, largely due to the broader economic slowdown. The situation worsened in FY 2021, as the impact of COVID-19-related restrictions disrupted manufacturing activities, bringing output down to 1,51,639 MVA. A slow recovery followed, with production reaching 1,63,265 MVA in FY 2022 and stabilizing at 1,63,933 MVA in FY 2023. However, FY 2024 marked the beginning of a stronger rebound, with output rising to 1,79,590 MVA, and further accelerating in FY 2025 to an estimated 249,042 MVA, indicating renewed momentum in the power infrastructure and manufacturing sector.

Substations in India: Historical Growth and Voltage-Wise Distribution

Over the past several years, India's substation capacity has experienced robust growth, reflecting the expansion of the country's power infrastructure to meet increasing electricity demand. From FY 2019 to FY 2024, the total substation capacity has grown from 899,663 MVA to 1,251,080 MVA, representing a substantial increase. This growth equates to a CAGR of 5.9%, demonstrating a consistent investment in strengthening and expanding the country's power distribution network.



Source: Niti Aayog, India Climate & Energy Dashboard

In FY 2019, the total substation capacity was 899,663 MVA. This capacity increased to 967,893 MVA in FY 2020 and further rose to 1,025,468 MVA in FY 2021. The upward trend continued with the capacity reaching 1,104,450 MVA in FY 2022. By FY 2023, the total capacity had grown to 1,180,352 MVA. The most recent data for FY 2024 shows a significant jump to 1,251,080 MVA, with projections for FY 2025 estimating a capacity of 1,265,700 MVA. This growth underscores the ongoing efforts to enhance power distribution and support the country's increasing energy needs.

Voltage-Wise Substation

As of July 2024, India's substation distribution reveals significant variations across different voltage levels and sectors. At the 220 kV level, most substations are state-owned i.e. 455,599 with Central and Private sectors contributing 14,521 and 1,957 substations, respectively. For the 400 kV level, the Central sector leads with 212,420 substations, followed closely by the State sector with 221,653 and the Private sector with 28,350. The 500 kV level shows a smaller number of substations, with the Central sector having 9,500, the Private sector 2,500, and the State sector 1,500. At 765 kV, the Central sector dominates with 238,700 substations, while the Private and State sectors have 31,000 and 28,000 substations, respectively. Lastly, at the 800 kV and 320 kV levels, the Central sector has 18,000 and 2,000 substations, with no contributions from the Private or State sectors at these voltage levels.

Voltage Level	Central	Private	State
220 kV	14,521	1,957	455,599
400 kV	212,420	28,350	221,653
500 kV	9,500	2,500	1,500
765 kV	238,700	31,000	28,000
800 kV	18,000	-	-
320 kV	2,000	-	-

The growth in substation capacity over the years and the bifurcation of substations across various voltage levels reflect India's commitment to expanding and modernizing its power infrastructure. The increasing capacity and strategic distribution of substations are critical to ensuring a reliable and efficient power supply across the country, supporting both current and future energy demands.

Demand Drivers

The demand for power transformers is directly dependent on expansion as well as modernization of power transmission capacity. Government objective of 100% electrification as well as higher demand for uninterrupted power from industrial and domestic consumers have led to sustained investment in increasing the transmission capacity in the country.

In addition, integration of renewable power into national grid along with need for smart transmission – due to the rise of electric charging stations and digitization & automation across industrial consumers have created the need for smart transformers that can control power transmission in an intelligent way. To meet this emerging need utilities will have to upgrade the transmission capability, by installing smart transformers that can independently regulate voltage, along with intelligent monitoring and diagnostic features.

These two developments will be the key demand drivers in the power transformer industry in the coming years.

From an end user perspective, initiatives like increasing electrification of railway infrastructure, growth in demand from industrial consumers due to large scale industrial growth, and higher demand from domestic consumers as the usage of electrical appliances goes up will create higher demand for power. This will in turn require expansion and upgradation of transmission capability creating demand for power transformers.

Growth in transmission infrastructure

The Ministry of Power has made significant strides in enhancing India's transmission infrastructure under Prime Minister Shri Narendra Modi's leadership. The recently finalized National Electricity Plan (2023-2032) aims to expand the transmission network from 485,000 ckm in 2024 to 648,000 ckm by 2032, accommodating a projected peak demand of 458 GW. This ambitious plan, with a total estimated cost of approximately INR 9.15 trillion, includes the addition of nine High Voltage Direct Current (HVDC) lines, boosting inter-regional transfer capacity from 119 GW to 168 GW. Recently, the Ministry approved 50.9 GW of transmission capacity, focusing on renewable energy evacuation, while also achieving the electrification of 83,596 Particularly Vulnerable Tribal Group (PVTG) households. Despite challenges like land acquisition and regulatory hurdles, the Ministry's initiatives aim to ensure energy security and facilitate the integration of renewable sources into the grid, marking a pivotal step towards a sustainable energy future for India.

Integration of renewable energy / variable renewable energy (VRE)

India is aggressively expanding its installed generation capacity in the renewable energy sector. As of FY 2025, the total installed renewable energy capacity has reached approximately 220 GW, accounting for nearly 46% of the country's overall installed power generation capacity of 475 GW. This marks a significant shift toward cleaner energy sources, reflecting India's strong policy push, large-scale solar and wind deployments, and commitment to meeting its long-term sustainability and climate goals. The substantial rise from previous years highlights the rapid pace at which renewables are being integrated into India's energy mix.

Solar and wind energy dominate Indian renewable energy domain, and generation centers are often located in far off location. This creates the need for a robust transmission infrastructure to facilitate of transfer of power from origin to destination. Moreover, the variable nature of power generated and the need for power evacuation meant the transmission infrastructure creates a strong demand for power transformers that will beef up the transmission capability.

The integration of Variable Renewable Energy (VRE) is pivotal for India's transition to a sustainable energy future, aiming for 500 GW of renewable capacity by 2030. The National Electricity Plan (2023-2032) addresses this by expanding the transmission network to 648,000 ckm and approving 50.9 GW of transmission capacity for VRE. With a focus on evacuating 280 GW of VRE to the Inter-State Transmission System (ISTS) by 2030, the plan emphasizes investments in advanced grid technologies and energy storage solutions. By overcoming integration challenges, India can maximize its renewable potential, reduce emissions, and secure energy for its growing economy.

Demand from railway electrification initiatives

In railway transportation, transformers are used to reduce the voltage level received from overhead lines to make it suitable to power essential train functions like traction, lighting, brakes and heating & ventilation. Indian Government has announced a plan to achieve 100% rail electrification by 2023 and make Indian railways a net zero carbon emitter by 2030. As part of that, railways are investing in aggressively scaling up freight capabilities and is electrifying the remaining lines. This initiative has seen Indian railways floating several tenders for procuring transformers, with leading global supplies like ABB securing multi-million dollar contracts. With a significant percentage of railway network yet to be electrified, the opportunities created by rail electrification is immense.

Demand from industrial sector

Industrial production has increased by leaps and bounds in the last decade alone, on the back of increasing demand. Billions of rupees worth of investments has gone into expand production capacity as well as modernizing the manufacturing infrastructure across all sectors. The growth in industrial production has increased the electricity consumption. Along with increase in power generation, this development also required improving the transmission infrastructure to bring down the voltage to levels that is combatable for usage. Similarly, electricity demand has increased from domestic households too, with increase in electrified homes as well as growth in the number of electronic and electrical appliances used.

Regulatory Scenario

Indian capital goods sector has been completely decontrolled to allow a level playing field for private companies. No industrial license is required for entry into this sector. Similarly, the quantum of payment for technology transfer, design & drawing, royalty etc to foreign collaborator has no limit. Up to 100% foreign direct investment is permitted in the sector and there are no restrictions/limits on import-export activities.

Removal of restrictive industrial licensing norms, easing regulations for private companies to enter the sector as well as relaxation of foreign direct investments (FDI) are few of the regulatory initiatives. In the FDI front, the Government currently allows up to 100% FDI under automatic route in most of the segments within the capital goods sector.

National Goods Policy, announced in 2016, is expected to be the key regulatory framework that would guide domestic capital goods manufacturing industry in the coming years. Primary objective of the policy includes increasing the annual production value of capital goods in the country to INR 750,000 Crore by 2025, up from INR 230,000 Crore that was prevailing in FY 2015. This policy, along with Make in India scheme, and the Atmanirhar Bharat Abhayan (in May 2020) is expected to fuel the capital goods industry in India in the coming years.

Future Scenario

The Indian transformer industry is experiencing a period of robust growth, driven by a confluence of factors. The market size is projected to expand significantly from INR 353.9 billion in FY 2025 to INR 522.98 billion by FY 2030 at a CAGR of ~8.1%. This growth trajectory is underpinned by the escalating demand for electricity, a consequence of rapid urbanization, industrialization, and a burgeoning economy.

Government initiatives are also playing a pivotal role in fostering the industry's growth. The government's emphasis on infrastructure development, renewable energy, and smart grids is creating a conducive environment for the transformer industry. These initiatives are driving investments in power transmission and distribution networks, renewable energy projects, and energy-efficient technologies, thereby stimulating demand for transformers.

Moreover, advancements in transformer technology are poised to fuel market expansion. Innovations in design, materials, and manufacturing processes are enabling the development of more efficient, reliable, and compact transformers. These technological advancements are enhancing the performance and capabilities of transformers, making them more attractive to customers and driving demand.

While the industry faces challenges such as competition and rising raw material costs, the overall outlook remains optimistic. The increasing demand for electricity, coupled with supportive government policies and technological advancements, presents significant opportunities for growth. The Indian transformer industry is well-positioned to capitalize on these opportunities and emerge as a global leader in the coming years.

Transformer Components Industry

Product overview

Transformers are essential devices in electrical power systems due to their ability to efficiently transfer electrical energy between different voltage levels. This capability is crucial for various applications, including long-distance power transmission, local distribution, and industrial processes. By stepping up or stepping down voltages, transformers enable the optimal transmission and utilization of electrical energy. This not only improves efficiency but also ensures safety and reliability in power systems. Each component plays a crucial role in the efficient and safe operation of these devices.

Component	Description
Core	The core is the magnetic heart of a transformer. It is typically made of laminated steel sheets, which help reduce eddy current losses. The core's shape and material determine the transformer's efficiency and magnetic properties.
Windings	Windings are coils of insulated copper or aluminum wire wrapped around the core. There are two types of windings: primary and secondary. The primary winding receives electrical power from the source, while the secondary winding delivers the transformed power to the load. The number of turns in each winding determines the voltage ratio of the transformer.
Insulation	Insulation is essential to prevent electrical short circuits between windings and the core. It is typically made of paper, oil, or synthetic materials. The quality and type of insulation directly affect the transformer's reliability and lifespan.
Bushings	Bushings are electrical connectors that provide a safe and reliable connection between the transformer and the external electrical system. They are typically made of porcelain or epoxy resin and are designed to withstand high voltages and environmental conditions.
Cooling System	Transformers generate heat during operation. A cooling system is necessary to dissipate this heat and prevent the transformer from overheating. Cooling systems can be air-cooled, oil-cooled, or water-cooled, depending on the size and power rating of the transformer.

Oil	In oil-filled transformers, oil serves as both a coolant and an insulating medium. It helps to transfer heat from the core and windings to the cooling system and provides additional insulation.
Tap Changer	Some transformers have a tap changer, which allows for adjusting the voltage ratio of the transformer. This is useful for maintaining a constant voltage level in the secondary circuit, even when the load or source voltage fluctuates.
Breakers	Breakers are protective devices that can interrupt the flow of current in the transformer if a fault occurs. They help to prevent damage to the transformer and the surrounding electrical system.

Types of Core Material and their applications in transformers

Transformers rely on magnetic cores to channel and concentrate the magnetic flux generated by the windings. The choice of core material significantly impacts the transformer's efficiency, size, and cost. Three common types of core materials are Cold Rolled Grain Oriented (CRGO) steel, amorphous core, and magnetic core.

Cold Rolled Grain Oriented (CRGO) Steel

CRGO steel is a specialized material renowned for its exceptional magnetic properties, making it a preferred choice for transformer cores. The manufacturing process involves cold rolling steel sheets and then annealing them in a magnetic field. This treatment aligns the iron crystals in a specific direction, significantly enhancing the material's magnetic characteristics. The aligned grains minimize energy losses due to eddy currents, leading to higher efficiency and lower operating temperatures in transformers. CRGO steel's combination of high magnetic permeability and low core losses makes it particularly suitable for large power transformers, where energy efficiency and reliability are paramount.

Global and Indian Players

Category	Company	Overview
Global Players	**Thyssenkrupp**	Thyssenkrupp is a leading global producer of electrical steel and has established its first CRGO steel plant in India, located in Nashik, Maharashtra. This facility has a production capacity of 50,000 tonnes annually, making it a significant player in the Indian CRGO market.
	NLMK Group	NLMK Group, a major global steel producer, is expanding its operations in India by setting up a CRGO steel manufacturing facility in Maharashtra. The new plant will have a production capacity of 64,000 tonnes per annum, addressing about 20% of India's current demand for CRGO steel.
	JFE Steel	JFE Steel, a prominent Japanese steel manufacturer, is collaborating with JSW Steel to form a joint venture in Karnataka, India. This partnership aims to produce a comprehensive range of CRGO steel products to meet the increasing demand for electrical steel in the region.
Indian Players	**Steel Authority of India Limited (SAIL)**	Steel Authority of India Limited (SAIL) is a major steel producer in India and is involved in the CRGO steel market. SAIL's overall production includes various steel products, with capacities in flat products relevant to electrical steel. The company is likely focusing on expanding its capabilities in response to rising domestic demand for CRGO steel. SAIL is looking forward to enhancing its CRGO production to reduce reliance on imports and better meet local needs.
	Jindal Steel & Power Limited (JSPL)	Jindal Steel & Power Limited (JSPL) is actively involved in the production of Cold-Rolled Grain-Oriented (CRGO) steel, essential for transformer and electrical applications. JSPL is enhancing its production capabilities for value-added steel products, including CRGO. The company's facilities are equipped to produce a range of steel grades. JSPL's focus on advancing its capabilities aligns with the growing demand for CRGO steel in the market.

	TATA Steel	Tata Steel is advancing CRGO steel production in India through collaborations with the Indian government and research institutions. The company is involved in developing indigenous CRGO technology with the Department of Scientific and Industrial Research (DSIR) and the National Metallurgical Laboratory (NML). A pilot plant is planned at NML in Jamshedpur to produce CRGO steel using new, locally developed processes, supported by a detailed report from Mecon.

Amorphous Core

Amorphous cores are constructed from non-crystalline alloys, often comprising iron, nickel, and boron. Unlike crystalline materials with a regular atomic structure, amorphous alloys exhibit a random arrangement of atoms. This unique structure effectively reduces eddy current losses, resulting in significantly higher efficiency compared to traditional CRGO steel, especially at higher frequencies. Amorphous cores are commonly employed in high-frequency transformers, such as those found in electronic devices and power supplies. Their superior efficiency and reduced heat generation contribute to improved performance and extended lifespan in these applications.

Magnetic Core

Magnetic cores can be fabricated from a variety of materials, including iron, silicon steel, and ferrites, each with distinct magnetic properties that suit specific applications. Iron cores are often utilized in low-frequency transformers due to their high saturation flux density, allowing them to handle larger magnetic loads. Silicon steel cores are well-suited for medium-frequency transformers, offering a balance between magnetic properties and cost. Ferrites, a class of ceramic materials, are commonly employed in high-frequency applications due to their low eddy current losses and high electrical resistivity. The selection of the appropriate core material depends on the transformer's

Market Scenario of CRGO Transformer Components in India

The market for CRGO transformer components in India has been steadily expanding in recent years, driven by the nation's rapid industrialization, urbanization, and increasing demand for electricity. CRGO steel, a high-quality electrical steel, is a crucial component in transformers, essential for power transmission and distribution.

With an estimated market size of INR 70.8 billion[8] in FY 2025, CRGO transformer components have witnessed significant growth. This growth is attributed to several factors, including:

- ***Infrastructure Development:*** India's ongoing infrastructure projects, such as smart cities, industrial parks, and transportation networks, have led to a surge in demand for transformers.
- ***Renewable Energy Expansion:*** The growing emphasis on renewable energy sources, such as solar and wind power, has necessitated the installation of numerous transformers for grid integration and local distribution.
- ***Industrial Growth:*** The expansion of various industries, including manufacturing, automotive, and electronics, has increased the demand for electrical power, driving the need for transformers.
- ***Technological Advancements*:** Advances in transformer technology, such as the development of more efficient and compact designs, have contributed to the growth of the market.

Despite the positive outlook, the market for CRGO transformer components in India faces certain challenges. The availability of high-quality CRGO steel at competitive prices is a critical factor. Additionally, the increasing competition from imported components and the need to comply with stringent quality standards can pose challenges for domestic manufacturers.

To capitalize on the growing market opportunities, Indian manufacturers are focusing on:

- ***Capacity Expansion:*** Investing in new production facilities to meet the rising demand for CRGO transformer components.
- ***Technological Upgradation:*** Adopting advanced manufacturing techniques and quality control measures to improve product efficiency and competitiveness.
- ***Research and Development:*** Investing in research and development to develop innovative products and solutions that cater to the evolving needs of the market.
- ***Strategic Partnerships:*** Collaborating with domestic and international players to strengthen supply chains and access new markets.

Overall, the market for CRGO transformer components in India is poised for continued growth, driven by the nation's economic development and increasing demand for electricity. By addressing the challenges and

[8] D&B Research Estimates, Industry Articles

capitalizing on the opportunities, Indian manufacturers can play a significant role in meeting the growing demand for these essential components.

CRGO Steel Scenario in India

India is grappling with a severe shortage of Cold Rolled Grain Oriented (CRGO) steel, a critical material used in the production of distribution and power transformers that are essential to the country's power grid. The shortage arises from the requirement to meet Bureau of Indian Standards (BIS) certifications and the absence of domestic manufacturing capacity until 2027.

This supply disruption has been worsened by the expiration or non-renewal of export licenses previously granted by the BIS to major exporters from China, a key supplier of CRGO steel to India. Several Chinese manufacturers have since halted exports to the Indian market, significantly curbing the flow of CRGO steel. India has traditionally relied on imports from China, South Korea, Japan, and Europe, all of which are required to meet BIS regulations under IS 3024 (2006).

As a result, the limited availability of CRGO steel is anticipated to drive prices higher, creating additional challenges for India's transformer manufacturing industry. With an annual demand for 325,000 tons of CRGO steel, the shortage is especially severe for the Hi-B grade, which is crucial for high-efficiency transformers. Globally, CRGO production stands at approximately 3 million tons, with China accounting for 45% of the supply. Industry leaders have called for easing import restrictions from Chinese mills such as Bao, Wisco, and Shougang to stabilize the supply chain and meet demand.

While a few Japanese and European suppliers continue to export CRGO steel to India, their capacity is limited and cannot sufficiently address the country's growing requirements. Government agencies and distribution companies (DISCOMs), which procure transformers made from CRGO steel, are already facing difficulties due to the constrained supply.

This shortage is likely to have a ripple effect across the energy sector, affecting the timely production of transformers and potentially increasing costs for DISCOMs. Without immediate solutions, the restricted availability of CRGO steel may slow down infrastructure development, leading to reduced consumption in the short term and forcing manufacturers to explore alternative materials or reduce production output. The industry continues to appeal for renewed import permissions to alleviate the supply shortage and ensure the stability of India's critical power infrastructure.

Key Applications of CRGO Steel

- Transformer Cores

The predominant application of CRGO steel is in the production of transformer cores, accounting for approximately 98% of its total usage. This includes large power transformers, distribution transformers, and smaller transformers. CRGO steel's high magnetic permeability allows transformers to operate more

efficiently by reducing energy losses, which directly contributes to improving overall power grid performance. The material also plays a vital role in minimizing eddy current losses, making it an ideal choice for energy transmission and distribution systems.

- Noise and Vibration Reduction

One of the unique attributes of CRGO steel is its reduced magnetostriction, which directly results in lower levels of noise and vibration during operation. This property is particularly advantageous in environments where noise reduction is critical, such as residential areas or facilities requiring quiet operation. By utilizing CRGO steel in transformer cores, manufacturers can ensure smoother and quieter device performance, enhancing the quality and efficiency of electrical systems.

- Lamination in Transformers

CRGO steel is also extensively used in transformer core lamination, a process where thin sheets of the material are layered to form the core. This technique minimizes material usage while maintaining optimal performance. The lamination of CRGO steel helps reduce magnetic losses by preventing eddy currents, further contributing to the energy efficiency of transformers. Laminated CRGO steel cores are a standard in modern transformer design, underscoring the material's importance in reducing power losses and enhancing durability.

- Energy-Saving Electrical Devices

Given its low core loss properties, CRGO steel is widely used in the production of energy-efficient electrical devices. Its ability to minimize energy wastage in transformers and electrical machinery supports the broader goal of energy conservation. By employing CRGO steel in energy-saving devices, manufacturers can lower operational costs while enhancing overall energy efficiency, which is increasingly important as global demand for efficient power systems grows.

- Winding in Motors and Generators

In addition to transformers, CRGO steel is critical in winding processes for motors and generators. The material’s excellent magnetic properties facilitate smoother winding, which is essential for manufacturing efficient electrical machines. The use of CRGO steel in motor windings improves the machines' overall performance and energy conversion, contributing to the efficiency of industrial and power generation applications.

- Current Transformers and Shunt Reactors

CRGO steel is also used in current transformers and shunt reactors, both of which are integral to electrical systems. Current transformers, which measure and control the flow of electricity, and shunt reactors, which help stabilize voltage levels, rely on the unique properties of CRGO steel to enhance their performance and

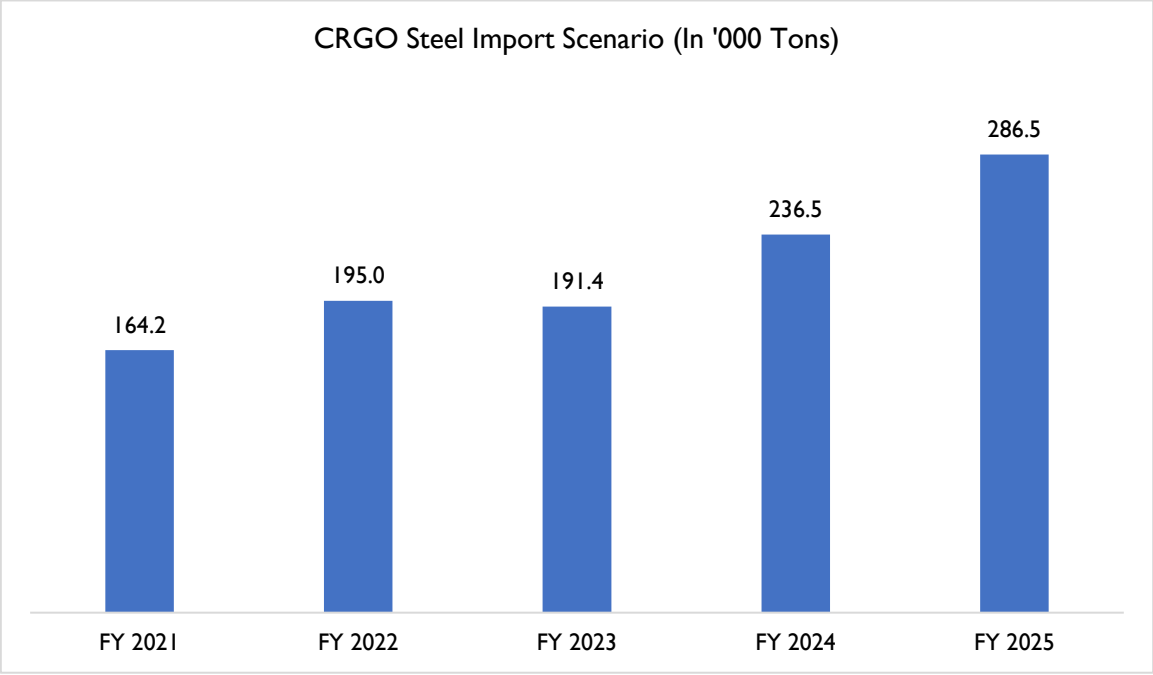
accuracy. In both applications, the material's low core loss and high permeability improve system reliability and efficiency.

- Power Generators

Power generators, particularly those used in energy production facilities, benefit from the application of CRGO steel in their cores. The material's magnetic characteristics ensure that power generators operate with minimal energy loss, which is crucial for maximizing energy output and maintaining operational efficiency. The role of CRGO steel in these generators further highlights its importance in the broader energy sector.

CRGO Steel Imported to India[9]

India's CRGO (Cold Rolled Grain Oriented) steel import trends reflect a gradual upward trajectory in recent years, indicating sustained and growing domestic demand for this critical material. After declining to 164.2 thousand tonnes in FY 2021, imports rebounded to 195.0 thousand tonnes in FY 2022. Although there was a marginal dip to 191.4 thousand tonnes in FY 2023, the trend turned sharply upward thereafter, imports surged to 236.5 thousand tonnes in FY 2024 and further to 286.5 thousand tonnes in FY 2025, marking the highest level recorded in this period. This consistent rise in import volumes underlines India's increasing dependence on external sources to meet its CRGO steel requirements, which are vital for applications in the power and transformer industry.



Source: Directorate General of Foreign Trade

In contrast, exports of CRGO steel from India have remained minimal, highlighting the country's strong domestic consumption needs and limited production surplus. After reaching a recent high of 11.1 thousand

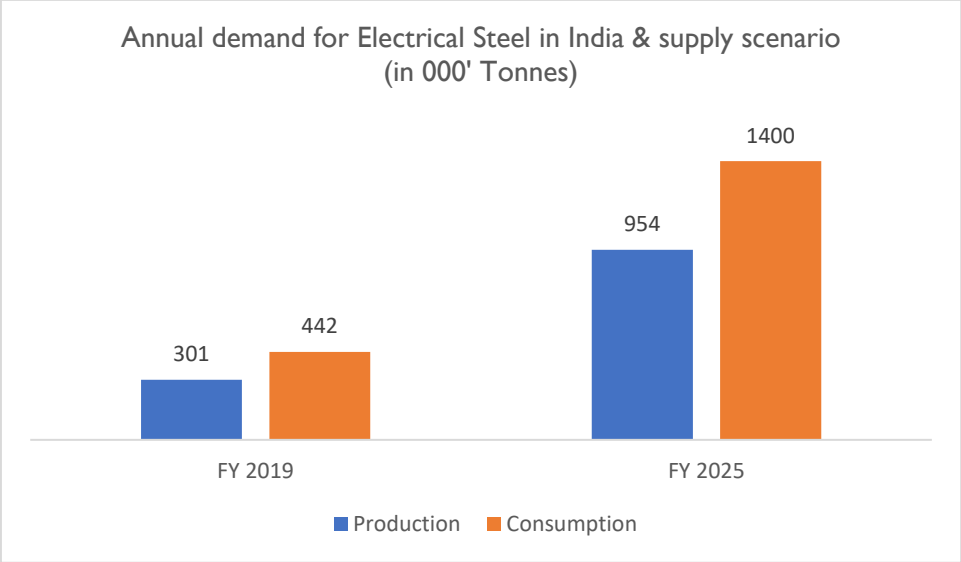
[9] For this trade scenario, the HS code taken is 72251100 Flat Rolled Products of Silicon Electrical Steel Grain Oriented

tonnes in FY 2023, exports declined sharply to 4.88 thousand tonnes in FY 2024, and further dropped to just 0.74 thousand tonnes in FY 2025. This sharp reduction in outbound volumes reflects the growing focus on meeting internal demand and the structural limitations in India's current CRGO manufacturing capacity. The widening disparity between imports and exports underscores India's continued dependence on foreign suppliers to bridge the supply gap in this critical segment of electrical steel.

Although India is advancing its domestic electrical steel manufacturing base, the production of high-grade CRGO steel remains constrained. The outlook for electrical steel in India is promising, driven by the rapid expansion of renewable energy, electric mobility, and power infrastructure modernization. However, challenges persist, particularly in the secure sourcing of essential raw materials such as silicon, much of which is still imported. This dependency not only affects the cost competitiveness of domestic production but also reinforces the need for policy support and value chain integration to reduce import reliance in the long term.

Annual demand for Electrical Steel in India & supply scenario

Electrical steel, a high-quality electrical steel used primarily in transformers, generators, and motors, has been witnessing a steady increase in demand in India. This surge is primarily driven by the nation's rapid industrialization, urbanization, and the growing emphasis on renewable energy sources.



Source: CMIE Industry Outlook

Production of electrical steel in India has been on the rise, with a notable increase from 301 thousand tonnes in FY 2019 to 442 thousand tonnes in FY 2025. However, the consumption of electrical steel has outpaced production during this period, indicating a growing demand-supply gap. In FY 2019, consumption stood at 954 thousand tonnes, while it rose to 1400 thousand tonnes in FY 2025.

This widening gap between supply and demand can be attributed to several factors. The increasing adoption of electric vehicles, coupled with the expansion of renewable energy infrastructure, has significantly boosted the demand for electrical steel. Moreover, the nation's infrastructure development projects, such as smart cities and transportation networks, have also contributed to the rising consumption of this specialized steel.

To address this growing demand-supply imbalance, India's steel industry is taking steps to enhance electrical steel production capacity. Investments in new production facilities and technological advancements are being made to ensure adequate supply to meet the country's growing needs. Additionally, efforts are being undertaken to improve the quality of domestically produced electrical steel to compete with imports.

However, the increasing demand for electrical steel, particularly in the context of India's ambitious renewable energy targets, presents a significant challenge. To bridge this gap, it will be crucial for the Indian steel industry to continue investing in capacity expansion, technological innovation, and quality improvement. Furthermore, government policies and incentives can play a vital role in supporting the growth of the electrical steel sector and ensuring a sustainable supply to meet the nation's evolving needs.

Key demand drivers

Infrastructure Development

India's rapid urbanization and industrialization have spurred significant investments in infrastructure projects. The construction of new power plants, transmission lines, and distribution networks necessitates a substantial number of transformers to ensure efficient power delivery. As India continues to modernize and expand its urban areas, the demand for transformers will remain high.

Renewable Energy Expansion

India's commitment to renewable energy has led to a surge in the installation of solar and wind power plants. These renewable energy sources require transformers to integrate their power output into the existing grid. As India transitions towards a cleaner energy mix, the demand for transformers will continue to grow.

Industrial Growth

India's thriving manufacturing sector, including automotive, electronics, and chemicals, is a major driver of economic growth. These industries require reliable and efficient power supply to operate effectively. Transformers play a crucial role in ensuring a stable and uninterrupted power supply to these industrial facilities.

Smart Grid Initiatives

The government's focus on developing smart grids, which enable more efficient and reliable power delivery, has created a demand for advanced transformers with intelligent features. These transformers can help optimize power distribution, reduce losses, and improve grid stability.

Rural Electrification

India's ongoing rural electrification programs aim to provide electricity to all households, including those in remote areas. This initiative requires a significant number of transformers to distribute power to rural communities. As more rural areas become electrified, the demand for transformers will continue to rise.

Economic Growth

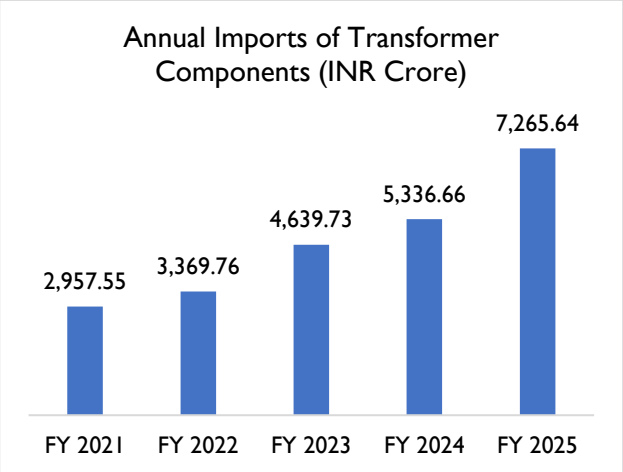
India's overall economic growth and rising living standards have led to increased demand for electricity in both residential and commercial sectors. As people's incomes rise and lifestyles improve, they consume more electricity, driving the need for transformers.

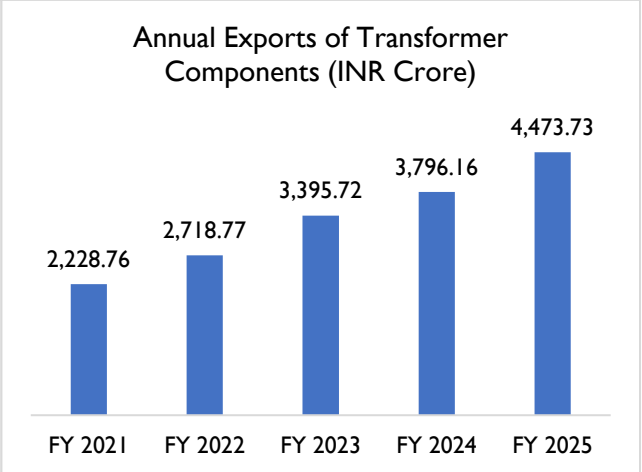
Government Policies

Government policies promoting energy efficiency and renewable energy have created a favorable environment for the transformer industry. These policies have encouraged investments in new transformer projects and technologies, while also fostering a sustainable energy future.

Import-Export Scenario of Transformer accessories & components

The Indian transformer component industry has experienced sustained growth in recent years, with both exports and imports exhibiting a notable upward trend. This dual growth reflects the dynamic nature of the sector, which is simultaneously gaining traction in international markets while also grappling with domestic supply challenges.[10]





Source: Directorate General of Foreign Trade

Export performance, in particular, highlights the increasing capability and competitiveness of Indian manufacturers in meeting global demand. From INR 2,228.76 crore in FY 2021, exports have consistently grown to reach INR 4,473.73 crore in FY 2025. This steady rise underscores India's emerging role as a reliable exporter of transformer components and suggests a gradual strengthening of domestic manufacturing prowess, especially in standardized and cost-competitive product segments.

[10] For this trade scenario, the HS code taken is 850490 Parts of Transformers, static converters, and inductors

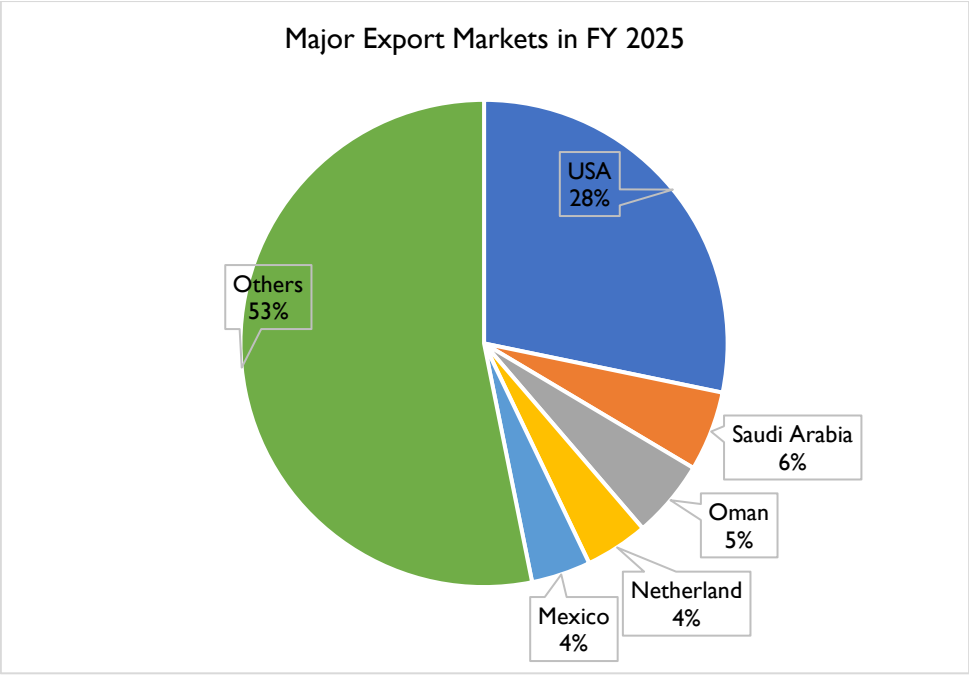
However, the concurrent rise in imports presents a contrasting picture. After a temporary decline to INR 2,957.55 crore in FY 2021, likely due to pandemic-related disruptions, imports rebounded sharply in the following years, reaching INR 7,265.64 crore in FY 2025. This substantial increase highlights persistent gaps in India's domestic production capabilities, particularly in addressing the demand for technologically advanced or highly specialized transformer components. The fact that import growth has outpaced export growth in absolute terms signals a deepening reliance on foreign suppliers, raising concerns about trade imbalances and long-term supply chain vulnerabilities within the sector.

The expanding trade gap can be attributed to several underlying factors. Increasing technological sophistication and the need for specialized components, such as advanced insulation materials, high-performance magnetic cores, or precision cooling systems, often necessitate sourcing from global suppliers with established capabilities. Additionally, considerations such as cost efficiency, shorter lead times, and stringent international quality benchmarks also drive import decisions.

To address this imbalance, the Indian transformer component industry must invest in technological upgrades, R&D, and capacity expansion. Enhancing domestic manufacturing capabilities and fostering innovation will be critical in reducing reliance on imports and improving self-sufficiency. Strengthening the domestic ecosystem will not only support the growth of the transformer industry but also enhance India's positioning as a globally competitive supplier of transformer components.

Top Export Markets

The Indian transformer component industry has been making significant strides in the global market, with exports to various countries around the world.



Source: Directorate General of Foreign Trade

The USA continues to be the largest export destination for Indian transformer components, accounting for a significant 28% of total exports in FY 2025. Robust economic activity, infrastructure modernization, and an ongoing push to upgrade electrical grids in the US have contributed to sustained demand for high-quality transformer components, positioning Indian manufacturers as reliable suppliers in this lucrative market.

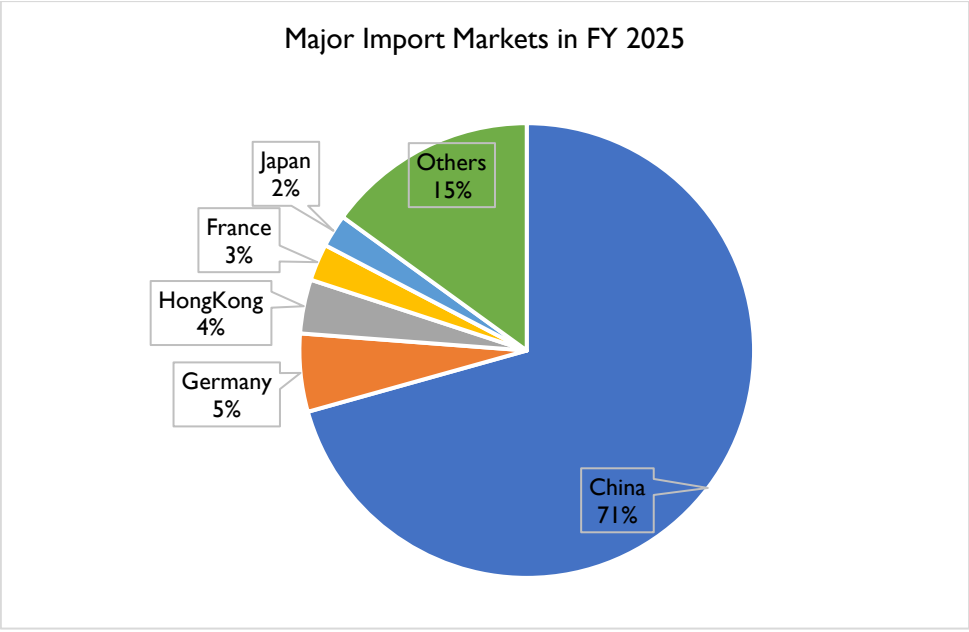
Saudi Arabia and Oman each contributed 5% to India's transformer component exports in FY 2025. These Middle Eastern economies, driven by ambitious infrastructure projects, rapid urbanization, and expanding energy networks, offer steady demand for power equipment. Their emphasis on energy diversification and electrification has created favourable export opportunities for Indian suppliers.

The Netherlands, contributing 4% of exports, has emerged as an important market for Indian transformer components, largely due to its focus on renewable energy integration, smart grid expansion, and energy-efficient technologies. Similarly, Mexico, also at 4%, represents a growing market in the Americas, where demand is being fuelled by industrial expansion and investment in power transmission infrastructure.

Collectively, these key markets, led by the USA, followed by Saudi Arabia, Oman, the Netherlands, and Mexico, underscore India's expanding global footprint in the transformer component segment. With 53% of exports distributed across other nations, the data reflects India's growing appeal as a manufacturing hub capable of serving diverse international markets. As Indian manufacturers continue to scale up capacity, invest in quality enhancements, and align with global standards, the country is well-positioned to deepen its presence in both established and emerging export destinations.

Top Import Markets

The Indian transformer component industry, while growing domestically, still relies on imports to meet a portion of its demand. The top 5 import markets for transformer components in India are:



Source: Directorate General of Foreign Trade

China remains the largest source of imported transformer components for India, accounting for a dominant 71% of total imports in FY 2025. With its expansive manufacturing base, cost competitiveness, and ability to supply a wide range of components at scale, China continues to play a central role in meeting India's transformer sector requirements.

Germany, contributing 6% to India's transformer component imports, is a key supplier known for its advanced engineering, high-quality standards, and specialization in precision components. German imports typically cater to the premium and technologically advanced segment of transformer manufacturing.

Hong Kong, a major re-export and trading hub, accounted for 4% of India's imports. Its strategic position in Asian supply chains and efficient logistics infrastructure make it an important gateway for sourcing components, particularly from mainland China and Southeast Asia.

France and Japan contributed 3% and 2%, respectively, to India's transformer component imports in FY 2025. France's presence reflects its niche offerings in power systems and electrical equipment, while Japan remains a key source of high-tech, specialized transformer components, especially those requiring precision, durability, and compliance with international performance standards.

Collectively, these five countries represent a significant share of India's transformer component imports, highlighting the sector's reliance on a select group of global suppliers. Despite ongoing efforts to strengthen domestic manufacturing, imports continue to play a vital role in meeting the technical and volume demands of India's transformer industry, particularly for high-specification and specialized parts.

Growth forecast

The CRGO transformer component industry in India is poised for significant growth in the coming years, driven by several factors. The market size is projected to increase from INR 70.8 billion in FY 2025 to approximately INR 104.60 billion in FY 2030[11] at a CAGR of ~8.1%.

Several key factors are contributing to this optimistic outlook. Firstly, India's ongoing infrastructure development, including the expansion of power grids, renewable energy projects, and industrialization, is driving a steady increase in demand for transformers. Secondly, the government's focus on smart grid initiatives and energy efficiency is creating opportunities for advanced transformer components.

Furthermore, the growing adoption of electric vehicles and the increasing penetration of renewable energy sources are expected to boost the demand for transformers. As India transitions towards a cleaner and more sustainable energy landscape, the need for efficient and reliable power distribution will drive the demand for high-quality transformer components.

[11] D&B Research and Estimates, Industry Articles

Additionally, technological advancements in transformer design and manufacturing are enabling the production of more efficient and compact components. These advancements are expected to enhance the performance and reliability of transformers, further driving market growth.

To capitalize on this growth potential, Indian manufacturers are investing in research and development, capacity expansion, and quality improvement. By focusing on innovation and meeting the evolving needs of the market, the CRGO transformer component industry in India is well-positioned to achieve significant growth in the coming years.

BIS Policy on CRGO Steel Imports

The Bureau of Indian Standards (BIS) was established under the BIS Act of 2016 to oversee standardization, quality control, and certification of all goods, processes, systems, and services in India. BIS certification is mandatory for both domestic and foreign manufacturers under the compulsory certification requirements, ensuring compliance with national quality standards. The certification process operates under two primary schemes: Scheme 1 (Indian Standards Institution or ISI) and Scheme 2 (Compulsory Registration Scheme or CRS), designed to maintain product quality and regulatory adherence.

In October 2023,[12] the BIS certification requirement was extended to imports, affecting Steel products in which Cold Rolled Grain Oriented (CRGO) steel is included, a critical material for various industries. As per this regulation, steel manufacturers must comply with the IS 3024:2015 standard for CRGO steel imports to ensure product quality, environmental sustainability, and fair market practices. While the policy applies to all importing nations, China, being a major producer and exporter of CRGO steel, is significantly impacted. The certification process has created bottlenecks, delayed imports and affecting industries reliant on CRGO steel.

This policy states that, "All the steel importers importing steel without BIS license to mandatorily apply and seek clarification from Ministry of Steel through QCO Portal for each & every imported steel consignment." The statement meaning all steel importers bringing in steel without a BIS license must mandatorily apply and seek clarification from the Ministry of Steel through the QCO Portal for each and every imported steel consignment. This measure ensures strict compliance with regulatory norms and prevents the entry of non-certified steel into the Indian market. The requirement for Chinese manufacturers to obtain BIS certification is a practical step toward easing disruptions while maintaining strict quality standards.

Here is why this policy specifically targets Chinese CRGO steel imports and how it will influence the volume of these imports.

1. **Quality Assurance**: Concerns about a potential influx of low-quality Chinese Cold Rolled Grain Oriented (CRGO) steel into India were a significant factor behind the Bureau of Indian Standards (BIS) policy regarding CRGO imports. To address these concerns, the BIS implemented stricter

[12] Ministry of Steel Government of India Technical Division, Circular

quality control measures, requiring BIS certification for imported CRGO steel, especially from China. This policy was aimed at protecting domestic manufacturers and ensuring high-quality standards within the Indian market.

2. **Environmental and Production Standards**: China's steel industry has faced criticism for lower environmental standards. The BIS policy ensures that imported steel meets India's sustainability criteria, promoting cleaner manufacturing practices. Also, this standard outlines the requirements for Cold Rolled Grain Oriented (CRGO) electrical steel sheets and strips, which serve as raw materials for electromagnetic devices like transformers, motors, and generators. To ensure quality and reliability, the Bureau of Indian Standards (BIS) policy mandates strict quality control measures for CRGO steel, safeguarding the Indian market and domestic manufacturers.

3. **Protection of Domestic Industry**: The policy acts as a safeguard against "dumping," ensuring that only high-quality products enter the Indian market, providing fair competition for local steel producers.

Impact on Chinese CRGO Steel Imports:

1. **Increased Compliance Costs**: The BIS certification process imposes additional costs on Chinese manufacturers exporting CRGO steel to India. They have to bear testing and certification fees for product evaluation in BIS-accredited labs, with any non-compliance requiring costly modifications and retesting. Factory audits further add to expenses as manufacturers must align production facilities with BIS standards. Logistical delays due to the lengthy certification timeline increase holding costs, affecting inventory management. To offset these rising expenses, Chinese exporters may either raise prices, impacting competitiveness, or cut profit margins, affecting their profitability and market positioning in India.

2. **Opportunities for Other Suppliers**: As compliance requirements are reshaping the market, global suppliers that meet BIS standards have the potential to expand their presence and capture a larger share of the Indian market.

3. **Long-term Impact on China's Exports**: While Chinese manufacturers who adapt to the BIS requirements can maintain market access, those unable to comply will lose access to the Indian market, impacting China's steel exports in the long run.

Overall, the BIS policy seeks to improve quality control, environmental responsibility, and fair competition while reducing India's dependency on low-quality Chinese CRGO steel.

Extension of BIS Requirements to Chinese Companies:

The introduction of BIS certification regulations has had a notable impact on Chinese steelmakers, particularly those who have historically been significant sources of CRGO steel imports to India. For the first time, three

Chinese steel manufacturers have successfully met the requirements for BIS certification, allowing them to continue exporting CRGO steel to India. This development is crucial, as these companies are now officially able to operate within India's stringent regulatory environment.

By obtaining BIS certification, Chinese companies are not only ensuring their continued access to the lucrative Indian market but are also required to adhere to India's quality and safety standards. The certification process involves a rigorous evaluation of the steel's quality, production facilities, and overall compliance with Indian norms. This introduces stricter oversight for Chinese manufacturers, which could increase their costs and operational complexity.

While the policy opens up opportunities for Chinese companies to supply CRGO steel to India, it also intensifies competition for Indian domestic producers. The influx of certified Chinese CRGO steel may impact the market share and pricing power of Indian manufacturers, potentially leading to pricing challenges. At the same time, Chinese manufacturers now play a significant role in addressing India's CRGO steel shortage, particularly given their massive production capacities compared to India's annual demand.

This decision helps alleviate India's supply chain bottlenecks but also highlights the delicate balance between addressing short-term supply needs and maintaining long-term strategic goals for self-reliance in critical manufacturing sectors. As India seeks to balance the benefits of imported steel with long-term objectives, it will be essential to expand domestic production capacity for CRGO steel. The Indian government could incentivize local manufacturers through subsidies, tax breaks, and funding for research and development to enhance CRGO production technologies. Additionally, diversifying supply sources by exploring additional international suppliers and encouraging collaborations or joint ventures with global steelmakers can help maintain a steady supply of high-quality CRGO steel, ensuring that quality standards are upheld.

SWOT Analysis of the Transformers and Transformer Component Industry in India

Strengths

Capability to Manufacture High-Voltage Transformers: Indian manufacturers can produce high-capacity transformers, including ultra-high-voltage (UHV) types up to 1200 kV. Advanced manufacturing facilities are equipped to design, test, and validate transformers for large-scale power transmission projects. The presence of research and development (R&D) centers further strengthens innovation in insulation materials, core design, and loss reduction technologies.

Advancements in Technology: The increased use of smart transformers with digital monitoring systems and IoT-based analytics enhances efficiency and predictive maintenance. Eco-friendly designs, such as dry-type transformers and ester-filled transformers, reduce environmental hazards and maintenance costs. The shift toward silicon-steel core materials and amorphous core transformers helps improve energy efficiency and reduce transmission losses.

Strong Presence in the Public Sector (SEBs): A significant portion of revenue is derived from State Electricity Boards (SEBs), which ensures stable demand and reduces reliance on private sector investments. Price variation clauses enable manufacturers to manage fluctuations in raw material costs.

Government Initiatives: Policies like "Make in India", the Production-Linked Incentive (PLI) scheme, and increased investments in renewable energy projects such as solar and wind farms promote local manufacturing. Initiatives such as Revamped Distribution Sector Scheme (RDSS) and the Green Energy Corridor further boost transformer demand for grid modernization.

Financial Stability: Many leading companies have low debt levels and maintain liquid investments, which ensures better-working capital management in this capital-intensive industry.

Growing Market Demand: A robust order pipeline, driven by urbanization, industrialization, and electrification projects, provides clear revenue visibility for the near future. With growing demand from sectors like metro rail, data centers, electric vehicle (EV) charging infrastructure, and renewable energy, transformer manufacturers with high production capacities are well-positioned to meet increasing infrastructure needs.

Smart Grids: The adoption of smart grid technology opens opportunities for upgrading aging power infrastructure, integrating AI-driven grid monitoring, and reducing transmission losses. Smart transformers enable real-time load balancing, remote diagnostics, and enhanced fault detection, making power distribution more reliable and efficient. The push for carbon neutrality is driving the adoption of green transformers with lower power losses, further strengthening industry prospects.

Weaknesses

Overcapacity Leading to Price Pressure: The transformer industry has seen significant capacity expansion in recent years, driven by increased investments in power infrastructure and renewable energy projects. However, the rise in manufacturing units and new market entrants has led to excess production capacity, intensifying price competition and reducing profit margins. Additionally, aggressive bidding in government tenders often results in contracts being awarded at low margins, further pressuring financial sustainability.

Aging Infrastructure: Many transformers in India's grid are outdated and require extensive maintenance and upgrades, resulting in increased operational costs.

Project Delays: Lengthy approval processes, land acquisition challenges, and environmental clearances often result in delays in the execution of power transmission and distribution projects. Bureaucratic inefficiencies in tendering and fund disbursement can slow down transformer procurement and installation. Furthermore, coordination issues between central, state, and private sector stakeholders contribute to project backlogs, delaying industry growth.

Financial Constraints: Many state-owned distribution companies (DISCOMs) face high debt burdens, revenue losses, and inefficient billing mechanisms, leading to delays in infrastructure upgrades and transformer replacements. Despite government schemes like UDAY and RDSS, financial instability in DISCOMs results in payment delays for manufacturers, disrupting cash flow and affecting investment in R&D and expansion.

Dependence on Utilities: The transformer industry heavily relies on spending from transmission and distribution utilities, making it vulnerable to fluctuations in utility budgets. Any policy shifts, subsidy reductions, or delays in fund allocation can directly impact industry growth. Private sector demand is growing but remains insufficient to offset the risks associated with public sector dependency.

Limited Availability of Advanced Materials: Certain advanced materials, such as laser-scribed, high-permeability 0.23 mm thick Cold Rolled grain-oriented (CRGO) steel for transformer cores, are not readily available in India.

Opportunities

Growing Demand from Renewable Energy & Green Hydrogen: Government initiatives such as the National Green Hydrogen Mission and Renewable Energy Development Programmes are significantly increasing the demand for power and distribution transformers. The rapid expansion of solar parks, wind farms, and hybrid renewable projects necessitates high-efficiency transformers for grid integration. Additionally, the increasing focus on captive solar power plants and decentralized energy generation is driving demand for inverter-duty transformers and solar-wind hybrid transformers. The adoption of green

transformers, which use bio-based insulating oils and eco-friendly materials, is also gaining traction to support sustainability goals.

Grid Modernization & Smart Transformers: The transition to smart grids and IoT-enabled transformers is revolutionizing power distribution by improving operational efficiency, real-time monitoring, and energy optimization. Features like remote diagnostics, AI-driven predictive maintenance, and dynamic voltage regulation are becoming industry standards. Self-healing grids, which automatically reroute power during faults, are being integrated with smart transformers to enhance reliability. The adoption of blockchain-based energy trading and demand-response mechanisms is further promoting smart grid advancements.

Government-Led Infrastructure Investments: National transmission capacity expansion, driven by initiatives such as the Revamped Distribution Sector Scheme (RDSS) and Power Grid Corporation's Transmission Network Expansion Plans, is creating new opportunities for transformer manufacturers. Reforms like UDAY (Ujwal DISCOM Assurance Yojana) and Deendayal Upadhyaya Gram Jyoti Yojana (DDUGJY) are supporting rural electrification and last-mile power delivery, fueling demand for distribution transformers. Investments in high-voltage direct current (HVDC) transmission, inter-state transmission projects (ISTS), and electrification of railway networks further boost the market for power transformers.

Replacement Demand: Many transformers installed decades ago now need replacement, leading to consistent demand for new and upgraded models. Aging infrastructure, combined with the need for higher energy efficiency and lower transmission losses, is driving the adoption of low-loss transformers with improved insulation and core materials. Additionally, the push for upgrading legacy substations and integrating higher capacity transformers in urban power networks is sustaining market demand. The transition from oil-filled to dry-type transformers in commercial buildings, metro stations, and industrial facilities is further driving the replacement market.

Threats

Intense Competition from MNCs & Local Players: The presence of established international players in the transformer industry creates intense competition for Indian manufacturers, both domestically and in export markets. As global and domestic players fiercely compete for contracts, price-based competition has intensified, leading to reduced profit margins.

Disruptions from Decentralized Energy & Microgrids: The growing use of microgrids and distributed energy solutions may lessen reliance on traditional grid transformers.

Fluctuations in Raw Material Prices: The transformer industry is highly sensitive to price volatility in key raw materials such as copper, aluminum, CRGO steel, and insulating oils. Copper and aluminum, which are used in winding materials, experience frequent global price fluctuations due to supply chain disruptions, mining constraints, and geopolitical factors.

Disruptions in Supply Chain: Geopolitical factors, import restrictions, and logistics delays may affect the industry's smooth operation. Due to rail transport restrictions, transformers weighing more than 250 tons cannot be transported by rail. This limitation necessitates the construction of single-phase transformers for units above certain capacities, potentially increasing costs and complexity.

Environmental Regulations: Strict norms on transformer losses and the requirement to replace existing transformers with level 3 transformers within a short timeframe pose challenges for manufacturers.

Industry Threats and Challenges

Degradation of Legacy Infrastructure

India's power T&D network is grappling with aging infrastructure, much of which dates back several decades. A significant portion of substations, transformers, and overhead lines have exceeded their designed operational life, leading to higher maintenance costs, safety risks, and increased downtime. India's distribution transformers are estimated to be operating beyond their optimal life, particularly in Tier 2 and Tier 3 cities. This outdated infrastructure not only hampers efficient electricity delivery but also increases vulnerability to outages and technical losses. The challenge is compounded by delayed upgradation due to funding constraints at state electricity boards and distribution companies (DISCOMs).

High Transmission and Distribution Losses

India continues to face one of the highest transmission and distribution (T&D) loss levels globally, posing a long-standing challenge for utilities and the transformer component industry. T&D losses rose to 16% in FY 2024, up from 15% in FY 2023, indicating ongoing inefficiencies despite reform efforts.[13] In FY 2025, these losses remain elevated, with some states far above the global average. The key drivers include outdated infrastructure, technical bottlenecks, and rampant electricity theft. For the transformer industry, such high losses signal poor network efficiency and contribute to repeated stress on components necessitating frequent replacements and upgrades, which in turn burden supply chains and inflate maintenance costs. Although schemes like the Revamped Distribution Sector Scheme (RDSS) are aimed at modernizing infrastructure and reducing losses, challenges in state-level implementation and the precarious financial position of DISCOMs continue to limit the pace of progress.

Raw Material Price Volatility

The power equipment and transformer industry in India remains highly vulnerable to fluctuations in the prices of key raw materials such as copper, aluminium, and CRGO steel most of which are imported. In 2025, global market instability driven by supply chain disruptions and geopolitical tensions has led to significant volatility in raw material costs. This has placed considerable financial pressure on manufacturers, particularly under fixed-price contracts, where passing on increased costs is difficult. The lack of adequate domestic production capacity for critical inputs further compounds the challenge, affecting project timelines and profit margins across the sector.

Delay in Transmission Capex Planned by Government

One of the most pressing challenges facing India's power sector today is the delay in planned transmission capital expenditure (Capex), which has emerged as a significant bottleneck in aligning transmission

[13] Industry Source

infrastructure growth with the country's rapidly expanding generation capacity, particularly in the renewable energy space. Timely execution of transmission projects is crucial not only to ensure grid reliability and peak load management, but also to enable seamless power evacuation from new solar and wind generation zones. However, implementation inefficiencies, regulatory delays, land acquisition hurdles, and poor contractor response have all contributed to persistent slippages. These issues not only delay infrastructure readiness but also weaken investor confidence and disrupt downstream segments like transformer component manufacturing, which depend on synchronized demand linked to substation and transmission line expansion.

As of April 2024, the cumulative value of delayed or at-risk transmission projects stood at over INR 44,000 crore, spanning both government-funded and Tariff-Based Competitive Bidding (TBCB) schemes. Of the 50 major projects undertaken by Power Grid Corporation of India (PGCIL), 18 projects worth INR 29,300 crore experienced delays averaging 32 months. In parallel, eight key TBCB projects valued at INR 8,755 crore have seen average delays of nearly 12 months. These delays are not merely on paper, they have real and cascading impacts on the sector. A prime example is the ISTS transmission system designed for evacuating 8.1 GW of solar capacity from Rajasthan under Phase II, Part C. Initially targeted for completion in December 2022, it faced a delay of almost two years due to environmental concerns linked to the Great Indian Bustard (GIB) habitat. Key elements like the 765 kV Bhadla-II to Sikar-II transmission line and the 2×1,500 MVA Sikar-II substation were only commissioned in December 2024. Similarly, Parts B and D of the same project, which were also delayed due to regulatory and ecological constraints, were only completed between August and October 2024.

Even private players have encountered bottlenecks. For example, Sterlite Power's projects, "Mumbai Urja Marg" and "Nangalbibra-Bongaigaon Transmission Ltd", were both delayed before achieving final commissioning in FY 2025. Despite the commissioning of six ISTS-TBCB schemes involving approximately INR 7,000 crore between April and December 2024, many of these were delayed beyond their original timelines. Such delays restrict timely renewable energy evacuation and leave generation capacity stranded, affecting return on investment for project developers and impacting tariff structures for discoms and end-consumers.

Challenges related to delayed transmission Capex are not confined to interstate or central projects; state-level utilities are facing similar constraints. Delhi Transco Limited (DTL) provides a glaring example of systemic inefficiency in capital project execution. During the 13th Five-Year Plan (2017–2022), DTL completed only 58 of the 120 proposed schemes, utilizing a mere INR 2,091 crore of the INR 5,728 crore allocated, just 36% of the budgeted Capex. The performance has remained similarly lackluster in the early years of the 14th Plan. Additionally, the utility witnessed 18 transformer failures since 2020, 11 of which occurred before reaching the 25-year regulatory lifespan. Due to the non-availability of new units, DTL resorted to repurposing old transformers or borrowing from other substations, leading to prolonged outages

at key substations during peak summer months of July-August 2024. Furthermore, repeated tender cancellations for procuring critical equipment, such as 500 MVA and 160 MVA transformers, due to poor market response and flawed tender design further exemplify inefficiencies in procurement and project planning.

The delay in transmission Capex across both central and state projects poses a severe threat to the power sector's operational efficiency and future readiness. These setbacks not only risk creating stranded renewable generation capacity but also expose the grid to vulnerabilities during demand peaks and extreme weather events. The lack of timely transmission build-out undermines energy security goals and slows down India's clean energy transition. For equipment suppliers, such as transformer and component manufacturers, delayed projects translate to uncertain order flows, affecting production planning and financial stability. Addressing these delays requires institutional reforms in project appraisal, faster regulatory clearances, better land acquisition mechanisms, and more efficient tendering processes to unlock the full potential of India's power infrastructure growth.

Grid Stability and Renewable Energy Integration

India's ambitious renewable energy targets, 500 GW of non-fossil fuel capacity by 2030, are crucial for decarbonising the power sector, but they bring with them significant technical and operational challenges, particularly related to grid stability and the integration of variable renewable energy (VRE) sources. A fundamental issue lies in the inherent variability and intermittency of solar and wind power. Solar generation drops at night and during cloudy weather, while wind output fluctuates with seasonal and meteorological patterns. This inconsistent generation profile makes it difficult to maintain real-time grid balance, especially in regions with a high share of renewables.

Further complicating the situation is the existing grid infrastructure, much of which was designed for conventional, centralised power sources and lacks the responsiveness needed to manage decentralized and intermittent VRE. In high renewable-potential states like Rajasthan, Gujarat, and Tamil Nadu, transmission bottlenecks frequently prevent the full evacuation of generated solar and wind power. This has led to significant curtailments, Tamil Nadu, for example, witnessed 1,000+ MW of wind energy curtailment during peak generation days in FY 2023 due to grid congestion. Similarly, the Bhadla solar park in Rajasthan, one of the largest in the world, has experienced partial curtailment despite surplus capacity because of inadequate downstream transmission readiness.

Energy storage is another critical gap. Large-scale storage systems are essential to absorb excess generation during off-peak periods and supply power during demand peaks or low renewable output. However, India's current energy storage capacity remains nascent. High upfront capital costs, limited domestic manufacturing, and concerns over battery lifespan and efficiency continue to hamper large-scale deployment. Although recent policy interventions like the Production Linked Incentive (PLI) scheme for advanced battery storage and

viability gap funding (VGF) support for public BESS projects are positive developments, the rollout remains slow relative to the pace of renewable capacity addition.

Moreover, grid management and forecasting capabilities remain underdeveloped. Accurate forecasting of solar and wind output is critical for grid operators to schedule power effectively and maintain frequency and voltage stability. While the Central Electricity Regulatory Commission (CERC) has mandated forecasting and scheduling norms, many state load dispatch centres (SLDCs) still lack the technical sophistication, software, or manpower to fully implement these systems. This adds to the unpredictability and reduces grid reliability during high VRE penetration periods.

Without rapid investment in modern grid infrastructure, grid-scale storage, and advanced forecasting tools, India's power system faces the risk of operational stress and stranded renewable capacity. This, in turn, affects investor confidence and return on capital for developers. Additionally, the lack of a well-functioning ancillary services market further limits the grid's ability to respond dynamically to VRE fluctuations.

While India's renewable energy growth is commendable, the supporting grid ecosystem needs urgent and parallel upgrading to ensure that clean energy can be fully utilised without compromising grid security. A coordinated approach involving central and state utilities, transmission companies, and private developers is vital to scale up smart grids, energy storage, and flexible generation technologies that will form the backbone of a high-renewable, low-carbon future.

Competitive Landscape

The Indian transformer component industry is characterized by a mix of organized and unorganized players, with varying levels of market fragmentation. While there are a few large, organized players with significant market share, the industry is still relatively fragmented, with numerous smaller, unorganized players operating in the market.

Competition from foreign players is intense, particularly from countries such as China, Germany, and the United States. These players often have lower manufacturing costs, economies of scale, and access to advanced technologies, making them formidable competitors. However, Indian manufacturers have been making strides in improving their competitiveness through investments in technology, quality, and capacity expansion.

Several factors influence competition within the Indian transformer component industry:

Price: Price is a significant factor driving competition, with manufacturers striving to offer competitive pricing to attract customers. However, quality and reliability are also important considerations, as buyers are increasingly seeking components that meet high standards.

Quality: The quality of transformer components is crucial for ensuring the efficient and reliable operation of transformers. Manufacturers that can deliver high-quality products have a competitive advantage.

Delivery Time: Timely delivery is essential in the transformer industry, as delays can impact project timelines and increase costs. Manufacturers with efficient supply chains and production processes can gain a competitive edge.

Customization: The ability to customize components to meet specific customer requirements can be a competitive advantage. Manufacturers that can offer tailored solutions can attract customers seeking unique products.

Technological Capabilities: Advanced manufacturing technologies and research and development capabilities can help manufacturers produce high-quality and innovative components.

Brand Reputation: A strong brand reputation can enhance a manufacturer's credibility and attract customers. Building a positive brand image through consistent quality and customer service is essential.

Overall, the Indian transformer component industry is becoming increasingly competitive, with both domestic and foreign players vying for market share. Manufacturers that can successfully navigate these competitive pressures by focusing on quality, innovation, and customer satisfaction will be well-positioned to thrive in the market.

Key Players Profiling

Company Name	Overview
Jay Bee Laminations	Established in 1988, Jay Bee Laminations Limited is a prominent manufacturer of CRGO Silicon steel cores for India's power and distribution transformer industry. With two manufacturing units in Noida (UP), the company specializes in producing CRGO and CRNGO steel cores used in transformers, inverters, reactors, and rectifiers. Jay Bee Laminations supplies to renowned manufacturers and operates with state-of-the-art facilities across 117,090 sq. ft., adhering to global quality standards. The company has over 250 customers, exports to more than 10 countries.
Vilas Transcore	Established in 1996 as a subsidiary of NJ Group under the leadership of Mr. Nilesh Patel, Vilas Transcore Limited has earned a prominent position in the CRGO processing industry. With over 27 years of experience, the company specializes in transformer lamination, toroidal cores, and CRGO slitted coils. Vilas Transcore is recognized for its reliable products, skilled workforce, and strong commitment to quality and customer satisfaction. The company maintains a global presence, exporting to countries such as the U.S., Canada, Turkey, and South Africa. Upholding values of excellence and integrity, Vilas Transcore aims to innovate and contribute to the electrical industry's growth.
KRYFS Power	KRYFS Power Components Ltd. is a leading transformer core manufacturer in India, with an annual capacity to convert 50,000 MT of CRGO electrical steel into transformer laminations and cores. Established in 1992, KRYFS has expanded its operations across 10 manufacturing facilities in India, offering a range of products from CRGO laminations and cores to transformers and transformer tanks. The company is known for its stringent quality control processes, advanced manufacturing technologies, and technical collaborations with global entities. It also engages in solar power generation, EPC transmission, and distribution services, contributing significantly to India's energy sector.

NLMK Group	NLMK Group is a leading global steel manufacturer, recognized for its vertically integrated business model with operations spanning mining and steelmaking in cost-efficient regions. It produces high-quality steel products, catering primarily to customers in Russia, North America, and the EU. NLMK's strategic advantage lies in its self-sufficiency in raw materials and energy, coupled with advanced technological production capabilities. The group holds a significant market share, accounting for 21% of Russian steel production in 2021, with an annual output of 14.5 million tonnes. NLMK employs 44,400 people and serves customers across 70 countries. Over the past decade, the company has invested $12.7 billion to enhance its operations.
Vardhman Stampings Pvt Ltd (VSPL)	Established in 1989, is a leading manufacturer of Cold-Rolled Grain-Oriented (CRGO) transformer laminations in India. With over 30 years of experience, the company is recognized as the fastest-growing and most future-oriented player in the CRGO sector. VSPL operates a state-of-the-art facility with a production capacity of over 30,000 MT per annum, the highest in India. Its emphasis on quality and innovation has earned it a loyal global clientele. Positioned as a key supplier in the Indian CRGO market, VSPL's expertise and focus on sustainability underscore its competitive strength.
Amod Stampings Pvt Ltd	Amod Stampings Pvt Ltd, established on April 3, 1995, in Baroda, Gujarat, is a key player in the Indian electrical steel sector, specializing in Cold-Rolled Grain-Oriented (CRGO) steel products. Amod Stampings manufactures CRGO steel laminations, transformer laminations, core coil assemblies, toroidal cores, and resin-molded transformers, positioning itself as a quality-driven supplier in the expanding electrical steel market.
Mahindra Intertrade Ltd	Mahindra Intertrade Ltd., operating under the brand Mahindra Accelo, is a prominent player in India's steel processing industry, particularly in Cold-Rolled Grain-Oriented (CRGO) steel products. Incorporated on March 20, 1978, the company is a key subsidiary of the Mahindra Group, specializing in CRGO laminations for transformers and high-grade steel products. With multiple manufacturing facilities across India and an

	international presence in Sharjah, UAE, Mahindra Accelo serves both domestic and global markets. The company is known for its strategic alliances, including collaborations with Japanese firms, and its commitment to sustainability by reducing carbon emissions and advancing the circular economy. Positioned as a leader in the electrical steel sector, Mahindra Accelo continues to drive innovation and contribute to the Mahindra Group's broader goals.

Financial Performance

Expense Snapshot

The financial performance of the Transformer industry has shown significant growth and dynamic changes in expenses over the period. Between FY 2020 and FY 2024, total sales have grown by a CAGR of 30.39%, indicating a robust expansion in the industry.

	Raw Material	Power & Fuel	Salary & Wage	SG&A	Interest
FY 2020	78.0%	1.0%	7.2%	2.9%	0.7%
FY 2021	75.0%	0.9%	6.5%	2.7%	0.4%
FY 2022	79.1%	0.8%	6.2%	2.0%	0.7%
FY 2023	75.7%	0.6%	4.8%	2.1%	0.3%
FY 2024	72.2%	0.5%	3.9%	2.4%	0.4%

Raw materials continue to represent the most significant cost component for transformer component manufacturers, accounting for an average of 76.0% of total expenses during the period FY 2020 to FY 2024. This underscores the industry's strong dependence on inputs like copper, CRGO/electrical steel, and insulating materials. Given this high-cost share, fluctuations in global commodity prices can materially influence manufacturers' margins and pricing strategies.

Power and fuel costs, although minor in absolute terms, have shown a gradual decline, averaging just 0.8% of total expenses over the same period. This reflects improved energy efficiency and possibly a growing share of captive or renewable energy in operations.

Salaries and wages have declined steadily as a share of expenses, from 7.2% in FY 2020 to 3.9% in FY 2024, averaging 5.7%, suggesting increased process automation and optimization in manpower deployment.

Selling, General & Administrative (SG&A) costs have remained relatively stable, averaging 2.4%, reflecting tight cost controls and a lean organizational structure common among component suppliers.

Meanwhile, interest expenses have averaged just 0.5%, pointing to conservative leverage levels and a preference for internal accruals or working capital management rather than aggressive debt-funded expansion.

Profitability Margins

	Operating Profit Margin	Net Profit Margin
FY 2020	7.3%	2.3%
FY 2021	10.3%	4.7%
FY 2022	11.6%	6.0%
FY 2023	14.8%	9.7%
FY 2024	20.1%	13.5%

The operating profit margin for transformer component manufacturers has exhibited a strong and consistent upward trend, rising from 7.3% in FY 2020 to 20.1% in FY 2024. This substantial improvement reflects enhanced operational efficiencies, better cost control, particularly in raw material and labour expenses, and improved capacity utilization.

Similarly, the net profit margin, which accounts for interest and tax costs, has increased sharply from 2.3% in FY 2020 to 13.5% in FY 2024. This improvement underscores the industry's ability to manage financial expenses effectively and benefit from both economies of scale and favourable market dynamics. The widening gap between operating and net margins also highlights improvements in debt servicing and reduced interest outgo over time.

Company Profile- Mangals Electricals Industries Limited[14]

Mangal Electrical Industries Limited, originally established as "Mangal Electrical Industries" under the Indian Partnership Act, 1932, on April 28, 1989, transitioned from a partnership firm to a private limited company on April 1, 2008, under Part IX of the Companies Act, 1956, becoming "Mangal Electrical Industries Private Limited." Subsequently, on July 25, 2024, it was converted into a public limited entity, now known as Mangal Electrical Industries Limited. The company specializes in processing transformer components, including transformer lamination, CRGO slit coils, amorphous cores, coil assemblies, core assemblies, wound cores, toroidal cores, and oil-immersed circuit breakers (ICBs). It also trades CRGO and CRNO coils, as well as amorphous ribbons. In addition, Mangal Electrical manufactures transformers with capacities ranging from single-phase 5 KVA to three-phase 10 MVA (medium power) units and provides EPC services for setting up electrical substations, catering to the power infrastructure sector.

[14] As per the information provided by company and public domain.

The company is an Indian manufacturer renowned for producing high-quality transformer components. The company has developed a reputation for its expertise in the industry and its commitment to providing innovative and reliable solutions. The company utilizes advanced manufacturing infrastructure and established quality systems to support its operations in transformer core production. The company employs a Cut-to-Length (CTL) machine with features such as V Notch units, two-hole punch units, and dual tip-cut mechanisms, enabling precise cutting of CRGO laminations for both distribution and power transformers. This technology allows for the efficient production of steplap CRGO cores in various configurations, helping to maintain accuracy and consistency across different transformer designs. The company's quality control process includes in-house testing capabilities through a NABL-accredited lab and the use of Brockhaus testing equipment. Additionally, compliance with standards recognized by organizations like NTPC and PGCIL helps ensure that the products meet required specifications. These practices reflect a structured approach to technology adoption and quality management within the company's operations.

Overview

- *Founded:* 1980
- *Headquarters:* Jaipur, Rajasthan, India
- *Products:* CRGO Slit Coils, CRGO Cut Laminations, CRGO Core Assemblies, Wound Cores, Amorphous Cores, Immersed Circuit Breakers
- *Certifications:* ISO 9001:2015 certified
- *Clients:* Renowned entities such as NTPC, PGCIL, Adani, Renew Power, and AVADA

Expertise and Services

Mangal Electrical Industries Ltd. offers a comprehensive range of services, including:

Custom Manufacturing: The company can tailor its products to meet specific customer requirements, ensuring optimal performance and efficiency.

Research and Development: Mangal Electrical Industries is committed to innovation and invests in research and development to stay ahead of industry trends.

Quality Assurance: The company adheres to stringent quality control measures to ensure that its products meet the highest standards.

Key Customers

- Industrial Project Utility
  - ❖ Domestic Customers: Transformer and Rectifiers India LTD, Shirdi Sai Electrical Ltd, SIEMENS, Indotech, Venkateshwarao Electricals
  - ❖ Global Customers: Voltamp Oman ltd, MTM Malaysia
- Infrastructure Developers

- ❖ Domestic Customers: Transformer and Rectifiers India LTD, TBEA, Hammond, Shirdi Sai Electrical Ltd, Crompton Greaves

- Public Sectors
  - ❖ Domestic Customers: BHEL, Transformers and Electricals Kerala Limited, Andrew Yule & Co. Ltd. and Karnataka Vidyuth Karkhane Limited
  - ❖ Global Customers: Arab Trans Egypt

Key Strengths

- *Expertise in CRGO Products:* The company specializes in the manufacturing of CRGO (Grain-Oriented Electrical Steel) products, which are essential components in transformers.
- *Advanced Manufacturing Facilities*: Mangal Electrical Industries is equipped with state-of-the-art manufacturing facilities and machinery to ensure efficient production and high-quality output.
- *Customer Relationships:* The company is building relationships with its clients through its commitment to quality, reliability, and customer satisfaction.

Mangal Electrical Industries Limited continues to be in the transformer component manufacturing industry, offering innovative solutions and contributing to the growth of India's electrical sector.

Growth Forecast

The forecast for transformer demand between 2023 and 2030 reflects a consistent and stable requirement of 381 units annually, with the total transformer capacity maintained at 118,390 MVA each year. This steady demand highlights a well-coordinated and long-term approach to power infrastructure planning. By ensuring a constant supply of transformers, the power sector is positioned to meet the operational needs of the grid without interruptions. The stability in transformer capacity indicates that the industry is focused on sustaining robust power transmission infrastructure, which is crucial for maintaining grid reliability and supporting the growing energy needs of the country.

Year	Transformers (Units)	Transformer Capacity (MVA)	Reactors (Units)	Reactor Capacity (MVAR)
FY 2024	381	118,390	195	18,204
FY 2025	381	118,390	195	18,204
FY 2026	381	118,390	195	18,204
FY 2027	381	118,390	195	18,204
FY 2028	381	118,390	195	18,204
FY 2029	381	118,390	195	18,204
FY 2030	381	118,390	195	18,204

Source: Central Electricity Authority, Ministry of Power

From a manufacturing standpoint, the consistent demand for transformers presents a favourable environment for production planning and operational efficiency. Manufacturers can anticipate steady orders, allowing for long-term production strategies that reduce uncertainty. This predictability enables them to optimize their supply chains and potentially realize economies of scale, resulting in cost efficiencies. Moreover, the uniform demand reduces the risk of overproduction or shortages, leading to better resource allocation and financial planning. By maintaining consistent manufacturing output, companies can ensure that they meet industry requirements while keeping operational costs in check.

The consistent investment in power transmission infrastructure reflects a strategic alignment with broader goals of enhancing grid reliability and capacity. This sustained focus on transformer demand ensures that the country is well-prepared for grid modernization and expansion initiatives. While the forecast does not incorporate potential advancements in transformer technology, it is essential to consider the evolving landscape, as future improvements in efficiency, materials, and design could impact the overall demand. Furthermore, high-voltage direct current (HVDC) projects, which will require significant converter transformer capacity, are expected to influence future transformer demand. Although not directly reflected in the table, these projects are a key component of the overall power infrastructure strategy and will play a vital role in shaping the transformer market in the coming years.

Peer Benchmarking

Key Indicators (INR Million)	Company Financials, FY 2025[15]		
	Mangal Electrical Industries Ltd	Jaybee Laminations Pvt Ltd	Vilas Transcore Ltd
Revenue from Operations	5,494	3,675	3,531
EBITDA	838	439	532
PAT	473	254	342
EBITDA Margin (%)	15%	12%	15%
PAT Margin (%)	9%	7%	10%
ROA	13%	11%	9%
ROCE	25%	24%	17%
Net Worth	1,622	1,476	2,881
Long-term Debt	115	78	0
Debt Equity Ratio	0.92	0.16	0.04
Return on Equity	29%	17%	12%

Key Indicators (INR Million)	Company Financials, FY 2024[16]					
	Mangal Electrical Industries Ltd	Mahindra Intertrade Ltd	Amod Stampings Pvt Ltd	Vardhaman Stampings Pvt Ltd	Jaybee Laminations Pvt Ltd	Vilas Transcore Ltd
Revenue from Operations	4,495	33,408	4,868	5,060	3,029	3,097
EBITDA	453	1,942	528	481	322	347
PAT	209	1,330	264	280	194	231
EBITDA Margin (%)	10%	6%	11%	9%	11%	11%
PAT Margin (%)	5%	4%	5%	6%	6%	7%
ROA	8%	8%	10%	10%	14%	11%

[15] FY 2025 financial data for KRYFS Power Component Ltd, Amod Stampings Pvt Ltd, Mahindra Intertrade Ltd, and Vardhaman Stampings Pvt Ltd are unavailable.
[16] FY 2024 financial data for KRYFS Power Component Ltd is not available

ROCE	20%	19%	33%	44%	45%	20%
Net Worth	1,150	9,098	1,427	801	630	1,594
Long-term Debt	186	480	87	279	50	32
Debt Equity Ratio	0.80	0.05	0.06	0.35	0.08	0.02
Return on Equity	18%	15%	18%	35%	31%	14%

	Company Financials, FY 2023[17]						
Key Indicators (INR Million)	Mangal Electrical Industries Ltd	KRYFS Power Component Ltd	Mahindra Intertrade Ltd	Amod Stampings Pvt Ltd	Vardhaman Stampings Pvt Ltd	Jaybee Laminations Pvt Ltd	Vilas Transcore Ltd
Revenue from Operations	3,543	8,587	32,315	4,728	3,660	2,467	2,826
EBITDA	479	784	1,686	608	332	245	315
PAT	247	445	1,131	342	181	130	202
EBITDA Margin (%)	14%	9%	5%	13%	9%	10%	11%
PAT Margin (%)	7%	5%	3%	7%	5%	5%	7%
ROA	11%	7%	8%	12%	7%	11%	11%
ROCE	23%	19%	19%	48%	37%	47%	21%
Net Worth	940	3,450	8,222	1,164	522	436	1,370
Long-term Debt	440	104	34	52	341	69	36
Debt Equity Ratio	1.03	0.03	0.00	0.04	0.65	0.16	0.03
Return on Equity	26%	13%	14%	29%	35%	30%	15%

The transformer sector in India continues to witness robust growth, driven by ongoing infrastructure development, the expansion of renewable energy projects, and a nationwide push towards grid modernization. Companies like Jaybee Laminations Pvt Ltd, Vilas Transcore Ltd, Mangal Electrical Industries Pvt Ltd, and others have shown consistent upward trends in revenues, reflecting the heightened demand for power generation and transmission solutions.

[17] The figures for Mangal Electrical Industries Ltd for FY 2023 and FY 2024 are updated as per latest balance sheet available.

The industry's revenue growth from FY 2023 through FY 2025 can be attributed to government investments in infrastructure, renewable energy integration, and initiatives to improve energy efficiency. The increased need for advanced transformers to support solar, wind, and other renewable energy sources has further propelled demand. Modernization of aging grids and the integration of variable renewable energy (VRE) are also key drivers, creating opportunities for transformer manufacturers to provide higher capacity and technologically advanced products.

Operational efficiency improvements and economies of scale have led to steady EBITDA margin growth across the sector. Companies are optimizing production processes and expanding capacity to meet demand, which enhances profitability. This reflects the sector's ability to leverage cost management strategies, allowing firms to sustain or improve profit margins.

In terms of profitability indicators like ROCE and ROA, the sector has shown notable improvements. The financial health of many companies has strengthened, with reduced reliance on external debt financing and more efficient capital utilization. Many firms are funding expansions primarily through internal accruals or short-term borrowing, maintaining balanced and healthy debt-equity ratios.

Overall, the transformer industry is poised for continued growth, driven by infrastructure investments, modernization efforts, and the ongoing shift toward renewable energy. Companies are focusing on cost efficiency, capacity expansion, and technological advancements to remain competitive in this evolving market, all of which contribute to stronger financial performance.