INDUSTRY REPORT ON HIGH VOLTAGE CONDUCTIVITY PRODUCTS AND SOLUTIONS

SUBMITTED TO: OSWAL CABLES

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1. Economic Outlook

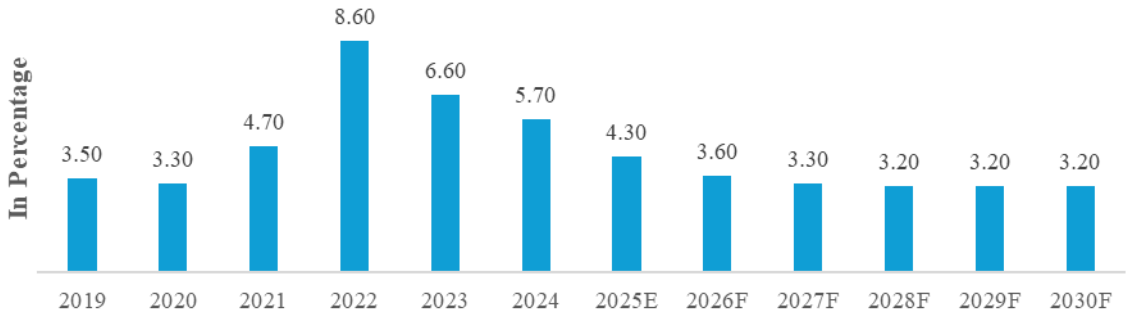
1.1.Global Economy Outlook

Global economic growth is projected to be maintained at a moderate pace, despite challenges such as inflation, geopolitical tensions, and supply chain disruptions being encountered by major economies. In contrast, accelerated growth is expected to be witnessed in emerging markets, particularly in Asia, where increased technology adoption and industrial expansion are being observed. Advancements in manufacturing, renewable energy, and digital technologies are anticipated to serve as key drivers of this growth, with India being positioned as a major contributor to global industrial progress.

1.1.1. Inflationary Landscape

The global economy's inflationary landscape has shifted noticeably across the past decade and will continue to evolve through 2030. In 2019, the worldwide inflation rate was 3.50%, reflecting a period of economic stability. In 2025, the inflation rate is estimated to rise to 4.30%, following several years of volatility driven by pandemic aftermath, energy price surges, and geopolitical tensions. By 2030, global inflation is forecast to moderate to around 3.20%, as supply chains become more resilient, technology integration improves productivity, and monetary authorities gradually normalize policy. While the future path is subject to ongoing risks from commodity shocks to regional conflicts the overall trend suggests a return to lower global inflation rates and steadier economic conditions.[1]

Figure 1.1: Global Economy Inflation Rate (In %), 2019-2030F



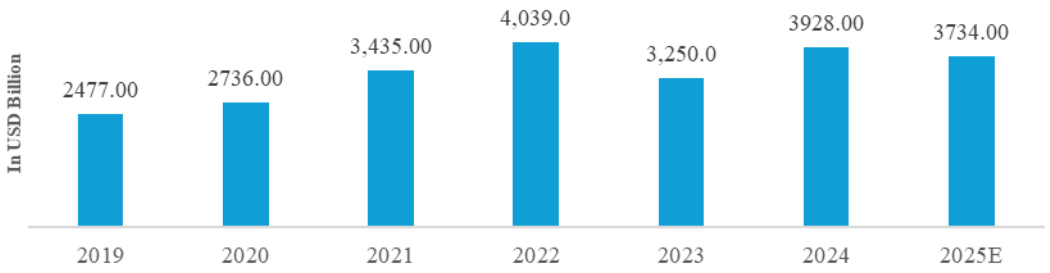
Source: International Monetary Fund (IMF) and Frost & Sullivan Analysis

1.1.2. Current account & International Investment

Global current account balances grew strongly in 2024, increasing by about 0.6% of world GDP and reversing the steady decline seen since the global financial crisis. The global current account balance stood at USD 2,477.00 Bn in 2019, reflecting relatively stable external positions across economies. By 2024, the balance widened significantly to USD 3,928.00 Bn, supported by strong trade surpluses in select regions and improved capital flows. However, in 2025, it is projected to moderate slightly to USD 3,734.00 Bn, indicating a partial adjustment in global trade and investment dynamics after the sharp expansion in the previous year.[2]

[1] https://www.imf.org/external/datamapper/PCPIPCH@WEO/OEMDC/ADVEC/WEOWORLD
[2] https://www.imf.org/en/Publications/ESR/Issues/2025/07/22/external-sector-report-2025

Figure 1.2: Global Current Account Balance (In USD Bn), 2019-2025E



Source: International Monetary Fund

The Net International Investment Position (NIIP) shows big differences between advanced and emerging economies from 2019 to 2024. Among advanced economies, Germany, Japan, and Switzerland held the strongest surpluses, with Germany's NIIP rising from USD 2.26 Tn in 2019 to USD 3.67 Tn in 2024, while Japan's position grew to USD 3.59 Tn. On the other hand, the United States stayed the world's largest debtor, with its deficit widening from USD –11.65 trillion to USD –26.23 trillion. Countries like Australia, France, Spain, and the UK also showed negative NIIP, though some saw small improvements in 2024.

In emerging economies, China recorded steady surpluses, increasing from USD 2.30 Tn in 2019 to USD 3.30 Tn in 2024, while Russia and Saudi Arabia also kept strong positive positions. In contrast, India, Brazil, Mexico, and Indonesia continued to face deficits, showing their reliance on outside financing despite steady growth

Table 1.1: Selected Economies: Net International Investment Position (In USD Bn), 2019–24

Advanced Economies (In USD Billion)	2019	2020	2021	2022	2023	2024
Australia	-654	-744	-613	-644	-544	-431
Belgium	217	258	402	334	332	400
Canada	473	745	1,086	776	1,074	1,388
France	-667	-863	-951	-698	-865	-643
Germany	2,260	2,658	2,922	2,932	3,169	3,668
Hong Kong SAR	1,579	2,122	2,111	1,769	1,759	2,044
Italy	-23	27	132	89	168	363
Japan	3,271	3,417	3,678	3,101	3,257	3,589
Korea	518	487	685	801	810	1,102
The Netherlands	729	900	714	562	611	731
Singapore	845	969	1,004	871	906	804
Spain	-1,020	-1,165	-969	-840	-838	-758
Sweden	72	60	126	197	233	403
Switzerland	668	881	867	787	918	1,180
United Kingdom	–306	-493	-391	-369	-461	-357
United States	-11,653	-14,707	-18,833	-16,264	-19,853	-26,232
Emerging Market and Developing Economies						
Argentina	113	122	124	123	108	67
Brazil	-786	-552	-601	-825	-1,102	-751
China	2,300	2,287	2,186	2,422	2,851	3,296
India	-375	-355	-377	-376	-370	-369

Indonesia	-338	-280	-277	-250	-258	-245
Malaysia	–9	20	22	12	22	-3
Mexico	-629	-549	-552	-614	-758	-590
Poland	-294	-273	-266	-244	-275	-258
Russia	359	517	487	768	856	949
Saudi Arabia	671	599	704	778	765	735
South Africa	31	112	102	82	102	115
Thailand	-23	39	40	-24	13	43
Tüüiye	-309	-384	-238	-358	-311	-295

Source: International Monetary Fund

1.1.3. IMF and WEF Commentaries on Global Outlook

IMF Commentary: Global Outlook (August 2025)

The International Monetary Fund (IMF) has projected that the global economy will expand at a moderate pace, with growth estimated between 2.80% to 3.00% in 2025 and slightly improving to 3.00% to 3.10% in 2026. While this outlook reflects resilience, it remains below the long-term historical average of 3.7 percent recorded during 2000 to 2019, highlighting a continued trend of subdued performance.

Among the major economies, the United States is expected to grow at 1.80%in 2025, marking a downward revision that underscores challenges around slower demand and policy uncertainty. China's growth has also been revised down, with forecasts lowered to 4.00% in 2025 from an earlier 4.60% estimate, reflecting structural headwinds and weaker external demand. India, however, continues to stand out as the fastest-growing large economy, with projections of 6.20% in 2025 and 6.30% in 2026, supported by strong domestic consumption and investment flows. Emerging markets are expected to outperform the global average, with a projected 3.70% growth rate in 2025.

Global inflation is forecast to ease, falling to 4.30% in 2025 compared with 5.70% in 2024. Advanced economies are expected to see inflation stabilize between 2.50% and 2.70%, reflecting the impact of tighter monetary policies. However, inflationary pressures are likely to persist in emerging and developing economies, where supply-side constraints and currency weaknesses may limit the pace of disinflation.

WEF Commentary: Global Outlook

The World Economic Forum (WEF) has echoed the IMF's views, describing the global economy as one of "tenuous resilience" amid persistent uncertainty. WEF emphasized the need for structural reforms aimed at boosting productivity and enhancing resilience. It also highlighted the importance of strengthening economic data standards and measurement tools, particularly for tracking the impacts of digitization, sustainability, and intangible assets. Both organizations agreed that upgrading policy frameworks and institutions will be critical to addressing challenges linked to aging populations, climate change, and rapid technological transformation

The IMF and WEF underline that the global economy is showing resilience, though risks remain substantial. Growth is subdued but not collapsing, with strength concentrated in select emerging markets such as India. The shared message is that today's resilience should not create complacency, as protectionism, demographic headwinds, and policy uncertainty could undermine long-term progress. Sustainable growth will depend on structural reforms, stronger institutions, and forward-looking policies that prepare economies for shifting global dynamics.

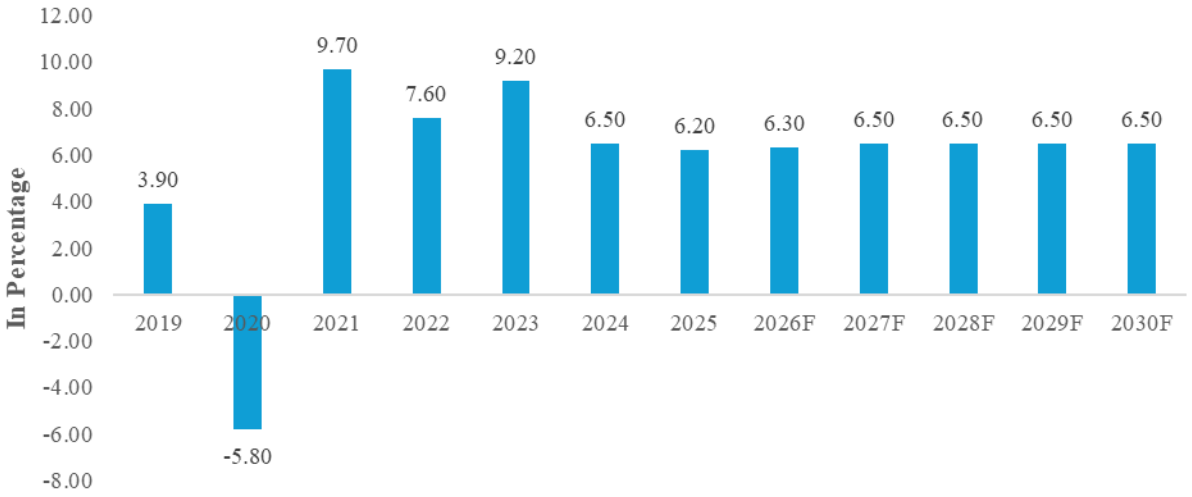
1.2.Indian Economy Outlook

The Indian economy is projected to maintain robust growth momentum, emerging as one of the fastest-growing major economies in the world. Strong domestic demand, government-led infrastructure development, and strategic policy reforms are supporting economic resilience.

1.2.1. GDP Growth and Outlook

India's GDP growth has shown steady and encouraging progress, reflecting the nation's growing resilience and the positive impact of forward-looking policies. In 2019, growth was recorded at 3.90%, influenced by global and domestic factors. Since then, a strong recovery was underway and growth reached to 6.20% in 2025, supported by increased public investment, expanding manufacturing, and rapid digital infrastructure development. By 2030, growth is projected to grow to 6.50%, driven by continued reforms, increasing private sector participation, and strong consumer demand. India is being increasingly recognized as a vital engine of global economic growth. [3]

Figure 1.3: Indian Real GDP Growth (In %), 2019-2030F



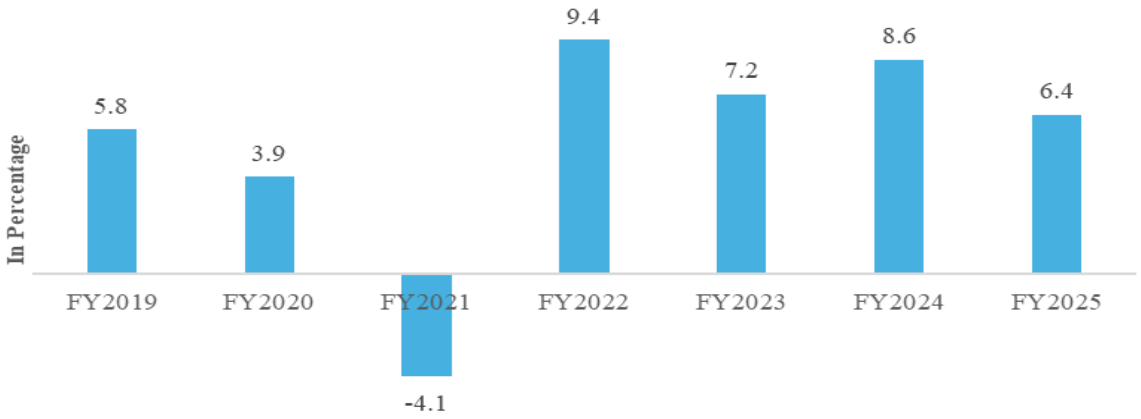
Source: International Monetary Fund (IMF) and Frost & Sullivan Analysis

1.2.2. Real Gross Value Added Growth

India's real Gross Value Added (GVA) growth was recorded at 5.80% in FY2019, marking moderate expansion prior to global and domestic headwinds. Growth subsequently accelerated to 8.60% in FY2024, driven by policy support, resilient domestic demand, and sectoral recovery. In FY2025, the growth was 6.40%, reflecting a transition toward more sustainable momentum following the post-pandemic rebound.[4]

[3] https://www.imf.org/external/datamapper/NGDP_RPCH@WEO/OEMDC/ADVEC/WEOWORLD
[4] https://www.pib.gov.in/PressReleasePage.aspx?PRID=2106921

Figure 1.4: Real GVA Growth (In %), FY2019-FY2025

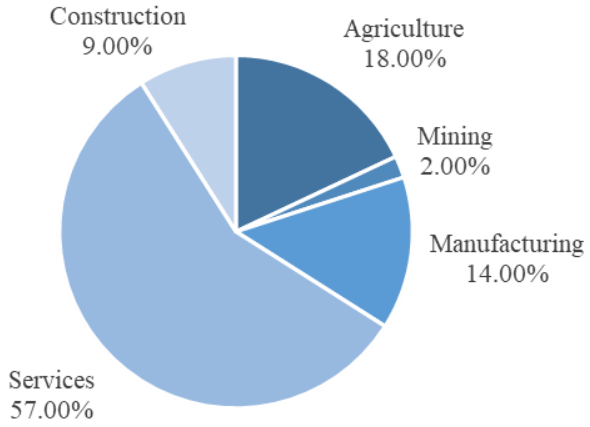


Source: Ministry of Statistics & Programme Implementation

1.2.3. GDP contribution by Agriculture, Industry and Services sector

In FY2024 the India's GDP is largely driven by the services sector, which contributes around 57.00% to the overall economy, highlighting the country's strong performance in areas such as IT, finance, and communications. The manufacturing sector accounts to 14.00%, reflecting the ongoing push towards industrial growth under initiatives like "Make in India." Agriculture continues to play a vital role, contributing 18.00%, especially in rural employment and food security. The construction sector contributes 9.00%, supported by infrastructure development and urbanization, while mining adds around 2.00% to the GDP. This sectoral distribution reflects a diversified economic base with increasing focus on industry and services.

Figure 1.5: GDP contribution by Sector (In %), FY2024



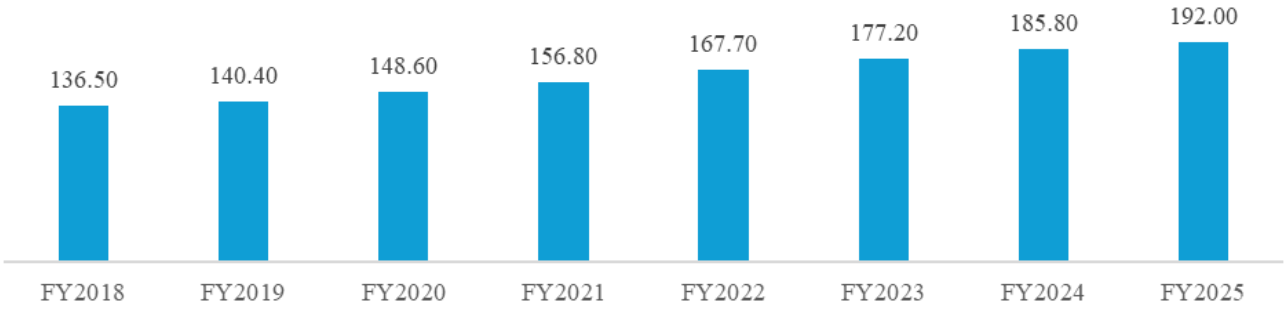
Source: Ministry of Statistics & Programme Implementation and Press Information Bureau (PIB)

1.2.4. Consumer Price Index

In FY2019, the CPI stood at 140.40, indicating relatively moderate inflation. By FY2024, it had increased to 185.80, driven by factors such as higher food and fuel prices, global supply chain disruptions, and domestic demand pressures. In FY2025, the CPI was 192.00, though at a slower pace, suggesting a gradual stabilization of inflation.[5]

[5] https://www.mospi.gov.in/sites/default/files/press_release/CPI_PR_13May25.pdf

Figure 1.6: Consumer Price Index, FY2019-FY2025

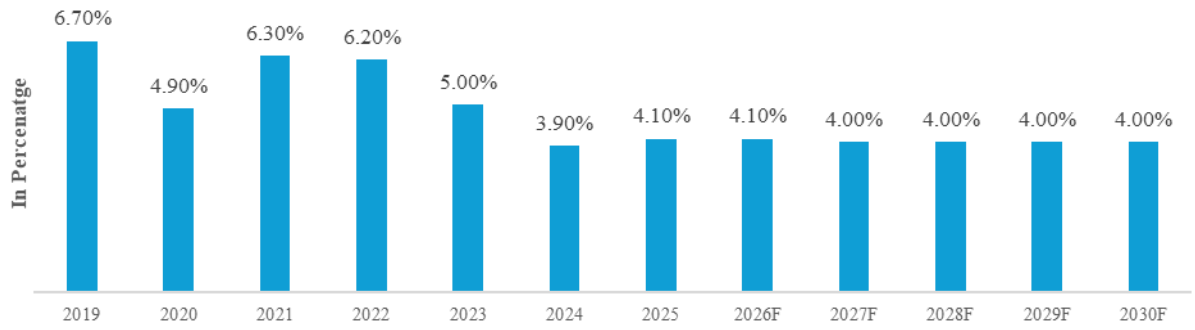


Source: Ministry of Statistics & Programme Implementation and Press Information Bureau (PIB)

1.2.5. Inflation Trends

Inflation in India has shown signs of moderation over the years, reflecting effective monetary policy measures and improved supply-side management. In 2019, inflation stood at 6.70%, driven by food price volatility, fuel costs, and external economic pressures. In 2025, the Inflation was accounted to 4.10%, supported by stable commodity prices, better supply chain efficiency, and calibrated interest rate policies. In 2030, inflation is forecasted to remain around 4.00%, indicating a sustained focus on price stability. This downward trend reflects a more balanced economic environment conducive to long-term growth and investment confidence.[6]

Figure 1.7: Inflation Growth Rate (End of period consumer prices) (In %), 2019-2030F



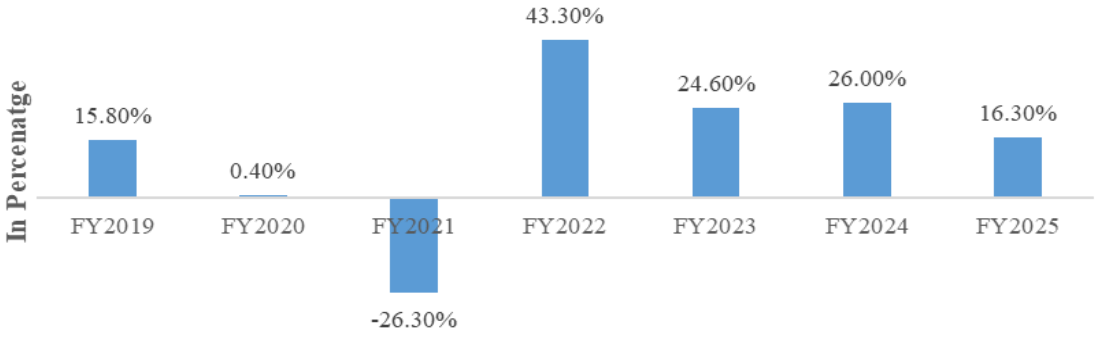
Source: International Monetary Fund (IMF) and Frost & Sullivan Analysis

1.2.6. Index of Industrial Production trends

The Index of Industrial Production (IIP) has increased between the period FY2022 to FY2025. This is influenced by growth in manufacturing, mining, and electricity. In FY2019, the IIP grew by 15.80%, supported by steady industrial activity and demand. The IIP increased by 26.00% in FY2024, driven by increased investments in infrastructure, and better performance in key sectors. In FY2025, the IIP growth is expected to grow by 16.30%, these trends show the strength and steady progress of India's industrial sector.

[6] https://www.imf.org/external/datamapper/PCPIEPCH@WEO/IND?zoom=IND&highlight=IND

Figure 1.8: Index of Industrial Production (IIP) Growth Rate (In %), FY2019-FY2025

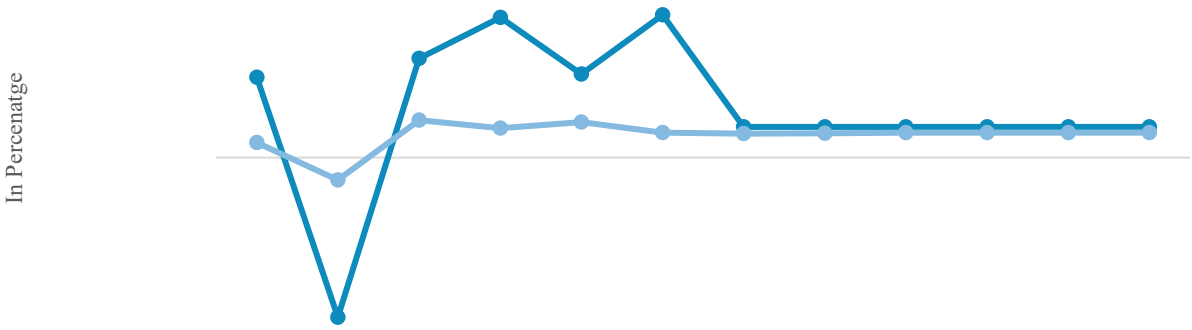


Source: Ministry of Statistics & Programme Implementation

1.2.7. Growth in GDP and Infrastructure Investments

The YoY growth in Government Infrastructure Investment was averaged around 15.45% between the period FY2019 to FY2025. The Government Infrastructure investment grew from INR 5.19 Tn in FY2019 to INR 10.00 Tn in FY2024.[7] The historical YoY GDP growth between the period FY2019 to FY2024 was 5.18% and is expected to grow at an average of 6.46% during the forecast period. The infrastructure investments are expected to reach INR 21.65 Tn by 2030 from INR 10.00 Tn in FY2024. The investments in infrastructure are expected to be one of the key drivers of GDP growth. In FY2023, India invested around USD 68.00 Bn in energy, which is 40% more than the average investment made between FY2016 and FY2020.

Figure 1.9: Growth in GDP and Infrastructure Investments (In %), FY2019-FY2030F



	FY2019	FY2020	FY2021	FY2022	FY2023	FY2024	FY2025	FY2026E	FY2027F	FY2028F	FY2029F	FY2030F
Infrstructure Investment Growth	20.85%	-41.37%	25.71%	36.36%	21.67%	36.99%	7.94%	7.94%	7.94%	7.94%	7.94%	7.94%
GDP Growth	3.90%	-5.80%	9.70%	7.60%	9.20%	6.50%	6.20%	6.30%	6.50%	6.50%	6.50%	6.50%

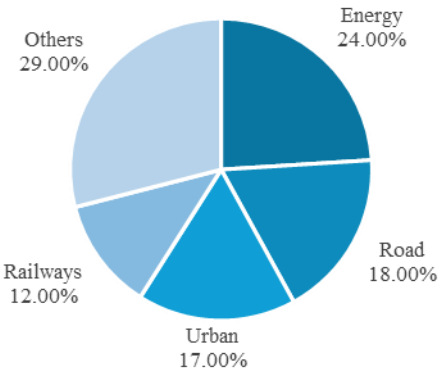
Source: International Monetary Fund (IMF), RBI Data and Frost & Sullivan Analysis

Infrastructure investment in India has been distributed across multiple sectors with Energy receiving the largest share at 24%, followed by Roads (18%), Urban infrastructure (17%), and Railways (12%). The remaining 29% has been allocated to "Others," which includes critical areas such as ports, airports, digital infrastructure, irrigation, rural development, agriculture and food processing, social infrastructure, and industrial infrastructure. This sectoral distribution reflects a diversified investment strategy, balancing core infrastructure development with enabling sectors that drive long-term economic growth, connectivity, and resilience.[8]

[7] https://www.pib.gov.in/PressReleaseIframePage.aspx?PRID=1578024

[8] https://dea.gov.in/sites/default/files/Report%20of%20the%20Task%20Force%20National%20Infrastructure%20Pipeline%20%28NIP%29%20-%20volume-i_1.pdf

Figure 1.10: Sector-wise break-up of Capital Expenditure (In %), FY2020-FY2025

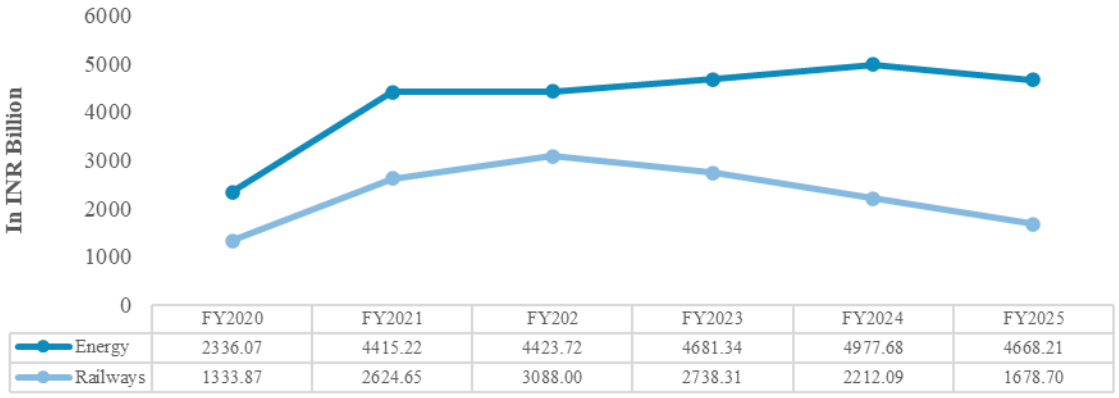


Source: Department of Economic Affairs

Note: Others include ports, airports, digital infrastructure, irrigation, rural development, agriculture and food processing, social infrastructure, and industrial infrastructure

The sector-wise capital expenditure in infrastructure shows strong allocation toward Energy and Railways during FY2020–FY2025. Investment in the Energy sector rose from INR 2,336.07 Bn in FY2020 to INR 4,977.68 Bn in FY2024, before moderating slightly to INR 4,668.21 Bn in FY2025. Similarly, Railways witnessed an increase from INR 1,333.87 Bn in FY2020 to INR 2,212.09 Bn in FY2024, with expenditure tapering to INR 1,678.70 Bn in FY2025.

Figure 1.11: Sector-wise break-up of Capital Expenditure in Infrastructure (In INR Bn) FY2020-FY2025



	FY2020	FY2021	FY202	FY2023	FY2024	FY2025
Energy	2336.07	4415.22	4423.72	4681.34	4977.68	4668.21
Railways	1333.87	2624.65	3088.00	2738.31	2212.09	1678.70

Source: Department of Economic Affairs |

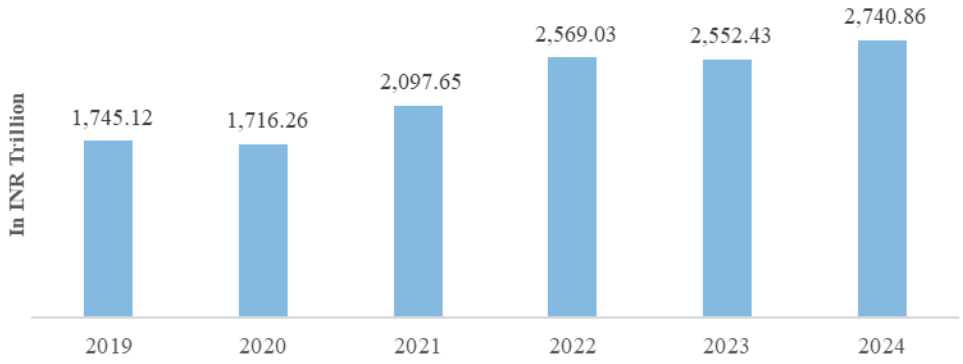
Note: Energy includes Power, Renewable Energy, Atomic Energy and Petroleum & Natural Gas

Global Export Market and Growth Trends

The global export market has grown strongly over the last five years, showing resilience despite worldwide challenges and a steady increase in international trade. In 2019, exports stood at INR 1,745.12 Tn, increasing to INR 2,740.86 Tn by 2024, with a CAGR of 9.45%. This growth shows that economies are becoming more connected, as companies build diverse supply chains, enter new markets, and make greater use of digital trade platforms.[9]

[9] https://data.worldbank.org/indicator/NE.EXP.GNFS.CD

Figure 1.12: Global Export Market (In USD Tn), 2019-2024



Source: World Data Bank

1.2.7.1.Export Market Growth Trends

- The global export market underwent notable shifts between 2019 and mid-2025, shaped by economic recovery cycles, technological advancements, geopolitical tensions, and evolving trade policies. After relative stability in 2019, International trade contracted sharply in early 2020 due to disrupted supply chains, reduced demand, and curtailed merchandise exports.
- A strong rebound followed in 2021–2022, with export volumes expanding by nearly 10.00% in 2021, supported by reopening economies and pent-up consumption, though momentum eased in 2022 amid increasing inflation and geopolitical frictions. By 2023–2024, growth had stabilized at a more moderate pace, with merchandise exports increasing just 2.90% in 2024, while commodity exports gained 6.80% in value, reflecting a cautious but resilient phase.
- In 2024, global exports expanded by nearly USD 32.31Tn, led primarily by developed economies. U.S. imports rose 14.00% and EU exports 6.00%, while growth across developing markets remained uneven. Merchandise trade volumes are projected to contract slightly by 0.20% in 2025, driven by a steep 12.60% decline in North American exports, partially offset by modest gains in Asia (+1.60%) and Europe (+1.00%). By contrast, services trade continues to demonstrate strong momentum, with 4.00% growth projected for 2025, underpinned by digital services, financial offerings, and healthcare.[10]

1.2.8. Concluding Remarks

The global economic outlook remains cautiously optimistic, with growth expected to continue at a moderate pace despite persistent challenges such as inflation, geopolitical tensions, and supply chain disruptions. While advanced economies face headwinds, emerging markets particularly in Asia are positioned for faster expansion, leveraging technology adoption and industrial growth. India stands out as a key driver of this momentum, maintaining its status as the fastest-growing major economy with projected GDP growth of 6.20% in FY2025. Between FY2020-FY2025, energy accounted to 24.00% and railways accounted to around 12.00% of the sector wise breakup of NIP capital expenditure. These two sectors combined accounted to 36.00% of the total NIP capital expenditure between FY2020-FY2025. To meet the increasing electricity needs and renewable energy targets, India plans to invest INR 9.10 Tn in T&D from FY2025 to FY2032.[11] This involves expanding transmission capacity to 1,274 GVA by FY2032 and adding around 1.91 lakh circuit kilometers (ckm) of transmission lines.[12] The government also aims to add 50 GW of power generation capacity annually until FY2030, driving demand for new transmission corridors and grid upgrades.

[10] https://www.wto.org/english/res_e/booksp_e/trade_outlook25_e.pdf
[11] https://energy.economictimes.indiatimes.com/news/power/indias-transmission-capex-set-to-touch-9-trillion-by-fy32-ind-ra/116154947
[12]https://economictimes.indiatimes.com/industry/energy/power/1-91-lakh-circuit-km-transmission-lines-to-be-added-by-2032/articleshow/119304609.cms

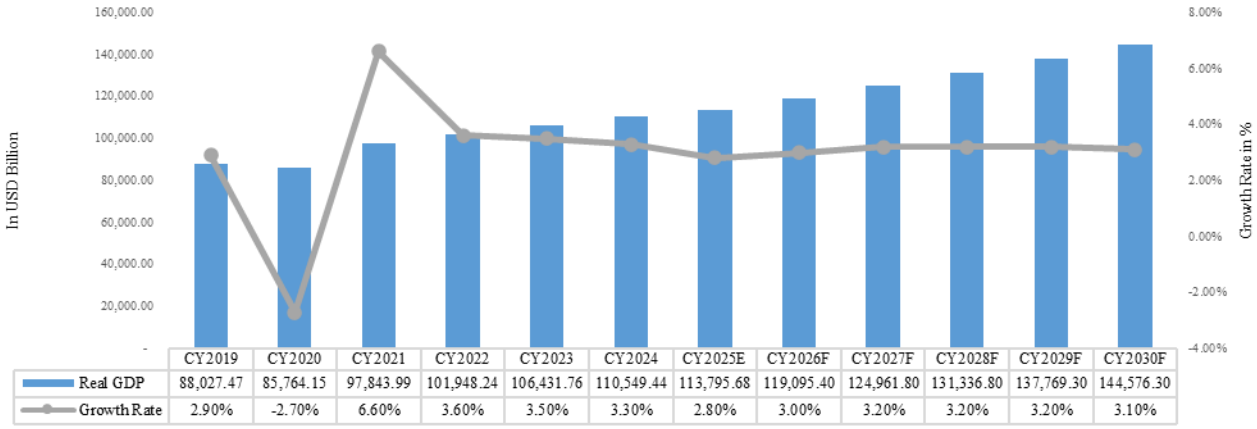
Inflation is expected to remain contained within the Reserve Bank of India's target range, supporting macroeconomic stability. As India advances toward becoming the world's third-largest economy by 2030, continued focus on structural reforms, investment in infrastructure, and effective supply-side management will be crucial for sustaining long-term growth and enhancing global competitiveness.

2. Macroeconomic Overview of Global and Indian Economy

2.1 Overview of Global Economy

2.1.1 Review and Outlook of Global GDP and GDP Growth

Figure 2.1: Global GDP (In USD Bn) and GDP Growth (In %), CY2019-CY2030F



	CY2019	CY2020	CY2021	CY2022	CY2023	CY2024	CY2025E	CY2026F	CY2027F	CY2028F	CY2029F	CY2030F
Real GDP	88,027.47	85,764.15	97,843.99	101,948.24	106,431.76	110,549.44	113,795.68	119,095.40	124,961.80	131,336.80	137,769.30	144,576.30
Growth Rate	2.90%	-2.70%	6.60%	3.60%	3.50%	3.30%	2.80%	3.00%	3.20%	3.20%	3.20%	3.10%

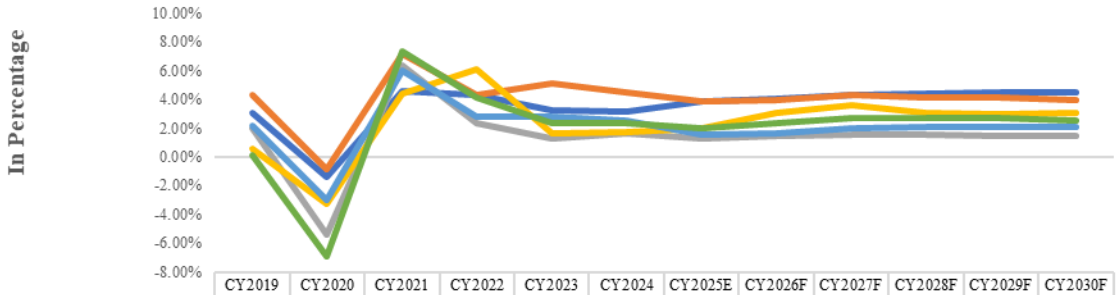
Source: International Monetary Fund (IMF) and Frost & Sullivan Analysis

Global real GDP is expected to increase, showing the strength and flexibility of the world economy. In CY2019, GDP was recorded at USD 88,027.47 Bn, with a growth rate of 2.90%. By CY2025, it is expected to grow to USD 113,795.68 Bn, with continued efforts to manage inflation and supply chain. By CY2030, global GDP is forecast to reach USD 144,576.30 Bn, with YoY growth expected at around 3.10%. This positive outlook is being supported by advances in technology, clean energy, and strong growth in emerging economies.

2.1.2 Review and outlook of GDP Growth in Key Global Economies (North America, Europe, Asia Pacific, Middle East & Africa, LATAM)

GDP growth across key global regions is shaped by regional economic structures, policy actions, and global market conditions. In CY2019, the highest growth rate was recorded in Asia and the Pacific at 4.30%, followed by Africa at 3.10% and North America at 2.20%. Growth was slower in Europe and the Middle East, at 2.00% and 0.60% respectively.

Figure 2.2: Global GDP Growth (In %), CY2019-CY2030F



	CY2019	CY2020	CY2021	CY2022	CY2023	CY2024	CY2025E	CY2026F	CY2027F	CY2028F	CY2029F	CY2030F
Africa	3.10%	-1.40%	4.60%	4.30%	3.30%	3.20%	3.90%	4.10%	4.30%	4.40%	4.50%	4.50%
Asia and Pacific	4.30%	-0.80%	7.20%	4.30%	5.10%	4.50%	3.90%	4.00%	4.30%	4.20%	4.20%	4.00%
Europe	2.00%	-5.40%	6.40%	2.40%	1.30%	1.70%	1.30%	1.50%	1.60%	1.60%	1.50%	1.50%
Middle East	0.60%	-3.20%	4.40%	6.10%	1.70%	1.80%	2.00%	3.10%	3.60%	3.10%	3.00%	3.10%
North America	2.20%	-3.00%	6.00%	2.80%	2.80%	2.60%	1.60%	1.70%	2.00%	2.10%	2.10%	2.10%
Latin America and the Caribbean	0.20%	-6.90%	7.40%	4.20%	2.40%	2.40%	2.00%	2.40%	2.70%	2.70%	2.70%	2.60%

Source: International Monetary Fund (IMF)

Africa: By CY2025, Africa's economy is projected to grow at 3.9%, driven by rapid urbanization, a young workforce, and rich natural resources. The continent has over USD 4.00 Tn in domestic capital through pension funds, sovereign wealth funds, and banks, yet faces an annual infrastructure financing gap of USD 130.00 Bn to USD 170.00 Bn.[13] Energy, with integrated cross-border grids, and transport, with over 7,000 km of rail under development, are key priorities. Public-private partnerships and institutions like Africa50, which has mobilized USD 8.00 Bn,[14] are central to advancing infrastructure, industrialization, and long-term economic transformation.

Asia and Pacific: The region is projected to grow at 3.90% by CY2025, the highest globally. The infrastructure investments by public and private sectors are robust, with an annual funding gap close to USD 1.70 Tn to sustain urbanization, drive economic growth, and achieve energy transition objectives.[15] Growth momentum is slightly slowed by global uncertainties and trade tensions, but strong domestic consumption, rapid technology adoption, and digital transformation help maintain stability and long-term progress.

Europe: Europe's growth is expected to remain modest at 1.30% by CY2025. The region prioritizes green energy, digital innovation, and climate-resilient infrastructure, with public spending, private capital, and PPPs driving decarbonization, renewable integration, and sustainable transport, despite demographic and structural economic challenges. However, modest recovery is anticipated, supported by technological innovation, green energy transition, and targeted investments by CY2030.

Middle East: By CY2025, growth in the Middle East is projected at 2.00%, driven by diversification policies reducing oil dependence. Regulatory reforms and expansion into sectors like tourism, logistics, and finance, along with energy transition, are expected to further support long-term growth. Infrastructure investments focus on economic diversification, energy transition, and social infrastructure. The public sector drives major projects, with growing private sector involvement via PPPs. Saudi Arabia and UAE lead, investing billions in transport, renewable energy, and digital infrastructure.

North America: North America is projected to expand by 1.60% in CY2025. Short-term pressures from global uncertainties may dampen growth, but the region's strong innovation capacity, advanced technology sectors, and robust consumer demand provide resilience and ensure moderate recovery by CY2030. The public investment includes

[13]https://african.business/2025/04/long-reads/bridging-africas-infrastructure-gap#:~:text=particularly%20from%20pension%20funds%2C%20insurers%20and%20private%20credit
[14] https://www.africa50.com/
[15] https://www.adb.org/publications/asia-infrastructure-needs

USD 550.00 Bn under the U.S. Infrastructure Investment with US equity investments reaching USD 45.00 Bn in 2022 and Canada's North leaf fund raising USD 2.60 Bn.[16]

Latin America and the Caribbean: The region is forecast to grow at 2.00% in CY2025, recovering from weak past performance. Structural reforms, trade expansion, and effective utilization of natural resources contribute to a stronger outlook, setting the foundation for sustained growth through CY2030. needs USD 2.22 Tn by CY2030 for infrastructure. Public funding dominates, while private capital and PPPs, supported by IDB, are growing especially in energy, transport, water, and telecom sectors.[17]

2.2 Overview of Indian Economy

India continues to stand out as one of the fastest-growing major economies in the world. The country's economic performance is being supported by strong domestic demand, government-led infrastructure development, and strategic policy reforms. Key initiatives such as "Make in India", the digitalization of services, and the transition to green energy have strengthened both the industrial and services sectors. The services sector, which contributes around 57.00% to GDP in FY2024, has emerged as a key driver, supported by robust performance in IT, finance, and communications. Manufacturing contributes about 14.00%, and agriculture around 18.00%, reflecting a broad-based and diversified economy.

India's global competitiveness is being enhanced through increasing investments, improving ease of doing business, and rapid technological adoption. These trends underscore India's role as a leading engine of growth in the global economy, especially within Asia

2.2.1 Near-Term Review and Outlook on GDP

India's GDP increased from 3.90% in CY2019 to an estimated 6.20% in CY2025. The growth outlook is optimistic, driven by a combination of public investments, expanding manufacturing capabilities, and the rollout of digital and physical infrastructure. By CY2030, GDP growth is projected to rise further to 6.20%, supported by continued reforms, increasing private sector participation, and increasing consumer demand.

India's inflation is expected to remain stable, moving only slightly from 3.90% in CY2024 to 4.00% in CY2025, enabling macroeconomic stability. The Consumer Price Index (CPI) is also showing signs of stabilization, increasing more slowly in FY2025 (to 192.00) after sharp increases in previous years due to global supply chain disruptions and high food and fuel prices.

The Index of Industrial Production (IIP) has rebounded strongly, growing by 26.00% in FY2024 following post-pandemic recovery and infrastructure-led growth, and is projected to grow at a more normalized rate of 16.30% in FY2025, indicating stable industrial momentum.

2.2.2 Interest rate trend

The interest rate trend in India in 2025 reflects a gradual easing stance by the Reserve Bank of India (RBI) amid easing inflation and efforts to support economic growth.

- The RBI's key policy rate, the repo rate, currently stands at 5.50% as of mid-2025, following a larger-than-expected 50 basis points cut in June 2025. This is the third rate cut in 2025, cumulatively reducing the repo rate by 100 basis points from 6.50% earlier in the year, bringing borrowing costs to their lowest level since August 2022.[18]

16 https://www.globenewswire.com/news-release/2024/04/09/2860209/0/en/North-America-Transportation-Infrastructure-Market-Set-to-Surpass-Valuation-of-USD-288-6-Billion-By-2032-at-3-5-CAGR-Astute-Analytica.html
17 https://caribbean.un.org/en/235558-sustainable-infrastructure-paving-way-future-generations-latin-america-and-caribbean
18 https://www.pib.gov.in/PressNoteDetails.aspx?NoteId=154573&ModuleId=3

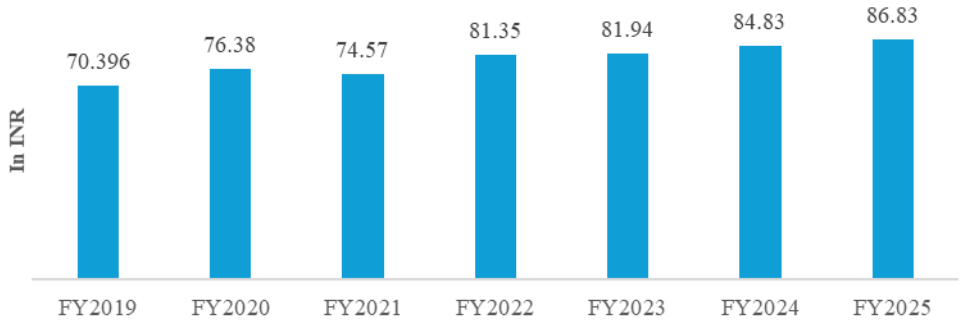
- Other key rates include the Standing Deposit Facility (SDF) rate at 5.25% and the Marginal Standing Facility (MSF) rate at 5.75%. The Cash Reserve Ratio (CRR) was also cut by 100 basis points from 4.00% to 3.00%, implemented in quarterly tranches starting September 2025.[19]
- The RBI's monetary policy stance has shifted from accommodative to neutral, maintaining a careful balance between keeping inflation under control (with the inflation forecast revised down to around 3.10%) and supporting continued GDP growth (around 6.20% forecast for FY2025-26).
- This easing environment has led to moderately higher fixed deposit rates offered by banks (ranging roughly from 5.00% to 7.50% depending on tenure and depositor category) and incremental reductions in lending rates.

India's interest rate trend in 2025 is characterized by monetary easing aimed at sustaining growth while managing inflation risks amid evolving global macroeconomic pressures

2.2.3 Currency

In FY2019, the Indian rupee averaged about 70.40 against the U.S. dollar, showing stable currency conditions. In FY2024, it had fallen to 84.83, mainly due to higher import costs, Increasing inflation, and tighter global monetary policies. This downward trend is expected to continue, with the rupee likely to reach around 86.83 in FY2025, pointing to ongoing depreciation. While depreciation raises import costs, it enhances the competitiveness of Indian goods and services internationally, driving exports and supporting overall trade growth.

Figure 2.3: Currency Convertion (In INR) FY2019-FY2025



Source: Frost & Sullivan Analysis

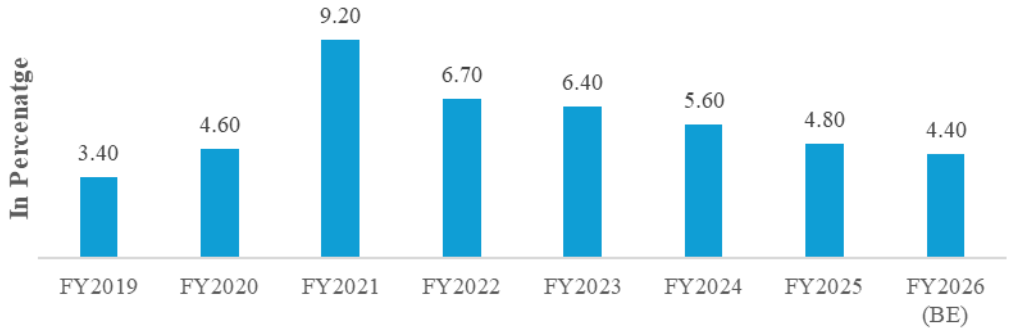
2.2.4 Fiscal Deficit/Surplus

In FY2019, the deficit was 3.40% of GDP, showing stable financial control. By FY2025, it is expected to rise to 4.80% because of larger spending on infrastructure, welfare, and growth programs. For FY2026, the Budget Estimate sets the deficit at 4.40%, showing an effort to slowly bring it down.

In recent years, India has generally recorded deficits, which grew significantly due to increased healthcare and relief spending. From 2019 to 2025, no fiscal surplus was recorded at the central government level. Instead, the focus has been on slowly reducing the deficit from a peak of about 9.20% of GDP in 2020-21 to a targeted 4.40% by 2025-2026 through careful spending and better revenue collection[20]

[19]https://www.newsonair.gov.in/rbis-monetary-policy-committee-keeps-repo-rate-unchanged-at-5-5-maintains-neutral-stance/#:~:text=The%20Monetary%20Policy%20Committee%20(MPC,Rate%20at%205.75%20per%20cent.
[20] https://www.indiabudget.gov.in/doc/Budget_at_Glance/bag2.pdf

Figure 2.4: Fiscal Deficit Percentage of GDP (In %) FY2019-FY2026

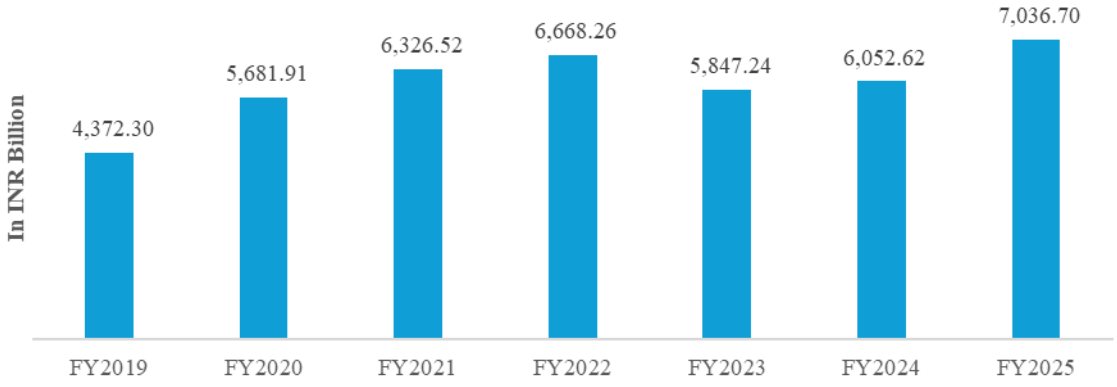


Source: Indian Budget
Note: FY2026 (BE) refers to the Budget Estimates

2.2.5 Foreign Direct Investment

In FY2019, FDI inflows stood at INR 4,372.30 Bn, reflecting steady investor confidence in the country's economic potential. By FY2025, inflows had increased to INR 7,036.70 Bn, marking a significant growth of about 61.00% over six years. This surge highlights India's growing attractiveness as a global investment destination, driven by liberalized policies, structural reforms, competitive labor markets, and a proactive government approach to strengthening the business environment

Figure 2.5: Foreign Direct Investments (In INR Bn) FY2019-FY2025

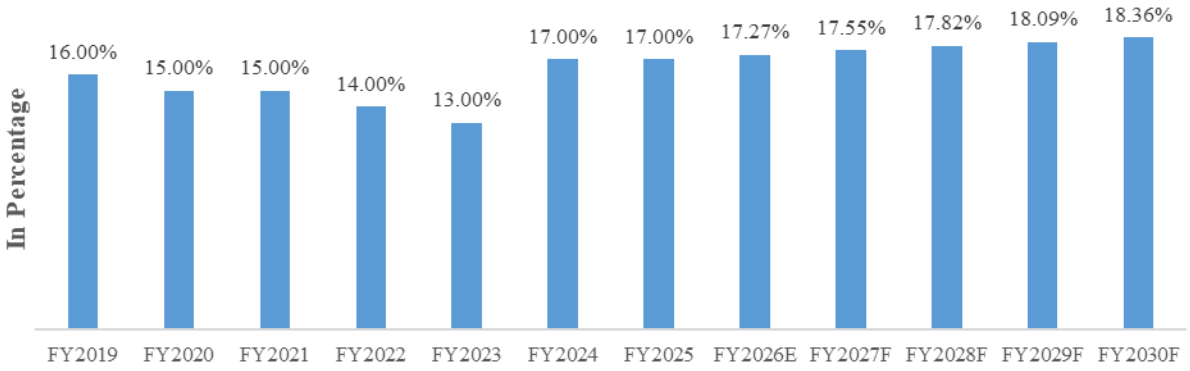


Source: Department for Promotion of Industry and Internal Trade

2.2.6 Contribution of Manufacturing sector to the GDP and commentary

The manufacturing sector is a vital part of India's economy, contributing significantly to employment, exports, and overall growth. It has consistently accounted for around 13.00% to 17.00% of the country's GDP in recent years.

Figure 2.6: Contribution of Manufacturing sector to the GDP (In %), FY2019-FY2030F



Source: Press Information Bureau (PIB)

In FY2025, the manufacturing sector contributed 17.00% to the country's GDP. The sector's contribution is forecast to reach approximately 18.36% by FY2030, driven by continued investments, infrastructure development, and initiatives like 'Make in India' and the Production Linked Incentive (PLI) schemes aimed at strengthening domestic manufacturing capabilities.

India's economic development is significantly influenced by the manufacturing sector, as employment is generated, innovation is fostered, and exports are enabled through its activities. Despite its strategic importance, a significant upward momentum in the sector's share of GDP has not been witnessed, primarily due to structural bottlenecks such as supply chain inefficiencies, infrastructure constraints, and regulatory hurdles.

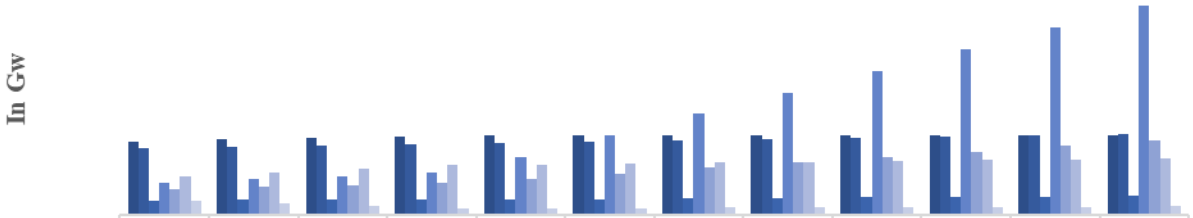
Initiatives such as 'Make in India,' the Production Linked Incentive (PLI) schemes, and the Atmanirbhar Bharat campaign have been launched to ensure the sector's revitalization, attract foreign direct investment, and enhance global competitiveness. Furthermore, productivity and value addition are expected to be improved in the medium to long term through increased emphasis on digitization, Industry 4.0, and skill development

3. OVERVIEW OF THE POWER SECTOR

3.1.Global- Installed power generation capacity by fuel sources

The global fuel-wise installed power generation capacity was projected to undergo significant changes between 2019 and 2030. By 2025, solar and wind capacities are expected to witness substantial increases, with solar to grow from 898.75 GW in 2019 to 5,838.00 GW by 2030. Wind capacity is projected to grow from 719.50 GW to 1,319.00 GW in 2025, reaching 2,079.00 GW by 2030. Modest growth is anticipated in gas and nuclear capacities, with gas expected to rise from 1,852.75 GW in 2019 to 2,262.00 GW by 2030, while nuclear is set to increase from 413.50 GW to 539.08 GW over the same period. Coal capacity is expected to remain stable at 2,243.00 GW in 2023 from 2,056.25 GW in 2019. Bio-power is projected to grow moderately, while hydro capacity appears to decline in 2025 before slightly recovering by 2030

Figure 3.1: Global Installed Power Generation Capacity by Fuel Sources, (In MW), 2019-2030F



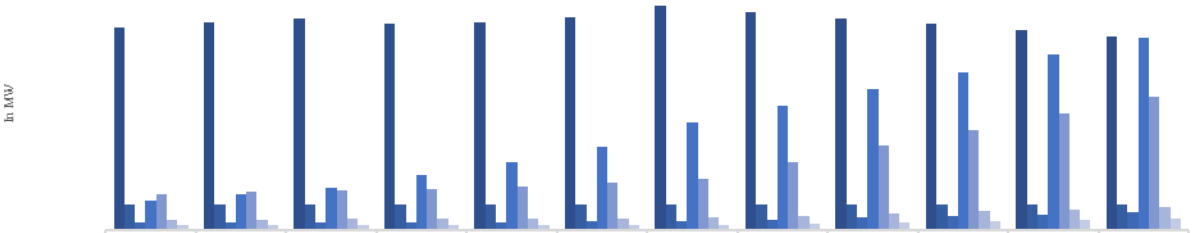
	2019	2020	2021	2022	2023	2024	2025E	2026F	2027F	2028F	2029F	2030F
Coal	2,056.25	2,105.50	2,154.75	2,204.00	2,243.00	2,243.00	2,243.00	2,243.00	2,243.00	2,243.00	2,243.00	2,243.00
Gas	1,852.75	1,895.50	1,938.25	1,981.00	2,007.00	2,043.43	2,079.86	2,116.29	2,152.71	2,189.14	2,225.57	2,262.00
Nuclear	413.50	414.67	415.83	417.00	416.00	433.58	451.17	468.75	486.33	503.92	521.50	539.08
Solar	898.75	994.17	1,089.58	1,185.00	1,610.00	2,214.00	2,818.00	3,422.00	4,026.00	4,630.00	5,234.00	5,838.00
Wind	719.50	779.33	839.17	899.00	1,015.00	1,167.00	1,319.00	1,471.00	1,623.00	1,775.00	1,927.00	2,079.00
Bio-Power	1,067.00	1,177.33	1,287.67	1,398.00	1,411.00	1,434.57	1,458.14	1,481.71	1,505.29	1,528.86	1,552.43	1,576.00
Hydro	392.00	321.33	250.67	180.00	188.00	195.71	203.43	211.14	218.86	226.57	234.29	242.00

Source: International Energy Agency (IEA)

3.2.Installed Power Generation Capacity of India by Fuel Sources

India's power generation mix is being changed significantly, with a clear move toward renewable energy. In FY2019, the energy sector was mainly powered by coal, with an installed capacity of 200,704.50 MW, while 79,412.00 MW accounted to renewable sources. A major increase was witnessed in solar power capacity, which was raised from 29,097.18 MW in FY2019 to 1,05,646.49 MW in FY2025. It is expected to reach 1,90,000 MW by FY2030. Wind capacity was increased steadily from 35,625.97 MW in FY2019 to 50,037.82 MW in FY2025 and is expected to more than double by FY2030, reaching 1,32,000 MW. Bio-power was also increased from 10,095.70 MW in FY2019 to 11,583.32 MW in FY2025. It is likely to reach 22,600 MW by FY2030. Hydro capacity was raised gradually from 4,593.15 MW to 5,100.55 MW between FY2019 and FY2025 and is expected to grow further to 10,400 MW by FY2030. [21] [22]

Figure 3.2: Installed Power Generation Capacity of India by Fuel Sources, (In MW), FY2019-FY2030F



	FY2019	FY2020	FY2021	FY2022	FY2023	FY2024	FY2025	FY2026F	FY2027F	FY2028F	FY2029F	FY2030F
Coal	200,704.50	205,134.50	209,294.50	204,079.50	205,235.50	210,969.51	221,813.00	215,792.60	209,772.20	203,751.80	197,731.40	191,711.00
Gas	24,937.21	24,955.36	24,924.00	24,899.50	24,824.20	24,818.20	24,533.00	24,605.80	24,678.60	24,751.40	24,824.20	24,897.00
Nuclear	6,780.00	6,780.00	6,780.00	6,780.00	6,780.00	8,180.00	8,180.00	9,920.00	11,660.00	13,400.00	15,140.00	16,880.00
Solar	29,097.18	35,607.24	41236.02	53,996.54	66,780.34	81,813.60	105,646.49	122,517.19	139,387.89	156,258.60	173,129.30	190,000.00
Wind	35,625.97	37,743.75	39247.05	40,357.58	42,633.13	45,886.51	50,037.82	66,430.26	82,822.69	99,215.13	115,607.56	132,000.00
Bio-Power	10,095.70	10,221.15	10,533.51	10,682.36	10,802.04	10,941.15	11,583.32	13,786.66	15,989.99	18,193.33	20,396.66	22,600.00
Hydro	4,593.15	4,683.16	4786.81	4,848.90	4,944.30	5,003.25	5,100.55	6,160.44	7,220.33	8,280.22	9,340.11	10,400.00

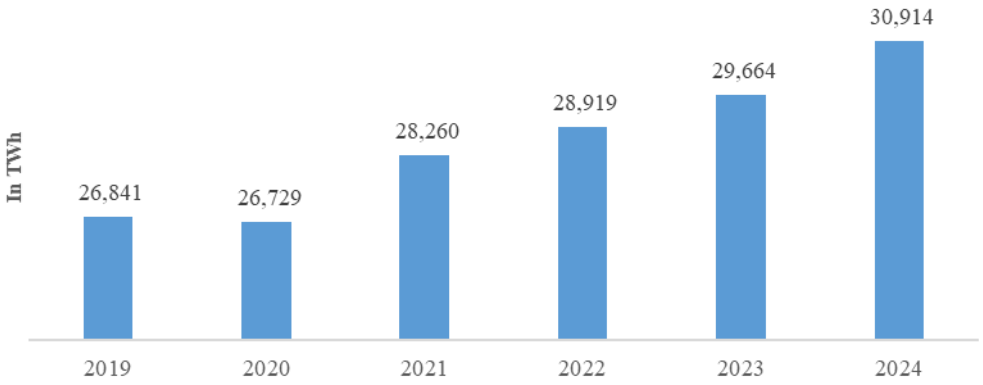
Source: Ministry of New & Renewable Energy and Central Electricity Authority (CEA)

[21] https://mnre.gov.in/en/year-wise-achievement/
[22] https://www.teriin.org/sites/default/files/2019-02/Exploring%20Electricity%20Supply-Mix%20Scenarios%20to%202030.pdf

3.3.Global Power Demand & Consumption Trend

The global power demand witnessed a steady growth between 2019 to 2024. In 2019 the power demand was 26,841 TWh which grew to 30,914 TWh in 2024[23] a 15% increase over five years. This was driven by economic expansion, increased electrification of industries and transport, and higher demand for cooling due to record temperatures. Asia accounts for over half of global electricity demand, with China alone contributing around 32% of global consumption in 2023. India also played a key role, with its power demand growing faster than that of all advanced economies combined in 2024. The rise in demand is driven by economic growth, electrification of transport and residential sectors, expansion of data centres, and increased use of air conditioning due to record global temperatures.

Figure 3.3: Global Power Demand (In TWh), 2019-2024



Source: Frost & Sullivan Analysis

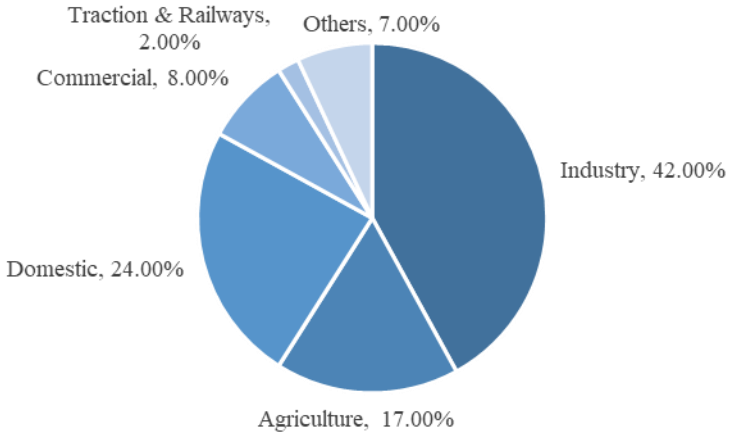
3.4.India's power demand & consumption by sector

India's power demand surged to unprecedented levels in FY2025, with peak demand reaching a record 230,993 MW in May and daily energy consumption ranging between 4,289 and 5,142 Mn units. This sharp rise was fuelled by rapid industrialization, urban expansion, and seasonal spikes, particularly during the hotter months. Notably, FY2025 alone witnessed a 7.00% year-on-year growth in power consumption.

Electricity consumption during FY2023– FY2024 reflected the country's diverse and evolving energy demands across sectors. The industrial sector continued to be the dominant consumer, accounting for 42.00% of total usage, highlighting the energy requirements of manufacturing, steel, cement, and mining industries. The domestic sector followed with a 24.00% share, driven by increasing electrification and household appliance usage. Agriculture consumed 17.00%, largely due to irrigation and water extraction needs. The commercial sector, supported by the growth of retail, office infrastructure, and hospitality, accounted for 8.00%. Electricity use by traction and railways stood at 2.00%, while other categories such as public lighting and utilities contributed the remaining 7.00%

[23] https://ember-energy.org/data/electricity-data-explorer/?data=demand&fuel=total

Figure 3.4: Consumption of Electricity by Sectors in India during 2023-24(P)



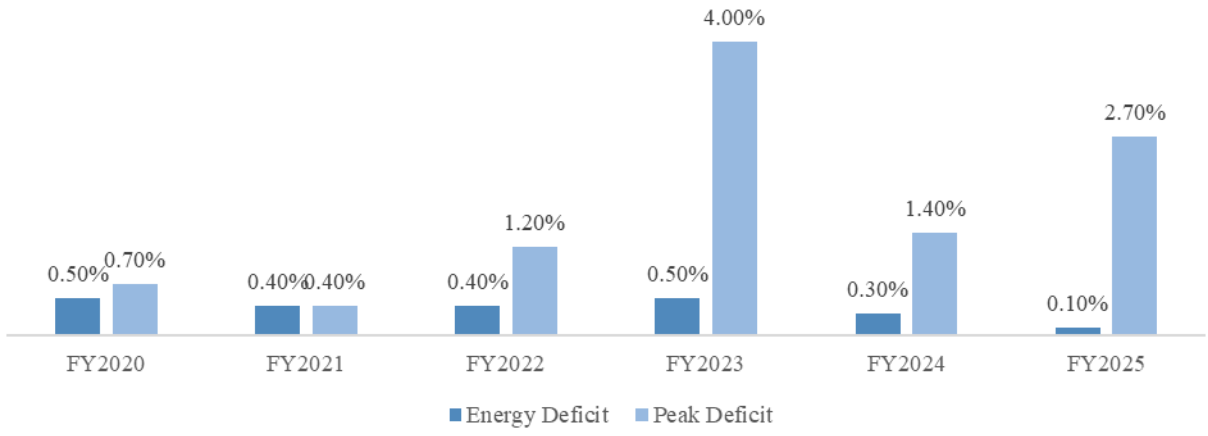
Source: Ministry of Power

3.5.Peak deficit and energy deficit trend in India

Peak deficit signifies the shortfall between peak electricity demand and the maximum supply the system can deliver at that moment. Even when the average annual deficit is low, high peaks can still trigger outages, load-shedding, or reliability concerns, particularly during summer heatwaves, evening hours, or industrial surges. Reducing peak deficit reflects not only growth in installed capacity but also improvements in storage deployment, flexible grid resources, and resilience measures that enable the system to manage sudden demand spikes. India's peak demand rose sharply from about 190 GW in January 2021 to nearly 250 GW in May 2024, yet the supply gap narrowed significantly over this period, demonstrating stronger system preparedness. Persistent or rising peak deficits, however, signal the need for additional peaking plants, expanded energy storage, and effective demand-side management to ensure reliability during critical hours.

The energy deficit the gap between demand and generation reduced from 0.50% in FY2020 to 0.30% in FY2024, and drop further to just 0.10% in FY2025, showing that supply is now almost meeting demand. The power generation in India has witnessed an addition of 1,94,394 MW of generation capacity over the last nine years. At present, the installed power generation capacity is about 4,26,132 MW. In FY2024, 9,943 MW of power generation capacity was added. Out of this, 1,674 MW accounted to fossil fuel sources and 8,269 MW accounted to non-fossil fuel sources. A total of 7,569 MW of renewable energy, including large hydro, was added. This includes 5,531 MW of solar, 1,931 MW of wind, 34 MW of biomass, 42 MW of small hydro, and 30 MW of large hydro. Around 1,93,000 circuit km of transmission lines have been built to create a single national power grid.[24]

Figure 3.5: Peak Deficit and Energy deficit in India, (In Percentage), FY2020 – FY2025



[24] https://static.pib.gov.in/WriteReadData/specificdocs/documents/2025/jun/doc2025622575501.pdf

Source: Central Electricity Authority (CEA) and Frost & Sullivan

Note: FY refers to 1st April to 31st March

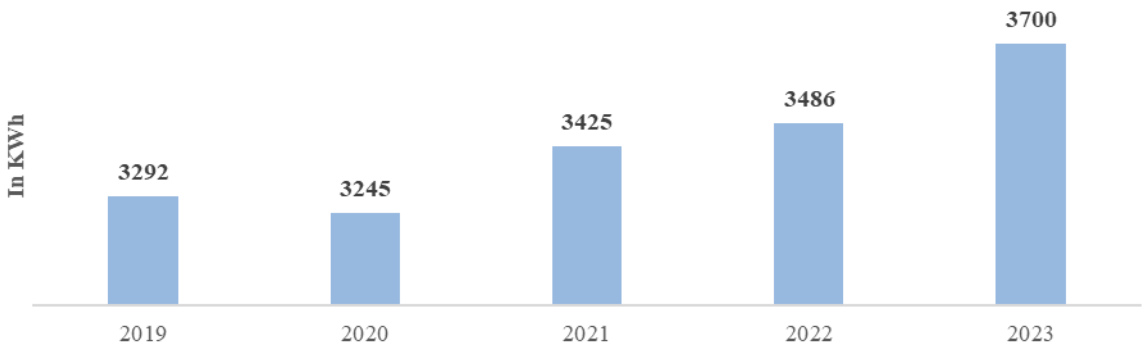
In rural areas, daily electricity supply increased from 12.5 hours in FY2015 to 21.9 hours in FY2024, while urban areas receive an average of 23.4 hours per day. The overall gap between electricity needed and supplied has come down sharply from 4.2% in FY2014 to 0.1% in FY2025. The small remaining gap is mostly due to issues in state-level power transmission and distribution systems, and financial problems faced by power distribution companies (DISCOMs). [25]

3.6.Statistics and Commentary on Global and Indian Power and Consumption Market

3.6.1. Global Per Capita Electricity Consumption

Global per capita electricity consumption rose steadily from 2019 to 2023. It was 3,292 kWh in 2019, dipped to 3,245 kWh in 2020, then increased to 3,425 kWh in 2021 and 3,486 kWh in 2022. By 2023, it reached approximately 3,700 kWh. This upward trend reflects economic recovery, expanded electricity access, and growing reliance on electricity in both industry and daily life.[26]

Figure 3.6: Global Per Capita Electricity Consumption, (In kWh), 2019 – 2023



Source: International Energy Agency (IEA)

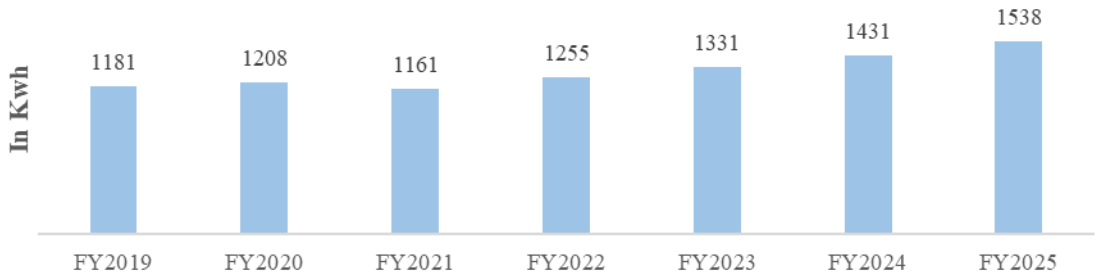
3.6.2. India's Per Capita Electricity Consumption

India's per capita electricity consumption has steadily increased in recent years, reflecting growing energy demand driven by population growth, urbanization, industrial development, and rising use of household appliances and gadgets, including air conditioners, washing machines, and other electrical devices. In FY2019, per capita consumption stood at 1,181 kWh. This increased to 1,431 kWh in FY2024, marking a growth of approximately 21% over five years and reached 1,538 kWh in FY2025, indicating continued improvement in access to electricity and living standards. [27] [28]

[25] https://www.pib.gov.in/PressReleasePage.aspx?PRID=2037000
[26] https://data.worldbank.org/indicator/EG.USE.ELEC.KH.PC
[27] https://cea.nic.in/wp-content/uploads/general/2024/General_Review_2024_2.pdf

[28]https://energy.economictimes.indiatimes.com/news/power/record-surge-in-indias-electricity-consumption-reaches-1538-kwh-per-capita/121756148

Figure 3.7: Per Capita Electricity Consumption in India, (In kWh), FY2019 – FY2025



Source: Central Electricity Authority (CEA)

3.6.3. Household Electrification

Household electrification in India has made significant progress in recent years, driven by government initiatives like the Pradhan Mantri Sahaj Bijli Har Ghar Yojana (SAUBHAGYA), which was launched by the Government of India in October 2017 with the objective of achieving universal household electrification. Under the scheme, electricity connections were to be provided to all willing un-electrified households in rural areas and to all willing poor households in urban areas across the country.

Approximately 28.60 Mn households were electrified under SAUBHAGYA from its inception until FY2022 (Up to March). In the State of Maharashtra, a total of 5,89,242 households were electrified under the scheme. This included:

- 5,42,914 rural households that were electrified through grid connections,
- 15,790 urban households that were electrified through grid connections, and
- 30,538 rural households that were electrified through off-grid solutions.

All sanctioned works under SAUBHAGYA have been successfully completed, and the scheme was officially closed on FY2022 (Upton March).

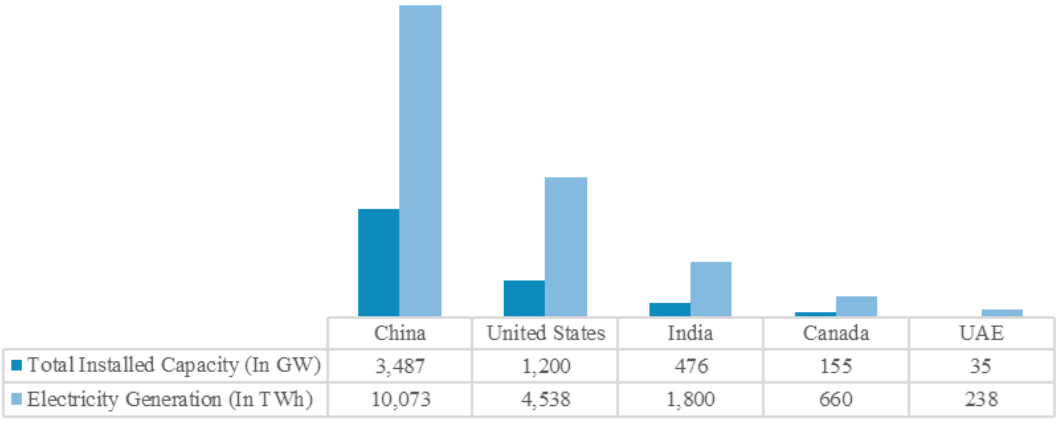
Additionally, the Revamped Distribution Sector Scheme (RDSS), support is being extended by the Government of India to states for electrifying households that were previously left out under the SAUBHAGYA scheme. Additionally, RDSS funding is being provided for on-grid electricity connections to Particularly Vulnerable Tribal Group (PVTG) households identified through the PM-JANMAN initiative. By July 2024, a total of 73,544 households had been electrified under RDSS, while 64,253 households had been electrified under Pradhan Mantri Janjati Adivasi Nyaya Maha Abhiyan (PM-JANMAN).[29]

3.6.4. India's position in the global power sector- (comparison with Developed and emerging economies (installed capacity, total power generation, consumption, and per capita electricity consumption)

India's growing influence in the global power sector was established through record-setting achievements across key metrics.

[29] https://www.pib.gov.in/PressReleasePage.aspx?PRID=2078460#:~:text=Government%20of%20India%20launched%20the,in%20urban%20areas%20in%20the

Figure 3.8: Global Power Sector Comparison, Installed Capacity vs Electricity Generation FY2025



	China	United States	India	Canada	UAE
Total Installed Capacity (In GW)	3,487	1,200	476	155	35
Electricity Generation (In TWh)	10,073	4,538	1,800	660	238

Source: Ministry of Statistics and Programme Implementation, PIB and Frost & Sullivan Analysis

By FY2025, the nation's total installed capacity was projected at approximately 476 GW, placing India as the third-largest power producer globally, following China (~3,487 GW) and the United States (~1,200 GW). Within this, the highest contribution was made by coal-based generation, which accounts for 221,813 MW, while renewable energy reached 2,20,096.35 MW, underscoring India's strong shift toward clean energy sources. [30] [31]

Electricity generation was expected to exceed 1,800 TWh in FY2024 – FY2025, ranking India third globally after China (~10,073 TWh) and the United States (~4,538 TWh). Within domestic consumption patterns, the industrial sector has emerged as the highest consumer, accounting for 42.00% of total electricity usage, indicating robust industrial activity and economic development. [32]

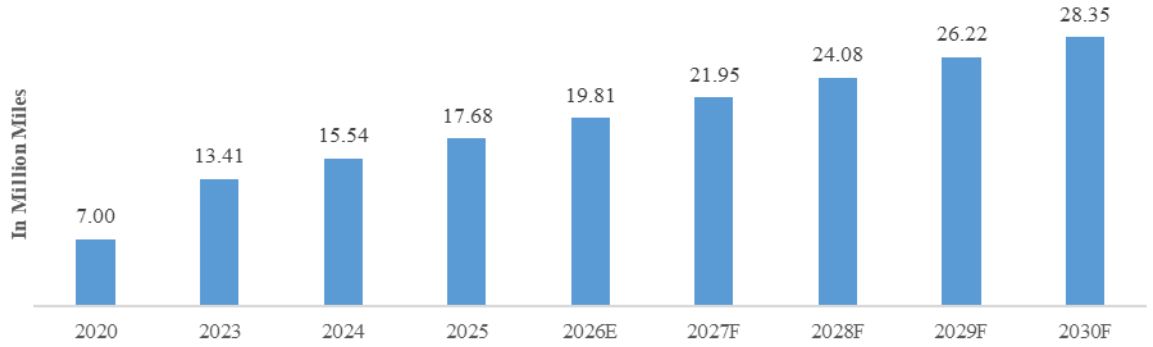
Although India's per capita electricity consumption is expected to reach 1,538 kWh in FY2025 [33]below the global average of ~3,600 kWh—it reflects a steady upward trajectory. The country's performance has been marked by significant investment, rapid infrastructure expansion, and improved energy access across urban and rural areas. India's ability to maintain the third-highest global position in both installed capacity and total power generation highlights its strategic progress, while its ongoing development points toward even greater potential in the coming years.

3.6.5. Global Growth in Transmission Line

It is estimated that there were around 7.00 Mn miles of transmission lines globally. This is expected to reach 28.35 Mn miles by 2030. The transmission line installation is expected to grow at a CAGR of 15.01% between the period 2020 to 2030. The growth in transmission lines is expected to be driven by China, US, and India, these three countries are expected to account to around 60% to 70% of the total installations during the forecast period. Another key driver for this market is the replacement of the older transmission lines.

[30] https://www.pib.gov.in/FactsheetDetails.aspx?Id=149218
[31] https://mospi.gov.in/sites/default/files/publication_reports/Energy_Statistics_2025/Energy%20Statistics%20India%202025_27032025.pdf
[32] https://www.cag.org.in/blogs/trends-electricity-consumption-india
[33]https://energy.economictimes.indiatimes.com/news/power/record-surge-in-indias-electricity-consumption-reaches-1538-kwh-per-capita/121756148

Figure 3.9: Global Growth in Transmission Line, (In Mn Miles), 2020 – 2030F



Source: International Energy Agency (IEA) and Frost & Sullivan Analysis

3.6.5.1. Planned Transmission Investments in Select Countries

The data from IEA indicates a planned investment towards transmission infrastructure at around USD 518.00 Bn between the period 2020-2040. The cumulative planned transmission investments by China and India are expected to account to 60% of the total investment during the above-mentioned period. France is also expected to account to around 20% of the total transmission related investment between 2020-2040F. [34]

Table 3.1: Planned Transmission Investments in Select Countries, (In Ckm), 2020 – 2040F

Planned Transmission Investments	Between the Years	USD Bn
China	(2021-2025)	205.00
India	(2024-2032)	110.00
France	(2024-2040)	104.00
United Kingdom	(2026-2031)	49.00
Brazil	(2024-2034)	21.00
Vietnam	(2021-2030)	15.00
Spain	(2021-2026)	8.00
South Africa	(2025-2034)	6.00

Source: International Energy Agency (IEA)

3.6.6. Power Transmission & Distribution Grid expansion plans and investment planned

India is executing a comprehensive and ambitious plan to expand and modernize its power transmission and distribution grid to support rapid demand growth and large-scale renewable energy integration.

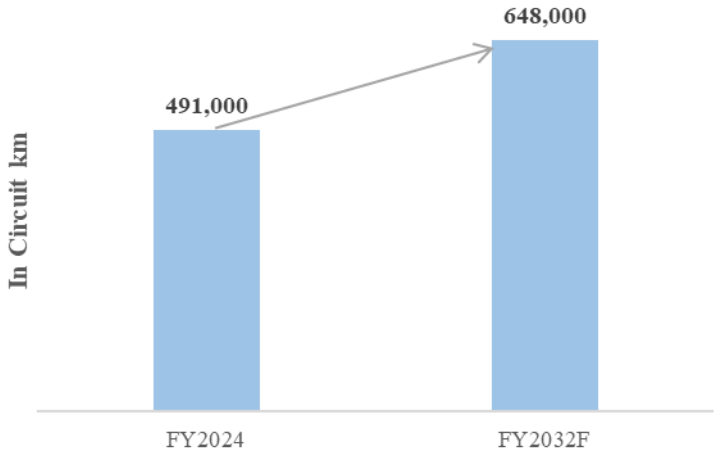
3.6.6.1.Transmission Network Expansion:

The government aims to expand the transmission network from 491,000 circuit kilometres (circuit km) in FY2024 to 648,000 circuit km by FY2032, which is an increase of around 32.00%. To support the growing share of renewable energy generation, the government has introduced the National Electricity Plan (Transmission), which outlines the addition of approximately 191,474 circuit kilometres of transmission lines and 1,274 Giga Volt Ampere (GVA) of transformation capacity between FY2022 – FY2023 and FY2031 – FY2032. The plan also includes the development of 33.25 GW of High Voltage Direct Current (HVDC) bi-pole links to enable efficient long-distance power transfer while minimizing losses. Furthermore, India's inter-regional transmission capacity is expected to rise from the current 119 GW to 143 GW by FY2027, and further to 168 GW by FY2032. This planned expansion is crucial for addressing

[34] https://iea.blob.core.windows.net/assets/a688d0f5-a100-447f-91a1-50b7b0d8eaa1/BuildingtheFutureTransmissionGrid.pdf

the regional imbalance between power generation and demand, especially given that renewable energy resources are heavily concentrated in a few states with high solar and wind potential. [35]

Figure 3.10: Growth in Transmission Line in India, (In Ckm), FY2024 – FY2032F



Source: Central Electricity Authority (CEA) and Ministry of Power

This expansion will support a projected peak demand of 458 GW by FY2032F and facilitate the integration of 500 GW of renewable energy by FY2032F and 600 GW by FY2032F. The plan includes the addition of 190,000 ckm of new transmission lines and a significant increase in substation capacity from 1,251 Gigavolt-Ampere (GVA) to 2,342 Gigavolt-Ampere by FY2032F.

The Revamped Distribution Sector Scheme (RDSS) aims to reduce losses, modernize infrastructure, and improve reliability across states. Focus on reconductoring legacy corridors with High-Temperature Low-Sag (HTLS) conductors to boost capacity without new land acquisition. The government launched an investment initiative of INR 9.12 Tn (USD 110.00 Bn) by FY2032F for transmission system expansion. Over INR 2.40 Tn is earmarked by FY2030 for upgrades and modernization alone. [36]

3.6.7. Private Investments in Electric Power Transmission

Private investment has become a key part of expanding India's power transmission system. Most new projects are executed through competitive bidding process, supported by government policies that encourage private funding and offer steady returns. Over the past ten years, private companies have played a growing role in building and improving transmission networks, helping to increase capacity, boost efficiency, and speed up the development of modern infrastructure. Earlier, this sector was mainly managed by government-owned companies like the Power Grid Corporation of India Limited (PGCIL). However, with the introduction of the Tariff-Based Competitive Bidding (TBCB) system has encouraged more private players to enter this space. TBCB is the main method used to award new projects, and by FY2032F, more than 90% of these projects are expected to be allocated through this process. [37]

Under the TBCB model, transmission projects are given to the company that offers the lowest bid. This approach promotes transparency, reduces costs, and encourages more companies to take part. By January FY2025, a total of 135 Interstate Transmission System (ISTS) projects had been put up for bidding under TBCB, with 74 projects awarded to private companies. Leading private players such as Adani Energy Solutions, Sterlite Power, Tata Power, and L&T Infrastructure Development Projects have made significant investments in both interstate and intrastate transmission networks. These companies are actively building and operating large transmission lines, including High Voltage Direct Current (HVDC) lines and green energy corridors, which help bring renewable energy into the national grid more efficiently.[38] Oswal Cables is committed towards green energy, and the company's setups are green energy compliant - LEEDS compliant facility and GRIHA 4-star application in progress

Private investments have also been encouraged through policy reforms, including the Electricity Act amendments, ease of Right-Of-Way (RoW) clearances, and guaranteed long-term returns under the regulated tariff mechanism.

[35] https://www.tndindia.com/power-transmission-for-economic-development/
[36] https://www.tndindia.com/power-transmission-for-economic-development/
[37] https://www.news18.com/business/is-india-missing-the-spark-transmission-sector-needs-private-surge-ws-el-9351840.html
38 https://www.pib.gov.in/PressReleasePage.aspx?PRID=2043155

Additionally, the National Monetisation Pipeline (NMP) includes monetization of transmission assets, opening further avenues for private capital infusion.

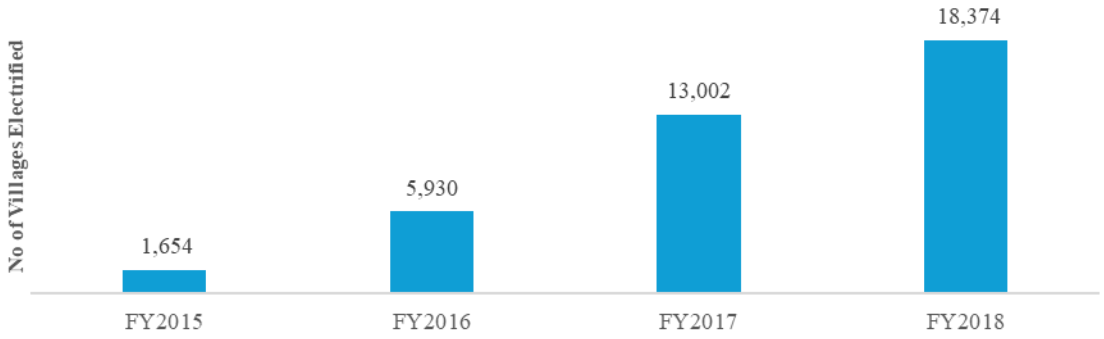
3.6.8. Government initiatives and regulations to enhance power distribution network and Rural Electrification

The Indian government has launched major initiatives and regulatory reforms to strengthen the power distribution network and achieve rural electrification. Flagship schemes like the Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY) and SAUBHAGYA have enabled 100% village electrification and connected over 28 Mn households to the grid. The Revamped Distribution Sector Scheme (RDSS), with an INR 3 trillion outlay, targets reducing losses, modernizing infrastructure, and improving reliability. These efforts, combined with regulatory reforms, tariff rationalization, and technology adoption, have significantly enhanced access, efficiency, and financial sustainability in India's power sector. [39]

3.6.8.1. Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY)

The Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY) was started by the Government of India in December 2014 to improve electricity supply in rural areas. Under this scheme, important work was done such as separating power lines for farming and non-farming use, strengthening and upgrading the local power network, and installing meters for transformers, feeders, and users. One of the main goals of the scheme was to provide free electricity connections to families living Below the Poverty Line (BPL). Electricity access was also provided to rural households so that their living conditions could be improved. As of 28th April, FY2018, the total number of electrified villages were around 18,374, under the Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY).[40]

Figure 3.11: Villages Electrified under DDUGJY, FY2015-FY2018



Source: Ministry of Power

3.6.8.2. Pradhan Mantri Sahaj Bijli Har Ghar Yojana (SAUBHAGYA)

The Government of India started the Pradhan Mantri Sahaj Bijli Har Ghar Yojana (SAUBHAGYA) in October 2017 to bring electricity to every household in the country. All willing households were electrified under this scheme. The household electrification in India increased from 26.20 Mn households in FY2019 to 28.60 Mn households in FY2022 under the SAUBHAGYA scheme.[41] [42]

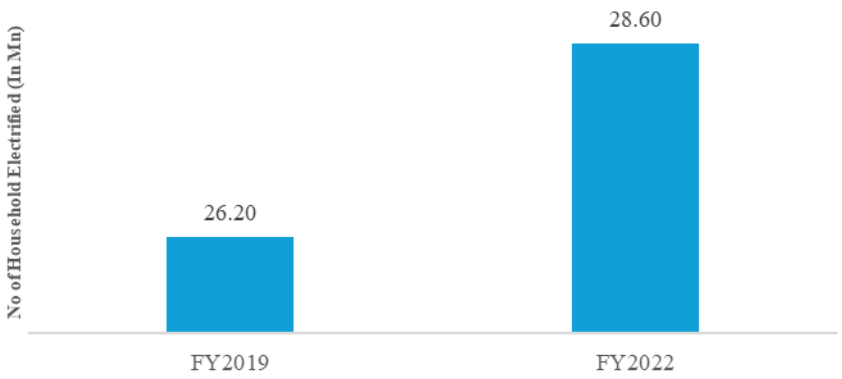
[39] https://www.pib.gov.in/PressNoteDetails.aspx?NoteId=154717&ModuleId=3

[40] https://www.pib.gov.in/PressReleasePage.aspx?PRID=1897040#:~:text=Press%20Release:Press%20Information%20Bureau,31st%20March%2C%202019%20respectively.

[41] https://www.pib.gov.in/PressReleseDetailm.aspx?PRID=2078460#:~:text=around%202.86%20crore%20households%20have%20been%20electrified

[42] https://www.impriindia.com/insights/saubhagya-yojana/

Figure 3.12: Total Households Electrified in SAUBHAGYA (FY2019 - FY2022)



Source: Ministry of Power

The state wise household electrified is given below:

Table 3.2: Total Households Electrified in SAUBHAGYA & DDUGJY scheme

Sl. No.	States/UTs	Number of Households Electrified
1	Andhra Pradesh	1,81,930
2	Arunachal Pradesh	47,089
3	Assam	23,26,656
4	Bihar	32,59,041
5	Chhattisgarh	7,92,368
6	Gujarat	41,317
7	Haryana	54,681
8	Himachal Pradesh	12,891
9	Jammu & Kashmir	3,77,045
10	Jharkhand	17,30,708
11	Karnataka	3,83,798
12	Ladakh	10,456
13	Madhya Pradesh	19,84,264
14	Maharashtra	15,17,922
15	Manipur	1,08,115
16	Meghalaya	2,00,240
17	Mizoram	27,970
18	Nagaland	1,39,516
19	Odisha	24,52,444
20	Puducherry	912
21	Punjab	3,477
22	Rajasthan	21,27,728
23	Sikkim	14,900
24	Tamil Nadu	2,170
25	Telangana	5,15,084
26	Tripura	1,39,090
27	Uttar Pradesh	91,80,571
28	Uttarakhand	2,48,751
29	West Bengal	7,32,290

Total	**2,86,13,424**

Source: Ministry of Power

The DDUGJY and SAUBHAGYA schemes have played pivotal roles in transforming India's rural electrification landscape, expanding access to millions, and driving social and economic development. The government's focus on both infrastructure and innovative technologies has made India a model for large-scale rural electrification, though ongoing efforts are needed to ensure consistent and sustainable power supply for all.

3.6.8.3.Funding Facilities for Infra Sector

The Indian Union Budget 2025-26 places a significant emphasis on infrastructure development as a critical driver for economic growth, job creation, and sustainable development. Recognizing infrastructure as a foundation for India's vision of becoming a developed nation by 2047 ("Viksit Bharat @ 2047"), the budget allocates a substantial portion of capital expenditure to upgrade and expand infrastructure across all sectors

1. **Capital Expenditure (Capex):**
    - Total capital expenditure allocation is INR 11.21 lakh crore (about 3.10% of GDP), marking a 10.10% increase over the previous year.
    - This capex budget spans sectors such as transport, energy, urban infrastructure, water, defence, and rural development.
2. **Sectoral Allocations:**
    - **Rural Development:** INR 1,90,406.00 Cr, including a rise in funds for rural housing and connectivity programs like Pradhan Mantri Gram Sadak Yojana (PMGSY).
    - **Water & Jal Shakti:** INR 99,503.00 Cr focused on better water management, reaching rural households under Jal Jeevan Mission.
    - **Defence Infrastructure:** INR 1.80 lakh crore allocated for capital outlay, a 12.90% increase over the previous year reflecting modernization efforts.
    - **Road Infrastructure:** Toll collections expected to rise to INR 36,000.00 Cr, a 44.00% increase, supporting enhanced road maintenance and new projects.[43]
3. **Funding Facilities & Schemes:**
    - The government continues with a scheme to provide interest-free loans to states of INR 1.5 lakh crore to accelerate capital expenditure.
    - Strong emphasis on Public-Private Partnerships (PPP) and private-sector participation backed by policy reforms.
    - The government's Asset Monetization Plan (2025-2030) aims to unlock existing infrastructure asset values to raise funds for new infrastructure.
4. **Strategic Initiatives:**
    - Investments in energy transition, clean energy infrastructure, and digital infrastructure are prioritized to support sustainable growth.
    - Infrastructure development is planned to improve connectivity, increase MSME productivity, and enable urban and rural transformation.

[43] https://prsindia.org/files/budget/budget_parliament/2025/Union_Budget_Analysis_2025-26.pdf

- Dedicated focus on sectors such as railways, ports, metros, and airports to enhance logistics and trade efficiency

3.6.8.4.Urban Infrastructure Development Fund (UIDF)

The Urban Infrastructure Development Fund (UIDF) is a central government initiative established to finance critical urban infrastructure projects in India's Tier-2 and Tier-3 cities. It was announced in the FY2024 Union Budget and operationalized with an initial corpus of INR 10,000.00 Cr. The fund is administered by the National Housing Bank (NHB) and modeled closely after the existing Rural Infrastructure Development Fund (RIDF). Its primary aim is to provide stable and long-term financing to public agencies, municipal corporations, and urban local bodies (ULBs) for delivering essential services such as water supply, sanitation, sewage, drains, and solid waste management.

Target Cities and Objectives

UIDF focuses on cities with populations ranging from 50,000 to under 1 Mn, encompassing:

- **Tier-3 cities**: 580 towns with population between 50,000 to 99,999
- **Tier-2 cities**: 459 towns with population between 1 lakh to 9,99,999.
  This focus aims to address infrastructure gaps in mid-sized urban centres, which account for around 40% of India's urban population

Eligible infrastructure projects under UIDF include:

- Water supply networks (new or rehabilitated)
- Stormwater and drainage systems
- Sewage systems and treatment plants
- Solid waste management facilities
- Construction of roads, overbridges, crematoriums
- Comprehensive area development (e.g., heritage conservation, transit-oriented development)

Financing Terms

UIDF offers attractive financing terms to ease fiscal burden on states:

- **Interest rate**: Bank Rate minus 1.50%
- **Repayment period**: 5 equal annual instalments over 7 years, inclusive of a 2-year moratorium
- **Interest payments**: Made quarterly during the repayment phase

UIDF provides structured and predictable financing for essential urban infrastructure, especially in otherwise underserved mid-sized cities. By doing so, it supports the improvement of public services, bolsters local governance capacity, and promotes balanced regional development.[44]

3.6.8.5.Green Energy Corridors (GEC)

The Green Energy Corridors (GEC) initiative is a major program by the Indian government aimed at developing intra-state transmission systems to integrate renewable energy into the power grid. Initiated in 2015 following a 2012 PGCIL study, the GEC supports large-scale integration of solar and wind energy. By end-2024, India's green energy capacity reached 214 GW, up 14% from 2023, with nearly 15 GW added between April and November. The country remains

[44] https://www.nhb.org.in/urban-infrastructure-development-fund-uidf/

on track to meet its 500 GW non-fossil target by 2030Supported by Central Financial Assistance (CFA), the initiative covers ten states across two phases to ensure efficient evacuation of renewable power.

- **Phase-I**: Implemented in eight renewable-rich states, Andhra Pradesh, Gujarat, Himachal Pradesh, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan, and Tamil Nadu by their respective State Transmission Utilities (STUs), focusing on building strong internal transmission networks.
- **Phase-II**: Implemented in seven states: Gujarat, Himachal Pradesh, Karnataka, Kerala, Rajasthan, Tamil Nadu, and Uttar Pradesh.

3.6.8.6.PLI Scheme - National Programme on High Efficiency Solar PV Modules

The Production Linked Incentive (PLI) Scheme – National Programme on High Efficiency Solar PV Modules is a key initiative by the Government of India to promote domestic production of advanced solar photovoltaic (PV) modules and reduce dependence on imports. With a total budget of INR 24,000 crore, the scheme is being rolled out in two phases to support gigawatt-scale manufacturing of high-efficiency solar modules.

Tranche-I offers financial incentives for five years after commissioning, based on the volume, efficiency, and domestic content of the modules produced. This has played a major role in transforming India's solar manufacturing sector, with capacity growing from 2 GW a decade ago to around 70 GW by 2025. In 2024 alone, 25.3 GW of new module capacity and 11.6 GW of solar cell capacity were added.

Tranche-II is expected to generate around 195,000 direct and 780,000 indirect jobs. Despite some delays, the PLI scheme remains crucial to India's renewable energy goals and energy self-reliance.

3.6.8.7. Tariff Based Competitive Bidding (TBCB)

Tariff Based Competitive Bidding (TBCB) is a transparent and market-driven mechanism introduced by the Indian government to allocate power transmission projects. It replaces the traditional cost-plus model by awarding projects to developers offering the lowest tariff, in line with Section 63 of the Electricity Act 2003 and the 2006 bidding guidelines. The primary goal of TBCB is to enhance competition, attract private sector participation, and ensure cost-effective and timely development of transmission infrastructure.

Over the past few years, TBCB has been used to award dozens of interstate transmission projects, with a total value exceeding INR 50,000.00 Crore. For example, a single bidding round was expected to include eight projects worth around INR 4,697.00 Crore. The model has encouraged the participation of major private companies such as Adani Transmission, Sterlite Grid, and Essel Infra. With the 2024 draft guidelines, public sector undertakings (PSUs) are also permitted to compete equally with private firms.

TBCB has resulted in significant cost savings, with tariffs reduced by 20–30% compared to cost-plus models, due to competitive pressure and improved project execution. The bidding process involves two stages: Request for Qualification (RFQ) and Request for Proposal (RFP), with strict timelines and evaluation criteria focused on levelized tariffs, technical specifications, and financial viability

3.6.9. Climate related challenges globally and need for energy transition

The world today is confronted with a growing climate crisis, marked by increasing global temperatures, an increasing frequency of extreme weather events, sea-level rise, and ecosystem disruptions. These effects are being driven primarily by the excessive accumulation of greenhouse gases (GHGs) in the atmosphere, caused by human activities such as the combustion of fossil fuels, deforestation, and industrial processes. The energy sector, particularly power generation is recognized as a major contributor to these emissions, with over 40.00% of global CO_2 output being attributed to it.

Under the Paris Agreement and through subsequent Conference of the Parties (COP) meetings, ambitious goals have been established to limit the rise in global temperatures to well below 2°C, with efforts aimed at keeping it under 1.5°C. Achieving these targets requires that rapid decarbonization be undertaken, along with increased reliance on renewable energy sources, improvements in energy efficiency, and substantial investment in clean technologies.

3.6.9.1.COP 26 and India's NDC declarations

The COP26, held in Glasgow in 2021, major announcements were made by India to show its commitment to climate action while continuing economic development. These steps were confirmed through India's updated Nationally Determined Contributions (NDCs) under the Paris Agreement. The key promises made included:

- A target for net-zero carbons emissions by FY2070
- A goal of reaching 500 GW of non-fossil energy capacity by FY2030
- Meeting 50% of electricity demand from renewables by FY2030
- A 45% reduction in emissions intensity of GDP from FY2005 levels by FY2030
- Avoidance of 1 Bn tonnes of carbon emissions by FY2030

These targets marked a shift from fossil fuel dependence toward a cleaner and more diverse energy mix. Policy support was also provided through initiatives like production-linked incentives (PLIs) for solar manufacturing, development of battery storage, and new rules to encourage offshore wind and power market reforms.

India's declarations were welcomed by the global community. The principle of common but differentiated responsibilities was highlighted, stressing that while all countries must act, developed nations must lead and support developing countries through funding and technology sharing. [45]

3.6.9.2. CEA plan on generation mixes till FY2032F, mainly on clean energy penetration

The government has outlined a generation mix roadmap to support the country's NDCs and energy transition. This roadmap, called the National Electricity Plan (Generation), shows how India's power mix will be changed to include more clean energy, while keeping power affordable and reliable.

- India aims to achieve a total installed power generation capacity of around 900 GW, with over 62% approximately 560 GW expected to come from non-fossil fuel sources such as solar, wind, hydro, and nuclear by FY2032F.
- Within this mix, renewable energy capacity is projected to reach between 500 GW – 600 GW, including around 270 GW from solar and 110 GW from wind energy. While thermal power capacity, primarily coal-based, is likely to remain stable or reduce in terms of its overall share, it will be upgraded and operated with greater flexibility to ensure grid stability.

India's ambitious energy transition and climate goals are supported by the substantial investments and policy reforms by the government across several critical areas:

- **Battery Energy Storage Systems (BESS) and Green Hydrogen BESS:** Large-scale battery storage projects are being planned and tendered to provide grid flexibility, manage renewable intermittency, and ensure round-the-clock power supply. The aim is to add over 47 GW of energy storage by FY2032F.
- **Green Hydrogen:** India is promoting green hydrogen as a clean fuel for industry and transport, with incentives for electrolyser manufacturing and pilot projects under the National Green Hydrogen Mission.
- **Flexibilization of Thermal Power Plants:** Existing coal and gas power plants are being upgraded to operate more flexibly. This allows them to ramp up or down quickly, complementing the variable output from wind and solar and maintaining grid stability.
- **Green Energy Corridor:** This flagship project is expanding to connect renewable-rich states like Gujarat, Rajasthan, Tamil Nadu, and Karnataka with major demand centres. The corridor includes new high-capacity transmission lines and substations, enabling the evacuation and balancing of large-scale renewable power.
- **Transmission Modernization:** Investments in HVDC lines, advanced conductors, and digital monitoring systems are improving efficiency and reliability across the grid. [46]

Regulatory Reforms

- **Renewable Energy Certificates (RECs):** The REC mechanism is being strengthened to allow utilities and industries to meet renewable purchase obligations flexibly and transparently.

[45] https://www.pib.gov.in/PressReleasePage.aspx?PRID=1795071

46 https://powerline.net.in/2025/03/06/enhancing-grid-stability-ceas-advisory-on-co-locating-energy-storage-with-solar-power-projects/#:~:text=The%20government%20has%20been%20taking,penetration%20of%2050%20per%20cent.&text=power%20sector.

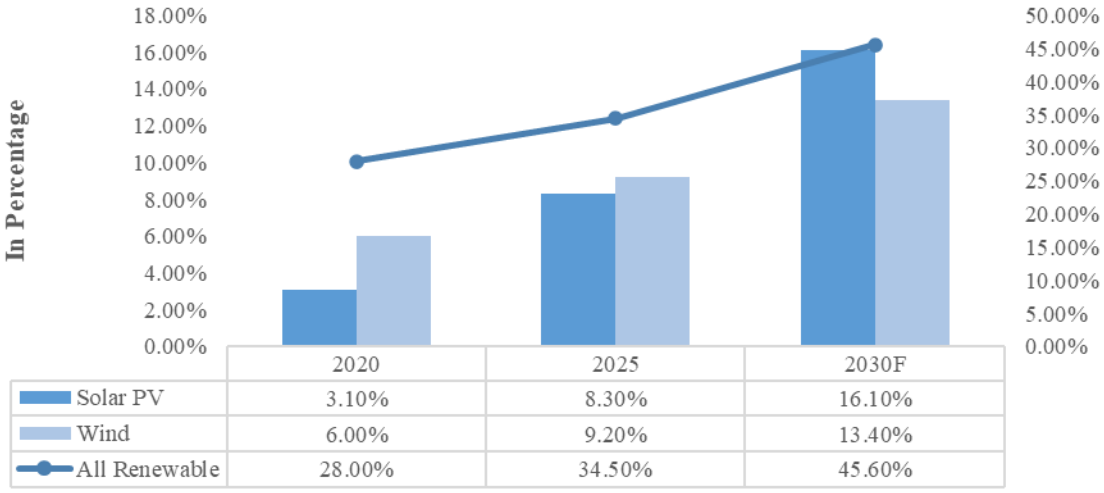
- **Carbon Trading:** India is developing a national carbon market, enabling trading of emission reductions, and incentivizing cleaner technologies.
- **Open Access Reforms:** Regulatory changes are making it easier for large consumers to buy renewable power directly from producers, fostering competition and accelerating clean energy adoption.

India's clean energy transition is underpinned by investments in storage, green hydrogen, and modern grid infrastructure, along with regulatory reforms to create a competitive and flexible power market. The expansion of the Green Energy Corridor and market-based tools like RECs and carbon trading are crucial for integrating renewables at scale. Achieving these goals will require strong intergovernmental collaboration and robust private sector engagement

3.7.Global Renewable Energy Mix

The global renewable energy electricity generation is expected to reach 17,577 TWh by 2030. The overall renewable energy is expected to account to 45.60% of the total electricity generated. By 2026, both wind and solar power generation are projected to exceed nuclear power generation. Subsequently, by 2029, solar PV is expected to overtake hydropower to become the world's largest source of renewable electricity, followed by wind power surpassing hydropower in 2030.

Figure 3.13: Global Renewable Energy Mix, (In TWh), 2020-2030F



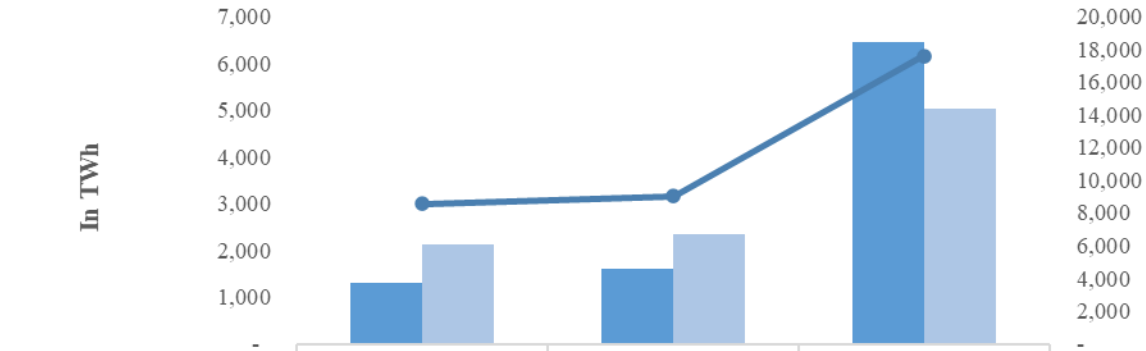
	2020	2025	2030F
Solar PV	3.10%	8.30%	16.10%
Wind	6.00%	9.20%	13.40%
All Renewable	28.00%	34.50%	45.60%

Source: International energy Agency (IEA)

3.7.1. Power Generation Capacity Addition by Renewable Energy Sources

Global renewable energy generation has shown strong growth, with total output increasing from 8,567 TWh in 2022 to 9,029 TWh in 2023. This upward trajectory is expected to continue and is estimated to reach 17,577 TWh by 2030. Solar energy has been the fastest-growing segment, increasing from 1,294 TWh in 2022 to 1,612 TWh in 2023, and is forecasted to reach 6,452 TWh by 2030, driven by declining technology costs, policy support, and widespread adoption. Wind power also continues to expand, with generation increasing from 2,120 TWh in 2022 to 2,336 TWh in 2023 and projected to nearly double to 5,024 TWh by 2030. These trends reflect a global shift towards clean energy sources and underline the critical role of solar and wind in driving future renewable capacity growth.

Figure 3.14: Power Generation Capacity Addition by Renewable Energy Source, (In TWh), 2020-2030F



	2022	2023	2030F
Solar	1,294	1,612	6,452
Wind	2,120	2,336	5,024
All Renewable Energy	8,567	9,029	17,577

Source: International energy Agency (IEA)

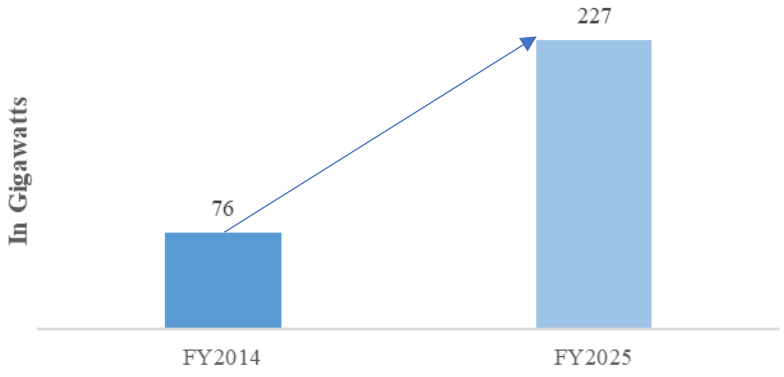
3.8.India's Renewable Energy Sector Overview

India's renewable energy sector has witnessed substantial expansion over the past decade, positioning the country as a global leader in clean energy adoption. This progress was supported by ambitious government targets, enabling policies, and large-scale investments in solar, wind, and other renewable technologies. As of FY2024, globally India ranks 4th in overall installed renewable energy capacity. Specifically, the country holds the 4th position in both wind and bio power installations, and the 5th position in solar and hydro power capacity. [47]

3.8.1. Installed Capacity and Growth Trends

India's renewable energy capacity has witnessed substantial growth, increasing from 76 GW in FY2014 to an estimated 227 GW in FY2025[48], reflecting a rise of nearly 199% over the period. This remarkable expansion underscores the country's rapidly advancing shift toward cleaner and more sustainable energy solutions. Rajasthan, Gujarat, and Madhya Pradesh led new capacity additions, with Rajasthan alone accounting for 33% of the new installations in FY2025.[49]

Figure 3.15: Renewable Energy Growth in India, (In GW), FY2014-FY2025

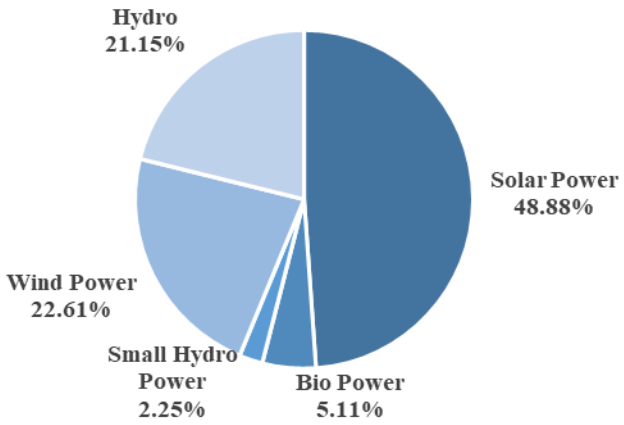


Source: Ministry of Power

[47] https://cdnbbsr.s3waas.gov.in/s3716e1b8c6cd17b771da77391355749f3/uploads/2024/10/20241029512325464.pdf
[48] https://www.pib.gov.in/PressNoteDetails.aspx?id=154717&NoteId=154717&ModuleId=3
[49] https://energy.economictimes.indiatimes.com/news/renewable/india-adds-1707-mw-of-new-renewable-energy-capacity-in-may-rajasthan-leads-with-33-share/121611595

India's power sector is one of the most diversified globally, encompassing electricity generation from renewable sources like solar, wind, biomass, small and large hydro. In response to increasing electricity demand, the country is steadily expanding its energy capacity to support both economic growth and long-term sustainability objectives

Figure 3.16: Renewable Energy Installed Power Capacity Mix, (In GW), FY2025



Source: Ministry of Power

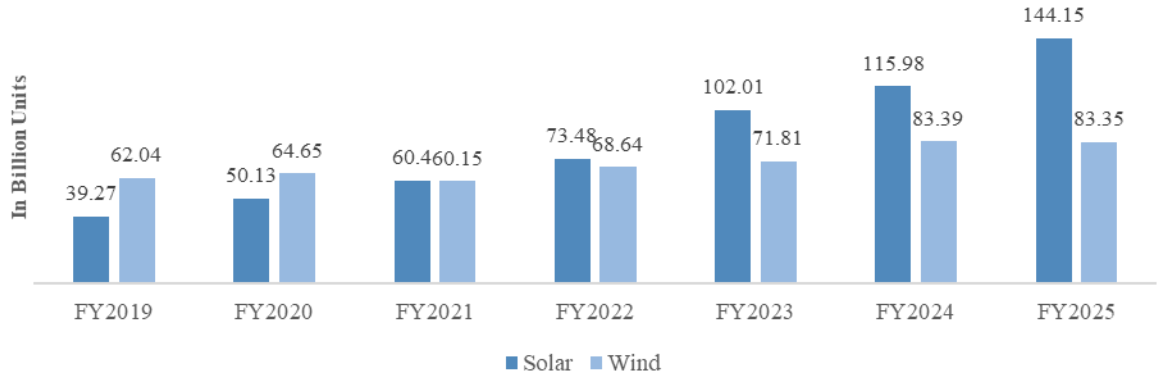
India's total installed power capacity in FY2025 demonstrates a robust and increasing contribution from renewable energy sources. Solar power accounted to the largest share, with 110.90 GW, making up about 48.88% of the total. Wind power accounted to 51.30 GW, contributing 22.61% to the mix. Hydro power (excluding small hydro) accounted for 48.00 GW, or 21.15% of the capacity. Installed Bio-power accounted to 11.60 GW, representing 5.11% of the total, while small hydro power reached 5.10 GW, contributing 2.25%. This diverse and balanced energy mix reflects India's strong commitment to building a sustainable, low-carbon, and resilient power sector to meet its growing energy demands. Oswal Cables has 5 wind power plant for the total capacity of 4.11 MW, out of which 4 are in Rajasthan and 1 is in Maharashtra. The Company has also established solar plants and has already installed grid-connected solar capacity of 5MW under the Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan (PM-KUSUM) Scheme, aimed at promoting the use of solar energy in the agriculture sector to reduce reliance on diesel and curbing environmental pollution. Another 2.5MW is under installation. Oswal cables has 2 solar power plants with the total capacity of 7.50 MW located in Rajasthan

3.9.Power Generation capacity addition by renewable energy sources (specifically Solar and wind) – historical and outlook

India has experienced substantial growth in power generation from renewable energy sources over the past decade. Renewable energy generation increased from 190.96 Bn units (BU) in 2014–15 to approximately 370.65 BU during April 2024 to February 2025,[50] nearly doubling over the period. As a result, the share of renewables in the country's total power generation has grown from 17.20% to around 22.20%.

[50] https://www.pib.gov.in/PressNoteDetails.aspx?NoteId=154717&ModuleId=3

Figure 3.17: Renewable Energy Generation, (In BU), FY2019-FY2025



Source: Ministry of Power

India's renewable energy generation has witnessed notable changes in recent years, particularly in solar and wind segments. Solar power generation increased from 39.27 Bn units (BU) in FY2019 to 144.15 BU in FY2024, with a CAGR of 24.20% reflecting rapid capacity addition and improved efficiency. Wind power generation also increased from 62.04 BU in FY2019 to 83.35 BU in FY2025, with a CAGR of 5.04% between the mentioned period.

3.10. Commentary on renewable energy capacity addition plan in the future

India has charted an ambitious path toward transforming its energy mix, with a strong focus on expanding renewable energy capacity. This transition is both climate-driven and strategic, aimed at enhancing energy security, promoting sustainability, and supporting economic growth.

India's renewable energy sector is planned to be expanded quickly and on a large scale across different sources. Between FY2025 and FY2030, major increases in capacity are expected, especially in solar and wind energy, which are expected to be the main growth segments. The highest addition is likely to be in solar power, with capacity projected to increase from 12,262.20 MW in FY2025 to 29,229.67 MW by FY2030 with a CAGR of 18.97%, showing its important role in the energy shift.

Wind power capacity is projected to rise from 8,911.00 MW to 17,771.00 MW, reflecting a CAGR of 14.80%. Biomass-based capacity is expected to grow from 621.40 MW to 828.33 MW at a CAGR of 5.92%, while small hydro capacity is forecast to increase from 392.80 MW to 524.00 MW at a CAGR of 5.93% during the same period. In contrast, large hydro capacity is anticipated to decline slightly, from 2,193.00 MW in FY2025 to 1,819.33 MW by FY2030.

Figure 3.18: Renewable Energy Installed Capacity Addition, (In MW), FY2025-FY2030F

	FY2025	FY2030F
Solar Power	12,262.20	29,229.67
Wind Power	8,911.00	17,771.00
Biomass	621.40	828.33
Small Hydro	392.80	524.00
Hydro	2,193.00	1,819.33

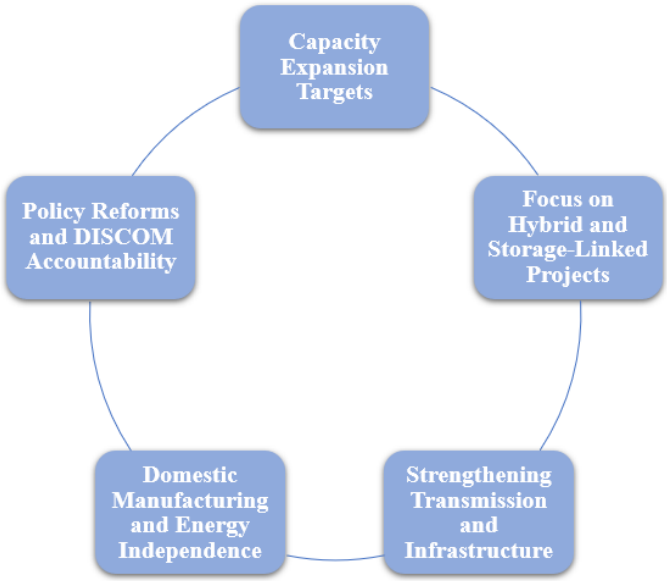
Source: Ministry of Power

In FY2025, solar energy dominated capacity additions, with 23.83 GW added compared to 15.03 GW in the previous year, bringing total installed solar capacity to 105.65 GW, including ground-mounted, rooftop, hybrid, and off-grid systems. Wind energy continued its steady rise with 4.15 GW of new capacity, reaching a cumulative 50.04 GW. Bioenergy capacity now totals 11.58 GW, while small hydro projects have achieved 5.10 GW, with 0.44 GW under implementation. These developments underscore India's commitment to a decentralized and diversified renewable energy mix, supporting sustainable growth and energy transition goals.[51]

3.10.1. India's Renewable Energy Expansion: Capacity Targets, Policy Actions, and Challenges

India's renewable energy expansion is guided by bold capacity targets, supportive policy actions, and a growing emphasis on sustainability

Figure 3.19: Renewable Energy Installed Capacity , Capacity Targets, Policy Actions, and Challenges



Source: Frost & Sullivan Analysis

1. Capacity Expansion Targets

India aims to achieve 500 GW of non-fossil fuel capacity by FY2030. As of now:

- By FY2026, the total renewable energy capacity (including large hydro) is projected to reach 250 GW, nearly half the FY2030 target.
- Over 75 GW of renewable capacity is expected to be added during FY2025 – FY2027, representing a sharp increase from previous years.
- This growth will be led by solar and wind installations, supported by increased investment and policy measures.

2. Focus on Hybrid and Storage-Linked Projects

To address the intermittency challenge of renewables:

- India is promoting hybrid systems (solar + wind).

[51] https://www.pib.gov.in/PressReleasePage.aspx?PRID=2120729

- Storage-integrated projects using Battery Energy Storage Systems (BESS) and pumped hydro are gaining traction.
- These projects now represent over 37.00% of planned capacity additions, up from 17.00%, signalling a growth market.

3. Strengthening Transmission and Infrastructure

As outlined in the National Electricity Plan:

- An investment of INR 9.15 Tn is planned by FY2032.
- 191,000 circuit km of transmission lines and 1,270 GVA of transformation capacity will be added.
- Green Energy Corridors are being expanded to efficiently deliver power from resource-rich states to demand centres.

4. Domestic Manufacturing and Energy Independence

Under the PLI Scheme, India is expanding its solar PV manufacturing:

- India's solar module manufacturing capacity witnessed a significant expansion, nearly doubling from 38 GW in FY2024 to 74 GW in FY2025.
- Investments in green hydrogen, off-grid systems, and large-scale manufacturing are being scaled up.
- These efforts aim to reduce import dependency and generate employment.

5. Policy Reforms and DISCOM Accountability

To improve execution:

- Power distribution companies (DISCOMs) are now required to process clean energy contracts within 30 days. Faster execution of Power Purchase Agreements (PPAs) is being mandated.
- These reforms are critical to sustaining the momentum of renewable capacity growth.

India's renewable energy capacity is being significantly expanded, with around 24,380 MW of additions expected in FY2025. If this pace continues, renewables may contribute 35.00% – 40.00% of the energy mix by FY2030, supporting climate and energy goals. Key actions are being taken, including hybrid system promotion, battery storage integration, and PLI-backed domestic manufacturing. However, challenges must be addressed, transmission and storage need faster deployment, PPA delays must be cleared, and coordination among DISCOMs, states, and the Centre must be improved. The next 2–5 years will be crucial, as the success of this roadmap will depend on timely reforms and execution.

3.11. Policy initiatives to drive Solar and Wind energy capacity in India

India has embarked on a transformative mission to secure clean and sustainable energy, guided by robust policy frameworks that emphasize solar and wind power. As of FY2025, installed non-fossil fuel capacity has reached 217.62 GW, underscoring India's commitment to climate targets and energy self-reliance. The major policy initiatives enabling this progress, offering insights into status and future direction.

1. **Jawaharlal Nehru National Solar Mission (JNNSM)**
   - **Launch & Scale-Up**: Initiated in January 2010, the NSM aimed to elevate India's solar capacity from 9 GW FY2016 to ~97.9 GW in FY2025.
   - **Programmatic Support**: Measures include solar parks, VGF schemes, canal-top and rooftop installations propelling large-scale adoption.
2. **Centralized Wind Data & CCDC Initiative**
   - **Wind Mapping Enhancement**: The Centralized Data Collection and Coordination (CCDC) Wind Initiative undertook resource mapping via 800+ monitoring stations, enabling site-specific wind farm development.

- **Capacity Gains**: India's installed solar power capacity increased from 21 GW in FY2014 to 51.3 GW by FY2026 marking more than a twofold growth over a decade. In FY2025 alone, 4.15 GW of new capacity was added.

3. **Hybrid and Offshore Wind Policies**
   - **Hybrid Farms**: National Wind-Solar Hybrid Policy promotes co-located projects. A notable example is the 30 GW Gujarat hybrid park.
   - **Offshore Wind Support**: An INR 74,530.00 Mn VGF scheme was approved to establish 1 GW offshore capacity off Gujarat and Tamil Nadu.
4. **Solar for Rural & Residential Development**
   - **PM-KUSUM (2019):** Incentivizes solar pumps and grid-tied agricultural feeders (CFA up to 50%). Over 10 Lakh solar pumps were installed in FY2025
   - **PM Surya Ghar Muft Bijli Yojana (Feb 2024):** Aims for rooftop solar on 10 Mn household rooftops by 2027. Over 700,000 installations achieved in under a year.
5. **PLI Scheme & Domestic Vigour**
   - **Domestic Content Requirement (DCR):** The scheme supports local solar manufacturing by requiring Indian-made crystalline-silicon cells using undiffuse black wafers (Tariff 3818) in government-approved solar projects by FY2025.
   - **Modified Special Incentive Package Scheme (M-SIPS**): Introduced to encourage investment in the electronics and solar manufacturing sectors, including solar PV cells and modules.
   - This bolsters India's drive toward manufacturing scale-up, economic growth, and employment creation.
6. **EPC Contracts:**

EPC (Engineering, Procurement, and Construction) contracts are the dominant project delivery model for utility-scale solar and wind projects in India. Under an EPC contract, a single contractor is responsible for the complete lifecycle of the project from design and procurement of materials to construction, commissioning, and handover. The total EPC market in India was estimated at INR 3,150.00 Bn in FY2024 and it is expected to grow at a CAGR of 10.65% and reach INR 5,780.00 Bn in FY2030.[52] Operation and maintenance (O&M) within the EPC process involves ensuring the constructed facility's efficient, reliable, and safe ongoing performance post-construction. It includes routine inspections, preventive maintenance, prompt repairs, personnel training, and adherence to safety and regulatory standards. O&M optimizes asset lifespan, minimizes downtime, and extends operational integrity. The government allocates significant funds within schemes like the Revamped Distribution Sector Scheme (RDSS), with approximately INR 3,037.58 Bn dedicated to strengthening transmission and distribution infrastructure between FY2022 to FY2026.[53]

- **Single-point responsibility**: The EPC contractor manages all aspects, reducing the owner's coordination burden.
- **Fixed cost and timeline**: The contract typically specifies a lump-sum price and a guaranteed completion date, transferring most execution risk to the contractor.
- **Quality and performance guarantees**: EPC contractors provide warranties and performance guarantees, ensuring the facility meets specified standards.
- **Compliance:** The contractor ensures adherence to technical standards, safety norms, and regulatory requirements

7. **SEB Tender Norms**

State Electricity Boards (SEBs) and other government agencies procure renewable energy projects through competitive tenders. Key norms include:

- Complete responsibility for electricity generation, transmission, and distribution was held by State Electricity Boards (SEBs) under the Electricity Supply Act of 1948.

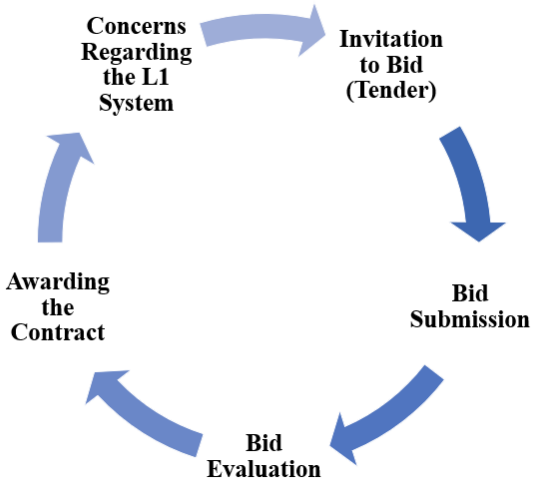
[52] https://www.business-standard.com/companies/news/epc-companies-to-see-9-11-pc-revenue-growth-in-fy26-crisil-125082500515_1.html
[53] https://www.pib.gov.in/PressReleaseIframePage.aspx?PRID=1897764

- The need for bilateral power purchase agreements was recognized after the 1991 amendment to the Electricity Supply Act, which allowed private Independent Power Producers (IPPs) to establish generation units and sell electricity to SEBs.
- Within three years of the amendment, 243 Memoranda of Understanding (MOUs) were signed by SEBs and state governments, representing over 90,000 MW of proposed capacity—more than the total installed capacity of India at that time.

8. L1 Bidding Process

The government tender L1 process is the primary procurement method for awarding energy projects, especially in renewable sectors like solar and wind in India. Here is how it works:

Figure 3.20: L1 Bidding Process Flow



Source: Frost & Sullivan Analysis

- **Invitation to Bid (Tender):**

A Request for Proposal (RFP) or Request for Tender (RfT) is issued by a government agency, where technical requirements, commercial terms, and submission timelines are outlined. These documents are typically published in newspapers, government e-procurement portals like GeM (Government e-Marketplace), and other official platforms. The evaluation criteria and deadlines are clearly specified in the RFP.

- **Bid Submission:**

Technical and commercial proposals are submitted by interested bidders in line with RFP guidelines. Technical bids are prepared to demonstrate eligibility, technical capability, and relevant experience. Commercial bids specify the price or tariff for executing the project, especially in renewable energy tenders.

- **Bid Evaluation:**

The bids are reviewed by a tender evaluation committee consisting of subject experts and agency officials. Technical bids are assessed first to ensure compliance with the minimum requirements. Only those passing the technical stage are considered for commercial evaluation. The lowest price bid (L1) is then identified among the qualified offers.

- **Awarding the Contract:**

Once the L1 bidder is found to have met all conditions and requirements, the contract is awarded. The agreement specifies the scope of work, timelines, payment terms, and other key deliverables.

- **Concerns Regarding the L1 System:**

Despite its widespread use, several concerns have been raised about the L1 process:

  - The focus on the lowest price may result in compromises on quality or innovation.
  - The long-term sustainability of very low bids may be questioned, especially in complex or technology-intensive projects.
  - Innovative firms or those using advanced technology may be discouraged if they cannot match the pricing of basic, standardized bidders

9. **Procurement Process Overview:** While renewable energy projects are initiated by customers such as State Electricity Boards (SEBs), government agencies, or private developers, the procurement process is governed by a structured framework. Tenders are issued with detailed technical specifications, financial terms, and pre-qualification (PQ) requirements. Engineering, Procurement, and Construction Contractors (EPC) and developers submit their bids in response. These bids are then evaluated based on compliance with PQ criteria and the lowest (L1) price offered. The contract is awarded to the lowest qualified bidder. Following the award, the project is executed under an EPC contract structure, with continuous monitoring to ensure compliance and performance throughout the implementation phase

India's policy landscape, characterized by landmark schemes like National Solar Mission (NSM), Centralized Consumer Data Centre (CCDC), Kisan Urja Suraksha evam Utthaan Mahabhiyan (KUSUM), Surya Ghar Muft Bijli Yojana, hybrid/offshore wind policies, Production Linked Incentive Scheme (PLI), and the Green Hydrogen Mission, is powering its ascent as a clean energy leader. With 217.6 GW of non-fossil energy capacity already operational and innovative solar–wind growth initiatives underway, India is on a credible path toward its 500 GW target by FY2030. Continued focus on grid infrastructure, storage adoption, and coordination mechanisms will be essential in overcoming implementation challenges. These policies have paved the foundation; now, swift execution will turn India's renewable vision into enduring achievement.

3.12. Market Structure: Organized vs. Unorganized Participants

India's solar and wind energy markets feature a dual market structure comprised of both organized and unorganized participants, each influencing capacity growth in distinct ways

3.12.1. Organized Participants

Organized players are typically large, well-capitalized companies often backed by private equity or major conglomerates that dominate utility-scale solar and wind projects. In the solar sector, the top 20 developers account [54]for nearly 80% of projects under development, though they represent about 58% of installed capacity. These companies benefit from:

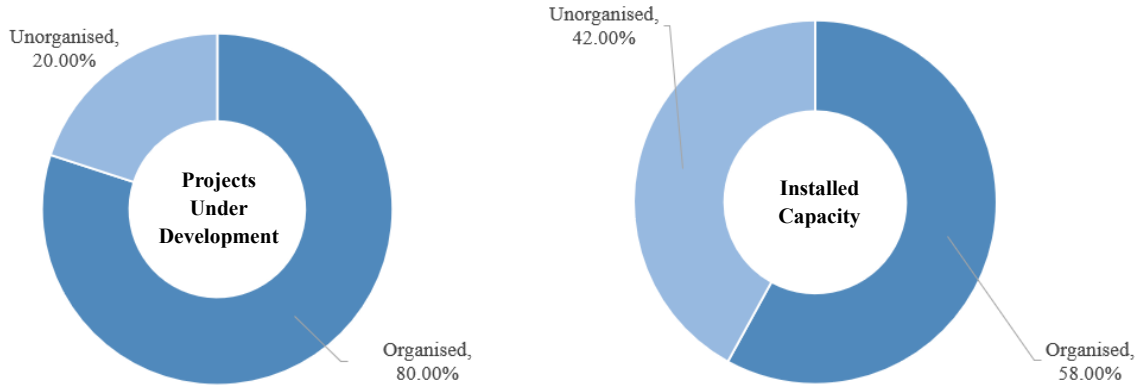
- Access to cheaper financing and international capital
- Ability to win large-scale projects through competitive bidding
- Advanced project management, technology adoption, and compliance with regulatory standards
- Policy support and incentives such as accelerated depreciation, concessional duties, and transparent tariff-based bidding processes.

Major organized players include Adani Green, Tata Power, ReNew Power, NTPC, and international firms in both solar and wind.

As per 2016 data, most renewable energy projects under development were dominated by the organized sector, which accounted for 80.00% of the pipeline. In contrast, only 20.00% of projects under development were being handled by unorganized participants. However, in terms of installed capacity, a more balanced distribution was observed. Approximately 58.00% of the installed capacity had been contributed by organized players, while 42.00% was attributed to unorganized players.

[54] https://energy.economictimes.indiatimes.com/news/renewable/solar-power-market-little-room-for-small-players-under-the-sun/54205343

Figure 3.21: Organized vs. Unorganized Participation in Solar and Wind Projects (Installed Capacity & Projects Under Development)



Source: Frost & Sullivan Analysis

3.12.2. Unorganized Participants

Unorganized participants are typically small and medium enterprises (SMEs), local EPC contractors, and smaller developers. Their presence is more pronounced in:

- Rooftop solar installations
- Small-scale, off-grid, and rural projects
- Localized services and last-mile delivery

While the unorganized sector accounts for many companies (over 500 in solar alone), their cumulative capacity is much smaller compared to organized players. They often face challenges such as:

- Limited access to low-cost capital
- Difficulty scaling up due to policy and market pressures
- Struggles with technical standards and compliance

The shift of unorganised companies to the organised sector in India is being driven by several key factors in 2025:

- **Government Initiatives and Policy Reforms:** Flagship schemes like the Production-Linked Incentive (PLI) program and the broader vision of Aatmanirbhar Bharat are incentivizing formalization. These policies provide financial incentives, support for MSMEs, and encourage companies to adopt formal business practices to access benefits.
- **Expansion of Digital Infrastructure:** The rapid growth of digital payment systems, e-invoicing, and GST compliance has made it easier and more necessary for businesses to operate formally. Digitalization reduces the cost and complexity of compliance, making the transition to the organised sector more attractive.
- **Access to Finance and Markets:** Organised sector companies have better access to formal credit, government tenders, and global supply chains. The push for a globally competitive domestic supply chain ecosystem is motivating unorganised players to formalise to participate in larger, more lucrative markets.
- **Regulatory Pressure and Compliance:** The implementation of GST and stricter tax enforcement have increased the cost and risk of remaining unorganised. Compliance requirements are pushing businesses to register and maintain proper records to avoid penalties and ensure business continuity.

- **Support for MSMEs:** The government has revitalised MSMEs through easier registration processes, subsidies, and support schemes, making it more viable for small businesses to join the organised sector and scale up.

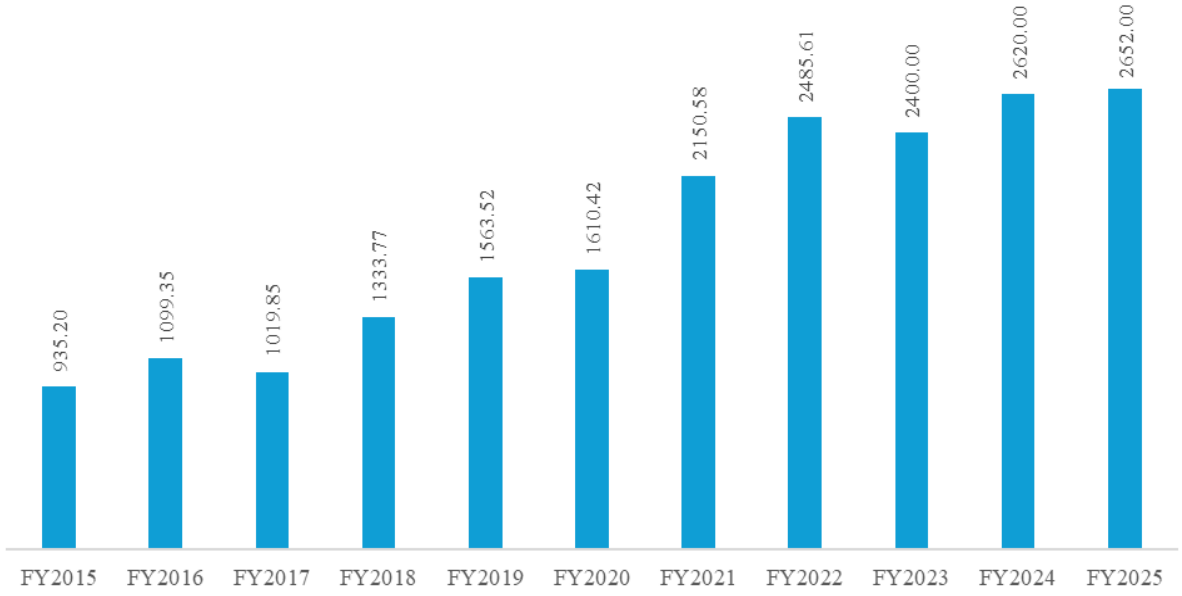
4. Overview of the Railway Sector in India

Indian Railways (IR), under the oversight of the Ministry of Railways, currently operates a broad-gauge railway network measuring approximately 69,512 route kilometers (RKM) as of April 2025. This makes it the world's third-largest rail system by route length. The network is served by a fleet composed of 327,991 freight wagons, 91,948 passenger coaches, and over 14,000 locomotives (electric, diesel, and steam). The railway infrastructure extends across 17 operational zonal railways and approximately 8,000–8,300 stations, which collectively serve a diverse geographic and demographic footprint

In FY 2024–25, IR transported 1.465 billion tons of freight—an annual increase from 1.443 billion tons in FY 2023–24. The system also recorded historic freight traffic in FY 2025, moving over 1.61 billion tones, positioning IR as the second-largest freight transporter globally behind China. Passenger carriage remains robust, with approximately 6.9 billion passengers utilizing the service in FY 2023–24 and daily ridership averaging 23 million.[55]

The FY 2024–25 budgetary allocation for IR amounted to INR 2620 billion, marking a record expenditure level and a nearly 32-fold increase over the INR 81.74 billion allocation in FY2013. Approximately, 76% (INR 1920 billion) was already utilized as of January 2025. In FY2024, IR recorded total receipts of INR 2,560 billion, resulting in a net operating surplus of INR 32.60 billion. Projected revenue for FY 2025–26 includes INR 928 billion from passenger services and INR 1,880 billion from freight. Total revenue for FY2025–26 is estimated to exceed INR 3 trillion, with anticipated passenger traffic of ~7.8–7.9 billion and freight volume staying on course towards a 3,000 million tonne target by 2027. [56]

Figure 4.1: Capital Outlay for Railway Sector FY2015 - FY2025 (INR Million)



Source: Union Budget

[55] https://static.pib.gov.in/WriteReadData/specificdocs/documents/2025/jun/doc2025611568101.pdf?

[56] https://www.pib.gov.in/PressNoteDetails.aspx?NoteId=151988&ModuleId=3

4.1.Railway sector expansion including investment layout planned

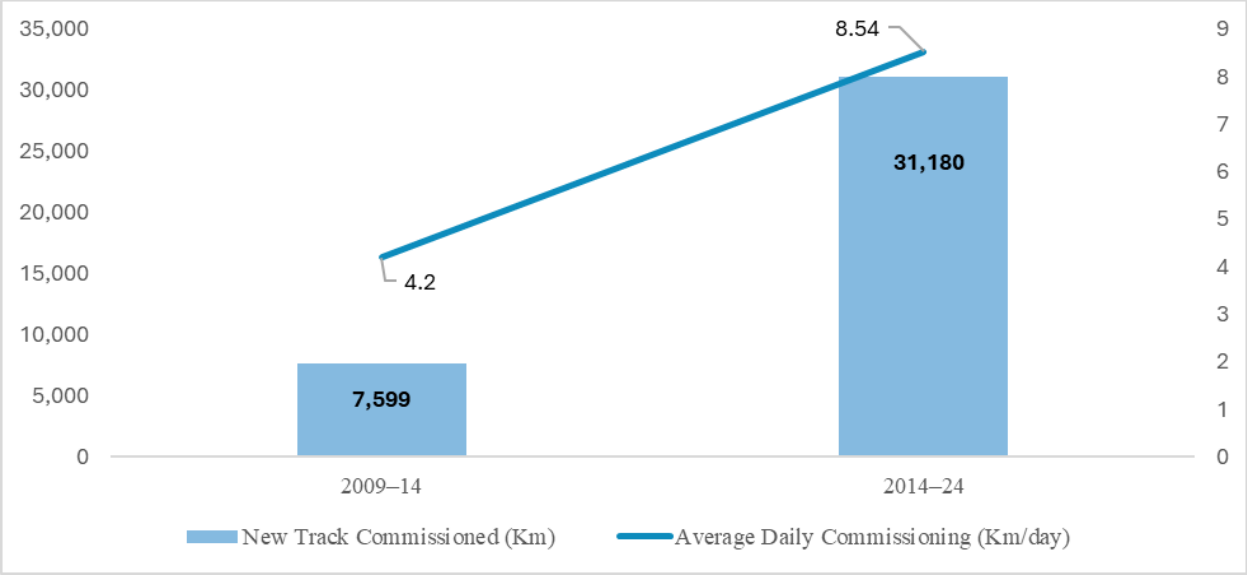
The government's emphasis on rail infrastructure is evident in its multi-tiered investment strategy, spanning network expansion, electrification, station modernization, and digital safety integration. The expansion blueprint is aligned with the National Rail Plan 2030 and PM Gati Shakti, fostering last-mile connectivity, freight corridor augmentation, and premium station upgrades, all within a progressive public-private partnership (PPP) framework. Sustainability goals, including net-zero emissions by 2030, further reinforce electrification and renewable energy integration.

4.1.1. Indian Railways Network expansion

Indian Railways has executed a significant expansion of its route network in the 2024 calendar year, commissioning 3,433 route kilometers (RKM) comprising 1,158 RKM of new lines, 259 RKM of gauge conversions, and 2,016 RKM of doubling/tripling. This accelerated pace—averaging approximately 9.2 km per day—marks the highest annual commissioning in the history of the organization and is aligned with objectives under the PM Gati Shakti National Master Plan. The total broad-gauge network stands at 69,512 RKM as of April 2025.

Since 2014, over 31,180 RKM has been added to the network through new lines, gauge conversions, and duplication projects, averaging 8.54 km per day over the decade. Concurrently, as of April 2024, 488 infrastructure projects (comprising 187 new lines, 40-gauge conversions, and 261 doubling schemes) totaling 44,488 RKM and with a sanctioned capital outlay of INR 7440 billion, were in various stages of planning or execution. Of this portfolio, 12,045 RKM have already been commissioned, supported by expenditure of INR 2,920 billion[57].

Figure 4.2: Decadal Acceleration in Railway Track Expansion (2009–2024)



Source: Ministry of Railways

The Cabinet Committee on Economic Affairs (CCEA) in May 2025 approved two critical line-multi-tracking corridor projects under the PM Gati Shakti agenda: a fourth line between Wardha–Ballarshah in Maharashtra and third/fourth lines between Ratlam–Nagda in Madhya Pradesh. These are funded at INR 33.99 billion and envisioned to decongest existing corridors, boost freight handling capacity, and uplift approximately 784 local villages and approximately 2 million residents

Several strategically important new-line projects have also progressed in less connected regions:

[57] https://www.pib.gov.in/PressReleaseIframePage.aspx?PRID=2078092

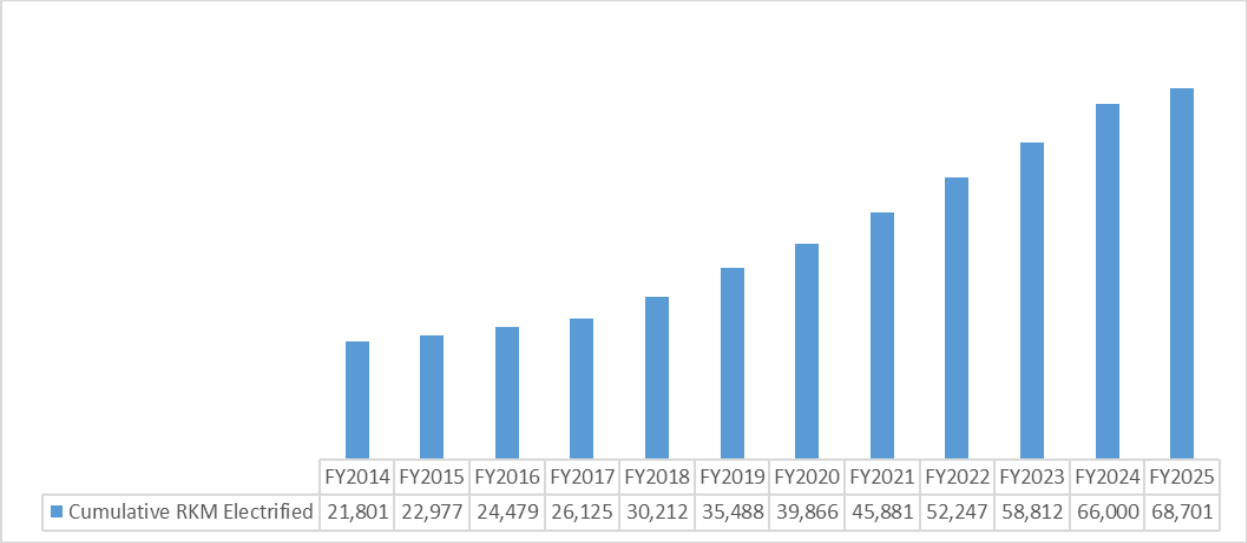
Table 4.1: New/Proposed Railway Lines

Railway Corridor	Zonal Railway	State(s)	Distance / Key Details
Kothagudem – Kirandul	South Central Railway (SCR)	Telangana → Chhattisgarh	160 km; integrates Bastar's "Red Corridor" into national rail network
Bairabi – Sairang (Aizawl link)	Northeast Frontier Railway (NFR)	Mizoram	51.38 km; includes 142 bridges, tunnels, and four stations; provides first direct rail access to Aizawl
Gunupur – Theruvali	East Coast Railway (ECoR)	Odisha	73.6 km; INR 13.26 billion project; land acquisition ongoing; expected completion within five years
Melli – Dentam	Northeast Frontier Railway (NFR)	Sikkim	~75 km; proposed connection via Jorethang–Legship; final location survey approved
Jiribam – Imphal	Northeast Frontier Railway (NFR)	Manipur	111 km; includes India's tallest rail pier bridge (141 m) and longest rail tunnel (~11.5 km)
Dimapur – Zubza (Kohima)	Northeast Frontier Railway (NFR)	Nagaland / Assam	~82.5 km; brings rail connectivity close to Kohima; involves extensive tunnelling and bridges
Murkongselek – Pasighat	Northeast Frontier Railway (NFR)	Assam → Arunachal Pradesh	26.15 km; two phases (15.6 km + 10.55 km); strategic rail connectivity for Arunachal Pradesh
Sivok – Rangpo	Northeast Frontier Railway (NFR)	West Bengal → Sikkim	44.96 km; includes 14 tunnels (38 km) and 13 major bridges; key strategic connectivity line
Zubza – Imphal	Northeast Frontier Railway (NFR)	Nagaland → Manipur	~140 km; proposed corridor linking Kohima to Imphal; final location survey recently approved

4.1.2. Indian Railways Electrification

Indian Railways has undertaken a mission-driven electrification program to convert its broad-gauge network to 25 kV AC traction. As of April 2025, approximately 68,701 RKM—or about 98.83% of the total 69,512 RKM electrified by April 2025—had been converted. This represents a significant acceleration over the past decades, driven by policy mandates and capital provisioning.

Figure 4.3. Electrification of Railway Route Km over the past decade



	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020	FY2021	FY2022	FY2023	FY2024	FY2025
Cumulative RKM Electrified	21,801	22,977	24,479	26,125	30,212	35,488	39,866	45,881	52,247	58,812	66,000	68,701

Source: Central Organization for Railway Electrification

From FY 2004–05 to FY 2013–14, railway electrification in India progressed at a modest pace of just 1.42 km/day. However, a marked acceleration occurred post-FY 2014, driven by a national policy shift aimed at full electrification of the broad-gauge network. In FY2023, Indian Railways electrified 6,565 RKM, followed by a record 7,188 RKM in FY2024. This momentum continued into FY2025, with 2,701 RKM electrified, raising the cumulative electrified network to approximately 68,701 RKM—covering nearly 99% of the broad-gauge network.[58]

Since FY 2014–15, Indian Railways has electrified over 47,510 RKM, a massive leap compared to previous decades. This rapid progress was enabled by enhanced budgetary allocations, improved inter-agency coordination, streamlined execution frameworks, and a strong policy focus on energy security, import substitution, and carbon reduction. To further support the electrification drive, the FY 2024–25 Union Budget allocated INR 65 billion, with an additional INR 61.59 billion earmarked for FY 2025–26, underlining the government's sustained commitment to a fully electrified and sustainable railway system.

Further, electrification of railway tracks reduces dependency on fossil fuels, decreased diesel consumption resulting in lower carbon emission. Electrification enables better haulage capacity and higher train speeds, leading to reduced travel time and enhanced efficiency. IR has witnessed a reduction in fuel consumption for traction purposes by 136 crore liters during 2023-24 as compared to 2018-19.

4.1.3. Renovation & Modernization

Indian Railways has embarked on an ambitious station redevelopment program under the Amrit Bharat Station Scheme (ABSS), formally launched in February 2023. The scheme is intended to modernize 1,275 key stations, transforming them into multimodal transport hubs with enhanced passenger amenities, integrated connectivity, cultural design elements, and improved safety and accessibility features. Investments of around INR 2,500 billion have already been made under the scheme.

[58] https://core.indianrailways.gov.in/uploads/IR%20MAp%202025(1).pdf

a) Station Redevelopment: Scale, Scope, and Expenditure

- On 22 May 2025, Prime Minister Narendra Modi inaugurated the first phase of the scheme, encompassing 103 redeveloped stations spread across 86 districts in 18 states and union territories.
- The estimated cost of this phase was INR 11.00 billion, averaging INR 107 million per station, falling within the Ministry's benchmark of INR 50-200 million for stations of varying importance.
- Redeveloped facilities include lifts, escalators, high-level platforms, digital signage, executive lounges, One Station One Product kiosks, modern restrooms, and EV charging points, reflecting both passenger-centric amenities and sustainable design elements

  Selected exemplary upgrades:

  - **Jaisalmer –** INR 1400 million investment, featuring two six-meter-wide foot-overbridges, 10 lifts/escalators, a 900 kVA solar rooftop system, rainwater harvesting, and EV charging stations, transforming it into a "world-class" facility
  - **Gadag (Karnataka)** – INR 232.4 million, equipped with platform shelters, lifts, escalators, parking, and regional cultural motifs
  - **Dharwad** – INR 171 million, with foot overbridge, lifts, signage, and disability-compliant toilets

b) Safety & Signaling Upgrades

Modernization also includes a notable strengthening of railway safety and signaling infrastructure:

- The Kavach Automatic Train Protection system has been rolled out over approximately 1,456 RKM as of September 2024, with an initial round of 144 locomotives equipped
- From FY 2025–26, deployment of 5,000–5,500 RKM of Kavach annually is planned, along with equipment installation across 10,000 locomotives

Optical fiber installations supporting the system are underway, inclusive of station networks and protected corridor infrastructure.

Table 4.2. Number of stations inauguration under Ayushman Bharat Mission till May 2025

State/UT	Number of Stations Inaugurated
Uttar Pradesh	19
Gujarat	18
Maharashtra	15
Madhya Pradesh	6
Karnataka	5
Chhattisgarh	5
Rajasthan	8
Tamil Nadu	9
Kerala	2
Andhra Pradesh	3
Telangana	3
West Bengal	3
Jharkhand	3
Assam	1
Haryana	1
Himachal Pradesh	1
Puducherry	1

Source: PIB

4.1.4. Key Initiatives to drive Railway sector growth in India

The Indian railway sector's growth is underpinned by a coordinated policy framework focusing on capacity creation, freight efficiency, private participation, and environmental sustainability. The Ministry of Railways, through dedicated programs and inter-ministerial coordination, has established structured regulatory pathways to meet long-term national logistics and sustainability goals.

1. National Rail Plan (NRP) – 2030

Announced in 2021 and developed by the Ministry of Railways, the NRP provides a long-term roadmap for infrastructure development by 2050, with actionable goals for 2030. The plan aims to:

- Increase freight modal share from ~27% to 45% by 2030.
- Double freight train speeds from ~22 km/h to 50 km/h.
- Add new Dedicated Freight Corridors (DFCs) and high-speed rail corridors.
- Achieve complete electrification and remove bottlenecks through line-doubling/tripling.
- Implement Vision 2024 components including:
    - Speed upgrades (160 km/h for select Golden Quadrilateral routes).
    - Elimination of all level crossings on high-density routes.
    - Station modernization and terminal expansion.

2. Rail Land Leasing Policy (2022) under PM Gati Shakti

Approved by the Union Cabinet in September 2022, this policy revises the terms for long-term leasing of railway land to accelerate multimodal infrastructure and terminal development under the PM Gati Shakti National Master Plan:

- Lease period extended to 35 years.
- Annual lease rent is fixed at 1.5% of market value, replacing earlier 6% rate.
- Enables development of 300 PM Gati Shakti Cargo Terminals by 2025–26.
- Expected to create over 0.125 million direct and indirect jobs.
- Applicable to cargo terminals, utilities (e.g., pipelines, power lines), and social infrastructure.

3. Net-Zero Carbon Emission Target by 2030

Indian Railways has officially committed to becoming a net-zero carbon emitter by 2030, as per Parliamentary records (December 2023). This target will be met by:

- Complete electrification of the broad-gauge network.
- Procurement and installation of 30 GW renewable energy capacity, including solar, wind, and hydropower.
- Deployment of energy-efficient technologies such as Head-on-Generation (HOG), LED lighting, and regenerative braking.
- Institutional collaborations, including a 2023 MoU with USAID for technical support on clean energy.

4. Rail Land Development Authority (RLDA) and Asset Monetization

The RLDA, under the Ministry of Railways, facilitates long-term monetization of surplus land and asset redevelopment through public-private partnerships:

- 43,000 hectares of land earmarked for commercial and mixed-use development.
- INR 17 billion raised through leasing of 21 land parcels.
- Ongoing redevelopment of 51 railway stations, 84 railway colonies, and 52 multifunctional complexes.

  This initiative supports station modernization under the Amrit Bharat and SMART station schemes.

5. **High-Speed Rail (HSR) Initiatives**
   - **Mumbai–Ahmedabad HSR Project (MAHSR):** India's first bullet train project (508 km), under construction with Japanese collaboration (Shinkansen technology).
   - Multiple **future HSR corridors** planned under the National Infrastructure Pipeline, connecting major routes such as:
     - Delhi–Varanasi
     - Delhi–Ahmedabad
     - Mumbai–Nagpur
     - Chennai–Mysuru
     - Varanasi–Howrah
   - Long-term vision: establish a **7,000+ km HSR network** across India to boost intercity travel efficiency, reduce congestion, and enhance passenger comfort.

     High-speed rail demands robust, high-quality signaling and power cables to withstand higher loads, speed-sensitive operations, and safety-critical requirements. As an RDSO-approved cable supplier, Oswal is strategically positioned to capture opportunities in this emerging segment by supplying specialized railway cables. The scaling of high-speed rail corridors will further expand demand for advanced LV/MV power cables and telecom/signal cables, reinforcing Oswal's role in India's transport infrastructure transformation. The company also received the following certifications: ISO 9001:2015 (Quality Management System), ISO 14001:2015 (Environmental Management System), and ISO 45001:2018 (Occupational Health & Safety Management System).

4.1.5. Railway-Specific Cable Demand Outlook

The overall wires and cables market in India is experiencing robust growth, driven by extensive infrastructure development, real estate expansion, industrialization, and the burgeoning renewable energy sector. Railways are a key contributor to this demand.

Key drivers for railway cable demand include:

- Electrification: The ongoing mission to electrify the entire broad-gauge network is the primary driver. As of April 1, 2025, approximately 68,701 Route Kilometers (rkm) were electrified, representing about 98.83% of the total broad-gauge network (69,512 rkm). The remaining sections are actively being taken up, with a target of 100% electrification. This necessitates significant quantities of overhead line equipment (OHE) cables (catenary, contact wires, feeders) and associated power cables for substations and traction.
- Capacity Augmentation: Projects like new lines, doubling/tripling/quadrupling of tracks, and dedicated freight corridors (DFCs) require extensive cabling for power, signaling, and telecommunications. Over the years, Indian Railways has consistently expanded its network through capacity augmentation initiatives. The

Union Budget 2023–24 alone allocated nearly INR 24,000 billion towards railway infrastructure, of which a significant portion is directed towards new line construction (around INR 3,185 billion).[59] Cumulatively, over 20,000 km of doubling and tripling works are sanctioned across various zones, while more than 10,000 km of new lines are in different stages of execution. These investments underline the scale of cabling demand for traction power, control systems, and digital connectivity across upcoming and ongoing projects

- Modernization of Rolling Stock and Stations: The Government of India has set out ambitious plans for rolling stock and station modernization that directly translate into significant cabling demand. As of 2025, 68 Vande Bharat trains (136 services) are operational, with 400 additional next-generation trainsets announced in Union Budget 2022, representing the single largest Electric Multiple Unit (EMU) expansion in Indian Railways' history. In parallel, the upcoming Vande Metro (NaMo Bharat) services are planned on city-pair routes of 100–200 km, with 50 trainsets proposed, designed to cater to daily commuters with metro-like frequency. Further, the Amrit Bharat Express, a push-pull non-AC alternative, currently has 8 trains in service and a pipeline of ~200 trainsets (50 under construction and 150 planned). On the station side, the Amrit Bharat Station Scheme (ABSS) targets 1,275 stations for modernization, out of which 103 redeveloped stations were inaugurated in May 2025[60].

- Safety Enhancements: The Kavach system is India's indigenously developed Automatic Train Protection (ATP) technology, designed to prevent collisions by automatically controlling train speed in case of human error. It integrates GPS-based real-time location tracking, RFID tagging, and radio communication between trains, stations, and control centers. The system ensures automatic braking if a loco pilot overshoots a signal or approaches another train on the same track, thereby enhancing operational safety. The Ministry of Railways has committed to a pan-India rollout of Kavach across 35,000 km of high-density and high-utilization routes by 2030, with 3,000 km already equipped as of 2025 and further contracts being tendered.

- Green Energy Initiatives: Indian Railways is also focusing on sourcing power from renewable energy, including setting up solar power capacities along tracks, which will further boost demand for solar-specific cables.

- Upcoming Electrification Projects and Cable Requirement Estimate

Key Cable Types in Railway Electrification:

1. Overhead Line Equipment (OHE) Cables (25 kV AC):
    - Catenary Wire: The main support wire.
    - Contact Wire: The wire directly contacted by the locomotive's pantograph.
    - Feeder Wires: Used in 2x25 kV autotransformer systems to transmit power at 50 kV, reducing losses. These run parallel to the track.
    - Droppers, Jumpers, Section Insulators: Smaller cables and components connecting the OHE.
2. Power Cables (Low Voltage & High Voltage):
    - 1100V AC/DC Power Cables: For signaling power supply, station lighting, and other auxiliary services. These can be armored multicore cables.

[59] https://www.pib.gov.in/PressReleaseIframePage.aspx?PRID=1907232
[60] https://www.pib.gov.in/PressReleasePage.aspx?PRID=2130229

- LT (Low Tension) Power Cables: For various electrical installations within stations, maintenance depots, and residential areas.
- HT (High Tension) Power Cables: For connecting traction substations to the grid.

3. Signaling and Telecommunication (S&T) Cables:
   - Signaling Cables: Multicore copper conductor PVC insulated and sheathed cables (e.g., 2, 4, 6, 9, 12, 18, 24, 30, and 37 cores) used for extending signaling circuits from cabins to trackside equipment (location boxes, point machines, signals).
   - Tail Cables: Smaller multicore cables (e.g., 5 to 12 cores) connecting location boxes to signaling gears.
   - Track Circuit Cables: Specific cables for track circuits to detect train presence.
   - Optical Fiber Cables (OFC): Increasingly used for high-speed data transmission for modern signaling systems, train control, and communication networks along the railway corridor.

Estimated Cable Requirement for Remaining Electrification:

While exact figures vary based on track configuration, signaling system complexity, and station density, a general estimation for a typical single-track kilometer of electrified line might involve:

- **OHE Conductors:** Approximately 2-3 km of heavy OHE conductors (catenary, contact wire, and potentially feeder) per track kilometer.
- **Power Cables (1100V/LT):** Approximately 0.5 - 1 km of multicore power cable per track kilometer, depending on equipment density.
- **Signaling Cables:** This is highly variable but could easily be 5-10 km of various multicore signaling cables per track kilometer.
- **Optical Fiber Cables (OFC):** Approximately 1-2 km of OFC per track kilometer, typically laid along the entire route.

Based on the remaining 811 route kilometers to be electrified, and assuming an average of 10-15 km of various types of cables (OHE, power, signaling, telecom) per route kilometer, the total estimated cable requirement would be:

- **Total Cable Requirement:** 811 rkm * (10 to 15 km/rkm) = 8,110 km to 12,165 km of various cables.

This estimate is highly generalized and does not account for specific project complexities, yard electrification, station areas, or the varying core counts and sizes of signaling/telecom cables. However, it provides a sense of the significant demand for railway-specific cables in the ongoing electrification drive.

4.1.6. Competitive Landscape for Railway Cables

The RDSO approval process is among the most stringent in India's public sector infrastructure ecosystem. It involves multiple stages of technical vetting, infrastructure audit, and field performance validation, and can take anywhere between 12 to 30 months for a new applicant.

Key Stages:

1. Application and Documentation

- Firms must submit complete details of their manufacturing setup, machinery, process flow, and internal quality systems.
- A detailed Quality Assurance Plan (QAP) and compliance with relevant IRS specifications (like IRS:S-63/2014 for underground cables or IRS:S-76/89 for indoor cables) is mandatory.

2. Infrastructure and Capability Assessment
    - RDSO conducts an audit of the manufacturing plant to verify:
        - In-house testing capability (insulation resistance, flame retardancy, tensile strength, etc.).
        - Calibration of testing equipment
        - Raw material traceability systems
        - Quality control during extrusion, sheathing, armoring, etc.
3. Prototype and Type Testing
    - Cables must undergo prototype testing either in an NABL-accredited lab or at RDSO's test facilities. Oswal Cables has type-tested its products through accredited laboratories such as Central Power Research Institute ("**CPRI**"), Electrical Research and Development Association ("**ERDA**") and Keuring van Elektrotechnische Materialen ("**Kinetrics**").
    - Failure at any stage requires re-submission, making the process iterative and compliance heavy.
4. Developmental Vendor Listing
    - Upon successful prototype approval, the firm is placed on RDSO's list as a "Developmental Vendor."
    - Supplies are monitored for quality over 12–24 months in actual field conditions.
5. Regular Vendor Status
    - After consistent field performance and further inspections, firms may be upgraded to "Approved Vendor" status.
    - Only fully approved vendors are eligible for unrestricted supply and are considered during large-scale railway tenders.

This process enforces high entry barriers, ensuring that only vendors with proven quality and infrastructure become long-term players in this market

Oswal Cables Pvt. Ltd. is among the select group of companies fully approved by RDSO (Research Designs and Standards Organization) for the supply of various railway signaling and power cables in India.

5. Review and Outlook of the T&D Conductor's Market

5.1. Manufacturing Process of Conductors

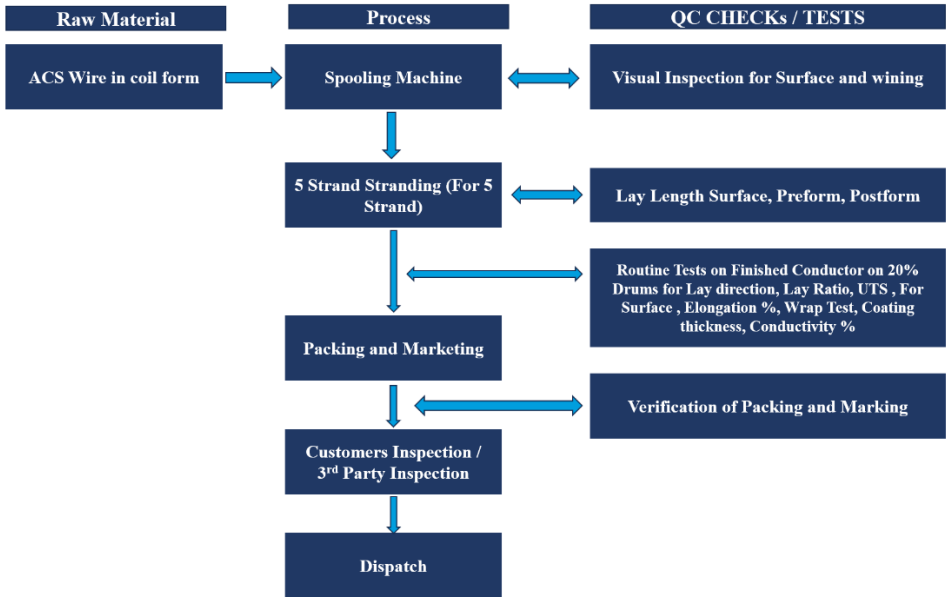
The use of conductors in power transmission is fundamental to the reliable delivery of electricity over vast distances, connecting power generation sources to substations and ultimately to consumers. Conductors serve as the physical medium through which electric current flows, and their selection is crucial for the efficiency, safety, and cost-

effectiveness of transmission systems. The main materials employed as conductors in power transmission lines are copper, aluminium, and steel-reinforced aluminium. Each of these materials has distinct properties that make them suitable for transmission applications.

Copper has exceptional electrical conductivity and tensile strength, allowing it to carry large amounts of current with minimal losses and withstand mechanical stresses from wind and ice. In modern transmission networks, aluminium and its alloys have largely replaced copper as the default conductor material. Aluminium offers reasonable conductivity at about 60% of copper's level but has just half the weight, making it easier to handle and install. Most importantly, aluminium is much more cost-effective and widely available, which is critical when considering the enormous scale of national power grids.

The conductor manufacturing process focuses on accurate stranding, regular testing, and careful quality checks to ensure strength and reliability.

Figure 5.1: Manufacturing Process of Conductors



Source: Frost & Sullivan Analysis

- **Raw Material:** The process begins with ACS (Aluminum Clad Steel) wire in coil form as the primary input.
- **Spooling Machine:** The ACS wire is fed into the spooling machine, where it undergoes visual inspection for surface finish and winding quality.
- **5-Strand Stranding Process:** The spooled wires are then processed through 5-strand stranding, forming the required conductor configuration.
- **Quality Control Checks**: To evaluate lay length, surface condition, and preform/postform characteristics
- **Routine Quality Checks (on 20% of drums):** Routine test is performed on 20% of the finished conductor drums, covering parameters such as lay direction, lay ratio, ultimate tensile strength (UTS), elongation percentage, surface finish, wrap test, coating thickness, and electrical conductivity.
- **Packing and Marking**: After testing, the conductors are packed, verified, and marked as part of quality assurance.
- **Customer / Third-party Inspection:** The packed conductors undergo final inspection by the customer or an external third party.
- **Dispatch:** Once all checks are cleared, the conductors are dispatched to their destination.

Oswal Cables is planning to invest into In-house rolling machine. An in-house rolling machine is a critical asset in cables and wires manufacturing, enabling the consistent shaping, sizing, and finishing of metal conductors (typically copper or aluminium) within the factory rather than relying on external suppliers.

Role in Manufacturing Process

Rolling machines are utilized after initial processes such as crushing, grinding, and wire drawing. In-house rolling mills precisely compress metal rods and draw them into wires or strips, refining thickness, dimensional tolerance, and surface quality. This process supports the transition from raw material to the conductors used inside various cables.

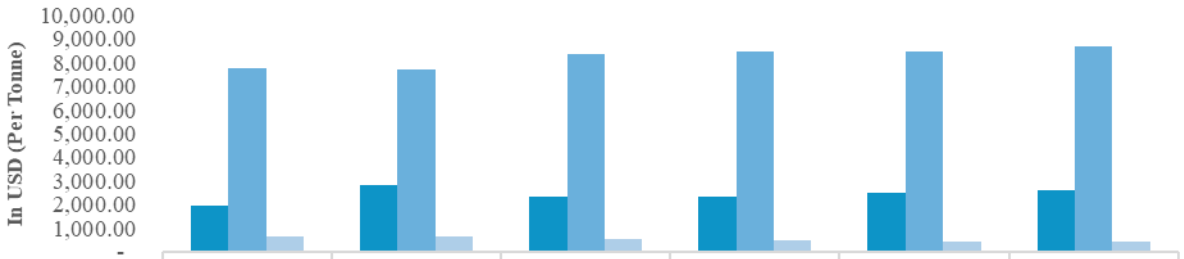
Key Benefits of In-House Rolling

- Enables direct control over quality, material dimensions, and process customization, leading to uniform wires with tight tolerances and excellent surface finish.
- Reduces lead times and supplier dependency, enhancing production scheduling flexibility and speed.
- Supports the ability to manufacture specialty profiles and custom gauges for various cable types, from house wiring to power cables.
- Facilitates integration with subsequent steps like annealing (softening), insulation, twisting/stranding, and extrusion in a single production workflow

5.2.Historical Price Trends on Raw Material – Global

The price trends of key raw materials such as aluminum, copper, and steel highlight the shifting dynamics of the global commodities market. Aluminum increased from USD 1,978.00 per tonne in 2020 to USD 2,612.00 per tonne in 2025, reflecting consistent demand growth across sectors like transportation, power, and construction, alongside rising input costs, and energy-linked pressures. Copper, driven by strong global consumption in renewable energy, electric vehicles, and electronics, increased from USD 7,742.00 per tonne in 2020 to USD 8,708.00 per tonne in 2025, maintaining its position as a critical enabler of energy transition technologies. In contrast, steel prices moved in the opposite direction, falling sharply from USD 664.00 per tonne in 2020 to USD 425.00 per tonne in 2025, largely due to global oversupply, high import competition from low-cost producers, and weakened margins in the industry

Figure 5.2: Global Price Trends on Raw Material, In USD (Per Tonne), 2019-2025



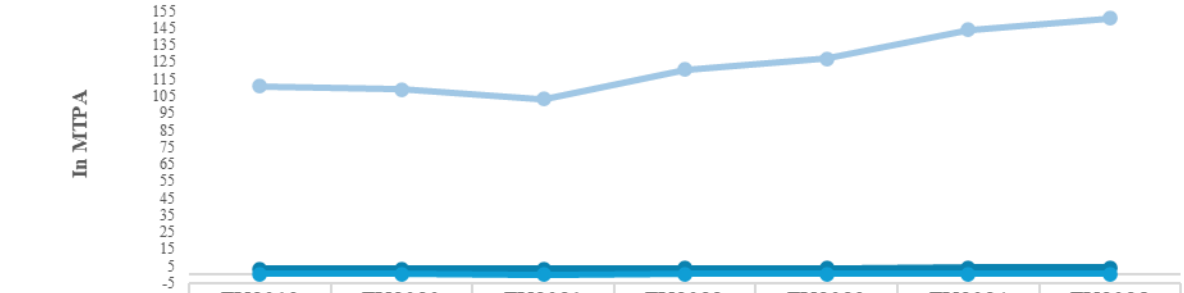
	2020	2021	2022	2023	2024	2025
Aluminum	1,978.00	2,807.00	2,360.00	2,335.00	2,516.00	2,612.00
Copper	7,742.00	7,691.00	8,388.00	8,475.00	8,478.00	8,708.00
Steel	664.00	646.00	565.00	497.00	442.00	425.00

Source: London Metal Exchange & Trading Economics

5.3.Production Trends on Raw Material – Domestic

India's metal production has shown notable growth from FY2019 to FY2025 across aluminum, copper, and steel sectors, reflecting the country's expanding industrial base and infrastructure development.

Figure 5.3: Production Trends on Raw Material, In Million Tonne Per Annum (MTPA), FY2019-FY2025



	FY2019	FY2020	FY2021	FY2022	FY2023	FY2024	FY2025
Aluminium	3.70	3.60	3.60	4.03	4.07	4.15	4.20
Copper	0.45	0.41	0.36	0.48	0.46	0.51	0.57
Steel	110.92	109.14	103.54	120.92	127.2	144.30	151.14

Source: Ministry of Mines, Ministry of Steel and Press Information Bureau
Note: Copper refers to Ore Copper and Steel refers to Crude Steel

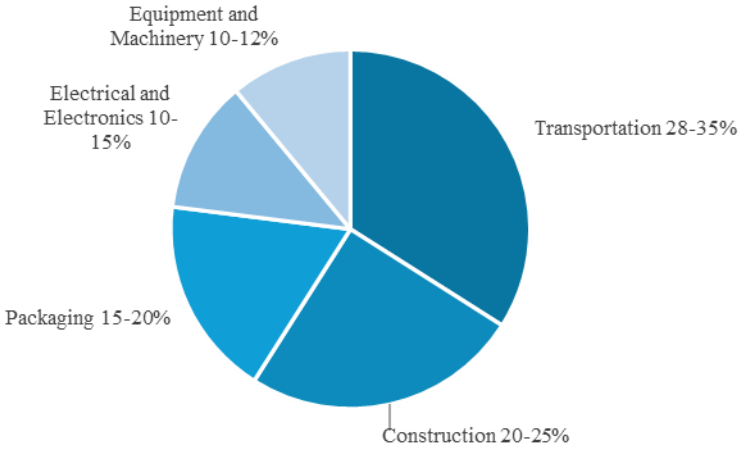
In FY2019, India's aluminium production was about 3.70 million tonnes per annum (MTPA) and reached 4.20 MTPA by FY2025[61], supported by increasing demand from automotive, packaging, construction, and the fast-growing electric vehicle (EV) sector. Copper production, though smaller in scale, grew from around 0.45 MTPA in FY2019 to 0.57 MTPA in FY2025[62], driven by capacity expansions and its growing role in renewable energy and infrastructure supply chains. Steel, however, has shown the sharpest growth, climbing from 110.92 MTPA in FY2019 to 151.14 MTPA in FY2025[63], propelled by investments under the National Steel Policy, Production-Linked Incentive (PLI) schemes, and large-scale infrastructure initiatives across housing, roads, railways, and urban development. With India now ranking as the world's second-largest crude steel producer, the sector is expected to maintain its growth momentum, with national targets aiming for a capacity of 300 MTPA by FY2031.[64] Oswal cables is also planning their own rolling mill for reverse integration and R&D at material level. The other plans include setting up a robust in-house testing lab that will be duly accredited and accepted.

5.4.End Use Industry of Aluminum, Copper, and Steel

Aluminum is a highly versatile metal valued for its lightweight, corrosion resistance, and recyclability, making it essential across industries. The transportation sector leads consumption at 28–35%, where aluminum is crucial in automotive, aerospace, and railways to improve efficiency and cut emissions. Construction follows with 20–25%, using aluminum in windows, doors, roofing, and structural parts for strength and flexibility. Packaging accounts for 15–20%, especially in cans, foils, and containers. The electrical and electronics sector consumes 10–15% due to its conductivity, while equipment and machinery use 10–12% in tools, appliances, and industrial applications. Together, these sectors highlight aluminum's indispensable role in modern economies

[61]https://mines.gov.in/webportal/content/Aluminium
[62] https://mines.gov.in/webportal/copper
[63] https://www.pib.gov.in/PressReleasePage.aspx?PRID=2088827
[64]https://www.ibef.org/industry/metals-and-mining#:~:text=targets%20of%20achieving%20a%20total%20crude%20steel%20capacity%20of%20300%20million%20tonnes

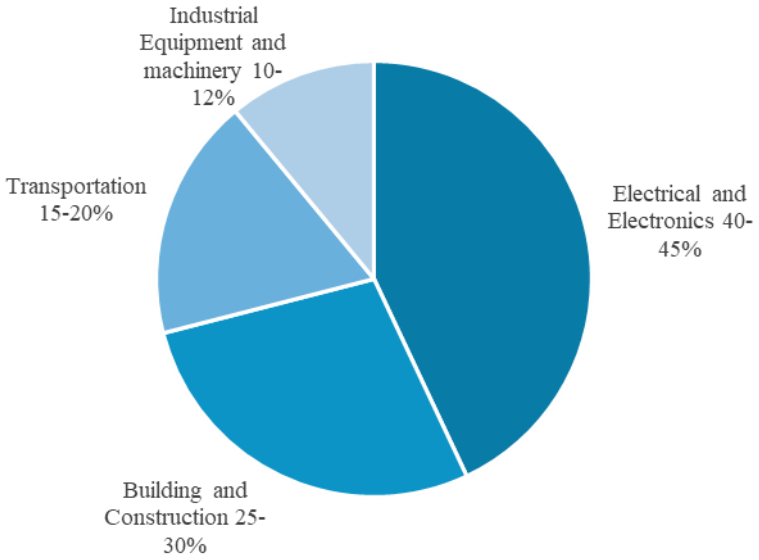
Figure 5.4: End-User Industry Distribution of Aluminium Consumption FY2025



Source: Ministry of Mines and Press Information Bureau

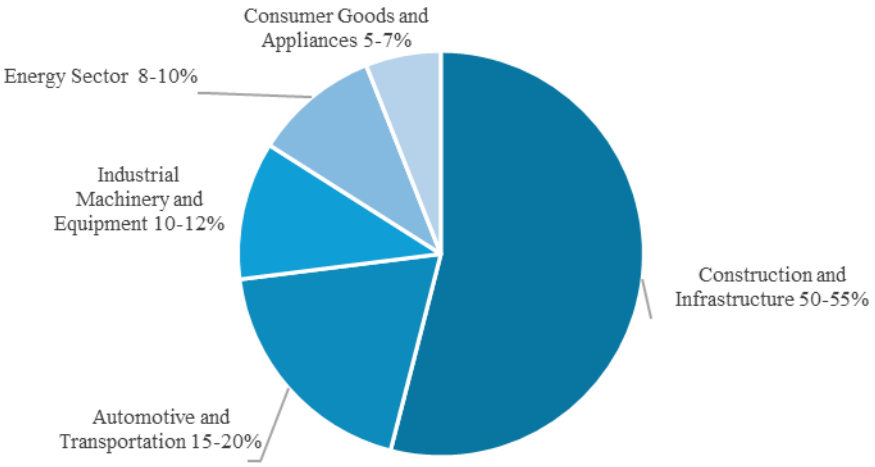
Copper plays a vital role across multiple industries due to its superior electrical and thermal conductivity, durability, and recyclability. The electrical and electronics sector is the largest consumer, accounting for 40%–45% of total demand, where copper is used extensively in wiring, cables, transformers, and electronic components. Building and construction contribute 25%–30%, utilizing copper in plumbing, roofing, and architectural applications for its strength and corrosion resistance. The transportation sector consumes 15%–20%, particularly in electric vehicles, railways, and automotive wiring systems. Industrial equipment and machinery represent 10%–12%, with copper used in motors, generators, and manufacturing systems, underscoring its essential role in industrial growth

Figure 5.5: End-User Industry Distribution of Copper Consumption FY2025



Steel is a fundamental material in modern economies, with its demand spread across diverse end-user industries. The construction and infrastructure sector dominates steel consumption, accounting for 50%–55%, where it is widely used in buildings, bridges, railways, and urban development projects. Automotive and transportation represent 15–20%, leveraging steel for vehicles, shipbuilding, and rail manufacturing due to its strength and durability. Industrial machinery and equipment consume 10%–12%, driven by manufacturing, mining, and heavy engineering. The energy sector contributes 8%–10%, utilizing steel in pipelines, power plants, and renewable projects. Consumer goods and appliances form 5%–7%, highlighting steel's versatility in everyday products.

Figure 5.6: End-User Industry Distribution of Steel Consumption FY2025



Source: Ministry of Steel and Press Information Bureau

5.5.Substations and Transmission Cables in the T&D Conductor Market

Substations are regarded as critical nodes in the power transmission and distribution network, where voltage is transformed, controlled, and routed to ensure reliable electricity supply to end users. Their functioning is supported by specialized transmission cables and conductors, which are required to withstand high voltages, manage large power flows, and enable protection and control systems. In India there were around 39,965 substations in FY2021 which is projected to increase to 52,157 by FY2030, adding nearly 12,192 new facilities in the sub-transmission segment (66/11 kV, 33/11 kV, 22/11 kV).[65] [66] Oswal Cables are an integrated manufacturer of high voltage conductivity products with a voltage spectrum of up to 765 kV, deployed across critical energy infrastructure uses including transmission and distribution, renewable energy integration, railways and industrial application.

Importance of Transmission Cables for Substations

- **High-Voltage Handling:** Substations manage voltage transformation from high transmission voltages (132 kV, 220 kV, 400 kV, and above) down to sub-transmission and distribution levels. Transmission cables used in substations must safely withstand these high voltages, with excellent insulation and shielding properties.
- **Power Transfer Capacity**: The conductors and cables installed within substations must accommodate large power flows reliably, ensuring minimal power loss and stable operation of transformers, switchgear, and busbars.
- **Control and Protection:** Beyond power conductors, substations require a suite of control, instrumentation, and protection cables to facilitate monitoring, fault detection, and system automation, which are vital for grid stability and remote operation.
- **Durability and Compliance:** Transmission cables for substations are typically engineered to resist extreme environmental conditions, thermal stress, and electrical surges, complying with standards such as IEC, BIS, and IEEE to ensure longevity and safety.

Role in the T&D Conductor Market

The demand for transmission cables in substations is a key driver in the T&D conductor market:

[65] https://www.tndindia.com/sub-transmission-substation-capacity-to-grow-29-per-cent-by-2030/
[66] https://www.eqmagpro.com/cea-draft-distribution-perspective-plan-2030-eq/

- **Growing Substation Capacity**: Expanding power networks, driven by renewable energy integration and grid modernization, are leading to increased substation installations and upgrades, thereby lifting transmission cable consumption.
- **Shift to High Voltage and Advanced Conductors**: To improve efficiency and reduce losses, utilities opt for advanced conductors like HTLS (High-Temperature Low-Sag) and higher voltage-rated cables within substations, impacting conductor specifications and market segmentation.
- **Project and EPC Focus:** Substation cable supply is often linked with utility-scale EPC contracts, requiring bulk T&D conductor procurement, thereby benefiting organized sector manufacturers well-versed in specialized transmission cable technologies. The EPC capabilities of Oswal Cables include design, procurement, construction, and commissioning. The company has implemented such projects for Indian State Governments and Offshore. The company has worked in sectors such as Transmission Lines, Distribution Lines and Substations.
- **Renewable Energy Integration**: Large-scale renewable projects require new substations for grid interconnection, amplifying demand for reliable transmission cables suited for solar, wind, and hybrid power projects

5.6.Mechanism for Awarding Transmission Projects in the Indian Market

The mechanism for awarding transmission projects in the Indian market primarily follows the "Tariff Based Competitive Bidding" (TBCB) process designed to ensure transparency, competitiveness, and efficient project execution under the regulatory framework of the Ministry of Power and the Central Electricity Regulatory Commission (CERC).

Key Steps in the Transmission Project Award Process: [67]

Figure 5.7: Transmission Project Award Process

Source: Frost & Sullivan Analysis

Project Identification & Notification: The Central Government or its agency, such as CTUIL (Central Transmission Utility of India Limited), identifies the need for a new transmission project. The project is notified publicly, and a Bid Process Coordinator (BPC) is appointed—often CTUIL or a specialized government entity—to coordinate the bidding process.

Preparation and Approval of Bid Documents: BPC prepares the Request for Proposal (RfP) and qualification documents as per Ministry of Power's Standard Bidding Documents. These documents include detailed project requirements, bid evaluation methodology, qualification criteria (financial net worth, experience, technical specs), timelines, Transmission Service Agreement (TSA) terms, and performance guarantees. Any deviations from standard guidelines require government approval.

Wide Publicity and Online Bidding: The RFP is published in multiple national newspapers, official websites, and trade magazines to ensure wide reach. The bidding is carried out electronically through a single-stage two-envelope system: technical bid and financial bid. Participation is international competitive bidding (ICB), encouraging global and domestic players.

[67] https://cercind.gov.in/2025/orders/471-AT-2025.pdf

Bid Evaluation and Reverse Auction: Technical bids are assessed first to ensure bidders meet minimum qualification criteria. Qualified bidders proceed to submit initial price bids. An e-reverse auction process follows, allowing multiple rounds to lower bid prices transparently. The bidder quoting the lowest tariff (transmission charge) after evaluation is selected.

Award and Agreement Execution: The winning bidder acquires the Special Purpose Vehicle (SPV) incorporated for the project. The bidder (now Transmission Service Provider, TSP) signs the Transmission Service Agreement (TSA) with the nodal agency. The TSP applies for a transmission license within five days of acquisition and starts project execution.

Public Disclosure and Commission Approval: The Bid Process Coordinator publicly discloses the final bid results. The tariff discovered through bidding is submitted to the Appropriate Commission for approval under Section 63 of the Electricity Act, 2003. The regulatory commission adopts the tariff unless objections arise

5.7. Revamped Distribution Sector Scheme (RDSS), 2021

The RDSS was launched by the Government of India in July 2021 with an outlay of about INR 3.04 lakh crore (INR 97,631.00 Cr as central government share). It is designed to improve the operational and financial health of state power distribution companies (DISCOMs). The scheme focuses on reducing aggregate technical & commercial (AT&C) losses, modernizing infrastructure, and ensuring reliable, 24x7 electricity supply. [68]

Key features include:

- Smart metering for consumers, feeders, and transformers.
- System strengthening with underground cabling, aerial bunched cables, and new distribution lines.
- IT/OT enablement such as SCADA, distribution management systems, and GIS mapping.
- Financial sustainability through loss reduction and better billing/collection efficiency.
- Conditional funding linked to performance benchmarks.

Current Impact on T&D Sector:

- **Smart metering rollout accelerated**: A total of 20.33 crore smart meters was sanctioned across 28 States and Union Territories, of which 2.41 crore have been installed as of July 15, 2025. [69]
- **Improved reliability of networks**: Outages in urban areas have already seen reduction where pilot projects were completed.
- **Lower AT&C losses:** Many DISCOMs are reporting gradual reduction from >20% to near 15–17% levels in pilot regions.[70]
- **Enhanced private participation**: Technology firms, EPC contractors, and smart meter providers are benefiting from new tenders.
- **Digitalization of grids**: Real-time monitoring systems are being deployed, improving fault detection and faster restoration.

Expected Impact on T&D Sector

- **Significant loss reduction:** Targeted AT&C losses are expected to be brought down to 12–15% nationwide.
- **Financially healthier DISCOMs**: With improved billing and collections, dependence on subsidies and bailouts is expected to be reduced. [71]
- **Boost to transmission planning**: More predictable load growth and reliable distribution will support integration of 500 GW non-fossil capacity by 2030.
- **Grid modernization**: Investments in underground cabling, feeder segregation, and SCADA will make distribution grids more robust and smart-grid ready.

[68] https://www.pib.gov.in/PressReleaseIframePage.aspx?PRID=1897764

[69]https://www.pib.gov.in/PressReleseDetail.aspx?PRID=2147902#:~:text=by%20PIB%20Delhi-,Under%20the%20Revamped%20Distribution%20Sector%20Scheme%20(RDSS)%2C%2020.33%20crore,revenue%20for%20all%20energy%20consumed.

[70] https://www.pib.gov.in/PressReleaseIframePage.aspx?PRID=1947709

[71] https://www.pib.gov.in/PressReleaseIframePage.aspx?PRID=1897764

- **Increased private investments**: Opportunities will continue to open for private players in smart meters, automation, and network upgrades.

Better rural and last-mile connectivity: With a focus on reliable supply, rural and semi-urban areas will see stronger distribution infrastructure.

5.8.Regulations for International and Domestic T&D Market

The transmission and distribution (T&D) sector operate under strict regulatory frameworks that ensure reliable, safe, and efficient power delivery.

Regulations for Domestic Market

In India, the Transmission and Distribution (T&D) sector is primarily governed by the Electricity Act, 2003, which provides the legal framework for licensing, tariff setting, and consumer protection. While generation was de-licensed to encourage competition, transmission and distribution remain regulated activities. Oversight is carried out by the Central Electricity Regulatory Commission (CERC) for interstate activities and the State Electricity Regulatory Commissions (SERCs) for intrastate activities.

Competitive bidding under the Tariff Based Competitive Bidding (TBCB) guidelines has enabled private participation in transmission projects since 2010–11. The introduction of the Indian Electricity Grid Code (IEGC 2023) further strengthens operational standards and reliability for transmission systems. Together, these measures create a structured and transparent environment that balances public oversight with opportunities for private investment.

Regulations for International Market

Globally, regulations for T&D systems are designed to ensure grid reliability, interoperability, and investment efficiency.

In North America, the North American Electric Reliability Corporation (NERC) enforces mandatory reliability standards across the bulk power system. [72]

In the European Union, transmission operations are guided by ENTSO-E network codes and monitored by the Agency for the Cooperation of Energy Regulators (ACER) to harmonize cross-border electricity markets. [73]

The UK follows a performance-linked regulatory model under Ofgem's RIIO framework (Revenue = Incentives + Innovation + Outputs), which encourages efficiency and innovation in grid operations. Internationally, the International Electrotechnical Commission (IEC) sets technical standards for equipment, interoperability, and safety, ensuring consistency across global T&D networks.[74]

Background of UDAY

The Ujwal DISCOM Assurance Yojana (UDAY) was launched in November 2015 to address the financial stress and operational inefficiencies of India's state-owned power distribution companies (DISCOMs). Under the scheme, state governments were allowed to take over 75% of DISCOM debt, refinancing it through bonds to ease the interest burden. UDAY also focused on reducing the Average Cost of Supply–Average Revenue Realized (ACS–ARR) gap, cutting Aggregate Technical and Commercial (AT&C) losses, and strengthening governance. By rationalizing debts and pushing for operational reforms, UDAY aimed to create a financially sustainable distribution sector capable of supporting India's growing electricity demand.

Benefits for Private Players on UDAY

Fiscally healthier ecosystem: Reduced DISCOM debts and operational inefficiencies pave the way for stable, profitable operations and bidding.

Market opening: With improved governance and performance metrics, private entities find it more attractive to enter via PPP models or distribution takeovers (e.g., in Delhi, Odisha). Examples: Delhi's TPDDL (a joint venture with Tata

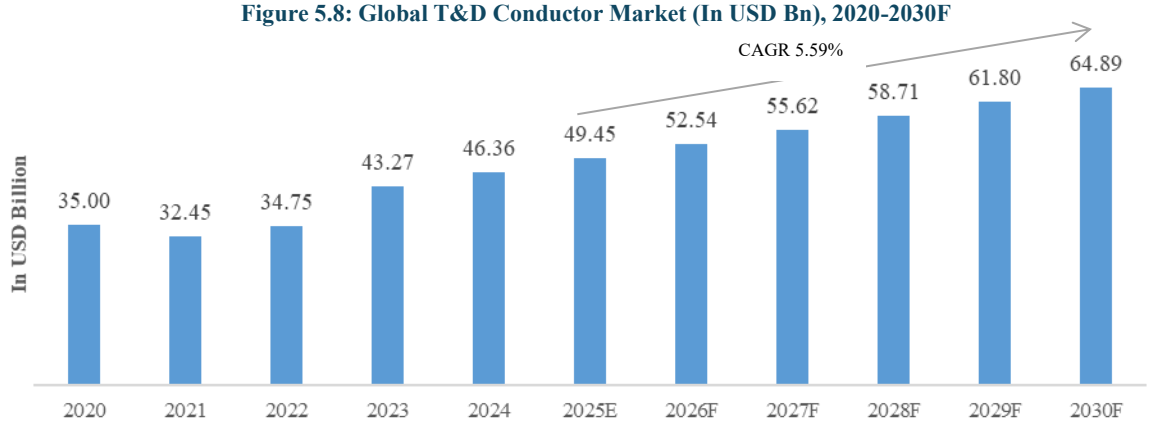
[72] https://www.certrec.com/resources/nerc-primer/a-primer-on-nercs-reliability-standards/
[73] https://www.neso.energy/document/40141/download
[74] https://www.ofgem.gov.uk/sites/default/files/2025-04/RIIO-2-NESO-Regulatory-Instructions-and-Guidance-Version-3.2.pdf

Power) and Odisha's TPNODL (PPP model with Tata and GRIDCO) showcase how UDAY-fed reforms create space for private participation

5.9.Global Market Overview- T&D Conductor Market

The global transmission and distribution (T&D) conductor market is experiencing robust growth, fuelled by rising electricity demand, rapid urbanization, and widespread investment in infrastructure and renewable energy integration. Asia-Pacific dominates the market, driven by extensive infrastructure development in China, India, and Southeast Asia, as these regions invest substantially in grid modernization, ultra-high voltage, and rural electrification. The T&D Conductor market accounted to USD 35.00 Bn in 2020 and expected to grow to USD 49.45 Bn by 2025 and further expand to USD 64.89 Bn by 2030 with a calculated CAGR of 5.59% between the period from 2025 to 2030.

Figure 5.8: Global T&D Conductor Market (In USD Bn), 2020-2030F



Source: Frost & Sullivan Analysis

Table 5.1 Conductor Product Listing

Category	Specification	Application
Medium Voltage Covered Conductor (MVCC)	Up to 33 kV, Aluminum	Used in overhead distribution lines, especially in forested or high-contamination areas. Provides superior reliability, reduces outage risk due to tree contact, and ensures higher safety standards compared to bare conductors.
All Aluminium Conductor (AAC)	EC Grade (99.7%) Al, ASTM B-231/BS 215/IEC 61089; concentric lay stranded	Overhead transmission and distribution in urban/coastal areas (short spans, high conductivity)
All Aluminium Alloy Conductor (AAAC)	Al-Mg-Si alloy (6201), ASTM B-399/IEC 61089/IS 398-IV	Overhead transmission/distribution, corrosion-prone areas (coastal), medium/high voltage lines
Aluminium Conductor Steel Reinforced (ACSR)	Aluminium 1350-H19 wires over galvanized steel core; ASTM B-232/IEC 61089	Overhead transmission, long spans, river crossings, high mechanical strength needed
High Temperature Low Sag Conductor (HTLS)	Al-Zr, Al-Mg-Si, composite/INVAR/carbon fibre core; up to 210–250°C; IEC/ASTM/IS	Upgrading transmission lines, high-capacity corridors, urban grid/renewables
Aluminium Conductor Steel Supported (ACSS)	Annealed Al strands over steel core, round/trapezoidal, 250°C rating	Reconductoring, high fluctuating loads, increased ampacity on existing lines

INVAR Conductor	Nickel-iron alloy core (INVAR); Al or Al-Zr outer layer, up to 210°C	Extra-high voltage, grid efficiency upgrades, urban/renewables integration
GAP Conductor	Trapezoidal thermal-resistant Al alloy (AT1/AT3) with gap over steel, grease-filled; IEC 62420	Uprating overhead transmission, high temp, double capacity with minimal tower mods
Aluminium Conductor Fibre Reinforced (ACFR)	Al (EC grade/Al-Zr alloy, trapezoidal) over carbon fibre composite core; up to 1000A	High capacity, low sag upgrades, coastal/corrosive and congested areas, renewable corridors

Source: Frost & Sullivan Analysis

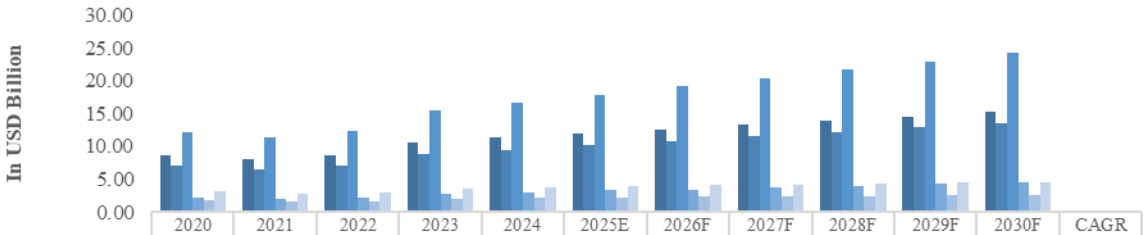
Note: The above list may not be Exhaustive

5.9.1. Global Market Sizes T&D Conductor Market– By Region

The global conductor market is projected to be driven by steady growth across all major regions through 2030. Technological advancements and smart grid deployment are shaping product development, while renewable energy projects and electric vehicle infrastructure contribute steadily to increased conductor demand. The highest CAGR of 6.45% is expected to be recorded in Asia-Pacific, fuelled by the urgent need to upgrade aging grid infrastructure, integrate renewable energy, and meet rising electricity demand from rapid urbanization and industrial expansion.

Leading economies such as China and India are aggressively expanding long-distance and cross-border electricity networks, reflecting their commitment to reliable, resilient, and environmentally sustainable transmission infrastructure. Europe and Africa are anticipated to follow with CAGRs of 6.10% and 6.36%, respectively, supported by grid modernization and electrification programs. Africa is an important market to Oswal Cables, Mozambique alone accounts to 42.35% of the total exports in FY2025.Oswal Cables is one of the key players in government projects in Mozambique. The other countries of interest in Africa are Senegal, Mauritania, Benin, Togo, and Niger East. The countries of interest for Oswal Cables in Central & South Africa are Rwanda, Burundi, Ethiopia, and DR Congo. A CAGR of 4.93% is forecasted for North America, driven by investments in aging grid replacement and smart infrastructure. Moderate growth is expected in Latin America and Others (Middle East and CIS), as rising electricity demand and energy transition continue to shape the market. Oswal Cable is expected to expand into USA & Europe, soon. LATAM is also an important market for Oswal cables, the company had a special focus in countries like Paraguay, Colombia, Peru, Mexico, and Costa Rica. LATAM market is grow at a CAGR of 3.13% from USD 2.23 Bn in 2025 to USD 2.60 Bn in 2030.

Figure 5.9: Regionwise T&D Conductor Market (In USD Bn), 2020-2030F



	2020	2021	2022	2023	2024	2025E	2026F	2027F	2028F	2029F	2030F	CAGR
North America	8.75	8.06	8.58	10.62	11.31	11.99	12.66	13.32	13.97	14.62	15.25	4.93%
Europe	7.00	6.52	7.02	8.78	9.46	10.14	10.82	11.51	12.21	12.92	13.63	6.10%
APAC	12.25	11.44	12.34	15.47	16.69	17.80	19.18	20.44	21.72	23.02	24.33	6.45%
Africa	2.10	1.98	2.15	2.73	2.97	3.34	3.47	3.73	3.99	4.26	4.54	6.36%
LATAM	1.75	1.59	1.67	2.03	2.13	2.23	2.31	2.39	2.47	2.53	2.60	3.13%
Others	3.15	2.86	2.99	3.63	3.80	3.96	4.10	4.23	4.34	4.45	4.54	2.80%

Source: Frost & Sullivan Analysis

5.10. Transmission Infrastructure Growth

Transmission infrastructure growth is driven by rising renewable integration, policy reforms, technology upgrades, and cross-regional interconnections. These factors collectively increase capacity, efficiency, and private sector investment

Total Transmission Line Network: India has over 475,000 circuit kilometres, the US and China each exceed 700,000 km, and Canada/UAE deploy significant networks per their size; growth is motivated by grid reliability and renewable power evacuation.

Growth in Transformation Capacity: Transformation capacity—measured in MVA—has surged due to upgrades for integrating solar and wind, reducing losses, and boosting system flexibility. India's capacity saw ~8% CAGR post-2015, driven by government targets and private investment.

Sector-Wise Share of Transmission Line Additions: Government-owned entities account for the majority—about 70%—of line additions, especially in interstate grids. The private sector, increasingly via TBCB (Tariff-Based Competitive Bidding), now contributes ~30% in new builds, particularly for renewables and strategic corridors.

Private Sector Participation in Transmission Sector: Private participation, enabled by competitive bidding and innovative funding, accelerates capacity expansion and brings market-driven efficiencies. Nearly 100% of new interstate transmission projects in India are awarded to private developers, and investment are increasing globally through PPPs and asset monetization.[75] India's historically public-dominated transmission sector now features active private firms, especially following reforms like the Electricity Act of 2003. The private sector's share of direct transmission line capacity remains modest, with an estimate of around 8% -12% market share, dominated by players like Adani Transmission, Sterlite Power, Tata Power, and several joint ventures with state or central agencies. Many projects are awarded through TBCB, allowing private firms to invest, operate, and eventually transfer assets back to public utilities after long concession periods (often 35 years).

5.11. Regulatory Frameworks and Policy Drivers Shaping the Global T&D Conductor Market

The global T&D conductor market is shaped by regulatory frameworks, grid codes, and policy drivers that ensure reliability, safety, efficiency, and enable cross-border power integration.

In the United States, no single national grid code is followed. Instead, the 2023 National Electrical Safety Code (IEEE C2) is used for design, clearance, and work practices. Conductor requirements are given by ASTM standards such as B232/B232M for ACSR and B401 for compact ACSR. The reliability of bulk power systems is ensured by NERC standards like TPL-001 for planning and FAC-003 for vegetation control. A new rule, FERC Order No. 1920 (May 2024), was issued to make 20-year regional planning compulsory and to encourage "right-sizing" of lines, which creates demand for advanced conductors.

In India, the design and operation of conductors are controlled by the Central Electricity Authority's Technical Standards and the Indian Electricity Grid Code (IEGC 2023). The manufacturing of conductors is guided by BIS standards, such as IS-398 for aluminium and ACSR conductors. National programs like the Green Energy Corridors have been planned to support renewable energy, where HTLS conductors and OPGW are promoted.

In Canada, the Canadian Electrical Code (CSA C22.3 No. 1) and harmonized CSA/IEC standards such as C61089 are followed. Extra rules are made by provincial operators like AESO in Alberta and IESO in Ontario.

In the UAE, the Abu Dhabi Transmission Code and the GCC Grid Code are applied, and IEC standards are used for procurement.

In China, national policy under the 14th Five-Year Plan has been made to expand the grid. Conductor design follows GB/T 1179-2017, which is close to IEC 61089, and is used for UHV and long-span lines. International projects like CASA-1000 and the ASEAN Power Grid (APAEC) also use IEC-based rules, which make it easier for conductors to be used in many countries

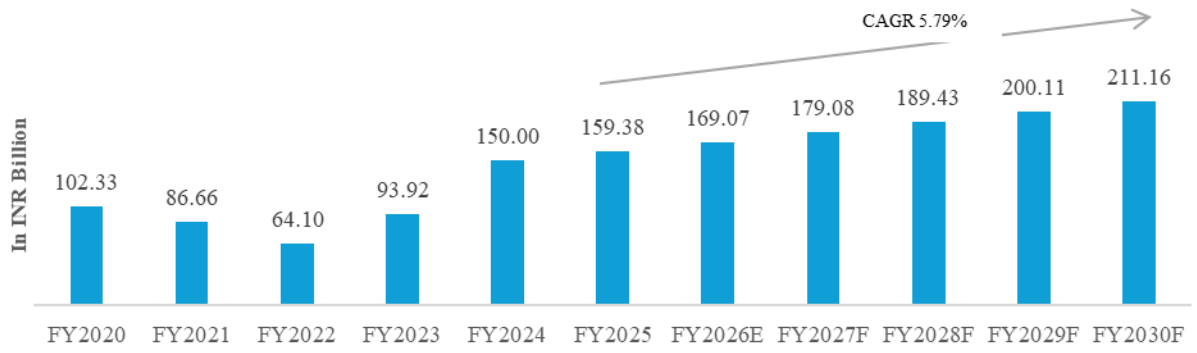
[75] https://ppi.worldbank.org/content/dam/PPI/resources/ppi_publication/web_publication/100989-BRI-VC-PUBLIC-ADD-SERIES-Box393254B-Knowledge-Notes-LW52-OKR.pdf

5.12. Indian T&D Conductor Market

Conductors, typically made from aluminum (AAC, AAAC, ACSR) and copper, are fundamental components that carry electric current in overhead transmission and distribution networks. Overhead conductors are widely used due to their cost efficiency, ease of installation, and maintainability.

The Indian transmission and distribution (T&D) conductors' market was accounted to INR 102.33 Bn in FY2020 and is expected to grow to INR 159.38 Bn by FY2025, reaching INR 211.16 Bn by FY2030 with a CAGR of 5.79% between the period FY2025–FY2030 period. The market's growth is being driven by significant investments in power infrastructure, sustained grid modernization programs, accelerated rural electrification initiatives, and the growing integration of renewable energy into the national transmission system. Oswal Cables is one of the oldest and leading exporters of cable and conductors from Rajasthan. The company has around three generations of experience and 5 decades of standing strong and they supply to 5 continents across 40 plus countries

Figure 5.10: India T&D Conductor Market (In INR Bn), FY2020-FY2030F



Source: Frost & Sullivan Analysis

India's T & D conductors' market is experiencing sustained growth, driven by large-scale investments in power infrastructure, expanding rural electrification programs, and consistent grid modernization efforts. The increasing share of renewable energy in the national energy mix is further accelerating demand for technologically advanced transmission and distribution (T&D) systems. Strategic government initiatives, such as Make in India, the Revamped Distribution Sector Scheme (RDSS), the Green Energy Corridors (GEC), the Pradhan Mantri Gati Shakti National Master Plan, and the Integrated Power Development Scheme (IPDS) are central to enhancing domestic manufacturing capabilities and strengthening national grid infrastructure.

The GEC, specifically, is enabling the large-scale integration of renewable energy by establishing high-capacity transmission corridors in resource-rich states including Gujarat, Rajasthan, Tamil Nadu, and Karnataka. This has significantly increased demand for conductors such as ACSR (Aluminium Conductor Steel Reinforced), AAAC (All Aluminium Alloy Conductor), and HTLS (High-Temperature Low-Sag) types.

Pradhan Mantri Gati Shakti National Master Plan which was introduced in 2021 provides a GIS-enabled platform to streamline inter-ministerial coordination, with 28,700 circuit km of new transmission lines planned by FY2025 at an estimated cost of INR 75.00 Bn.[76]

Meanwhile, the IPDS has modernized urban T&D networks, driving significant consumption of AB (Aerial Bunched) and UG (Underground) cables over 246,000 km of ACSR/AAAC lines alone.[77]

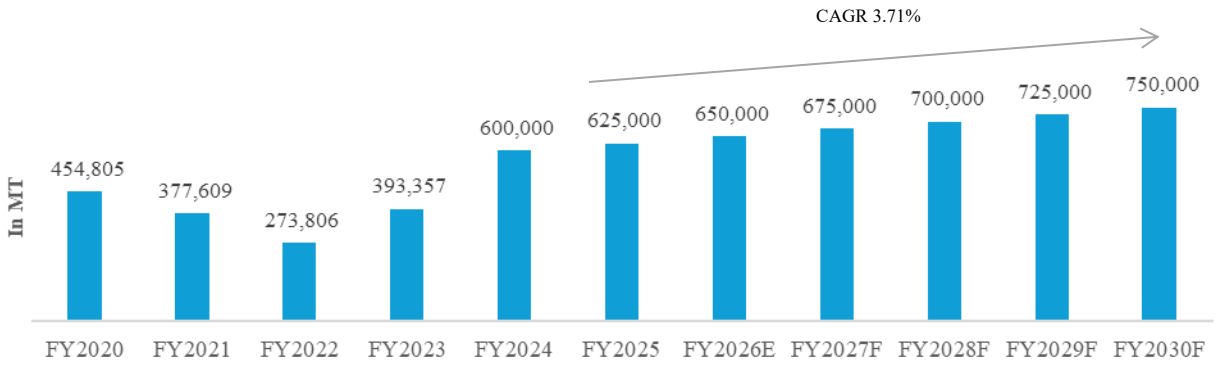
Industry challenges include volatile raw material prices, logistical barriers such as right-of-way acquisition, and the need to upgrade aging infrastructure. Nonetheless, with projected investments of over INR 9.00 Tn[78] in power transmission by 2032 and increasing adoption of advanced conductors such as ACSR, AAAC, and HTLS, India's

[76] https://www.eprmagazine.com/news/pm-gatishakti-master-plan-expands-power-transmission-network/
[77] https://powerline.net.in/2018/01/04/growth-opportunity-2/
[78] https://www.ibef.org/news/india-to-spend-over-rs-9-trillion-us-107-89-billion-on-power-transmission-infra-by-2032-govt

T&D conductor market is positioned for sustained, innovation-driven expansion focused on reliability, efficiency, and renewable energy integration

The conductor production is projected to grow from 4,54,805 metric tonnes (MT) in FY2025 to 7,50,000 MT by FY2030 with a CAGR of 3.71% between FY2025 to FY2030. The growth drives the infrastructure development, rising electrification needs, and the increasing adoption of advanced conductor technologies across the country's expanding transmission and distribution (T&D) network

Figure 5.11: Conductor Production (In MT), FY2020-FY2030F



Source: Frost & Sullivan Analysis

India's transmission infrastructure has expanded substantially, with the transmission line length at 220 kV and above crossing approximately 470,000 circuit kilometres as of 2023, making it one of the largest in the world. Annual additions typically range between 15,000 to 20,000 circuit kilometres, reflecting steady growth to meet rising electricity demand and integration of renewable sources. The country's transformation capacity reached close to 1,200 GVA, growing at around 8-9% CAGR over the past decade. With ambitious renewable energy targets set at 500 GW by 2030, demand for advanced conductors like High Temperature Low Sag (HTLS) and Optical Ground Wire (OPGW) is expected to increase sharply, especially in interstate transmission corridors to enhance grid capacity and reliability.

5.13. Indian T&D Conductor Market- By Type

Aluminium is often combined with a steel core to create aluminium conductor steel reinforced (ACSR) cables to enhance strength and enable longer spans between support towers. In these conductors, the steel core provides the necessary mechanical strength, while the surrounding strands of aluminium deliver the electrical conductivity. This hybrid design ensures that power lines can span greater distances, endure severe weather, and support high-tension lines without excessive sag or risk of breakage. ACSR conductors are now standard for overhead high-voltage transmission lines worldwide. High-Temperature Low-Sag (HTLS) conductors are increasingly used in India's transmission expansion, enabling higher power transfer without major right-of-way additions. Underground cabling is increasingly being adopted by both state and central transmission utilities as it offers higher safety compared to overhead lines. Increasing government infrastructure investments, especially under the Smart Cities Mission, are expected to drive demand further and open new growth opportunities within the country's cable segment.

Key Applications in Smart Cities:

Smart Grids and Power Distribution: High-performance power cables (XLPE, hybrid, HTLS) provide reliable electricity for distributed energy resources, smart meters, and grid automation.

Renewable Energy Integration: Specialized DC/AC cables, control cables, and armored energy cables connect solar panels, wind farms, and battery storage to urban grids with low losses and high weather resistance.

Intelligent Transportation and EV Charging: Low-voltage control and armored power cables support smart traffic signals, road sensors, and public EV fast-charging stations, enabling real-time congestion management and clean mobility.

Smart Buildings and Homes: Flame retardant (FR, FRLS) and halogen-free cables distribute power and data in home automation, intelligent lighting, climate control, and advanced safety systems.

Communication and IoT Connectivity: Fiber optic cables and hybrid power-data cables enable high-speed internet, seamless IoT integration, and citywide data sharing for automated management, safety, and analytics.

Security and Surveillance: Copper and fibre optic cables power and carry data for security cameras, sensors, AI-driven threat detection, access control systems, and emergency networks in public spaces.

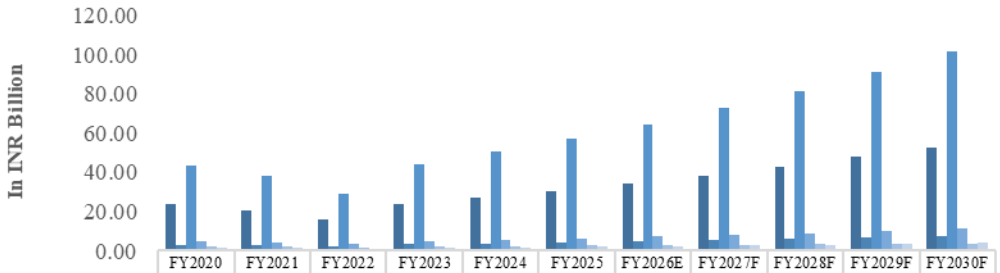
Underground Cabling for Safety and Urban Aesthetics: XLPE-insulated and armored underground cables minimize accidents, outage risks, and urban clutter by replacing overhead lines in densely populated areas

Other specialized conductors include All-Aluminium Alloy Conductors (AAAC) and cadmium-copper alloys, the latter used only in rare circumstances where exceptionally high strength is needed, and cost is less of a concern. Regardless of material, overhead transmission conductors are generally constructed as stranded wires, meaning they consist of a central core surrounded by multiple layers of wires twisted in opposite directions. This stranded configuration increases flexibility, reduces the likelihood of breakage, and improves performance under the dynamic loads experienced by power lines.

The choice of conductor is influenced by multiple factors beyond electrical performance. These include mechanical strength, especially for long spans and high-tension applications; resistance to corrosion for exposure to different climates; weight, which affects the design and cost of tower supports; as well as overall cost and availability. Environmental and operational conditions, such as wind, ice-loading, and potential for corrosion, also play significant roles in determining the optimal conductor type for a given project.

India's domestic demand for aluminium conductors is expected to grow significantly across all categories between FY2025 and FY2030. ACSR conductors are projected to increase from INR 57.29 Bn to INR 101.36 Bn, registering a growth of 77%. AAC demand is anticipated to rise by 73.00%, from INR 30.56 Bn to INR 52.89 Bn. AAAC conductors will see a 75.00% increase in demand, growing from INR 4.12 Bn to INR 7.21 Bn. HTLS conductors are expected to witness 78.00% growth, reaching INR 11.26 Bn from INR 6.31 Bn. Meanwhile, ACAR conductors will grow by 81.00%, from INR 2.14 Bn to INR 3.87 Bn, and bundled conductors are forecasted to expand by 40.00%, rising from INR 2.57 Bn to INR 3.60 Bn. This upward trend reflects the growing focus on grid modernization, capacity expansion, and adoption of advanced conductor technologies in India's power sector.

Figure 5.12: Aluminium Conductor Type Split (In INR Bn), FY2020-FY2030F



	FY2020	FY2021	FY2022	FY2023	FY2024	FY2025	FY2026E	FY2027F	FY2028F	FY2029F	FY2030F
Aluminum Conductor (AAC)	23.54	20.61	15.76	23.88	27.08	30.56	34.34	38.44	42.88	47.69	52.89
All Aluminum Alloy Conductor (AAAC)	3.14	2.75	2.11	3.20	3.64	4.12	4.64	5.20	5.82	6.48	7.21
Aluminum Conductor Steel Reinforced (ACSR)	43.15	37.95	29.15	44.37	50.54	57.29	64.66	72.70	81.46	90.99	101.36
High Temperature Low Sag Conductor (HTLS)	4.71	4.15	3.19	4.87	5.56	6.31	7.13	8.03	9.02	10.09	11.26
Bundled Conductors	2.35	2.00	1.48	2.16	2.37	2.57	2.78	2.99	3.20	3.40	3.60
Aluminum Reinforced (ACAR)	1.57	1.39	1.07	1.64	1.88	2.14	2.42	2.74	3.08	3.46	3.87

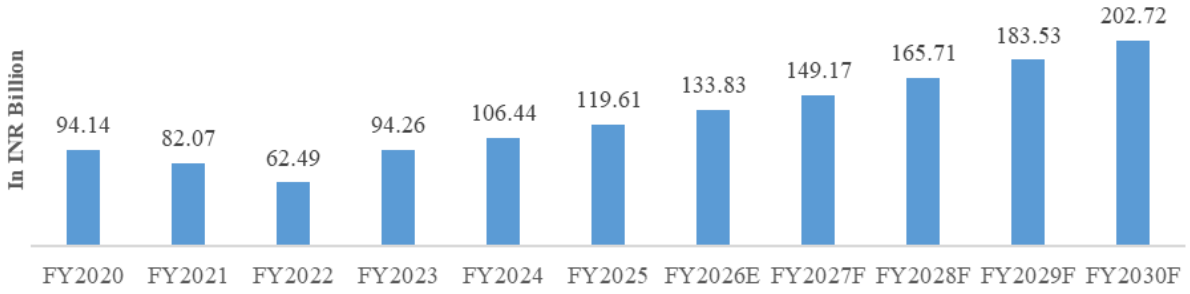
Source: Frost & Sullivan Analysis

5.13.1. Indian O/H Conductors Market

The key drivers in the Indian Overhead (O/H) conductors market include government-led initiatives to modernize aging grid assets, expand electrification to rural and semi-urban areas, and upgrade and build new high-voltage corridors to support grid reliability and renewable integration. India's ambitious renewable energy targets and increasing cross-regional power flows are driving demand for high-strength, lightweight conductors suitable for long-distance and ultra-high-voltage applications. Despite challenges like high initial costs and raw material price volatility, the Indian OH conductor market is set for continued expansion, underpinned by strong policy support, sustained utility

investments, and a growing commitment to sustainability and technological advancement. The o/h conductor market was expected to grow from INR 119.61 in FY2025 to INR 202.72 Bn in FY2030.

Figure 5.13: O/H Conductor Market (In INR Bn), FY2020-FY2030F



Source: Frost & Sullivan Analysis

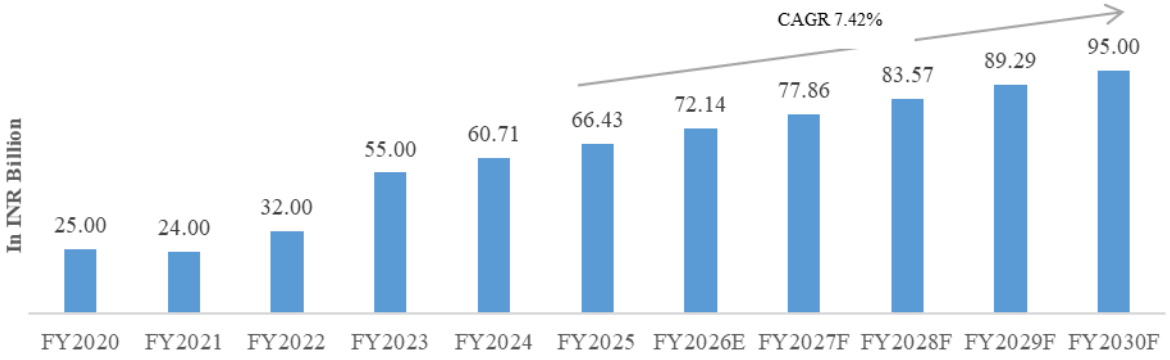
5.13.1.1. O/H Conductors Market Export Contribution and Key Markets

India's conductor manufacturers have focused on tapping global markets, especially in Asia, Africa, and Latin America, by offering competitively priced, reliable products tailored for diverse local requirements. The expansion of the power and infrastructure sectors worldwide, along with increasing electrification and integration of renewables, is fuelling steady international demand for advanced O/H conductors.

This export performance is underpinned by policy support such as the Make in India initiative, sustained investment in manufacturing capacity, and an ongoing emphasis on technological advancement. Going forward, India is well-positioned to increase its share of the global O/H conductor market, benefitting from expanding transmission needs, grid modernization efforts, and a favourable trade balance in this sector

India's overhead conductor exports have shown robust growth, increasing from INR 55.00 Bn in FY2023 to INR 66.43 Bn in FY2025 and projected to reach INR 95.00 Bn in FY2030 with a CAGR of 7.42% between FY2025 to FY2030. India exported approximately USD 531.00 Mn worth of electric conductors (50,180 tonnes) in FY2023, with top export destinations being the US (USD 113.00 Mn), Australia (USD 63.00 Mn), Nepal, Paraguay, and Nigeria. Key global markets include North America, Europe, and APAC, reflecting strong demand driven by grid expansion and renewable energy integration. India's competitive pricing, quality standards, and growing international reach are solidifying its position in the global overhead conductor's trade.

Figure 5.14:India O/H Conductor Export Market (In INR Bn), FY2020-FY2030F



Source: World bank and Frost & Sullivan Analysis

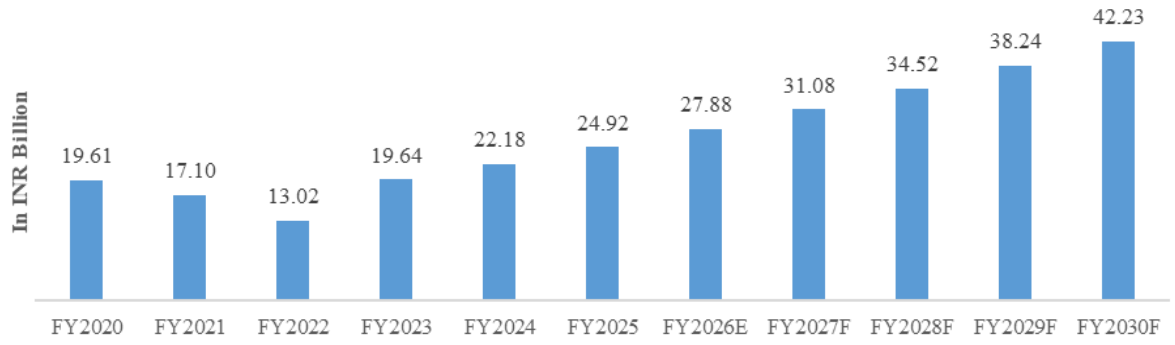
5.13.2. Medium Voltage Covered Conductors (MVCC)

The conductor is typically rated between 11 kV and 33 kV, are insulated overhead conductors engineered to enhance the safety, efficiency, and reliability of power distribution systems. Featuring a multi-layer design, including a core

conductor (commonly AAAC or ACSR), XLPE insulation, and a UV-resistant outer jacket and offer superior protection against conductor clashing, vegetation contact, wildlife interference, and adverse weather conditions.

Medium voltage conductors are estimated to account for approximately 25.00% to 28.00% of the total power and transmission market. The market was accounted to INR 19.61 Bn in FY2020 and expected to grow to INR 24.92 Bn by FY2025, with projections indicating it is expected to reach INR 42.23 Bn by FY2030. This growth is being driven by increased investments in grid modernization, distribution network upgrades, and the adoption of advanced conductor technologies in medium-voltage applications.

Figure 5.15: Medium Voltage Covered Conductors (MVCC) Market (In INR Bn), FY2020-FY2030F



Source: Frost & Sullivan Analysis

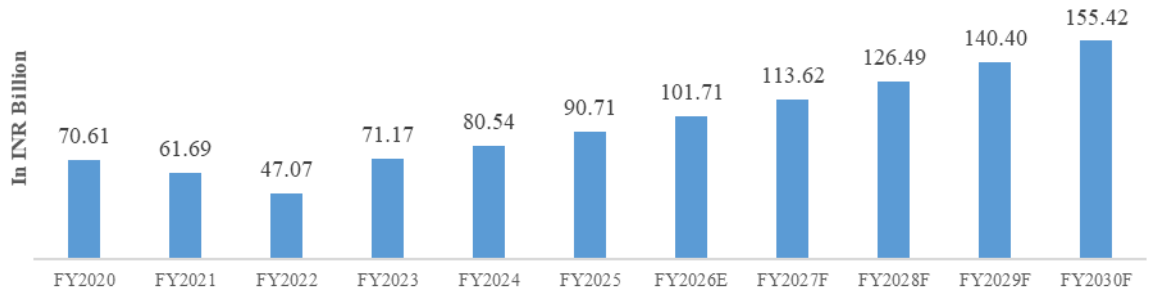
5.13.3. O/H Conductors Market Analysis by End-user market

The overhead (o/h) conductors' market is primarily segmented and driven by its end-user markets, with a clear dominance and varied application across sectors:

5.13.3.1. Power T&D network

The overhead (O/H) conductors' market is a core part of the power transmission and distribution (T&D) sector, supported by growing global efforts to upgrade infrastructure, expand electrification, and integrate renewable energy sources. Aluminium is the preferred choice for most modern overhead transmission lines due to its light weight, good conductivity, and cost-effectiveness. For the same electrical resistance, aluminium wires are significantly lighter than copper, making them practical for long spans. The most widely used type is Aluminium Conductor Steel Reinforced (ACSR), which combines aluminium's conductivity with a steel core that adds mechanical strength. Steel in this context is not the main conductor but serves to support the cable over long distances and withstand environmental stresses. The market was accounted to INR 70.61 Bn in FY2020 and is estimated to reach INR 90.71 Bn by FY2025. It is further projected to expand to INR 155.42 Bn by FY2030.

Figure 5.16: O/H Conductors in Power & Transmission Market (In INR Bn), FY2020-FY2030F



Source: Frost & Sullivan Analysis

5.13.3.2. Railways

The demand for o/h conductors in the Indian railway sector is expected to grow from INR 30.24 Bn in FY2025 to INR 51.81 Bn by FY2030. The railway segment is anticipated to contribute 25.00% of the overhead conductor market. Within railway applications, copper conductors are projected to maintain a dominant 70.00% share, driven by their superior conductivity and reliability in traction and signalling systems.

Overhead conductors used in railway electrification lines in India are primarily made from copper and a range of high-strength copper alloys, designed to meet the demanding requirements of high current capacity, mechanical strength, and durability. The main conductor types include:

Contact Wires: These are most manufactured from copper or copper alloys (such as copper-silver, copper-cadmium, copper-magnesium, and copper-tin). They typically have cross-sectional areas ranging from 80 mm^2 to 193 mm^2. Copper is preferred due to its superior electrical conductivity, while various alloys are chosen to enhance tensile strength, wear resistance, and thermal stability, especially for high-speed lines and locations with intensive usage.

Catenary/Messenger Wires: These wires support and maintain the position of the contact wire. They are commonly made from copper alloys (like cadmium-copper, magnesium-copper, or bronze), providing a balance of strength and conductivity.

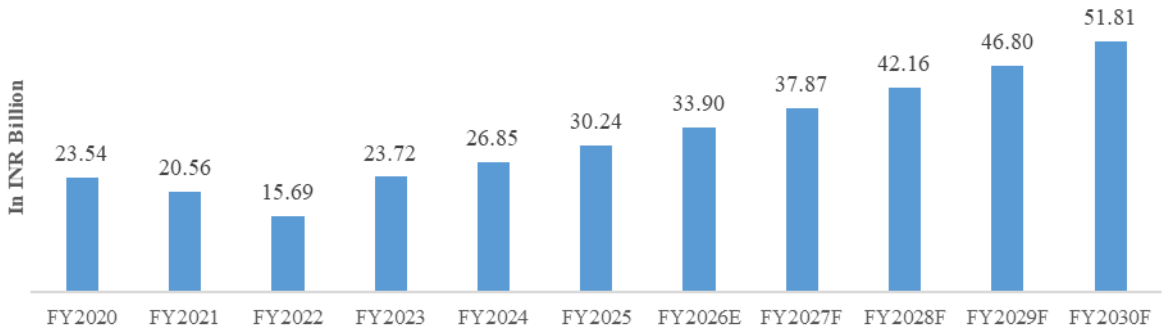
Jumper, Feeder, Span, and Dropper Wires: These auxiliary wires are typically made from copper, copper-magnesium, or bronze, depending on specific mechanical and electrical requirements.

Rigid Overhead Conductor Rails: In specific scenarios, particularly in tunnels or locations with limited clearance, aluminium alloy extrusions are used for rigid overhead conductors.

India's railway electrification standards, adhering to RDSO and international guidelines, mandate these material choices to optimize both conductivity for efficient power transmission and mechanical properties for long-term performance under varying operational stresses

Aluminium conductors are expected to comprise the remaining 30.00%, primarily used in transmission and overhead electrification. This growth underscores Indian Railways' ongoing focus on network electrification and modernization

Figure 5.17: O/H Conductors in Railways (In INR Bn), FY2020-FY2030F



Source: Frost & Sullivan Analysis

5.14. Key Growth Drivers for the T&D Sector

- **Growing Energy Demand**: In 2024, global energy demand was increased by 2.20%, higher than the decade's average of 1.3%. Electricity use was raised by 4.30%, adding nearly 1,100 terawatt-hours like Japan's yearly consumption. This was recorded as the largest rise outside of recovery periods after recessions. More than 80% of this growth was contributed by emerging and developing economies, as it was driven by population growth, urbanization, and industrial activity. [79]
- **Integration of Renewable Energy**: In 2024, 38% of the increase in global energy supply was provided by renewables, mainly solar and wind. Solar and wind output was expanded by 16%, nearly nine times faster

[79] https://iea.blob.core.windows.net/assets/5b169aa1-bc88-4c96-b828-aaa50406ba80/GlobalEnergyReview2025.pdf

than overall energy demand. By 2050, it is projected that 37–74% of global electricity will be supplied by renewables.

- **Modernization & Upgradation of Grids**: A large share of transmission and distribution networks is still operated with old or overloaded systems. When grids are modernized, technical losses about 8–10% in many emerging countries—are reduced, and efficiency, reliability, and capacity are improved.
- **Government Support & Policy Initiatives**: Support for T&D expansion was given by national governments through strong policies and investment. In India, 476 GW of installed capacity was reached by June 2025. Power shortages were cut from 4.2% in 2014 to 0.1% in 2025, showing how reliability was improved through grid reinforcement.
- **Rising Peak Load Demand**: Growing use of air conditioning, electric vehicles, and industrial machinery creates higher peak demand, pushing utilities to strengthen their networks.
- **Electrification of Rural & Remote Areas**: Millions still lack reliable electricity access, especially in developing regions. Extending T&D networks to underserved areas is a key growth driver.
- **Adoption of Smart Grid Technologies**: The shift toward digital, automated, and flexible grid systems requires advanced T&D networks that can manage real-time power flow and improve resilience. In 2024, over 40% of global electricity generation was provided by clean energy sources such as solar, wind, hydro, and nuclear

5.15. Commentary on Technology changes incl use of High-Performance Conductors (HPC) and HTLS conductors

The transmission and distribution (T&D) conductors' market is experiencing rapid technological advancement, primarily driven by the adoption of High-Performance Conductors (HPC) and High-Temperature Low-Sag (HTLS) conductors, as well as digitization through Artificial Intelligence (AI), Machine Learning (ML), and automation.

Key innovations are reshaping conductor design, diagnostics, and grid management. Below is a summary of major technological shifts:

1. High-Performance Conductors (HPC) & High-Temperature Low-Sag HTLS Technologies

HTLS conductors (e.g., ACCC, ACSS, and GAP-type) are engineered to carry double the current of conventional ACSR conductors with lower sag and higher thermal ratings, making them ideal for capacity enhancement without new right-of-way (ROW) requirements.

These conductors are widely deployed in congested urban corridors and renewable energy corridors, especially in countries like India, China, and the US.

Benefits:

- Operate at 210–250°C
- Reduced line sag improves safety and clearance
- Lower line losses enhance energy efficiency

Advanced Aluminum Alloy and Composite Core Conductors:

Use of aluminium alloy wires and carbon fibre composite cores (e.g., ACCC) offers superior strength-to-weight ratio and corrosion resistance. Widely used in high-cost terrain (mountainous or coastal regions) and for long-span overhead lines.

2. AI & Machine Learning in Grid Monitoring

Smart Cable Diagnostics and Predictive Maintenance:

- AI & ML technologies are revolutionizing asset management by powering predictive analytics that identify weak links in the grid before failure.
- Utilities leverage digital twin modelling and historical data to forecast conductor aging, detect hotspots, or predict sag and tension changes.

3. Quality Control & Automation in Manufacturing

Modern conductor manufacturing plants use robotics, automation, and machine vision systems to:

- Ensure uniform stranding and material consistency
- Detect micro-level defects in real time

- Reduce human error and improve throughput

Automated testing stations are applied for tensile strength, jacket integrity, conductivity, and temperature resistance verification.

4. **Integration with Smart Grids**
   - Sensors embedded along transmission lines can transmit real-time data on temperature, line load, and sag to control centres via IoT.
   - This enables Dynamic Line Rating (DLR), allowing utilities to safely increase current flow through transmission lines based on actual, rather than static, environmental conditions.

Integration with SCADA systems and substation automation offers fully digitized T&D networks.

5.16. Global & Domestic Transmission Investments and Developments

To meet the growing demand for electricity, integrate renewable energy, and modernize power networks, major transmission line projects are being rolled out across the world and in India. Significant investments are being directed toward expanding line capacity, upgrading infrastructure, and setting ambitious completion targets to enhance grid strength and reliability.

Global Transmission Projects

- Multiple ultra-high-voltage direct current (UHVDC) projects are being developed in China, including the 800 kV Gansu-Zhejiang DC line with a 4 GW capacity and an estimated cost of USD 5.00 Bn. Construction was started in 2024.
- In Brazil, major UHVDC transmission systems for clean energy delivery are being implemented, covering 10,500 km of projects auctioned in 2023. The State Grid of China has been engaged as a contractor.
- In advanced economies such as the US and Europe, along with China, transmission infrastructure is projected to increase by 120% by 2035. Around 1.8 Mn km of new lines are expected to be added, while nearly 1 Mn km are planned for replacement in advanced regions.
- High-voltage subsea cables are being rapidly expanded in Europe and North America to integrate offshore wind power. Investments exceeding USD 22.00 Bn in Europe by 2025 and USD 16.88 Bn in North America have been committed.
- In Australia, 4,581 km of new transmission lines are planned by 2030 to connect renewable energy zones with major demand hubs, with long-term expansions around 28,000 km under consideration for green energy exports. [80]

Indian Domestic Projects

- India's transmission network was expanded to 494,994 circuit km (220 kV and above) by May 2025, with an additional 8,830 circuit km of line length added in FY2024- FY2025.[81]
- A target has been set by the government to grow the transmission network from 485,000 circuit km in FY2024 to 650,000 circuit km by FY2032, mainly for integrating 500 GW of non-fossil fuel capacity.
- National priority has been placed on HVDC expansion. Between FY2023 and FY2032, 33 GW of capacity is expected to be linked through HVDC systems, including recently commissioned 765 kV lines.
- Policy updates announced in June 2025 were aimed at streamlining bidding for transmission projects and reducing connection timelines for renewables. Flexible rules for substation locations and better grid access for wind and storage projects were also introduced. [82]

[80] https://iea.blob.core.windows.net/assets/6fbf940a-d4e8-4156-b8e0-07c2f793c094/BuildingtheFutureTransmissionGrid.pdf
[81] https://indianinfrastructure.com/2025/07/06/transmission-trends-building-a-robust-and-reliable-grid/
[82] https://iea.blob.core.windows.net/assets/6fbf940a-d4e8-4156-b8e0-07c2f793c094/BuildingtheFutureTransmissionGrid.pdf

6. Review and Outlook of the Power Cables Market

6.1.Overview of Power Cables

A power cable is a specialized type of electrical cable designed for the transmission and distribution of electrical power across short and long distances. Unlike signal or data cables, which carry low-voltage information, power cables are engineered to handle higher currents and voltages safely and efficiently.

A typical power cable consists of:

- **Conductors** (usually copper or aluminium) to carry the electrical current.
- **Insulation** to prevent leakage and protect against electrical hazards.
- **Protective sheaths** to safeguard the cable from environmental and mechanical damage

Power cables have a wide range of applications across residential, commercial, industrial, and utility sectors. Common uses include:

- **Domestic wiring** and the connection of household appliances.
- **Commercial infrastructure**, such as offices, hospitals, shopping malls, and public buildings.
- **Industrial operations**, including heavy machinery, motors, and equipment.
- **Utility networks**, where they connect power generation sources to substations and distribute electricity across cities and regions

Voltage Classes of Power Cables: Power cables are classified based on their voltage ratings, which determine their suitability for different applications:

- **Low Voltage (LV): 300/500 V, 450/750 V, 600/1000 V:** Used in domestic, office, and light industrial environments.
- **Medium Voltage (MV): 1.8/3.0 kV, 3/6 kV, 6/10 kV, up to 30 kV:** Suitable for regional distribution and large industrial machinery.
- **High Voltage (HV): 36/66 kV, 64/110 kV, up to 150 kV:** Used for transmitting power over long distances.
- **Extra High Voltage (EHV): Up to 400 kV and above:** Employed in national transmission networks linking power plants and substations.

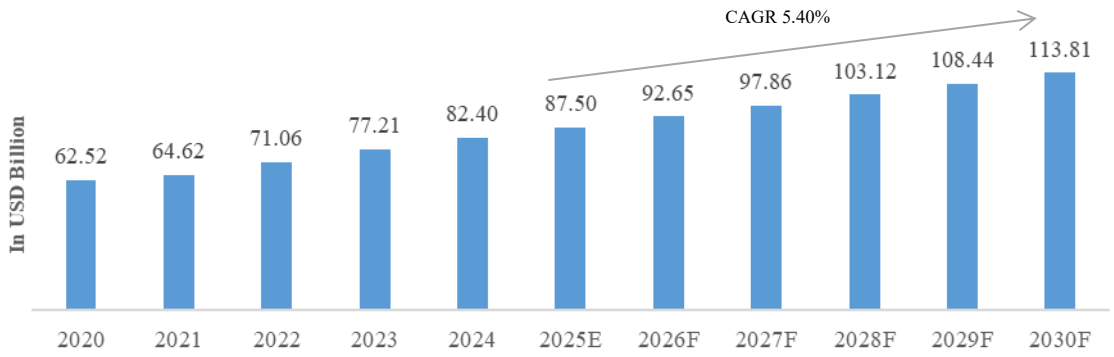
6.2.Global Power Cables Market Size

The global power cable market is a vital segment of the electrical infrastructure industry, underpinning worldwide efforts in electrification, infrastructure expansion, and the integration of renewable energy. In 2025, the market is estimated to USD 87.50 Bn and is projected to reach USD 113.81 Bn by 2030 with a CAGR of 5.40%.

Key Market Drivers

- **Urbanization and Industrial Growth**: Global increases in population, accelerating urbanization, and rapid industrialization are boosting the need for reliable power and, therefore, robust cable networks across residential, commercial, and industrial domains.
- **Grid Modernization**: Many regions are upgrading and expanding aging transmission and distribution (T&D) networks to enhance efficiency, reduce technical losses, and support resilient, smart grids.
- **Renewable Energy Integration**: The shift to wind, solar, and hydro requires advanced, XLPE, and submarine cables to transmit clean power from often remote generation sites to load centres, supporting both energy transition policies and decarbonization goals.
- **Smart Grid and Electrification Initiatives**: With a global focus on digitization, smart city development, and widespread electrification, demand is rising for intelligent, fire-resistant, and high-conductivity cables in new-age grid and building projects

Figure 6.1: Global Power Cable Market (In USD Bn), 2020-2030F



Source: Frost & Sullivan Analysis

Power cables play a critical role in transmitting and distributing electricity across residential, commercial, industrial, and utility sectors. As countries invest in grid modernization, smart city development, and cross-border energy networks, the need for high-performance, durable, and energy-efficient cabling solutions is increasing.

- **Key Trends and Drivers**

Grid Modernization and Infrastructure Expansion: Governments worldwide are upgrading aging electrical infrastructure and expanding national grids to meet rising energy demands. These investments are driving demand for high-performance transmission and distribution (T&D) cables.

Renewable Energy Integration: The rapid adoption of solar, wind, and hydro energy projects has increased the need for specialized cables—such as solar cables, underground cables, and high-voltage export cables—suitable for harsh environments and long-distance transmission.

Urbanization and Smart Cities: Rapid urbanization, particularly in emerging economies, is pushing the development of smart cities. These projects require advanced cabling systems for underground distribution, energy-efficient buildings, and intelligent transportation networks.

Industrial Automation and Electrification: The shift toward Industry 4.0 has increased the use of control, instrumentation, and communication cables in automated industrial setups. Electrification of manufacturing and transport is also boosting cable demand.

Electric Vehicles (EVs) and Charging Infrastructure: Global EV adoption is accelerating the need for DC and high-capacity power cables, especially for public and private EV charging networks, grid connectivity, and battery storage systems.

Technological Advancements in Cable Design: Innovation in materials (XLPE, halogen-free compounds), enhanced fire safety, and smart cables with integrated sensors are gaining traction to improve performance, durability, and monitoring capabilities.

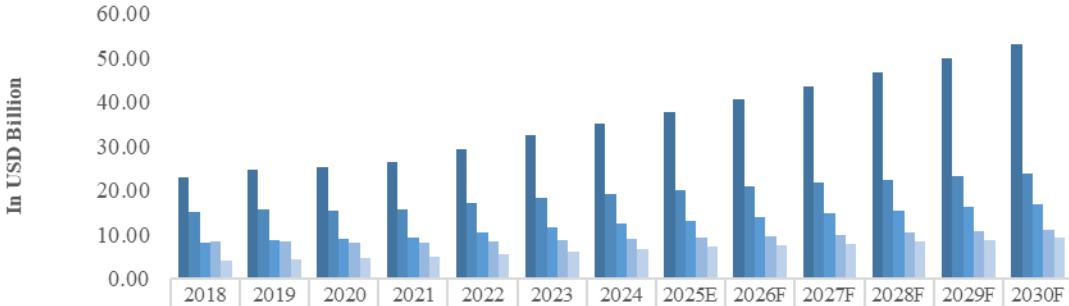
Energy Efficiency Regulations: Stricter energy and safety regulations are prompting the use of high-quality, certified cables with better insulation, reduced energy loss, and longer lifespans, particularly in developed regions.

Cross-border Power Transmission Projects: The rise of regional interconnectors and cross-border power trade agreements is driving the demand for high-voltage AC and DC cables for long-distance transmission, including submarine cable networks.

6.2.1. Region wise Power Cable Market

The regional power cables market is projected to grow at varying rates across regions from FY2025 to FY2030, influenced by differences in economic development and infrastructure priorities.

Figure 6.2: Regionwise Power Cable Market, (In USD Bn), 2020-2030F



	2018	2019	2020	2021	2022	2023	2024	2025E	2026F	2027F	2028F	2029F	2030F	CAGR
APAC	22.87	24.53	25.11	26.33	29.37	32.36	35.02	37.77	40.61	43.55	46.58	49.70	52.92	6.98%
Europe	15.01	15.62	15.52	15.80	17.10	18.29	19.20	20.04	20.85	21.63	22.38	23.10	23.79	3.49%
MEA	8.27	8.84	9.02	9.43	10.49	11.53	12.44	13.18	13.93	14.68	15.43	16.19	16.96	5.16%
North America	8.33	8.46	8.19	8.11	8.53	8.84	8.98	9.35	9.70	10.03	10.35	10.64	10.93	3.17%
South America	4.16	4.51	4.67	4.94	5.57	6.19	6.76	7.16	7.57	7.98	8.39	8.80	9.22	5.18%

Source: Frost & Sullivan Analysis

The highest growth, at approximately 40.00%, is expected in the Asia-Pacific (APAC) region, driven by rapid urbanization, large infrastructure investments, and clean energy expansion, particularly in China and India. In second, both the Middle East & Africa (MEA) and South America are projected to grow by around 29.00%, supported by grid development, electrification programs, and renewable energy projects in countries such as Saudi Arabia, Egypt, Brazil, and Chile. Europe ranks fourth with a projected 19.00% growth, underpinned by energy transition goals and investments in offshore wind and cross-border power links like the Viking Link. North America is expected to record the slowest growth at 17.00%, with a focus on upgrading existing infrastructure and enhancing grid resilience rather than large-scale new capacity additions.

The key growth drivers in APAC are:

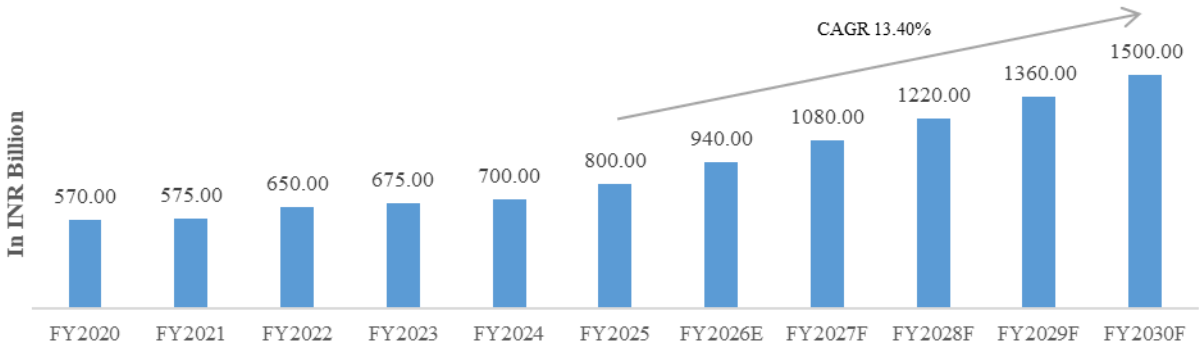
- **Rapid Urbanization & Infrastructure Growth:** Expanding cities require more housing, transportation systems, and commercial buildings, driving higher demand for power cables.
- **Industrialization & Manufacturing Expansion**: Growth in factories and industrial zones increases the need for reliable electricity connections and heavy-duty cabling.
- **Investment in Renewable Energy Projects**: Solar, wind, and hydro projects need extensive cabling to transmit clean power to the grid.
- **Government Policy & Grid Modernization**: Supportive regulations and initiatives are pushing for upgraded, more efficient, and resilient electricity networks.
- **Technological Advancements & Smart Grids**: Adoption of smart grids, automation, and digital monitoring systems boosts demand for advanced, high-performance cables.
- **Rising Electricity Demand & Electrification**: Rapid population growth and higher use of appliances, devices, and equipment are driving electricity consumption.

Adoption of Electric Vehicles (EVs): Growing EV adoption creates demand for charging infrastructure and stronger distribution networks.

6.3.Wires and Cables Market- India

The Indian wires and cables market is projected to witness strong and sustained growth between FY2025 and FY2030. Valued at approximately INR 800.00 Bn in FY2025, the market is expected to reach around INR 1,500.00 Bn by FY2030 with a CAGR of 13.40%. This robust expansion will be driven by large-scale investments in power transmission and distribution, urban infrastructure development, and industrial modernization. Government-led electrification programs, housing schemes, and the growing demand for renewable energy integration will further support market growth. Rising demand from sectors like railways, metros, and smart cities is also expected to contribute significantly. The segments of the Indian wires and Cables market are discussed in the next section

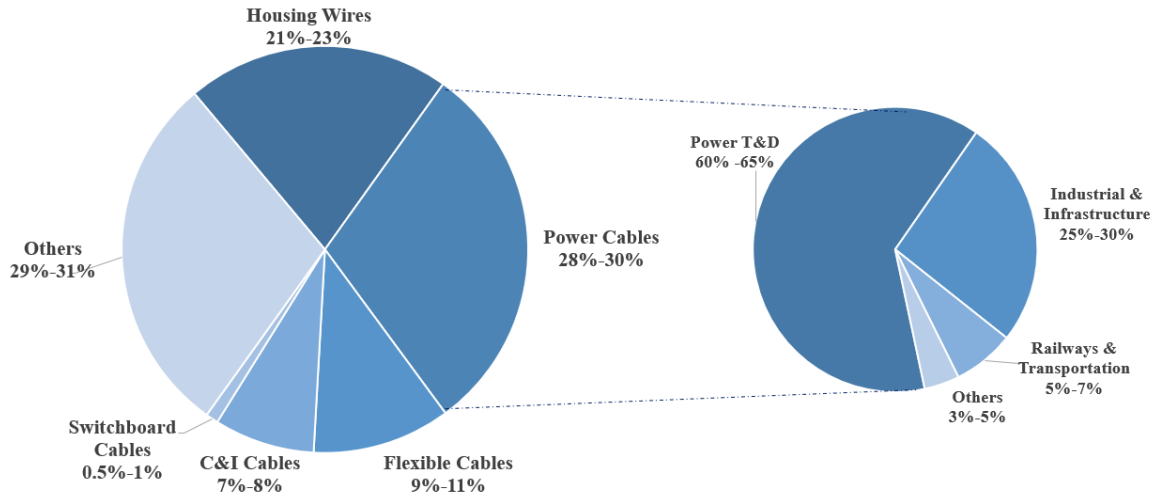
Figure 6.3: India Wires and Cable Market (In INR Bn), FY2020-FY2030F



Source: Frost & Sullivan Analysis

In FY2025, the Indian cables and wires market demonstrated strong segment-wise growth. Power cables continued to dominate with a 28%-30% share, supported by robust investments in grid expansion and renewable energy integration. Housing wires, with a 21%-23% share, benefited from steady growth in urban housing and electrification programs under government schemes like PMAY and Saubhagya. Flexible cables accounted to 9%-11% and C&I cables accounted to 7%-8%, it witnessed an increase in demand, driven by rising industrial automation, manufacturing growth, and smart building deployments. Switchboard cables contributed 0.5%-1%, while other specialized cables made up the remaining 29%-31%, reflecting the market's diversity. Oswal Cables has a clear focus on product line expansion, they have added more than 10 products in the last 5 years. The future includes its entry to the building wire segment.

Figure 6.4: Indian Wires and Cable Market, By End Use Segment (In %), FY2025



Source: Frost & Sullivan Analysis

The power cable segment was dominated by power T&D sector which accounted to 60%-65% share and is expected to grow steadily due to national grid modernization and inter-regional transmission projects. The industrial and infrastructure segment 25%-30% gained from metro, airport, and highway projects, while the railways and transport segment 5%-7% expanded with increased electrification and high-speed rail investments. Other applications contributed 3%-5%, showing a diversified yet infrastructure-centric market growth.

6.3.1. Supply Chain- Wires and Cables Market in India

The supply chain in the cable and wires market in India is characterized by several key components and trends as of 2025:

Raw Materials:

- Copper and aluminium are the primary conductive materials, accounting for 40-60% of the cable's raw material cost.
- Polymers such as PVC and polyethylene are significant for insulation and sheathing.
- Raw material price volatility, especially in copper and aluminium, poses a major challenge.
- Domestic metal supply is constrained due to environmental concerns and limited mining capacity, necessitating imports and hedging strategies.

Manufacturing:

- India hosts several leading producers like Polycab, Havells, KEI, RR Kabel, Finolex, and Apar, with manufacturing facilities increasingly automated and meeting international standards (RoHS, BIS).
- The wide-range product portfolio of Oswal Cables include, standard conductors, advanced conductors, aerial bunched cables, low-voltage energy cables, railway signalling cables, service drop cables, and concentric cables. The company manufactures a variety of conductors and cables of up to 4 cores, with sizes ranging from 1.5 sq. mm to 1,000 sq. mm and strand counts from 7 to 127. With such diversified product portfolio conforming to multiple specifications and broad voltage applications, Oswal Cables have become a comprehensive solution provider for the energy transmission and distribution industry
- The industry is investing in technology upgrades, smart cable production, and sustainable practices to align with infrastructure demands and export needs.
- Production capacity is expanding, with plans for ~40% capacity increase in FY25–26 to meet domestic and global demand.

Distribution and Sales:

- The supply chain includes a wide dealer and distributor network servicing growth sectors such as power transmission, real estate, railways, metro systems, EV charging infrastructure, and telecom.
- Export markets (Europe, US) are key focus areas, benefiting from the China+1 trade strategy.

Government and Regulatory Influences:

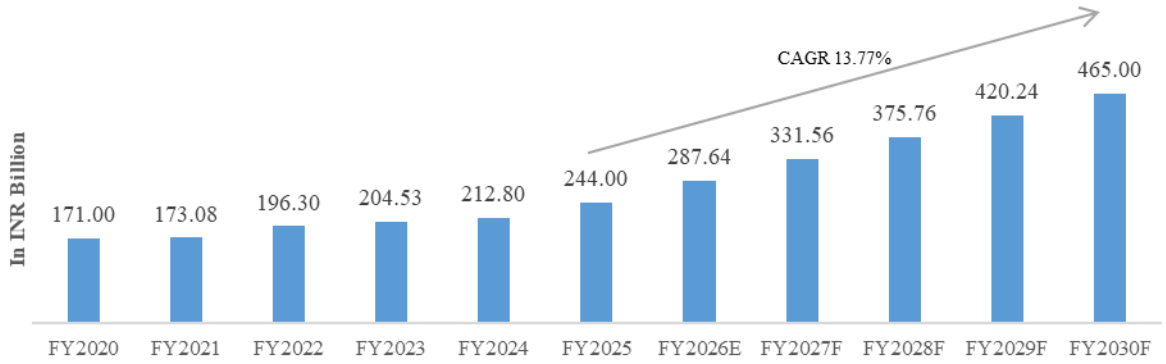
- The government supports the sector through schemes like the Production-Linked Incentive (PLI) program and standards enforcement (BIS, CEA).
- Infrastructure development programs (power distribution modernization, railway electrification, digital connectivity) drive consistent demand for cables.
- Customs duty rationalization on certain inputs lowers production costs.

6.3.2. Indian Power Cables Market

India’s power cables market is projected to grow significantly from INR 244.00 Bn in FY2025 to INR 465.00 Bn by FY2030, registering a robust CAGR of 13.77% during the forecast period. This growth is primarily fuelled by large-scale investments in power infrastructure, rapid urbanization, and increasing electrification in rural and semi-urban areas.

The Indian power cables market is significantly supported by large-scale government initiatives aimed at modernizing infrastructure and enabling clean energy transitions. The Revamped Distribution Sector Scheme (RDSS), launched by the Ministry of Power, seeks to reduce AT&C (Aggregate Technical and Commercial) losses, improve the quality and reliability of electricity supply, and strengthen distribution networks. With an allocation of INR 3.03 Tn (approximately USD 37.00 Bn) until FY2026, the scheme promotes underground cabling, feeder separation, AMI (Advanced Metering Infrastructure), and SCADA/automation systems, collectively boosting demand for medium- and high-voltage power cables and advanced conductors.

Figure 6.5: Power Cable Market, India, (In INR Bn), FY2020-FY2030F



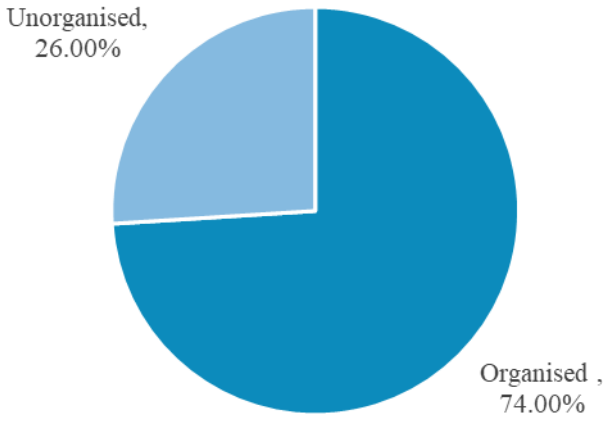
Source: Frost & Sullivan Analysis

In parallel, the Smart Cities Mission, which covers over 100 urban centres driving infrastructure upgrades such as smart cabling, automated substations, and fire-safe wiring systems. This has increased adoption of FRLSH (Fire Retardant Low Smoke Halogen-free) cables and compact conductor solutions suitable for dense city environments. Furthermore, India's COP-26 commitment to achieve 500 GW of non-fossil fuel capacity by FY2030 is driving investment in renewable energy corridors, necessitating robust transmission infrastructure. High-performance aluminium alloy and HTLS (High-Temperature Low-Sag) conductors are increasingly deployed to support solar and wind power integration, while grid enhancements and energy storage systems are also being prioritized.

6.3.3. Market Share: Organized vs Unorganized

In India, the organized sector dominates the power cable industry with around 76% market share, while the unorganized sector holds the remaining 24%. Among organized players, Polycab leads with 22%, followed by Havells at 16%, Finolex at 14%, KEI at 12%, and RR Kabel at 10%, together accounting for nearly three-fourths of the organized market.

Figure 6.6: Wires and Cable Players Market Share (In %), FY2025



Source: Frost & Sullivan Analysis

Trends Driving Growth of Organized Players

Organized manufacturers are steadily gaining ground over unorganized players due to multiple industry dynamics:

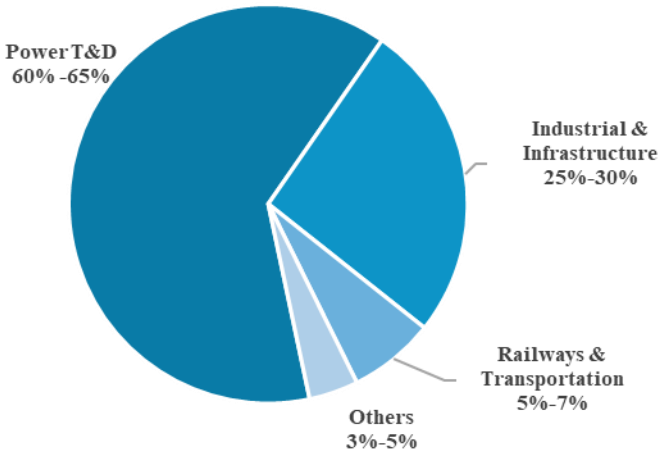
- **Stronger regulations**: Enforcement of BIS (Bureau of Indian Standards) norms and quality checks are reducing the presence of low-cost, non-compliant products, favouring established players.

- **Infrastructure push**: Large-scale public and private investments in electrification, smart grids, digital connectivity, and industrial projects are increasing demand for certified, branded products.
- **Competitive advantages**: Leading companies leverage strong distribution networks, digital marketing, technology-backed products, and backward integration to expand into semi-urban and rural markets.
- **Favourable growth outlook**: Revenue for organized players is projected to grow at 15–16% in FY2026, supported by domestic infrastructure expansion, rising exports, and the global China+1 supply chain strategy

6.4.India Power cables market Analysis by End-user market

The Indian power cables market was driven by large-scale investments in infrastructure, urbanization, and electrification programs. Key demand is being generated from sectors such as utilities, renewable energy, manufacturing, railways, and metro projects. The push for smart cities, rural electrification under government schemes like Saubhagya, and expansion of industrial parks and data centres are further supporting market growth. Medium and low voltage cables dominate usage in distribution networks, while demand for high voltage cables is rising with grid modernization. Additionally, increasing focus on energy efficiency and safety standards is promoting the adoption of advanced cable technologies across the country. The following represents the market share distribution across different end-user sectors in the Power Cable Market

Figure 6.7: Power Cable Market End User Sectors , FY2025



Source: Frost & Sullivan Analysis

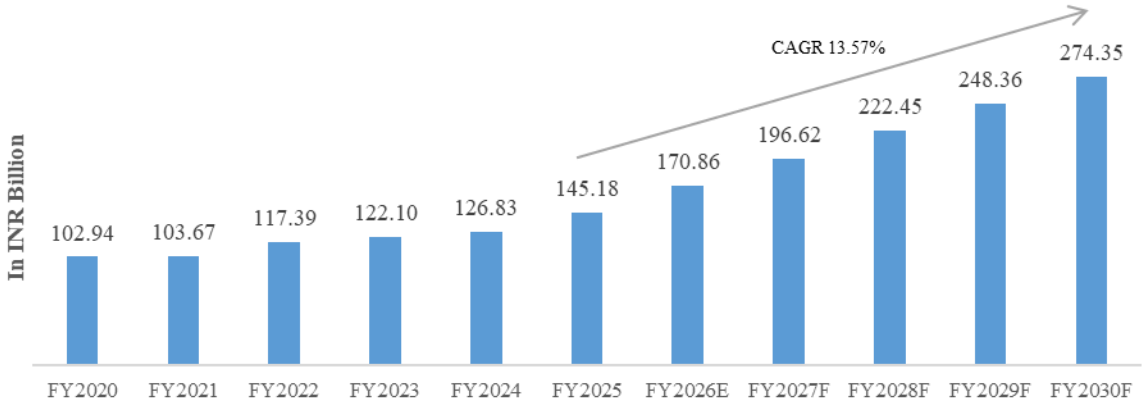
Note: Others which includes telecommunications, automotive and specialty sectors.

6.4.1. Power T&D network

India's Power Transmission & Distribution (T&D) network remains the primary driver of the country's power cables market, contributing approximately 60%-65% of the total market. The segment is poised for significant expansion, with demand projected to increase from INR 145.18 Bn in FY2025 to INR 274.35 Bn by FY2030 with a CAGR of 13.57%.

This growth is mainly driven by important factors such as national initiatives focused on grid modernization, rural electrification, and the integration of renewable energy capacities such as solar and wind. Additionally, the shift toward underground cabling in urban centres, smart grid implementation, and upgrades in aging transmission infrastructure are further accelerating the need for reliable, high-performance power cables.

Figure 6.8: Power T&D Market , India, (In INR Bn), FY2020-FY2030F



Source: Frost & Sullivan Analysis

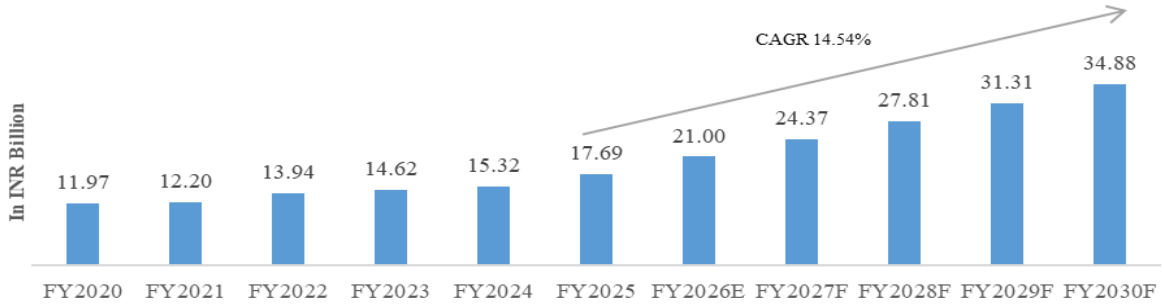
Entry barriers to the Power T&D network Industry are as follows:

1. High capital requirements: Large upfront investments are needed for infrastructure, equipment, and long project timelines, making it difficult for new players to enter.
2. Complex regulatory approvals and land acquisition: Multiple and often overlapping permissions for right-of-way, land use, and environmental/forest clearances create significant delays and uncertainty.
3. Access to grid and transmission licenses: Existing incumbents often dominate grid access and hold transmission licenses, limiting entry for new operators.
4. Unpredictable pricing and cost/revenue visibility: Regulated power tariffs, lack of standardized compensation for land or right-of-way, and price variation in equipment make financial planning risky for entrants.
5. Limited access to finance and supply chain bottlenecks: State-owned or established firms enjoy preferential access to funding and critical materials, while new entrants face credit and procurement challenges, especially for specialized components like HVDC equipment.

6.4.2. Railways

The demand for power cables is expected to grow from INR 17.69 Bn in FY2025 to INR 34.88 Bn by FY2030 with a CAGR of 14.54%. The railway sector contributes 5%-7% of India's power cables market. This growth is largely driven by the government's focus on 100% railway electrification, modernization of railway infrastructure, and the development of high-speed and semi-high-speed rail corridors.

Figure 6.9: Power Cable in Railways, India, (In INR Bn), FY2020-FY2030F



Source: Frost & Sullivan Analysis

The projects such as Dedicated Freight Corridors (DFCs), metro rail expansions, and smart station upgrades are further accelerating the demand for specialized power cables designed for reliable, high-performance operations in the railway environment.

Dedicated Freight Corridors (DFCs): Developed by the Dedicated Freight Corridor Corporation of India Ltd. (DFCCIL), the Eastern (1,856 km) and Western DFC (1,504 km) are major infrastructure megaprojects designed to transport freight more efficiently. Significant growth in India's power cable market is being driven by the development of Dedicated Freight Corridors (DFCs), which are facilitating large-scale electrification, infrastructure upgrades, and industrial expansion along strategic routes. Increased demand for high-, medium-, and low-voltage cables, including fire-retardant and signalling cables, is being observed because of DFCs' emphasis on substations, smart terminals, and integration with industrial corridors. Supported by an investment exceeding INR 814.59 Bn, DFCs are expected to generate sustained demand for power cables, particularly in railway and industrial segments.

Metro Rail Expansion Projects: India's metro expansion across 20+ cities and 70+ projects is driving demand for underground XLPE HT/LT cables, FRLSH/LSZH fire-safe cables, and SCADA-compatible low-voltage and control cables.

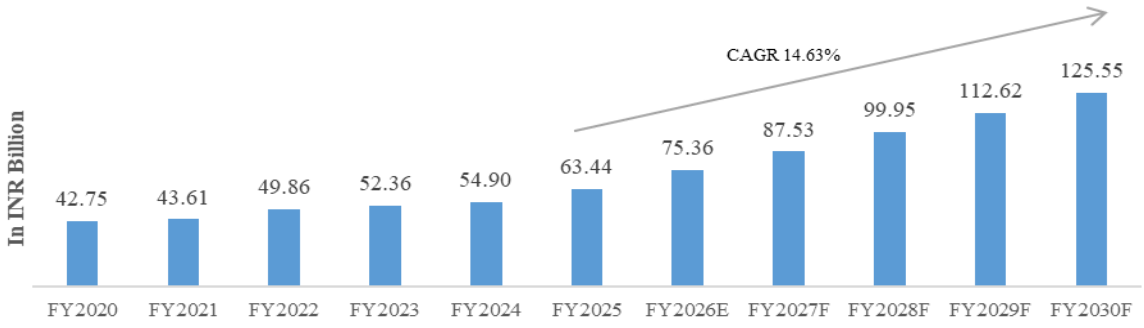
Entry barriers to the Railways are as follows:

1. High capital investment: Large amounts are needed for tracks, rolling stock, signaling, depots, and supporting infrastructure.
2. Stringent regulatory requirements: Complex approvals for land acquisition, operational licensing, and safety compliance hinder new entrants.
3. Infrastructure access and capacity allocation: Incumbents often control key assets like stations and depots, restricting access for newcomers.
4. Long project timelines and uncertain returns: Rail projects involve lengthy build times and delayed revenue generation, deterring private and smaller investors.
5. Incumbent advantage and procurement hurdles: Established operators benefit from experience, economies of scale, and preferential terms in public tenders, making market entry difficult

6.4.3. Industrial and Infrastructure

The Industrial & Infrastructure segment is a key end-use category within the power cables market, encompassing a wide range of applications across industrial facilities and large-scale infrastructure projects. The market was accounted to INR 63.44 Bn in FY2025 and projected to grow to INR 125.55 Bn by FY2030, registering a CAGR of 14.63%. This growth is fuelled by the rapid development of industrial corridors and smart cities, increased power demand from manufacturing sectors, large-scale government infrastructure initiatives such as PM Gati Shakti, and the electrification of public utilities. Additionally, the integration of renewable energy sources is driving the need for advanced and scalable grid infrastructure. As a result, demand for high-performance power cables designed for continuous, high-load operations in industrial and infrastructure settings is set to rise steadily

Figure 6.10: Industrial & Infrastructure Market, India, (In INR Bn), FY2020-FY2030F



Source: Frost & Sullivan Analysis

Government-backed initiatives like “Make in India” and the development of industrial clusters and SEZs are further supporting demand for power and control cables across various manufacturing sectors.

Simultaneously, the expansion of commercial infrastructure, including malls, IT parks, hospitals, data centres, and smart buildings is boosting the requirement for high-specification FRLS, LSZH, and energy-efficient cables. The growth of data centres, driven by cloud adoption and 5G rollout, is further accelerating demand for low-loss and high-capacity wiring solutions.

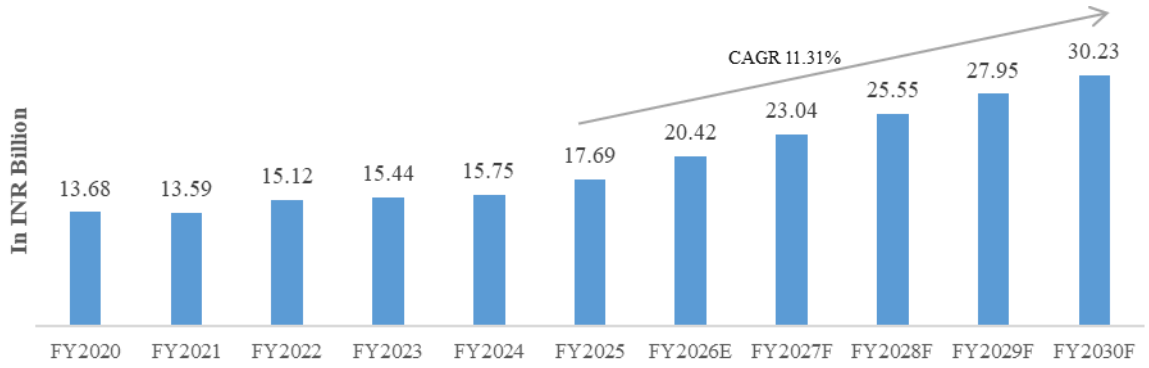
Entry barriers to the Industrial and Infrastructure are as follows:

1. High capital investment: Substantial upfront spending on land, machinery, and plants deters new entrants.
2. Regulatory requirements and approvals: Complex procedures for permits, environmental clearances, and compliance slow down or restrict new projects.
3. Access to technology and expertise: Advanced manufacturing and infrastructure projects often require proprietary technology, skilled labor, and technical know-how that are not easily available.
4. Entrenched competition and brand presence: Incumbent firms have established customer relationships, supplier contracts, and brand loyalty, making it tough for new companies to gain market share.
5. Supply chain and resource access constraints: Reliable sourcing of raw materials, components, and distribution channels is critical, and newcomers may face higher costs or limited access compared to established players

6.4.4. Others

The "Others" segment in the power cables market includes a diverse range of end-use applications such as telecommunications, automotive and specialty sectors. These areas, though individually smaller, collectively contribute significantly to overall cable demand. The market for this segment is projected to grow from INR 17.69 Bn in FY2025 to INR 30.23 Bn by FY2030 with a CAGR of 11.31%. Growth is driven by rising urban housing demand, expansion of telecom networks, increasing data centre investments, electrification in the automotive sector, and ongoing development of specialized infrastructure like smart ports and airports.

Figure 6.11: Other Segment Market, India, (In INR Bn), FY2020-FY2030F



Source: Frost & Sullivan Analysis

Key Application Areas:

Telecommunications: Power cables ensure reliable energy supply to telecom equipment such as mobile towers, fibre optic hubs, and backup power systems, supporting continuous connectivity and communication networks.

Residential: Increasing urbanization and housing developments boost demand for reliable low voltage cables inside homes for power distribution and smart home automation.

Automotive: Rising adoption of electric vehicles (EVs) and sophisticated automotive electronics require specialized power and data cables to support battery-to-motor power transmission, infotainment, and autonomous systems.

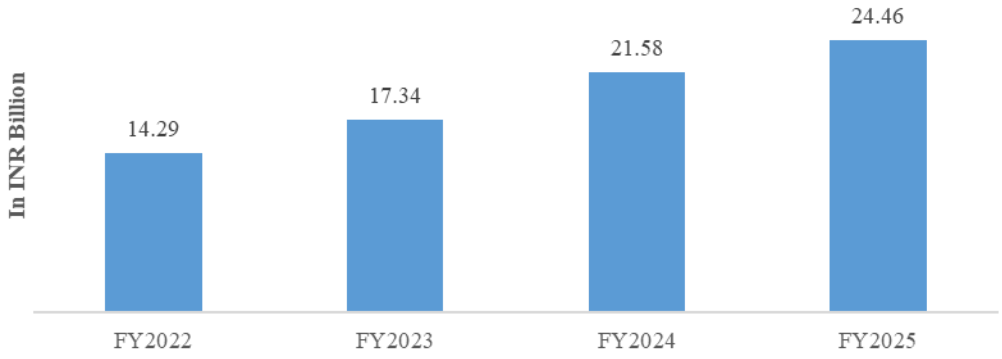
Specialty Sectors: Includes sectors like military, offshore platforms, and green energy installations needing cables with enhanced durability, multi-functionality, and environmental compliance.

6.5.Trade Outlook - Cables

6.5.1. Cables Import

India's imports, primarily of low-voltage (LV) and high-voltage (HV) power cables, have steadily increased from INR 14.29 Bn [83] in FY2022 to INR 24.46 Bn in FY2025.[84] This reflects a 71% cumulative growth over four years, indicating rising domestic demand for certain specialized or high-performance cable products not widely manufactured within the country. The growth is driven by expanding infrastructure, industrial modernization, and projects that require advanced cable specifications. Despite India's growing manufacturing capabilities, the increase in imports underscores its dependence on global suppliers for specialized or project-specific cable needs.

Figure 6.12: Import of Cables, (In INR Bn), FY2022-FY2025



Source: IEEMA

Note: HSN Code: 854442

- **Key Drivers of Cable Imports**

Rising Demand for Advanced Technology Cables: Importing countries often rely on foreign suppliers for specialized cables made with advanced materials (e.g., XLPE, EPR insulation), high-performance designs (fire-resistant, low-smoke zero halogen), and precision manufacturing required for extra high voltage, submarine, and EV infrastructure cables.

Infrastructure Expansion and Modernization Needs: Rapid urbanization, industrialization, and grid modernization projects (smart grids, renewables integration, microgrids) push importing countries to source high-quality cables internationally to meet technical specifications and delivery timelines**.**

Renewable Energy and EV Charging Growth: The surge in solar, wind, and electric vehicle infrastructure requires specialty cables that may not be fully produced domestically, increasing import reliance.

Shortage of Domestic Manufacturing Capacity: Many regions, including developed countries and some developing economies, face local industry limitations or supply chain constraints, requiring imports to fill demand gaps, especially for medium, high, and extra high voltage cables**.**

Global Supply Chain and Trade Patterns: Despite efforts like "Make in India," globalized trade means import dependency persists for some cable types, driven by cost, quality, technology, and certifications from key exporters like China, Germany, Japan, and South Korea.

[83] https://ieema.org/wp-content/uploads/2020/07/Indian-Electrical-Equip-Ind-Overview_FY21-22_Mar-22.pdf
[84] https://ieema.org/wp-content/uploads/2020/07/Indian-Electrical-Equip-Ind-Overview_Apr-Mar-25.pdf

Regulatory and Quality Compliance: Higher standards for safety, environmental compliance, and efficiency often leading importing countries to procure cables certified under stringent international standards unavailable from all domestic producers.

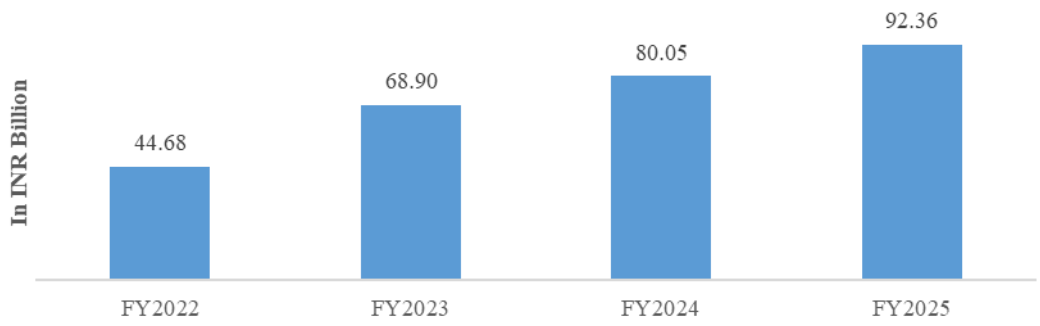
Technological Advancements and Product Innovation: Innovations such as fiber optic power cables, EV fast-charging cables, and smart monitoring cables originate in selecting global manufacturing hubs, creating demand for imports.

Sectoral Demand from Key Industries: Telecommunications, data centers, industrial automation, and transportation sectors require specific cable types that drive import demand.

6.5.2. Cables Export

India's export of cables has witnessed robust growth, increased from INR 44.68 Bn[85] in FY2022 to INR 92.36 Bn in FY2025.[86] This strong performance reflects the increasing global competitiveness of Indian cable manufacturers, driven by improved product quality, cost efficiency, and rising demand from international infrastructure and industrial projects. The consistent year-on-year growth highlights India's expanding presence in global markets, particularly in regions seeking reliable and affordable cable solutions for energy, construction, and telecommunications sectors. This export momentum also underscores the sector's manufacturing strength and its alignment with the government's "Make in India" initiative. Oswal Cables is one of the top exporters from India to Latin America and it accounts to 15% of their total sales. The company also focusses predominantly on exports and is one of the first companies to enter Senegal and South America.

Figure 6.13: Export of Cables, (In INR Bn), FY2022-FY2025



Source: IEEMA

Note: HSN Code: 8544

- **Key Drivers of Cable Exports**

Strong Global Demand for Power Infrastructure: Growing investments worldwide in power transmission and distribution networks, renewable energy projects, electrification of railways, metros, and electric vehicle (EV) infrastructure are driving the need for high-quality power cables from India.

Government Support and Infrastructure Development: Initiatives like Pradhan Mantri Awas Yojana (PMAY), Smart Cities Mission, rural electrification schemes (Saubhagya 2.0), and Bharat Net Phase III boost domestic demand and improve manufacturing scale and quality, indirectly supporting exports.

Renewable Energy and EV Adoption: India's renewable energy targets (500 GW by 2030) and rising EV adoption trigger demand for specialized cables for grid modernization and EV charging infrastructure globally, propelling exports.

Established Export Markets and Rising Geographies: India has cemented strong footholds in the USA, Europe, Middle East (Saudi Arabia, Oman), Africa, and Southeast Asia, with exports growing for both LV and HV cables.

[85] https://ieema.org/wp-content/uploads/2020/07/Indian-Electrical-Equip-Ind-Overview_FY21-22_Mar-22.pdf
[86] https://ieema.org/wp-content/uploads/2020/07/Indian-Electrical-Equip-Ind-Overview_Apr-Mar-25.pdf

Industry Capacity Expansion and Technology Upgrades: Leading Indian cable companies are investing heavily in manufacturing capacity (targeting 15%+ growth), product innovation, and sustainable practices, improving export competitiveness.

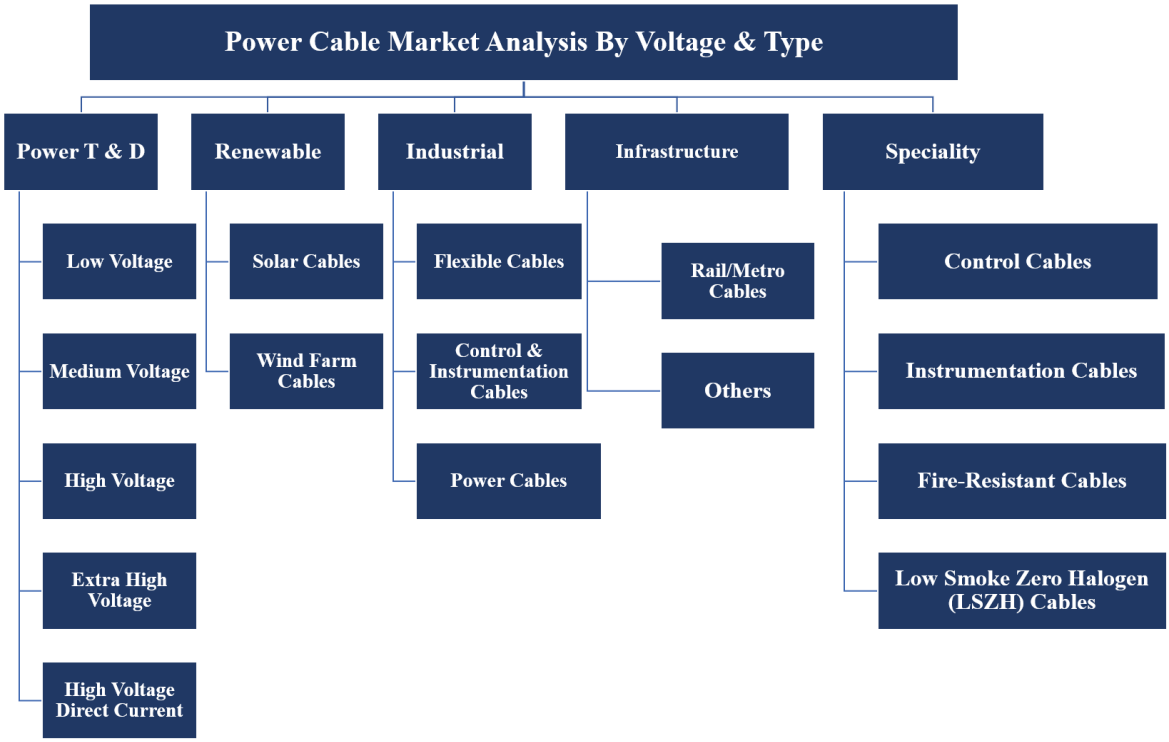
Sustainability and Regulatory Alignment: Increasing adoption of eco-friendly, fire-resistant, low-smoke zero halogen (LSZH), and recycled-material cables aligns Indian exports with global environmental and safety demands.

Digital and Telecom Infrastructure Growth: Expansion in data centres, 5G fibre deployments, and smart infrastructure drive demand for both power and optical fibre cables, supporting exports as India is a net fibre exporter as well.

6.6.Power Cables Market Analysis by type

India's power cables market is expected to grow from INR 244.00 Bn in FY2025 to INR 465.00 Bn by FY2030, at a CAGR of 13.77%. This growth is driven by higher investments in transmission and distribution networks, urban electrification, and renewable energy projects. Demand for high-voltage, fire-resistant, and underground cables are increasing, as they improve transmission efficiency, reduce energy losses, and enhance grid reliability, supporting the country's need for a stable and sustainable power infrastructure. The power cable market was segmented as below:

Figure 6.14: Power Cable Market Analysis by Voltage & Type

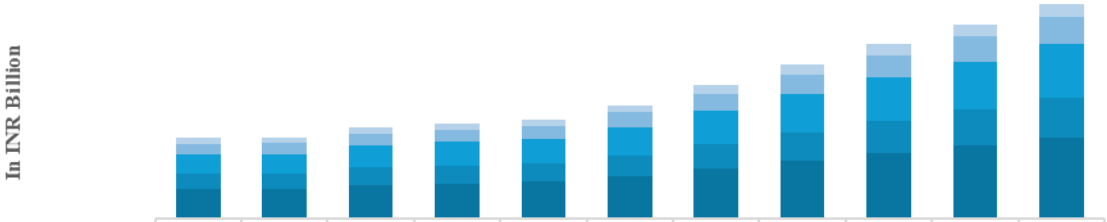


Source: Frost & Sullivan Analysis

6.6.1. Power T & D Market Analysis by Voltage

Power cables, especially high-voltage (HV) and extra-high voltage (EHV) cables, are essential for long-distance electricity transmission. These cables transmit bulk power from generation stations, including thermal, hydro, solar, and wind farms, to substations and urban load centers. The growing integration of renewable energy sources has significantly increased the demand for advanced, high-capacity transmission cables that can handle larger loads and fluctuating power outputs. These cables typically range from 66 kV to above 220 kV and are designed to operate safely over vast distances, minimizing energy losses. Technologies such as underground and subsea cables enable transmission in sensitive urban and offshore environments, expanding access to green energy.

Figure 6.15: Power T&D Market by Voltage (In INR Bn), FY2020-FY2030F



	FY2020	FY2021	FY2022	FY2023	FY2024	FY2025	FY2026E	FY2027F	FY2028F	FY2029F	FY2030F
High Voltage Direct Current	7.21	7.15	7.98	8.18	8.37	9.44	10.93	12.39	13.79	15.15	16.46
Extra High Voltage	13.38	13.48	15.26	15.87	16.49	18.87	22.21	25.56	28.92	32.29	35.67
High Voltage	24.71	24.98	28.41	29.67	30.95	35.57	42.03	48.56	55.17	61.84	68.59
Medium Voltage	19.56	19.59	22.07	22.83	23.59	26.86	31.44	35.98	40.49	44.95	49.38
Low Voltage	38.09	38.46	43.67	45.54	47.43	54.44	64.24	74.12	84.09	94.13	104.25

Source: Frost & Sullivan Analysis

The Power Transmission & Distribution (T&D) network is expected to expand from INR 145.18 Bn in FY2025 to INR 274.35 Bn by FY2030, representing a substantial increase of 166.6% over the decade. This growth is being supported by sustained electricity demand, large-scale grid modernization programs, and the accelerated integration of renewable energy sources. The Low Voltage segment accounted to INR 54.44 Bn in FY2025 will grew to INR 104.25 Bn by FY2030 with a growth of 91.50%, largely attributed to rural electrification, residential connectivity, and the adoption of distributed generation systems such as rooftop solar.

The Medium Voltage segment will grow from INR 26.86 Bn to INR 49.38 Bn, achieving 83.80% growth, supported by industrial and commercial developments as well as increasing demand from data centres and transport electrification. The High Voltage segment is forecasted to expand from INR 35.57 Bn to INR 68.59 Bn, reflecting 92.80% growth, mainly attributed to urban infrastructure development, industrial expansion, and the need for stable bulk power delivery. The Extra High Voltage (EHV) segment will rise from INR 18.87 Bn to INR 35.67 Bn, posting 89.10% growth, as long-distance transmission, and cross-border energy trade gain traction to support renewable energy corridors. The High Voltage Direct Current (HVDC) segment is set to increase from INR 9.44 Bn to INR 16.46 Bn, with 74.4% growth, reflecting its rising importance in long-distance bulk power transfer, offshore wind projects, and interregional grid strengthening

Table 6.1 Cables Product Listing

Category	Specification	Application
Medium Voltage Underground Cable	Up to 66 kV, available in Aluminum and Copper variants	Designed for underground transmission and distribution networks, industrial power evacuation, and utility feeders where reliability and load-carrying capacity are critical.
Low Voltage Cable Unarmoured	Up to 1.1 kV, Copper & Aluminum, up to 4 Core	Suitable for residential, commercial, and light industrial applications where mechanical protection is not critical. Commonly used for internal distribution, control panels, and flexible connections.
Low Voltage Cable Armoured	Up to 1.1 kV, Copper & Aluminum, up to 4 Core	Provides mechanical protection in harsh environments. Ideal for underground cabling, outdoor installations, industrial networks, and infrastructure projects requiring durability and resilience.
Low Voltage PV Cable	1.1 kV	Specially designed for solar photovoltaic systems. Provides IJV resistance, weather resistance, and long service life under outdoor conditions. Used for DC string connections between panels and to inverters.

Building Wire	Up to 10 sqmm	Used for internal wiring of residential, commercial, and industrial buildings. Provides safe and efficient distribution of electricity to lighting, sockets, and appliances.
Solar AC Cable	Up to 10 sqmm	Used for AC side connections in solar power plants, carrying power from inverters to distribution panels. Offers high flexibility, UV/weather resistance, and flame-retardant properties.
Aerial Bunched Cables (ABC)	Stranded Al or Al alloy phase (XLPE insulated), neutral may be bare, IS 8130/IS 398/IEC	LV/MV/HV distribution, theft-prone areas, urban/rural feeders, streetlighting
LT XLPE/PVC (Aluminium) Energy Cables	Al conductor, XLPE/PVC insulation, armoured/overall PVC sheath, 1.1kV–3.3kV; IS 1554/IS 7098/IEC 60502	AC/DC power distribution, underground, building/infrastructure supply
LT XLPE/PVC (Copper) Energy Cables	High conductivity copper, XLPE/PVC insulated, armoured/sheath, 1.1kV; IS 1554/IS 7098/IEC 60502	Power/control circuits, infrastructure, building electrification, stringent current needs

Source: Frost & Sullivan Analysis

Note: The above list may not be Exhaustive

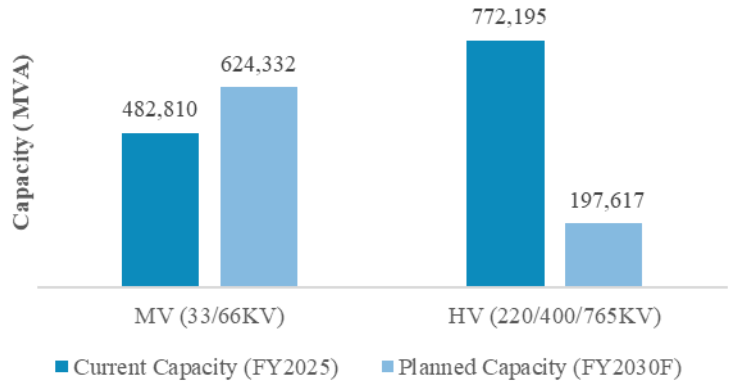
6.6.2. Current and Planned AC Transmission Capacity by Voltage Levels

The growth of India's power sector has been strongly supported by continuous expansion in transmission capacity across multiple voltage levels. Transmission capacity bifurcation by voltage provides clarity on the system's present strength and its ability to meet future load growth. Current capacity and planned additions reveal how investments are being prioritized across low voltage (LV), medium voltage (MV), and high voltage (HV) segments.

India's AC transformation capacity crossed approximately 1.35 Mn MVA in FY2025[87], underscoring the country's expanding grid infrastructure. Within this, the medium voltage (33/66 kV) segment accounts for 4,82,810 MVA in FY2025 and is projected to rise to 6,24,332 MVA by FY2030, reflecting sustained growth in regional and sub-transmission networks. The high voltage (220/400/765 kV) segment currently contributes 7,72,195 MVA, with an additional 1,97,617 MVA planned by FY203F to enhance long-distance transmission, integrate renewable energy, and strengthen grid stability. Together, these expansions emphasize India's focus on building a resilient and future-ready transmission system[88]

[87]https://indianinfrastructure.com/2025/07/06/transmission-trends-building-a-robust-and-reliable-grid/#:~:text=AC%20transformation%20capacity%20was%201%2C354%2C103%20MVA
[88] https://ieema.org/industry-intelligence/industry-update/

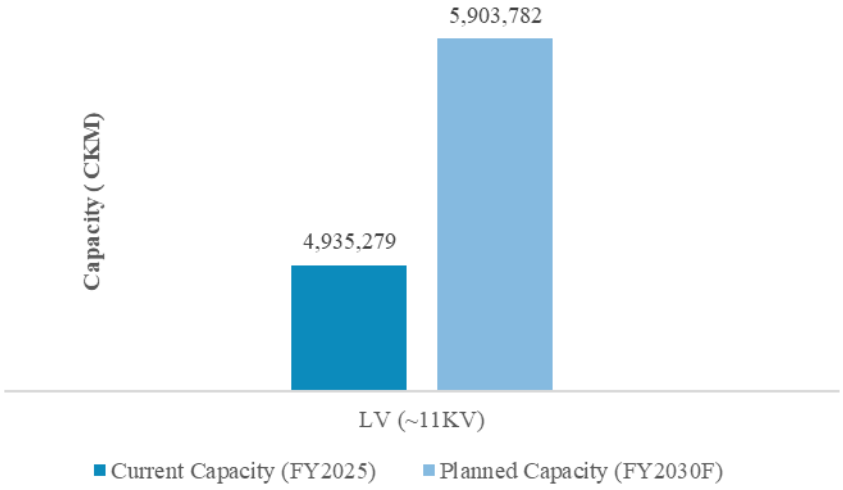
Figure 6.16: Current and Planned AC Transmission Capacity for Medium & High Voltage, In Megavolt-Ampere (MVA), FY2025-FY2030F



Source: Indian Electrical and Electronic Manufacturer Association

India's low-voltage (~11 kV) AC transmission network plays a critical role in last-mile distribution and regional connectivity. As of FY2025, the total line length stands at 49,35,279 circuit kilometers (CKM), with planned expansion to 59,03,782 CKM by FY2030. This growth of nearly 1 Mn CKM reflects the country's sustained efforts to strengthen distribution infrastructure, improve rural and urban electrification, and enhance reliability at the consumer end.[89]

Figure 6.17: Current and Planned AC Transmission Capacity for Low Voltage, In Circuit Kilometer (CKM), FY2025-FY2030F

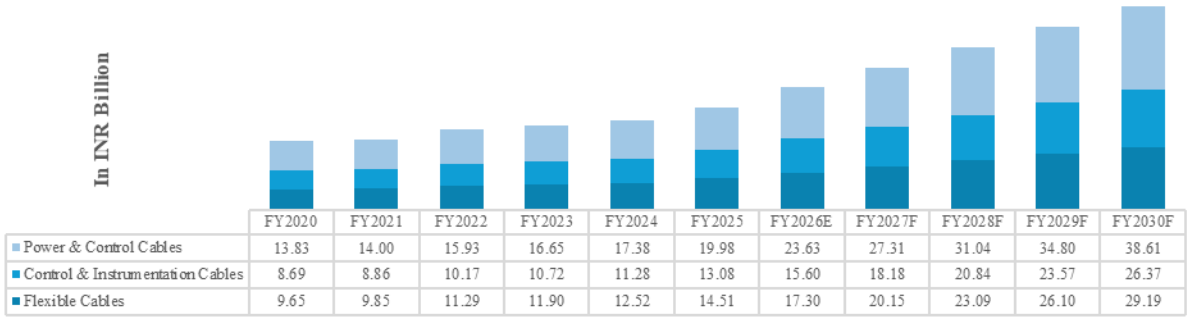


Source: Indian Electrical and Electronic Manufacturer Association

[89] https://ieema.org/industry-intelligence/industry-update/

6.6.3. Industrial Market Analysis by Cable Type

Figure 6.18: Power T&D Market by Type (In INR Bn), FY2020-FY2030F



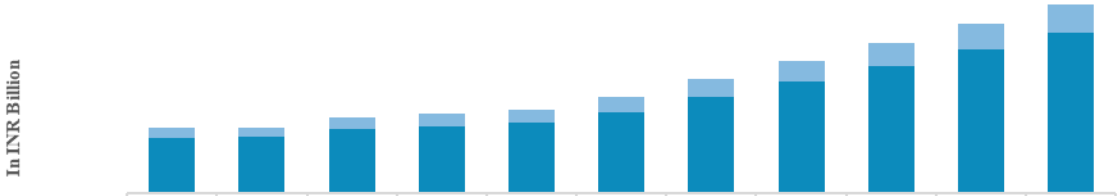
	FY2020	FY2021	FY2022	FY2023	FY2024	FY2025	FY2026E	FY2027F	FY2028F	FY2029F	FY2030F
Power & Control Cables	13.83	14.00	15.93	16.65	17.38	19.98	23.63	27.31	31.04	34.80	38.61
Control & Instrumentation Cables	8.69	8.86	10.17	10.72	11.28	13.08	15.60	18.18	20.84	23.57	26.37
Flexible Cables	9.65	9.85	11.29	11.90	12.52	14.51	17.30	20.15	23.09	26.10	29.19

Source: Frost & Sullivan Analysis

The industrial cable segment is expected to witness strong expansion between FY2025 and FY2030, supported by increasing industrial automation, infrastructure modernization, and increasing electricity demand across key sectors. Flexible Cables which are used in machinery, robotics, renewable energy systems, and manufacturing lines where constant movement and bending require high durability. The market is projected to grow from INR 14.51 Bn in FY2025 to INR 29.19 Bn by FY2030, reflecting a robust 101.2% increase. This growth is being driven by demand in manufacturing, robotics, and renewable energy installations, where flexibility and durability are essential. Control & Instrumentation Cables are utilized in process industries such as oil & gas, chemicals, and power plants for transmitting signals, monitoring operations, and ensuring precise control in automated systems. The market is expected to increase from INR 13.08 Bn in FY2025 to INR 26.37 Bn by FY2030 with 101.6% growth. The increasing adoption is being fuelled by industrial automation, process control systems, and the digitalization of production facilities. Power & Control Cables are extensively deployed in metro rail networks, smart cities, heavy industries, and utility projects to enable safe and efficient power distribution which are expected to increase from INR 19.98 Bn in FY2025 to INR 38.61 Bn by FY2030, with a 93.2% growth, supported by heavy industries, utilities, and large-scale infrastructure projects that require reliable power distribution and control networks

6.6.4. Infrastructure Market Analysis by End Use

Figure 6.19: Infrastructure Market by End Use (In INR Bn), FY2020-FY2030F



	FY2020	FY2021	FY2022	FY2023	FY2024	FY2025	FY2026E	FY2027F	FY2028F	FY2029F	FY2030F
Others	2.14	2.18	2.49	2.62	2.75	3.17	3.77	4.38	5.00	5.63	6.28
Rail/ Metro Cables	12.01	12.20	13.94	14.62	15.32	17.69	21.00	24.37	27.81	31.31	34.88

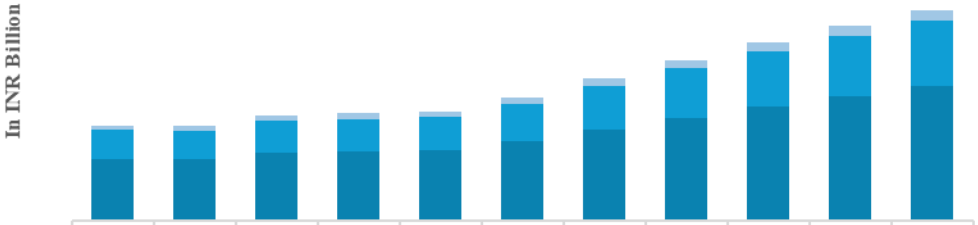
Source: Frost & Sullivan Analysis

Cables in infrastructure are regarded as essential for powering, controlling, and monitoring various systems that are supporting India's rapid urbanization and modernization. In railways and metro systems, cables are extensively utilized for signalling, traction, power supply, and communication, through which efficient and safe operations are ensured. The Rail/Metro cables market is projected to grow from INR 17.69 Bn in FY2025 to INR 34.88 Bn by FY2030, reflecting a strong CAGR of 14.54%, driven by metro rail expansion in urban centres and modernization of railway networks. The Others segment, which includes cables used in airports, highways, and other infrastructure

projects, is expected to rise from INR 3.17 Bn to INR 6.28 Bn during the same period, registering a CAGR of 14.63%, supported by large-scale infrastructure spending under national programs. The budgetary provisions of INR 9.12 lakh crore in FY2026 for infrastructure development, encompassing smart cities, transportation, and energy projects, are expected to strengthen the demand for cables.[90]

6.6.5. Specialty Cable Market Analysis by Type

Figure 6.20: Speciality Cable Market by Type (In INR Bn), FY2020-FY2030F



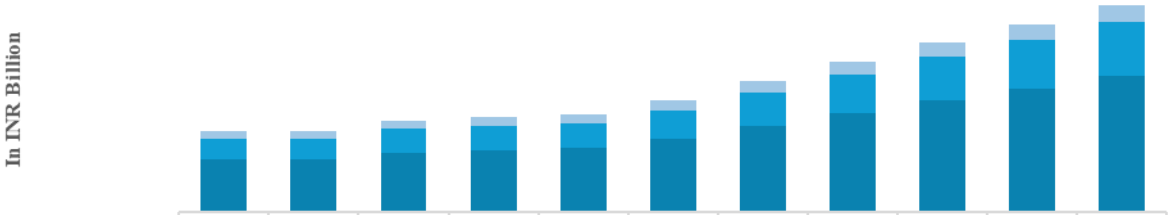
	FY2020	FY2021	FY2022	FY2023	FY2024	FY2025	FY2026E	FY2027F	FY2028F	FY2029F	FY2030F
Low Smoke Zero Halogen Cables	0.21	0.20	0.23	0.23	0.24	0.27	0.31	0.35	0.38	0.42	0.45
Fire Resistance Cables	1.24	1.23	1.37	1.40	1.44	1.62	1.87	2.12	2.36	2.59	2.81
Control & Instrumentation Cables	2.68	2.65	2.94	3.00	3.05	3.42	3.95	4.45	4.92	5.37	5.80

Source: Frost & Sullivan Analysis

Control & Instrumentation Cables, Fire-Resistant Cables, and Low Smoke Zero Halogen (LSZH) Cables are witnessing strong demand growth in India's speciality cable market. Control & Instrumentation Cables, growing at a CAGR of 11.14%, are critical for accurate monitoring and automation in power, process, and manufacturing industries. Fire-Resistant Cables, with the highest CAGR of 11.67%, are gaining traction in metros, airports, and high-rise buildings, ensuring circuit integrity during fire emergencies. LSZH Cables, expanding at 11.31% CAGR, are increasingly adopted in smart buildings, hospitals, and data centres for their low smoke, non-toxic emissions, and compliance with global safety and environmental standards. Programs such as the Smart Cities Mission and AMRUT (Atal Mission for Rejuvenation and Urban Transformation) are driving adoption of LSZH and fire-resistant cables in urban infrastructure, hospitals, metro systems, and high-rise buildings. Investments under the National Infrastructure Pipeline (NIP) and the Make in India initiative are boosting domestic production and deployment of Control & Instrumentation Cables across power plants, industrial automation, and process industries.

6.6.6. Renewable Cable Market Analysis by Type

Figure 6.21: Renewable Cable Market by Type (In INR Bn), FY2020-FY2030F



	FY2020	FY2021	FY2022	FY2023	FY2024	FY2025	FY2026E	FY2027F	FY2028F	FY2029F	FY2030F
Others	1.82	1.79	1.97	2.00	2.02	2.26	2.58	2.89	3.18	3.45	3.70
Wind Farm Cables	4.55	4.58	5.18	5.38	5.59	6.39	7.52	8.64	9.77	10.90	12.03
Solar Cables	11.82	11.87	13.40	13.90	14.39	16.42	19.27	22.10	24.92	27.73	30.54

Source: Frost & Sullivan Analysis

Cables used in renewable energy systems are engineered to ensure efficient power transmission and withstand harsh environmental conditions. In solar applications, solar cables are the largest segment, designed with UV resistance,

[90] https://economictimes.indiatimes.com/industry/energy/power/india-to-see-over-rs-9-lakh-cr-spending-on-power-transmission-infra-by-2032/articleshow/115736936.cms?from=mdr

flexibility, and high temperature endurance. The solar cable market is projected to grow by 85.90% between 2025 and 2030, supported by large-scale solar parks and rooftop projects. Wind farm cables, including HVAC and HVDC variants, are expected to grow by 89.20% between FY2025 and FY2030, as onshore and offshore wind installations accelerate. Offshore projects also demand subsea cables capable of withstanding marine conditions, with India's plans for 30 GW of offshore wind capacity by FY2030 expected to significantly boost demand Other renewable cables, covering hydro, geothermal, storage, and hybrid applications, are projected to grow by 61.50% between FY2025 and FY2030, reflecting diversified clean energy adoption and the rising need for reliable transmission infrastructure. Key players in India's renewable (solar) cables market include established giants like Polycab India Ltd., Havells India Ltd., and KEI Industries Ltd. alongside specialized firms such as Lapp India, Helukabel India, and Finolex Cables. Other significant players are RR Kabel, Apar Industries, and Sterlite Power Transmission, with new entrants like the Adani and Aditya Birla Groups also expected to increase competition.

The entry barriers to the renewable cables industry include:

1. High capital investment and advanced technology: Significant funds are needed for manufacturing facilities and R&D, combined with the need for specialized technical expertise.
2. Raw material price volatility: Copper dominates costs (~80% of LV cable production cost), with fluctuations causing financial unpredictability; alternatives like aluminum have limitations.
3. Regulatory and project execution delays: Delays in permits, clearances, and skilled personnel availability impact timelines and cost efficiency.
4. Intense price competition and market consolidation: Established global players dominate, while low-cost producers create competitive pressure that raises entry risks.
5. Demand uncertainty linked to renewable energy policy and infrastructure: The sector's growth depends heavily on renewable energy project pipeline stability, grid development, and government commitments

7. Competitive Benchmarking of Key Players

7.1. Company Profile Capabilities and Offerings landscaping

The following listed public companies are taken as peer group based on similarity of products, business, revenue and margin profile, and the segments in which the Company operates. The other companies which may be operating in same sector, however, are not considered comparable on an overall basis with that of Company's business due to any or all the following reasons - business portfolio / product & service profile / customer profiles / size / operating profitability / revenue profile / geographic presence etc.

Figure 7.1: Company Profile Capabilities and Offerings Landscaping

Company	Year Founded	Headquarters	Employees	Export as a Percentage of Total Sale	Product Portfolio	Key Verticals	Major Geographies Covered
Oswal Cable Ltd	1971	Jaipur, Rajasthan	619	35.00%	Bare aluminium conductors (AAC, AAAC, ACSR), LT XLPE/PVC cables, aerial bunched cables, multi-strand power conductors, transformers.	Power transmission & distribution, infrastructure, telecom, turnkey T&D projects.	India, Middle East, Latin America & Africa
Dynamic Cable Ltd	2007	Jaipur, Rajasthan	978	9.00%	LV, MV, HV power cables; control & instrumentation cables; railway signalling cables; solar cables.	Power generation & transmission, railways, solar, industrial, airports, real estate projects.	Pan-India, focus on North & West, select global markets.
Universal Cables Ltd	1962	Gurugram, Haryana	864	4.00%	Power cables (HT/LT, XLPE & PVC), specialty wires, mining & ship cables, capacitors, engineering services.	Power, railways, fertilizers, petrochemicals, mining, shipbuilding, defense, OEM/custom sectors.	India and export operations to over 45 countries.
Diamond Power Infrastructure Ltd.	1992	Vadodara, Gujarat	1,000	12.00%	Power and control cables, Transmission and distribution conductors, Power and distribution transformers, Transmission towers, Specialty cables and EPC turnkey solutions	Power T&D, Industrial engineering and construction, Utilities, Infrastructure projects	India, Africa
APAR Industries Ltd.	1958	Mumbai, Maharashtra	1900+	32.80%	Conductors, cables, transformer oils, lubricants, specialty oils, polymers, telecom solutions	Power T&D, renewables, railways, specialty cables, telecom, automotive, lubricants	India, Australia, SE Asia, Middle East, Latin America, North America, Africa; exports to 140+ countries
KEI Industries Ltd.	1968	New Delhi, India	2,935	13.00%	EHV cables, HT & LT power cables, control cables, instrumentation cables, house wire, stainless steel wire	Power infrastructure, renewables, railways & metro, EPC projects, real estate, industrial, retail	India, Middle East, Africa, Australia, Europe, USA (started export in 2023), 50+ countries

Source: Company Website, Annual reports

7.2.Key Financial Metrics

The revenue of Oswal Cables was INR 6,354.66 Mn in FY2025 and the EBITDA was INR 586.69 Mn during the above-mentioned period. The EBITDA Margin was 9.23% during the period FY2025.

Figure 7.2: Key Financial Metrics, FY2025

	Metrics	Oswal Cable Ltd	Dynamic Cable Ltd	Universal cables	Diamond Power Infrastructure Ltd.	APAR Industries Ltd.	KEI Industries Ltd.
Headquarters		Jaipur, Rajasthan , Medak district, Telangana	Jaipur, Rajasthan	Satna- Madhya Pradesh, Haryana, Goa	Vadodara, Gujarat	Mumbai, Maharashtra	New Delhi
Company Type		Public	Public	Public	Public	Public	Public
Revenue from Operation	In INR Mn	6,354.66	10,253.73	24,083.86	11,153.93	1,85,812.10	97,358.77
PAT	In INR Mn	297.72	648.21	893.85	344.98	8,213.00	6,964.14
PAT Margin	In %	4.66%	6.28%	3.68%	3.09%	4.40%	7.10%
EBITDA	In INR Mn	586.69	1,053.64	1,796.03	667.78	15,473.00	9,909.63
EBITDA Margin	In %	9.23%	10.28%	7.46%	5.99%	8.33%	10.18%
Key Industries		Power Transmission and Distribution, Electrical Infrastructure, Telecom	Power Generation, Transmission and Distribution, Railways, Airports, Real Estate, Industrial Projects, And Solar	Power Transmission and Distribution, Railways, Fertilizers, Petrochemicals, Mining, Shipbuilding, Defense, Chemical, Steel Plants, Construction, And OEMs.	Power Transmission and Distribution, Cables, Conductors, Transformers, and EPC services, Serving Utilities	Transformer Oils and Specialty Oils (TSO), Conductors (including overhead conductors for power transmission), and Power & Telecom Cables	Cables and Wires, specialty control and instrumentation cables, flexible, solar, fire-resistant types, alongside house wires, winding wires, and stainless-steel conductors.

Source: Company Website, Annual reports

Figure 7.3: Key Performance Indicators, FY2023-FY2025

Key Performance Indicator	Metrics	Oswal Cables Limited			Dynamic Cables Limited			Universal Cables Limited			Diamond Power Infrastructure Ltd.			APAR Industries Ltd.			KEI Industrie Ltd.		
		FY2025	FY2024	FY2023	FY2025	FY2024	FY2023	FY2025	FY2024	FY2023	FY2025	FY2024	FY2023	FY2025	FY2024	FY2023	FY2025	FY2024	FY2023
Revenue from Operations	In INR Mn	6,354.66	4,929.53	3,373.72	10,253.73	7,680.04	6,686.30	24,083.86	20,206.68	22,019.51	11,153.93	3,433.71	154.56	1,85,812.10	1,61,529.80	1,43,363.00	97,358.77	81,207.28	69,081.74
EBITDA	In INR Mn	586.69	394.80	261.69	1,053.64	772.80	627.74	1,796.03	1,616.92	1,853.66	667.78	421.27	(236.53)	15,473.00	15,270.70	12,269.30	9,909.63	8,538.65	7,020.14
EBITDA Margin	In %	9.23%	8.01%	7.76%	10.28%	10.06%	9.39%	7.46%	8.00%	8.42%	5.99%	12.27%	-153.03%	8.33%	9.45%	8.56%	10.18%	10.51%	10.16%
PAT	In INR Mn	297.72	267.4	111.95	648.21	377.71	310.14	893.85	1,082.25	631.89	344.98	170.25	(428.79)	8,213.00	8,251.10	6,377.20	6,964.14	5,807.33	4,773.42
PAT Margin	In %	4.66%	5.30%	3.31%	6.28%	4.90%	4.62%	3.68%	5.29%	2.85%	3.09%	4.95%	-272.78%	4.40%	5.08%	4.44%	7.10%	7.12%	6.88%
Revenue CAGR (FY 2023 to FY 2025)	In %	37.24%			23.84%			4.58%			749.49%			13.85%			18.72%		
EBITDA CAGR (FY 2023 to FY 2025)	In %	49.73%			29.56%			-1.57%			NA			12.30%			18.81%		
PAT CAGR (FY 2023 to FY 2025)	In %	63.08%			44.57%			18.94%			NA			13.48%			20.79%		
Debt / Equity	Ratio	1.09	1.32	1.33	0.16	0.56	0.46	0.48	0.43	6.24	-0.52	-0.47	-0.37	0.10	0.10	0.14	0.03	0.04	0.05
Fixed Assets Turnover Ratio	Ratio	18.14	15.15	12.20	12.31	12.26	12.03	10.29	11.36	15.98	0.96	0.33	0.01	12.98	14.30	16.21	12.88	15.00	14.28
Inventory Turnover Ratio	Ratio	15.86	16.38	14.47	6.13	5.89	6.15	5.63	5.47	6.01	6.14	2.90	0.36	5.07	4.91	4.96	5.07	5.28	5.07
ROE	In %	27.42%	33.87%	21.49%	17.34%	17.65%	17.48%	5.04%	6.10%	8.93%	-3.93%	-1.75%	4.38%	18.24%	21.29%	28.52%	12.04%	18.45%	18.44%
ROCE	In %	30.10%	23.86%	21.20%	23.66%	22.44%	24.17%	5.83%	5.43%	3.18%	-10.75%	-4.25%	6.87%	33.59%	38.82%	55.84%	22.75%	30.70%	29.49%
No of Operating Facilities	Units	2	2	2	3	3	3	2	2	1	1	1	1	11	11	9	6	6	5
Export Countries	Units	14	12	7	42+	40+	40+	50+	NA	NA	30	NA	NA	140+	140+	140+	60+	60+	60+

Source: Company Website, Annual reports [91] [92] [93] [94] [95]

Note: The high losses reported by Diamond Power Infrastructure Limited in FY23 were due to the ongoing Corporate Insolvency Resolution Process (CIRP) and related capital restructuring completed in September 2022

- Oswal Cables EBITDA and PAT grew at the fastest CAGR of 49.73% and 63.08% respectively over the last three Fiscals and the company recorded the highest RoE of 27.42% in the Fiscal 2025, as compared to the above listed peers. Similarly, Oswal Cables had second highest RoCE of 30.10% in Fiscal 2025, amongst the listed peer group
- Oswal Cables has demonstrated strong financial growth in recent years, positioning itself among the top ten cable and conductor companies in India by turnover. The company's revenue from operations increased significantly from INR 3,373.72 Mn in FY2023 to INR 6,354.66 Mn in FY2025, reflecting a CAGR of 37.24% making them one of the fastest growing MSME.
- The Inventory turnover ratio for Oswal Cable is 15.46 in FY2025 which is the highest amongst the peers which have been compared in the industry peer section in the above table.
- Oswal Cables recorded the highest Fixed Assets Turnover Ratio and Inventory Turnover Ratio in FY2025, thereby becoming the most working capital efficient company, as compared to the above listed peers

[91] https://www.dynamiccables.co.in/Annual-Report-2023-24.pdf : https://www.dynamiccables.co.in/Annual-Report-2024-25.pdf
[92] https://unistar.co.in/Financial-Information/Annual-Report-2022-23.pdf ; https://unistar.co.in/Financial-Information/Annual-Report-2024-25.pdf
[93] https://paramountcables.com/wp-content/uploads/2023/11/Outcome-of-Board-meeting-07.11.2023.pdf : https://paramountcables.com/wp-content/uploads/2025/05/Outcome-of-the-Board-Meeting-of-the-Company-for-the-Quarter-ended-31.03.2025.pdf
[94] https://dicabs.com/wp-content/uploads/2023/06/Annual-Report-2023-2024-1.pdf : https://dicabs.com/wp-content/uploads/2023/06/Investor-Presentation-FY-2025.pdf
[95] https://www.cordscable.com/cordscable/media/kResultssigned.pdf : https://www.cordscable.com/cordscable/media/results/24-25/fResultQ4.pdf

7.2.1. Revenue Split between Domestic and Export Share

Oswal Cables saw strong growth in both domestic and export sales. Domestic revenue increased from INR 2,127.2 Mn in FY2023 to INR 4,087.0 Mn in FY2025, showing steady progress. Export revenue accounted to INR 2,154.2 Mn in FY2025**.** Oswal cables have received several national and international rewards in the last 3-5 years from the govt of India and other organizations. In FY2025 the company received a special trophy for excellence in export of engineering services in the category of small enterprises from EEPC India at the 52nd and 53rd Export Award, Northern Region

Table 7.1: Domestic and Export Share (In INR Mn), FY2023-FY2025

Year	FY2023		FY2024		FY2025	
Domestic & Export Share (In INR Mn)	Domestic	Exports	Domestic	Exports	Domestic	Exports
Oswal Cables	65.00%	35.00%	46.00%	54.00%	65.00%	35.00%
Dynamic Cable Ltd	97.00%	3.00%	88.00%	12.00%	91.00%	9.00%
Universal Cables	95.00%	5.00%	95.00%	5.00%	96.00%	4.00%
Diamond Power Infrastructure Ltd.	NA	NA	NA	NA	NA	NA
APAR Industries Ltd.	51.69%	48.31%	54.80%	45.20%	67.20%	32.80%
KEI Industries Ltd.	90.00%	10.00%	87.00%	13.00%	87.00%	13.00%

Source: Company Website, Annual reports

Note: Domestic & Export details for Diamond Power Infrastructure Ltd is not available.

7.3.SWOT Analysis of the Cables and Conductors Industry in India

Strengths

Established Market Presence: The Indian cables and conductors' industry have built strong credibility over decades, supplying to diverse applications such as power, telecom, infrastructure, transport, and industry. A mix of domestic dominance and rising exports strengthens brand recognition and customer trust globally.

Diverse Product Portfolio: The sector offers a wide range of products, including power, control, instrumentation, fiber optics, and specialty cables. This diversification reduces dependence on a single demand driver and supports multiple end-use industries.

Quality Standards and Certifications: Increasing adoption of BIS, ISO, and international certifications enhances the sector's reputation, enabling access to government projects, exports, and safety-critical applications.

Expanding Domestic Distribution: Extensive dealer networks and distribution reach across India position the industry well to capture demand from rural electrification, urban infrastructure, and smart city projects.

Capacity Availability: Many manufacturers have scaled up capacity, with headroom available to meet surging demand from power transmission, construction, and industrial projects.

High Entry and Exit Barriers: Oswal Cables has gradually developed the capability to manufacture products up to 765 kV by steadily building its expertise through supplying low- and medium-voltage products and participating in increasingly large infrastructure projects. Given the critical end-use of our products and the stringent certification, qualification, and approval requirements, the industry presents significant entry barriers for new players.

We are among the select group of companies approved by RDSO for railway signaling and energy cables in India, underscoring our technical competence and credibility. Obtaining supplier registrations with government electricity companies and institutional customers typically involves a 6–12-month process of detailed technical submissions, audits, type testing, and factory inspections. Customers also conduct regular and costly audits of our facilities, ranging

from ₹2 million to ₹15 million per audit, which further reflects the high compliance threshold. For critical categories like HTLS conductors and export-grade cables, we undergo extensive third-party type testing at NABL-accredited and international labs (CPRI, ERDA, Kinetrics, UL, TÜV), often requiring six to twelve months and significant financial outlays per product variant.

On the export front, Oswal Cables has established a presence across 28 countries during the last three fiscals, including key markets such as the USA, West Africa, and South America, with exports contributing 34–54% of revenues. Entry into these geographies requires extensive certifications (UL, IEC, NFC), regulatory familiarity, operational competence, and cultural understanding, which we have consistently demonstrated.

Further, considering the criticality of high-voltage energy products, customers prioritise reliability, customised solutions, and consistency of supply. The extensive pre-approval processes and resource commitments required to onboard suppliers create high switching costs, time lags, and risks of product variation. These exit barriers reinforce long-term customer stickiness and deepen our relationships.

Collectively, these factors establish Oswal Cables as part of a select group of qualified and trusted suppliers, creating a strong competitive moat in the cable and conductors' industry

Weaknesses

Scale Disparity: The industry is highly fragmented. While a few large players dominate, many mid- and small-sized companies operate with limited scale, restricting their ability to compete on price, capacity, and technology.

Brand Visibility Gaps: Smaller and mid-sized manufacturers struggle with limited marketing, clear focus on positioning in premium and consumer-driven segments could open newer market opportunities.

Exposure to Raw Material Volatility: High dependence on copper, aluminum, and polymers makes the sector vulnerable to commodity price fluctuations, often challenging higher margins.

Limited R&D Investment: Overall sectoral investment in R&D remains modest compared to global peers, companies that invest in R&D investments in areas like smart cables, flame-retardant variants, and advanced conductor technologies could witness exponential growth in future.

Opportunities

Infrastructure & Electrification Boom: Big investments in power, metros, roads, and rural electrification are driving demand for cables and conductors.

Renewable Energy & Smart Grids: Growth in solar, wind, and grid modernization creates demand for high-voltage, DC-compatible, and advanced grid-integration cables.

EV Adoption & Automotive Wiring: The push toward electric vehicles is generating new opportunities in EV charging cables, battery wiring, and automotive harnesses.

Export Growth via China+1 Strategy: With global buyers diversifying away from China, Indian cable manufacturers have a strong chance to capture market share in Asia, Africa, and the Americas.

Rising Safety & Sustainability Standards: Demand for eco-friendly, fire-resistant, and LSZH cables is growing across sectors like metros, airports, and real estate, creating space for differentiated offerings.

Strategic Partnerships: Collaborations with EPC contractors, global technology providers, and large infrastructure players can enhance competitiveness and market reach.

Threats

Intense Competition: The sector faces pressure from both large, organized players with economies of scale and unorganized firms competing on price, creating margin challenges.

Entry of Large Conglomerates: Diversified giants entering the cables market increase competitive intensity, potentially reshaping pricing, and profitability dynamics.

Technological Disruption: Rapid adoption of IoT-enabled smart cables, fiber optics, and Industry 4.0 manufacturing demands continuous innovation. Companies who keep in pace with the technological disruption are expected to grow faster than their peers in the future.

Economic & Policy Uncertainty: Delays in infrastructure spending, global trade restrictions, or domestic policy shifts may delay demand growth across the sector.

8. Conclusion

The Indian wires and cables market stands at the forefront of transformation, fueled by robust infrastructure investments, rising electrification, and a national push toward digital and green growth. Between FY2025 and FY2030, demand will expand at double-digit growth, supported by power transmission upgrades, renewable energy integration, EV charging networks, smart cities, data centers, and telecom expansion.

Growth Driven by Infrastructure and Electrification:

India's ambitious infrastructure programs across power, transport, telecom, real estate, and EV charging are fueling cable demand. Government-led electrification and urbanization ensure long-term momentum, making infrastructure expansion the cornerstone of industry growth.

Steady Double-Digit Expansion:

The market is forecast to grow at 13.40% CAGR between FY2025 to FY2030. Traditional segments will expand, but fiber optic and specialty cables will outpace due to rising demand from smart cities, data centers, and renewable energy projects.

Segmented Approach Needed:

A tailored strategy is critical. EHV and HV cables will dominate power transmission; fiber optic and jelly-filled cables will lead telecom growth; FRLS and LSZH wires will secure real estate demand; and advanced automotive wiring will power EV adoption.

Sustainability Becomes Central:

Sustainability is now a market mandate. Compliance with RoHS, REACH, LSZH, recyclable, and energy-efficient standards is increasingly demanded by regulators and customers. Eco-friendly products will define leadership in both domestic and global markets.

Digital Transformation Accelerates:

Smart cables, IoT integration, and automation in manufacturing are becoming differentiators. Adoption of Industry 4.0 technologies will enhance efficiency, ensure quality, and address the surging demand for high-speed connectivity and smart grid solutions.

Quality and Certification as Differentiators:

Compliance with BIS, ISO, IEC, and fire-safety standards is now a prerequisite rather than a value-add. Strict certification drives consolidation, with organized players gaining market share through superior quality assurance and strong R&D.

Raw Material Volatility Persists:

Unpredictable swings in copper, aluminum, and polymer prices continue to threaten profitability. Manufacturers must adopt procurement strategies, hedging mechanisms, recycling practices, and alternative materials to mitigate risks.

China+1 and Export Opportunity:

Global supply chain diversification is creating opportunities for India. However, success requires scaling up capacity, achieving global certifications, and ensuring cost competitiveness. India's compliance-focused manufacturing makes it a strong alternative to China.

Tiered Competitive Landscape:

The market remains fragmented. Large, organized players such as Polycab, KEI, Havells, Oswal Cables, and RR Kabel are scaling faster due to better distribution, R&D, and branding. Smaller players must specialize or consolidate to remain viable.

Power Sector and Renewables Are Key:

The expansion of power transmission, smart grids, and renewable integration will drive demand for HVDC, HTLS, and grid-ready cables. Renewables will remain a major anchor for cable consumption in the coming decade.

Telecom and Data Infrastructure Surge:

India's 5G rollout, FTTH expansion, and undersea cable projects are transforming the telecom landscape. Fiber optic cables will witness record demand, with data centers and digital infrastructure as growth multipliers.

Automotive/EV Wiring Boom:

EV adoption is increasing wiring intensity per vehicle and creating new demand for lightweight, heat-resistant, high-capacity cables. EV charging networks will further expand opportunities in specialized power cables.

Regulatory Push for Safety and Compliance:

Stricter fire-safety rules, LSZH standards, and building codes in metro and real estate projects mandate product upgrades. Early adopters of safe, certified cables can command premium positioning.

Investment in R&D and Innovation:

R&D is critical for creating flame-retardant, ultra-flexible, and fiber-integrated products. Investment in testing, prototyping, and innovation will enable manufacturers to adapt to megaprojects, urbanization, and export opportunities.

Global and Domestic Partnerships:

Strategic alliances, JVs, and mergers are reshaping capacity and innovation. Entry of conglomerates like Adani and UltraTech will intensify competition, making collaborations key to scale, distribution, and technological advancement.

Industry-wide Outlook:

Manufacturers that embrace sustainability, digital transformation, quality, and R&D-driven innovation, while diversifying into global markets, will emerge as leaders. The Indian cables sector is poised not only for strong growth but also for a strategic redefinition in the global value chain by FY2030.

Abbreviations

GDP	Gross Domestic Product
NIIP	Net International Investment Position
FDI	Foreign Direct Investment
IMF	International Monetary Fund
WEF	World Economic Forum
GVA	Gross Value Added
CPI	Consumer Price Index
RBI	Reserve Bank of India
IIP	Index of Industrial Production
Ckm	Circuit Kilometers
RKM	Route Kilometers
Gw	Giga Watts
PPP	Public-Private Partnership
SDF	Standing Deposit Facility
MSF	Marginal Standing Facility
CRR	Cash Reserve Ratio
PLI	Production Linked Incentive
DISCOM	Distribution Companies
SAUBHAGYA	Sahaj Bijli Har Ghar Yojana
RDSS	Revamped Distribution Sector Scheme
PVTG	Particularly Vulnerable Tribal Group
PM - JANMAN	Pradhan Mantri Janjati Adivasi Nyaya Maha Abhiyan
DDUGJY	Deen Dayal Upadhyaya Gram Jyoti Yojana
PMGSY	Pradhan Mantri Gram Sadak Yojana
RCPLWEA	Road Connectivity Project for Left Wing Extremism Affected Areas
UIDF	Urban Infrastructure Development Fund
ULB	Urban Local Bodies
GVA	Gigavolt - Ampere
HTLS	High Temperature Low Sag
HVDC	High Voltage Direct Current
PGCIL	Power Grid Corporation of India Limited
ISTS	Interstate Transmission System
NMP	National Monetization Pipeline
BPL	Below the Poverty Line
GEC	Green Energy Corridors
CFA	Central Financial Assistance
PV	Photovoltaic
TBCB	Tariff Based Competitive Bidding
GHGs	Greenhouse Gases
COP	Conference of the Parties
BESS	Battery Energy Storage Systems
PPA	Power Purchase Agreements
JNNSM	Jawaharlal Nehru National Solar Mission

CCDC	Centralized Data Collection and Coordination
DCR	Domestic Content Requirement
M-SIPS	Modified Special Incentive Package Scheme
RFP	Request for Proposal
RFT	Request for Tender
NSM	National Solar Mission
KUSUM	Kisan Urja Suraksha evam Utthaan Mahabhiyan
CCEA	Cabinet Committee on Economic Affairs
RLDA	Rail Land Development Authority
HSR	High-Speed Rail
EMU	Electric Multiple Unit
ACS	Aluminum Clad Steel
CERC	Central Electricity Regulatory Commission
CTUIL	Central Transmission Utility of India Limited
TSA	Transmission Service Agreement
ICB	International Competitive Bidding

Annexure

The report titled "Industry Report on High Voltage Conductivity Products and Solutions" covers the Indian power sector, Indian railways and the transmission and distribution conductor market, and the power cables market. The report also covers the global future growth potential across the regions. The power cables are further segmented by power T&D, renewable, industrial, infrastructure, and specialty. The individual market size across each of these segments has been covered in detail in the report. The final chapter is competitive profiling of key domestic players in this market.

Oswal Cables: Comprehensive Company Profile

Introduction

Founded in 1971 and headquartered in Jaipur, Rajasthan, Oswal Cables has evolved into one of the premium Indian manufacturers supplying power transmission and distribution products. Oswal Cables is one of the oldest and leading exporters of cable and conductors from Rajasthan.

Oswal Cables Business Portfolio

Oswal Cables are into manufacturing of cables and conductors, renewable energy generation and EPC. The company has manufacturing facilities in Jaipur and Hyderabad where they manufacture cables and conductors. Oswal Cables has a clear focus on product line expansion, they have added more than 10 products in the last 5 years. The future includes its entry into the building wire segment. Oswal Cables is one of the top exporters from India to Latin America and it accounts to 15% of their total sales. The company also focusses predominantly on exports and is one of the first companies to enter Senegal and South America.

Oswal Cables has 5 wind power plants for the total capacity of 4.11 MW, out of which 4 are in Rajasthan and 1 is in Maharashtra. The Company has also established solar plants and has already installed grid-connected solar capacity of 5MW under the Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan (PM-KUSUM) Scheme, aimed at

promoting the use of solar energy in the agriculture sector to reduce reliance on diesel and curbing environmental pollution. Another 2.5MW is under installation. Oswal cables has 2 solar power plants with a total capacity of 7.50 MW located in Rajasthan.

The EPC capabilities of Oswal Cables include design, procurement, construction, and commissioning. The company has implemented such projects for Indian State Governments and Offshore. The company has worked in sectors such as Transmission Lines, Distribution Lines and Substations.

Manufacturing Facilities

Oswal Cables operates two major state-of-the-art manufacturing plants located in Jaipur (Rajasthan) and Hyderabad (Andhra Pradesh). These strategically placed facilities are equipped with advanced production lines and testing laboratories to meet domestic and global quality standards.

Jaipur Plant: Specializes in manufacturing bare aluminum conductors such as AAC, ACSR, AAAC, and HTLS conductors. The Jaipur facility features sophisticated machinery and overhead cranes for efficient material handling. An expansion at Mahindra World City adds over 55,000 square meters of industrial space to meet growing demand.

Hyderabad Plant: Focuses on manufacturing insulated power cables, including LT XLPE and PVC insulated cables, aerial bunched cables, and specialty cables. The facility boasts automated production lines approved for conductor manufacturing up to 765 kV. This plant enhances the company's capacity to serve high-voltage transmission and distribution projects.

Both plants employ skilled engineers, technicians, and workers, streamlining operations with modern quality assurance labs that ensure consistent product reliability.

Sales Performance

Oswal Cables has demonstrated strong financial growth in recent years, positioning itself among the top ten cable and conductor companies in India by turnover. Oswal Cables has demonstrated strong financial growth in recent years, positioning itself among the top ten cable and conductor companies in India by turnover. The company's revenue from operations increased significantly from INR 3,373.72 Mn in FY2023 to INR 6,354.66 Mn in FY2025, reflecting a CAGR of 37.24% making them one of the fastest growing MSME.

Certifications and Quality Assurance

Oswal Cables is ISO 9001:2000 certified, highlighting its dedication to maintaining rigorous quality management systems. Its products bear the ISI mark, signifying compliance with Indian standards, alongside certifications aligned with international benchmarks to ensure product excellence. The company also received ISO 14001:2015 (Environmental Management System), and ISO 45001:2018 (Occupational Health & Safety Management System)

Oswal Cables has type-tested its products through accredited laboratories such as Central Power Research Institute ("CPRI"), Electrical Research and Development Association ("ERDA") and Keuring van Elektrotechnische Materialen ("Kinetrics"). The Company's Jaipur Unit has been audited by Underwriters Laboratories (UL), which enables the company to export to United States of America.

Oswal cables have received several national and international rewards in the last 3-5 years from the govt of India and other organizations. In FY2025 the company received a special trophy for excellence in export of engineering services in the category of small enterprises from EEPC India at the 52nd and 53rd Export Award, Northern Region

The company's manufacturing processes include extensive testing like electrical, mechanical, and chemical tests, reinforcing product safety and performance. This strict quality assurance supports Oswal's reputation as a trusted supplier to utilities, large infrastructure projects, and EPC contractors.

Oswal cables is also planning their own rolling mill for reverse integration and R&D at material level. The other plans include setting up a robust in-house testing lab that will be duly accredited and accepted.

Key Clients and Market Presence

Oswal Cables serves a broad clientele comprising government utilities, private infrastructure players, EPC contractors, telecommunication companies, railways, and renewable energy developers. It holds approvals and credentials from prestigious entities such as Indian Railways, Power Grid Corporation of India Limited, and State Electricity Boards.

By maintaining close collaboration with customers, Oswal Cables addresses customized requirements and market complexities efficiently, strengthening its position across India's power infrastructure value chain. The company's strong financial health, with improving operating income and cash flow, supports ongoing business growth.

International Market Presence

Current Markets

The top three countries of export for Oswal Cables are Mozambique, Benin, and Paraguay, which account to 42.35%, 14.56% and 12.46% of the total exports, respectively. The company exports to around 14 countries globally.

Future Markets

Below mentioned are the focus countries for the company where Oswal Cables have started approval process:

North America: United States of America, Canada, Mexico

Middle East / Asia / Africa: Iraq, Israel, Egypt, South Africa, Georgia, Jordan

Latin America: Colombia, Bolivia, Paraguay, Uruguay, Peru, Chile

Europe: Italy, Hungary, Montenegro, Poland, Norway, Sweden, Cyprus, Romania, Finland

United Kingdom: United Kingdom

Central America: Costa Rica, Puerto Rico, Ecuador