

**Atlanta Electricals Limited**

# Strategic assessment of Transformer market

**Final report**

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*Signature*

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# 1 Global and domestic macroeconomic overview

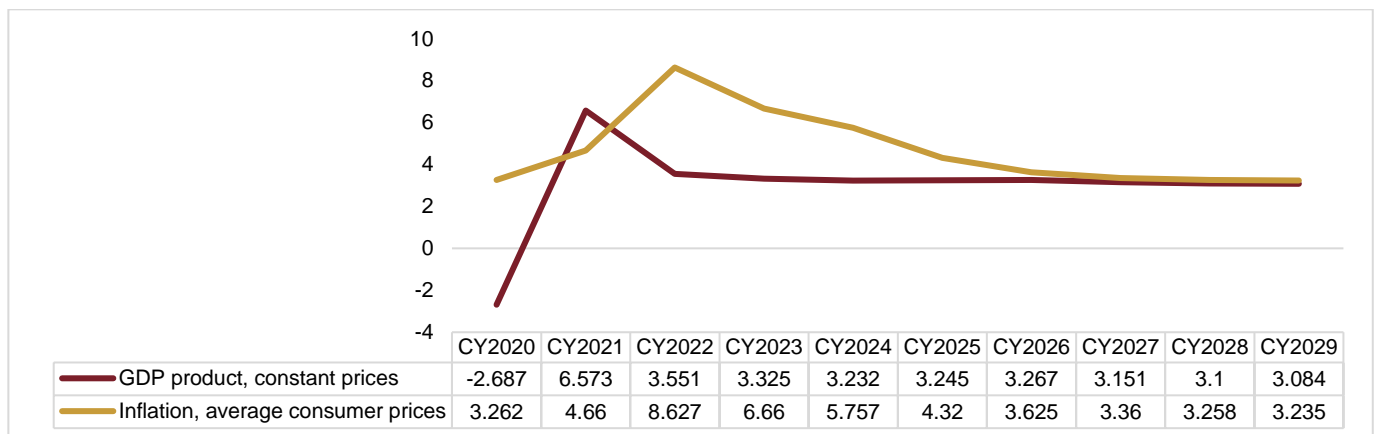
## 1.1 Global macroeconomics

### 1.1.1 Overview and outlook of global GDP trends

As per the International Monetary Fund (IMF) World Economic Outlook (October 2024), global growth is expected to remain stable yet underwhelming. At 3.2% in 2024 and 2025, the growth projection is virtually unchanged from those in both July 2024 and April 2024.

Cyclical imbalances have eased since the beginning of the year 2024, leading to a better alignment of economic activity with potential output in major economies. This adjustment is bringing inflation rates across countries closer together and on balance has contributed to lower global inflation. As per IMF, global headline inflation is expected to fall from an annual average of 6.7% in 2023 to 5.8% in 2024 and 4.3% in 2025, with advanced economies returning to their inflation targets sooner than emerging market and developing economies.

**Figure 1: Global GDP and inflation projections by IMF**



Source: IMF World Economic Outlook database: October 2024; Crisil Intelligence

### 1.1.2 Overview of GDP for key economies

Indian gross domestic product (GDP) has been growing consistently. In the last ten years, except for years affected by COVID-19, India's growth has been highest amongst the top ten economies and other emerging countries as well. With the receding risk of global recession, India has been identified as an economic growth center by various International Agencies as well as global rating firms.

**Table 1: Historical growth of real GDP for major economies (figures in %)**

Country	CY14	CY15	CY16	CY17	CY18	CY19	CY20	CY21	CY22	CY23
<b>India*</b>	7.41	8.00	8.26	6.80	6.45	3.87	(5.78)	9.69	6.99	8.15
<b>Brazil</b>	0.50	(3.55)	(3.28)	1.32	1.78	1.22	(3.28)	4.76	3.02	2.91
<b>Canada</b>	2.87	0.65	1.04	3.03	2.74	1.91	(5.04)	5.29	3.82	1.25
<b>China</b>	7.39	7.02	6.85	6.95	6.75	5.95	2.24	8.45	2.95	5.25
<b>France</b>	1.02	0.99	0.72	2.29	1.59	2.08	(7.59)	6.83	2.62	1.12
<b>Germany</b>	2.17	1.66	2.29	2.71	1.12	0.99	(4.10)	3.67	1.37	(0.26)
<b>Italy</b>	(0.00)	0.89	1.24	1.60	0.83	0.43	(8.87)	8.93	4.66	0.70
<b>Japan</b>	0.30	1.56	0.75	1.68	0.64	(0.40)	(4.17)	2.71	1.16	1.68
<b>United Kingdom</b>	3.20	2.22	1.92	2.66	1.41	1.62	(10.30)	8.58	4.84	0.34
<b>United States</b>	2.52	2.95	1.82	2.46	2.97	2.58	(2.16)	6.06	2.51	2.89

\*India Financial Year,



Source: World Economic Outlook Database (October 2024) by IMF; Crisil Intelligence

Services activity is expanding at a slower pace in most major economies (the US, the Eurozone, the United Kingdom and Japan) as indicated by Purchasing Managers' Index (PMI) reading, which remain above 50 but are lower compared with August 2024. In China, the National Bureau of Statistics (NBS) PMI is showing a contraction in the services sector. A sustained contraction in the services sector is worrying about global economic growth as manufacturing activity is now contracting in all key economies except the UK.

- **The rate cut cycle has begun in the United States**

The US GDP grew at an annualised and seasonally adjusted 3.0% in the second quarter of 2024, up from 1.6% in the first quarter, driven by robust consumer spending, according to the "third" estimate by the Bureau of Economic Analysis.

The S&P Global US Manufacturing PMI fell further to 47.3 in September from 47.9 the previous month, signaling the sharpest decline in the manufacturing sector since June 2023. On the other hand, the S&P Global US Services PMI Business Activity Index continued to indicate expansion, although it moderated slightly to 55.2 in September from 55.7 in the previous month. The sector has been expanding for 20 consecutive months.

The US labour market was stronger than expected in September as non-farm jobs rose to 254,000 from 159,000 in August (revised up from 142,000) and higher than the average monthly gain of 203,000 over the previous 12 months. The unemployment rate eased slightly to 4.1% in September from 4.2% the previous month.

US inflation eased marginally to 2.4% in September from 2.5% in August, on account of a sharper fall in energy prices during the month (-6.8% vs -4.0%). However, both food (2.3% vs 2.1%) and core inflation excluding food and energy (3.3% vs 3.2%) picked up. Within core inflation, shelter inflation eased significantly (4.9% vs 5.2%).

Given the sustained momentum towards the 2% inflation target, the Federal Reserve cut the federal funds rate by 50 bps to 4.75%-5.00% in its September meeting (this was prior to the release of September inflation data). S&P Global expects further rate cuts such that the federal funds rate to reach its terminal value of 3.00- 3.25% by 2025 end, with both upside and downside risks.

- **Eurozone manufacturing activity contracts further**

GDP growth in the Euro area fell marginally to 0.2% in quarter (seasonally adjusted) in the second quarter of 2024 from 0.3% in the previous quarter. Growth in Spain moderated slightly to 0.8% (provisional) from 0.9% (provisional) in the previous quarter. Growth in France and Italy slowed as well (both growing at 0.2% versus 0.3% in the first quarter) while Germany saw a contraction (-0.1% provisional vs 0.2% provisional).

The HCOB Eurozone Manufacturing PMI fell to 45.0 in September from 45.8 in the previous month, indicating a deeper contraction in European manufacturing activity. However, the HCOB Eurozone Services PMI Business Activity Index continued to indicate an expansion in services sector activity although at a slower rate (51.4 in September from 52.9 in the previous month).

Inflation in the euro area continued to ease significantly to 1.7% in September from 2.2% in August due to deepening deflation in energy prices (-6.1% vs -3.0%) and a marginal decrease in core inflation (2.7% vs 2.8%). On the other hand, inflation in the food-related category picked up marginally to 2.4% from 2.3%. The slight decrease in core inflation was due to a drop in services inflation (3.9% vs 4.1%) while non-energy industrial goods remained steady at 0.4%.

As the disinflationary process sustains and economic activity showed some recent weakness, the European Central Bank cut the deposit facility rate (DFR) – the rate which the central bank now steers monetary action through- by a further 25 basis points to 3.25% at its October meeting. Historically, the main refinancing operations (MRO) rate has been 50 bps above the DFR, whereas the marginal lending facility (MLF) rate has been 25 bps above the MRO rate. However, a technical adjustment that came into effect from September 18, made the spread between the DFR, MRO and the MLF asymmetrical, with the spread between the MRO and the DRF shrinking to 15 bps from 50 bps earlier.

The spread between the MRO and the MLF is to remain the same. This to facilitate lower volatility in the short-term money market rates as they are henceforth more likely to track the magnitude of the DFR.

- **Inflation in the UK eases sharply in September**

GDP growth in the UK dropped marginally to 0.5% on quarter in the second quarter of 2024, from 0.7% in the first quarter. Growth in the second quarter was revised lower from the first estimate of 0.6%, mainly due to a downward revision in all three output sectors (services, production, and construction). Services sector growth was revised down to 0.6% from the previous estimate of 0.8%, while the production sector contracted by 0.3% versus the previously estimated 0.1%. The construction sector contracted by 0.2%, as against the previously estimated 0.1% contraction. On the expenditure side, government consumption growth was revised down to 1.1% from the previously estimated 1.4%.

The S&P Global UK Manufacturing PMI stood at 51.5 in September versus 52.5 in the previous month. The index has been in the expansionary zone for five consecutive months, indicating a sustained manufacturing rebound. Services sector activity expanded, although at a slower rate, as indicated by the S&P Global UK Services PMI Business Activity Index, which stood at 52.4 in September versus 53.7 in the previous month. Activity in the services sector has expanded on a sustained basis since November 2023.

Inflation in the UK eased sharply to 1.7% in September from 2.2% in August led by significant easing in inflation excluding food, energy, alcohol and tobacco or core inflation- (3.2% vs 3.6%), especially inflation in services (4.9% vs 5.6%) and deepening deflation in goods prices (-1.4% vs -0.9%). On the other hand, inflation in food and non-alcoholic beverages picked up significantly to 1.9% from 1.3% in August.

- **Inflation in Japan picks up in August after steady run**

Japan's manufacturing activity, as measured through the au Jibun Bank Japan Manufacturing PMI, continued to contract (49.7 in September vs 49.8 in the previous month). Services activity continued to expand although at a marginally slower pace as indicated by the au Jibun Bank Japan Services Business Activity Index (53.1 in September versus 53.7 in the previous month).

Inflation in Japan picked up to 3.0% in August from 2.8% in the previous month, driven primarily by a sharp rise in food inflation (3.6% vs 2.9%). Core inflation (all items except fresh food and energy) rose marginally as well (2.0% vs 1.9%) while energy inflation remained steady at 12.0%.

Trade surplus narrowed to 703.2 billion yen (non-seasonally adjusted) in August 2024 from 940.1 billion yen in August 2023, as exports grew at a faster pace than imports (5.5% and 2.3% on-year respectively).

- **China engages in monetary easing to curb deflationary pressures**

The official NBS Manufacturing PMI picked up to 49.8% in September, up from 49.1% in the previous month but remained below the 50.0 mark. Non-manufacturing activities continued to expand, although at a slower rate, with the NBS Non-Manufacturing Business Index at 50.0% in September versus 50.3% in the previous month. That said, the seasonally adjusted Services PMI was at 49.9% in September, down from 50.2% in August, indicating the first contraction in activity since December 2023.

The Caixin China General Manufacturing PMI also decreased to 49.3 in September from 50.4 in August, indicating that the contraction in manufacturing is clearly underway. However, the Caixin China General Services Business Activity Index was at 50.3 in the month, down from 51.6 in August, indicating services activity expanded at a slower pace.

Inflation eased marginally to 0.4% in September from 0.6% in the previous month on the back of deflation in the non-food category (-0.2% vs 0.2%) and an easing of core (0.1% vs 0.3%) as well as services inflation (0.2% vs 0.5%). However, there was a slight pick-up in food and tobacco inflation (2.3% vs 2.1% in the previous month).

To mitigate deflationary pressures, the People's Bank of China announced several monetary stimulus measures in September. These included a lowering of the reserve requirement ratio by 50 bps to inject greater liquidity into the system and a 20-bps reduction in the seven-day reverse repo rate to 1.5%. The latter will subsequently lead to further

easing in the medium-term lending facility as well as the loan prime rate. A reduction in the mortgage downpayments for second home buyers was also announced. Furthermore, a significant Rmb 800 billion stimulus was also provided directly to equity markets by the creation of a Rmb 500 billion fund for stock buying by non-bank financial companies (insurance providers, pension funds, brokers, etcetera) as well as an allocation of Rmb 300 billion to enable companies to engage in stock buybacks.

The above monetary stimulus was followed up with a proposed fiscal stimulus by the Chinese Finance Ministry in mid-October. The Ministry announced that there would be a one-time expansion of the bond swap programme to tackle the build-up of local governments' "hidden debt" (off-balance sheet debt which is typically financed through local government financing vehicles). Additional measures included the issuance of special sovereign bonds to replenish banks' capital as well as a provision to enable local governments to use special local bonds to purchase unsold housing inventory. Additionally, the Ministry also signaled that there was room to potentially increase the fiscal deficit for the current year, but did not mention a specific figure.

### 1.1.3 Outlook on GDP for key economies

In October 2024, IMF released World Economic Outlook. As per IMF, the past four years have put the resilience of the global economy to the test. The global economy has demonstrated resilience overall, but this masks uneven performance across regions and lingering fragilities. According to IMF, following the post pandemic rebound, the global projection for GDP growth has been hovering at about 3 percent, both in the short and the medium term. Growth in India is projected to remain strong at ~7 percent in 2024 and ~6.5 percent in 2025, with the robustness reflecting continuing strength in domestic demand and a rising working-age population.

**Table 2: Real GDP annual growth forecast of major economies (figures in %)**

Country	CY24 (P)	CY25 (P)	CY26 (P)	CY27 (P)	CY28 (P)	CY29 (P)
India*	7.02	6.46	6.47	6.48	6.49	6.50
Brazil	3.04	2.16	2.25	2.35	2.45	2.47
Canada	1.34	2.39	1.97	1.82	1.78	1.64
China	4.82	4.48	4.10	3.58	3.37	3.29
France	1.10	1.06	1.35	1.42	1.44	1.35
Germany	0.01	0.79	1.40	1.15	0.85	0.74
Italy	0.67	0.76	0.70	0.60	0.68	0.71
Japan	0.32	1.14	0.84	0.65	0.64	0.52
United Kingdom	1.08	1.48	1.54	1.46	1.37	1.35
United States	2.77	2.15	2.03	2.12	2.12	2.12

\*For India financial Year. (P): Projected

Source: World Economic Outlook Database (October 2024) by IMF; Crisil Intelligence

### 1.1.4 India as preferred manufacturing destination

India has various advantages which makes it an attractive destination for global manufacturing investments. Some of these advantages are summarised below:

**Government initiatives:** The Central government has launched various initiatives such as "Make in India", "Startup India", and "Digital India" to promote manufacturing. These initiatives aim to create a business-friendly environment, improve infrastructure, and provide incentives for manufacturers.

**Economic growth:** India is one of the key large economies which is showing encouraging economic indicators. India has become the fifth largest economy in the world in CY 2023 and India's real GDP is estimated to grow the highest amongst the top 10 economies.



**Demographic dividend:** India has an added advantage of young population. It has a large and young population, with more than 65% of its population below the age of 35. This can help in providing the significant workforce required for the manufacturing sector.

**Infrastructure development:** The Indian government is investing heavily in infrastructure development, including roads, ports, and airports, which can improve connectivity and reduce logistics costs for manufacturers.

**Increasing domestic demand:** India's growing middle class and increasing consumer spending power are driving demand for manufactured goods, creating opportunities for domestic manufacturers.

**Sunrise sectors:** Sunrise sectors such as mobiles, computers and information technology, telecommunication devices, consumer electronics, aerospace and defence industries, automobiles are pushing the investment in manufacturing. Technological advancements and increased consumer demand for new and innovative products are driving the investments.

**Competitive labour cost:** India has a competitive labor cost advantage compared to other countries (special western countries), making it an attractive destination for manufacturers looking to set up production facilities.

**Digitalization and Industry 4.0:** The adoption of digital technologies like artificial intelligence, robotics, and the Internet of Things (IoT) can improve manufacturing efficiency, productivity, and competitiveness, driving growth in the sector.

**Skilled workforce:** India has a large pool of skilled engineers and technicians, which can support the growth of the manufacturing sector. Indian Government also focusing on skill development through various initiatives such as National Policy on Skill Development & Entrepreneurship, Pradhan Mantri Kaushal Vikas Yojana, Craftsmen Training Scheme, National Apprenticeship Promotion Scheme, Entrepreneurship Training, Skill India Digital Hub platform etc.

**Ease of doing business:** The Central government has taken various steps to provide simpler regulatory environment, compliance requirements, single window clearance and improve the ease of doing business. This helps manufacturers to set up and operate in the country efficiently. Improved EoDB (from 132<sup>nd</sup> rank in 2013 to 63<sup>rd</sup> rank in 2020) make it a favourable destination for manufacturing.

**Growing exports:** According to recent data from the Commerce Ministry, India's export competitiveness has witnessed notable advancements over the last five years, particularly in petroleum, precious stones, agrochemicals, and sugar. This growth has been marked by a surge in the country's share in global trade across these sectors, alongside other segments like electrical goods, tyres, and semiconductor devices.

As a result of these, India's manufacturing sector has seen some the new investments in production facilities (both greenfield as well as brownfield) by leading MNCs like Siemens, GE, Philips, Samsung, PepsiCo, ABB etc.

- Siemens Limited has planned the expansion of two Indian factories, augmenting its manufacturing capabilities namely Power Transformer factory in Kalwa and Vacuum Interrupter factory in Goa. The total Capex investment is projected to surpass Rs 10 billion.
- GE Aerospace has set up Multi-Modal Facility (MMF) in Pune with an investment of USD 200 million.
- Philips India inaugurated its innovation campus in Yelahanka, Bengaluru; It also planned a new R&D centre to expand its Healthcare Innovation Centre (HIC) in Pune, Maharashtra.
- On June 7, 2017, Samsung announced an investment of INR 49.15 billion to add new capacity at the Noida plant in Uttar Pradesh.
- ABB India in February 2023, inaugurated its new state-of-the-art factory in Nashik, Maharashtra doubling its Gas Insulated Switchgear (GIS) production capacity.
- In April 2024, PepsiCo India, a leading global consumer packaged goods company, announced an investment of Rs. 12.66 billion in India to establish a state-of-the-art flavour manufacturing facility in Ujjain, Madhya Pradesh.
- Jaguar Land Rover, a subsidiary of Tata Motors has started production from Pune Plant

- Mercedes-Benz India's production facility in Chakan near Pune
- Rolls-Royce Engineering Centre (Aerospace) at Bangalore and Engineering Centre (Power Systems) at Pune

### 1.1.5 China plus one

China Plus One strategy encourages companies to diversify their operations by expanding outside of China while still maintaining a presence in the country and mitigate risks associated with relying on a single country. This strategy is becoming increasingly popular in the manufacturing industry, as companies look to reduce their dependence on China and diversify their supply chains. There are several factors encouraging the China Plus One strategy. Some of them are the rising cost of labor in China; the increasing complexity of the Chinese regulatory environment; the growing political risk in China; the increasing demand for diversification from investors; number of other countries that are emerging as potential destinations. Countries like India, Vietnam, Malaysia, and Thailand offer several advantages, including lower labor costs, favorable government policies, and access to new markets. India is one of the potential destinations for manufacturing due to its low labor cost as well as favorable political and regulatory environment for manufacturing.

The China +1 strategy presents both opportunities and challenges for the Indian manufacturing industry. It can help to attract foreign direct investment (FDI), create employment opportunities in India, economic growth and minimize supply chain disruptions. On the hand, it can also pose challenges such as competition from other countries, limited availability of suitable infrastructure, regulatory challenges and availability of skilled and employable workforce. By addressing these challenges, India can position itself as an attractive destination for companies looking to diversify their manufacturing operations beyond China.

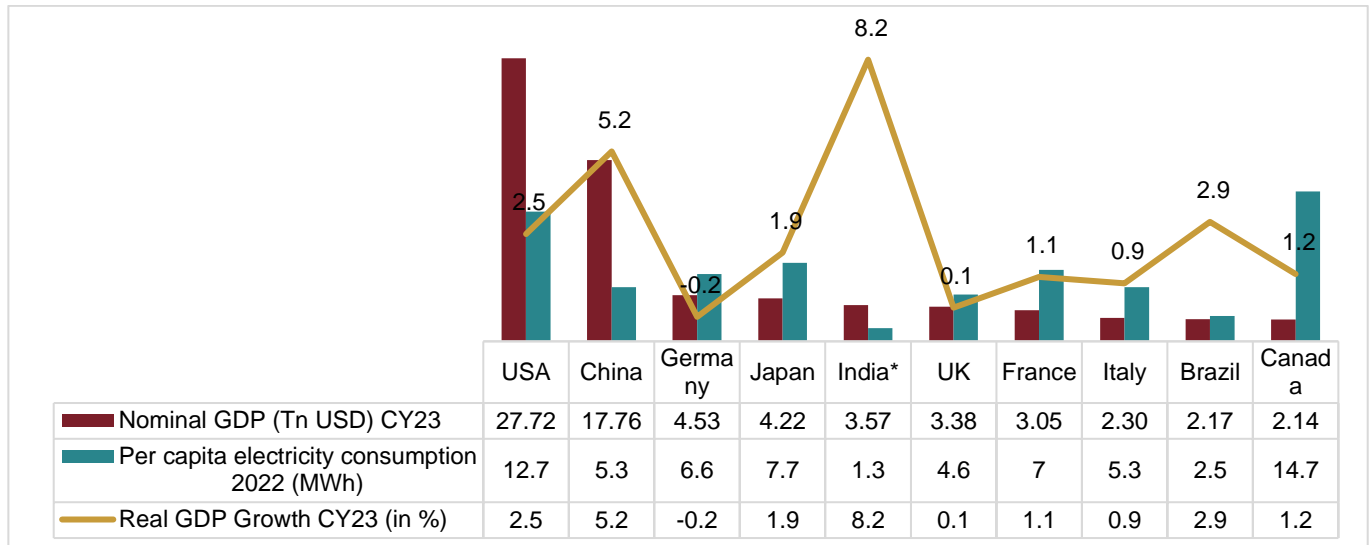
## 1.2 Domestic macroeconomics

### 1.2.1 Real GDP growth in India

India's GDP at constant (fiscal 2012) prices was Rs. 173.8 trillion (provisional estimates) for fiscal 2024 vis-à-vis the first revised estimate of Rs.160.7 trillion for fiscal 2023 as per data released by the National Statistical Office (NSO) in May 2024. This translates into a growth of 8.2% over fiscal 2023. As per first advance estimates by NSO, India's real GDP is estimated to grow at 6.4% in fiscal 2025.

India has become the fifth largest economy in the world in CY 2023, according to the IMF's World Economic Outlook (October 2024). As per IMF GDP Forecasts (October 2024), India's real GDP growth is estimated at 6.5% in 2025, the highest amongst the top 10 economies.

**Figure 2: Comparison of India's economy with other major nations**



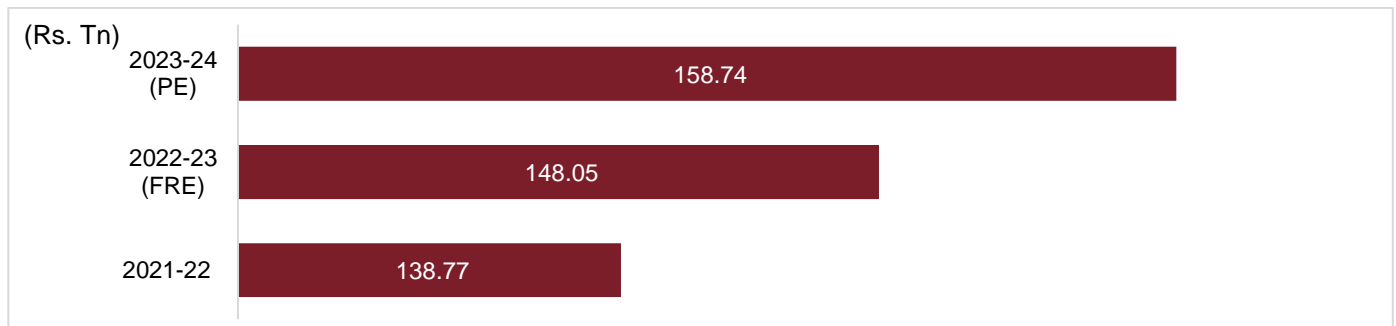
\*India Financial Year,

Source: World Economic Outlook Database (October-2024) by IMF; IEA, CEA, Crisil Intelligence

### 1.2.2 GVA performance

The real gross value added (GVA) has grown by 7.2% in 2023-24 from 6.7% in 2022-23. This GVA growth has been mainly due to a significant growth of 9.9% in the Manufacturing sector in 2023-24, compared to -2.2% in 2022-23 and growth of 7.1% in 2023-24 compared to 1.9% in 2022-23 for the Mining & Quarrying sector.

**Figure 3: GVA at basic prices**



FRE: first revised estimates; PE: provisional estimates

Source: Ministry of Statistics and Programme Implementation, Crisil Intelligence

### 1.2.3 India's GDP recovered with subsiding of the pandemic

In the past 11 years (during fiscal 2014 to 2024), India's GDP at constant (fiscal 2012) prices grew at a compounded growth of ~5.3% (CAGR).

After strong GDP print in the past three years, Crisil Intelligence <sup>1</sup> expects some moderation to 6.8% this fiscal 2025. The growth will still be higher than the pre-pandemic decadal average of 6.7%, continuing to position India as the fastest growing major economy.

<sup>1</sup> Based on Crisil Centre for Economic Research (C-CER) projections

Projections of key economic indicators for India in this Chapter are as per the C-CER

**Figure 4: Crisil's key projections**

Parameters	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25P
GDP growth (%)	6.8%	6.5%	3.9%	-5.8%	9.7%	7.0%	8.2%	6.8%
CPI (% average)	3.6%	3.4%	4.8%	6.2%	5.5%	6.7%	5.4%	4.6%
CAD/GDP (%)	-1.8%	-2.1%	-0.9%	0.9%	-1.2%	-2.0%	-0.7%	-1.0%
FAD/GDP (%)	3.5%	3.4%	4.6%	9.2%	6.7%	6.4%	5.6%	4.9%
Exchange rate (Rs/\$ March-end)	65.0	69.5	74.4	72.8	76.2	82.3	83.0	84.0
10-year G-sec yield (% March-end)	7.6%	7.5%	6.2%	6.2%	6.8%	7.4%	7.1%	6.7%

*P: Projected; CPI: Consumer Price Index-linked; CAD: Current account deficit; G-sec: Government security; FAD: Fiscal account deficit*

*Source: CSO, Reserve Bank of India (RBI), Crisil estimates*

GDP grew 5.4% on-year in the second quarter of this fiscal, a sharp deceleration from the 6.7% in the first quarter of fiscal 2025. This comes over high growth in the second quarter of fiscal 2024, in which the economy had grown 8.1%. On the supply side, gross value-add (GVA) of 5.6% was slightly higher than 5.4% GDP growth.

Risks to GDP growth are tilted toward the downside this fiscal given the lackluster second quarter growth number. However, certain high frequency indicators from October such as Index of Industrial Production, automobile sales and export growth are showing encouraging signs of a revival in the third quarter, indicating the slowdown in the second quarter could be transitory

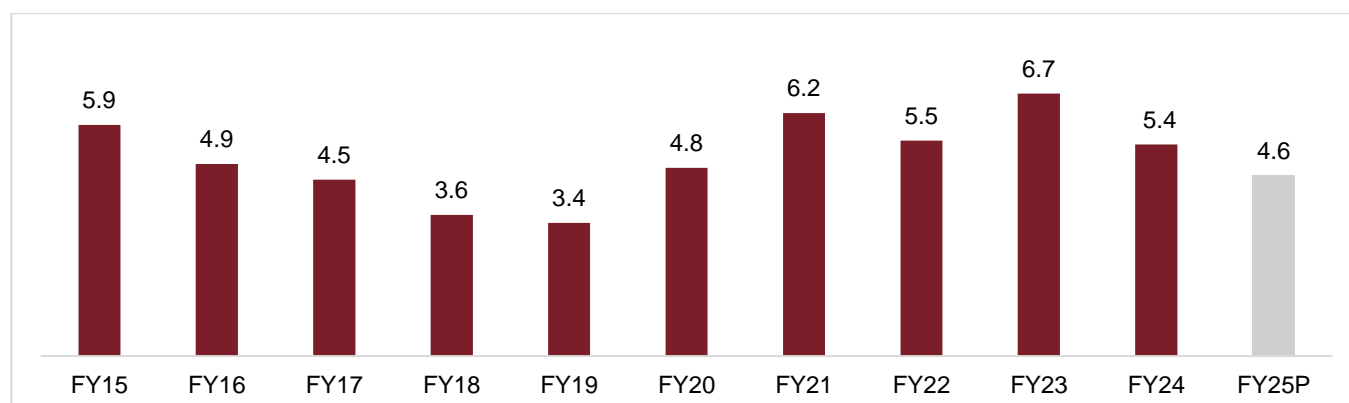
Going forward, industrial activity is expected to improve in the second half of this fiscal with recovering consumption demand. However, elevated interest rates and fiscal consolidation are expected to slow GDP growth this fiscal. Crisil Intelligence expects GDP growth at 6.8% on-year this fiscal compared with 8.2% in the previous fiscal, with risks tilted downwards. A revival in private investment is critical to sustain the investment momentum this fiscal, while geopolitical tensions remain a risk for trade flows and supply-chain pressures for industry.

## 1.2.4 Outlook

### 1.2.4.1 Consumer Price Index

Correction in vegetable inflation and a dip in foodgrain inflation to a 28-month low cooled food inflation in November. As a result, headline consumer price inflation declined to 5.5% — within the Reserve Bank of India's (RBI) upper tolerance limit of 6%, but still at a distance from the central bank's 4% target. Even so, food inflation remains high at 9% in November, driven by rigidity in vegetable inflation and elevation in edible oils inflation, warranting caution. Edible oils inflation at a 30-month high of 13.3% is being driven by global supply disruptions and increase in import duties, and since October has seen the fastest sequential climb among all food categories. The non-food component of Consumer Price Index (CPI) inflation remained low at 3.1%, supported by the recent softening in global energy and commodity prices.

**Figure 5: CPI inflation (% y-o-y)**



*P: Projected; Source: NSO, CEIC, Crisil Intelligence*

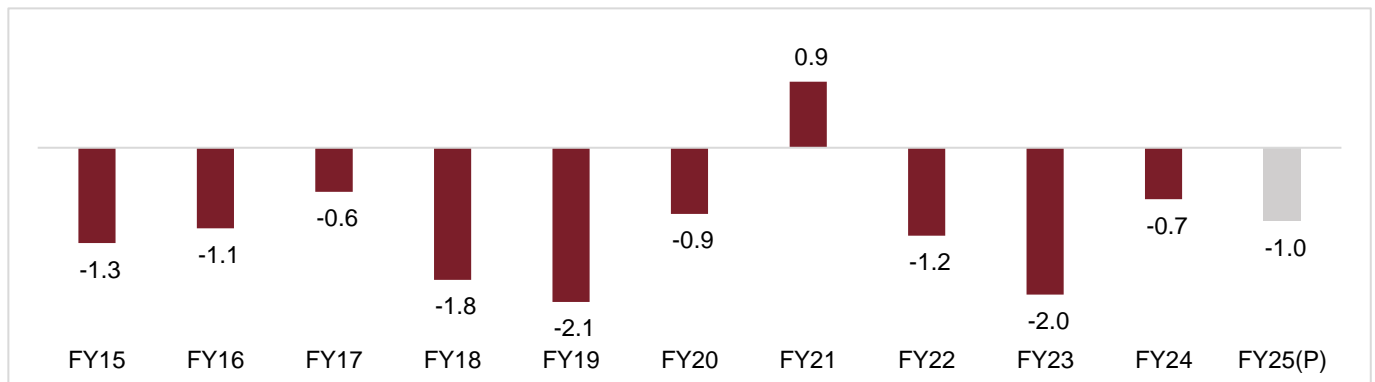
In the coming weeks, we expect food prices to ease sequentially. Vegetable prices tend to come down in December when the kharif crop enters the market. A high base from last year will also help lower inflation since vegetable prices missed their seasonal decline last year. Pressure from edible oil prices, though, will have to be monitored. The RBI Governor noted in his December policy statement that manufacturing and services firms expect their selling prices to increase in the fourth quarter of this fiscal, which could push up non-food inflation. Yet, given subdued domestic demand conditions and soft global prices, we expect non-food inflation to remain benign for the rest of the fiscal. Overall, Crisil Intelligence expects inflation to soften in the coming months led by food inflation; however, rigidity in vegetable and edible oil prices keep the upside pressure high. Crisil Intelligence expects retail inflation to average 4.6% this fiscal 2025 with some upside bias to the forecast and expect a policy rate cut in February 2025.

### 1.2.4.2 Current Account Deficit

India's current account deficit (CAD) widened to \$9.7 billion (1.1% of GDP) in the first quarter (April-June) of fiscal 2025, data from the RBI showed. This compares with a deficit of \$8.9 billion (1% of GDP) in the first quarter of fiscal 2024. It also signifies a U-turn from a surplus of \$4.6 billion (0.5% of GDP) in the fourth quarter of the previous fiscal year.

The on-year widening in CAD was largely driven by a rise in the merchandise trade deficit to \$65.1 billion from \$56.7 billion a year ago. While muted global demand weighed on export growth (up 6.0% on-year) in Q1 fiscal 2025, higher crude oil prices and logistics costs amidst geopolitical tensions pushed up imports significantly faster (8.4% on-year). That said, services trade surplus and secondary income (large remittances) grew, providing a cushion to the current account balance.

**Figure 6: Current account deficit (As a % of GDP)**



*(P) Projected; Source: RBI, SBI, Crisil Intelligence*

As a result of the reversal in CAD to deficit from surplus and lower financial inflows, the rupee depreciated mildly in Q1 fiscal 2025 to average 83.42/\$, compared with 83.02/\$ in Q4 fiscal 2024. In Q1 FY24, the rupee averaged 82.2/\$.

Even as merchandise trade deficit has come under some pressure, robust services exports and healthy remittances flow should help keep the CAD in the safe zone this fiscal. Crisil Intelligence expects CAD at ~1.0% of GDP in fiscal 2025, compared with 0.7% last fiscal. That said, Q2 is expected to see some uptick in CAD (owing to subdued goods exports and an increase in imports, and a rise in gems and jewellery and core imports). In addition, the impact of geopolitical issues will continue to remain monitorable.

### 1.2.4.3 Fiscal deficit

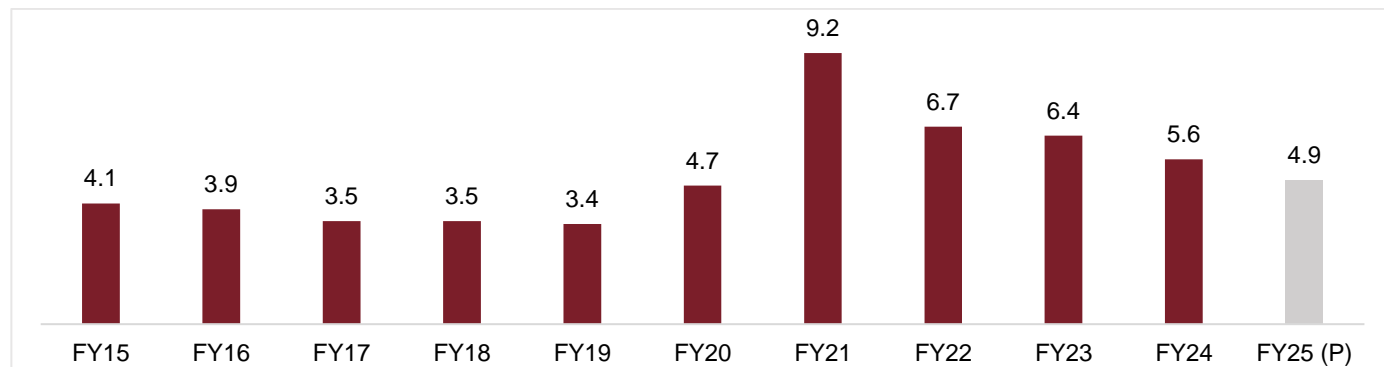
The fiscal deficit in 2020 reached a high of 9.2% of GDP during the pandemic. It has since decreased significantly. The fiscal deficit during fiscal 2024 stood at 5.6% of the GDP and was better than the previous estimates of 5.8% due to higher revenue realisation and lower expenditure according to the data released by the Controller General of



Accounts (CGA) on May 31, 2024. Numerically, the fiscal deficit--the gap between expenditure and revenue, was at Rs. 16.53 trillion.

The government's gross market borrowings through dated securities are expected to be 9.2% lower on-year at Rs 14 trillion in fiscal 2025 as the government has reduced its fiscal deficit target to 4.9% of GDP (from 5.6% in the previous fiscal).

**Figure 7: Fiscal Deficit as % of the GDP**



P: Projected

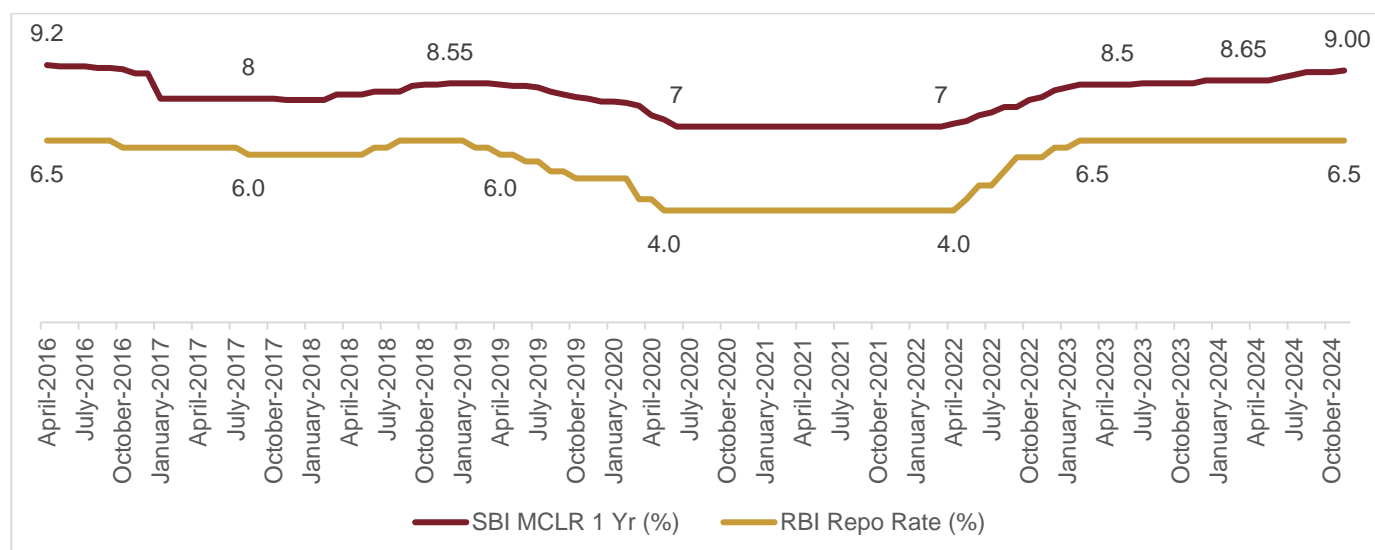
Source: RBI, Provisional Accounts for 2023- 2024 by Controller General of Accounts, Crisil Intelligence

#### 1.2.4.4 Interest rates

Focused on paring inflation towards its 4% target and comforted by high GDP growth, the Monetary Policy Committee (MPC) kept the repo rate unchanged for the eleventh straight time at its December 2024 meeting. The last time RBI changed policy rates was in February 2023. The RBI has raised the repo rate by 250 basis points (bps) since March 2022.

Compared to March 2023, the 1-year marginal cost of lending rate (MCLR) has seen an increase of 50 bps. It has risen to 200 bps since March 2022. Bank lending rates are above their pre-pandemic average, and higher lending rates could lead to some softening in bank credit going forward.

**Figure 8: Interest rates increasing (%)**



Source: RBI, SBI, Crisil Intelligence

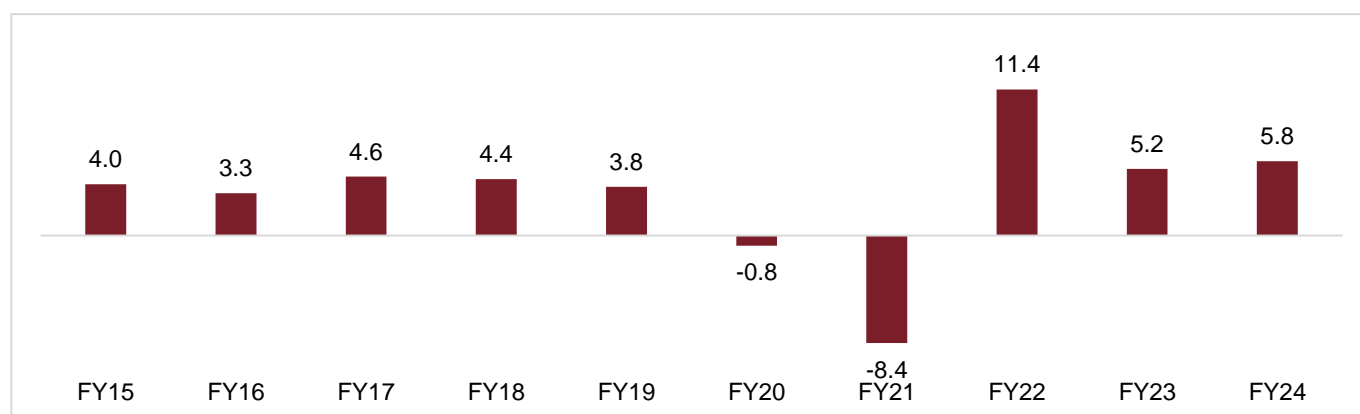
Crisil Intelligence expects inflation to moderate to 4.6% this fiscal 2025 from 5.4% in the previous fiscal 2024. Intelligence expects food inflation to ease in the second half of fiscal 2025 as kharif arrivals enter the market. Vegetables prices can correct quickly with the fresh arrivals. Additionally, healthy water reservoir levels augur well

for rabi production. Domestic growth is expected to moderate this fiscal due to elevated interest rates and a lower fiscal impulse to growth. Rate cuts by major global central banks will give the RBI space to ease its policy. That said, S&P Global sees fewer rate cuts by the Fed in 2025 compared with expectations three months ago. Against this backdrop, Intelligence expects the first rate cut in February 2025.

### 1.2.4.5 PMI and IIP trend

The Index of Industrial Production (IIP) is an indicator that measures the changes in the volume of production of industrial products during a given period. IIP growth rate for fiscal 2024 over fiscal 2023 stood at 5.8%. The cumulative growth rates of the three sectors, Mining, Manufacturing and Electricity for the fiscal 2024 over the corresponding period of the previous year were 7.5%, 5.5% and 7.1%, respectively.

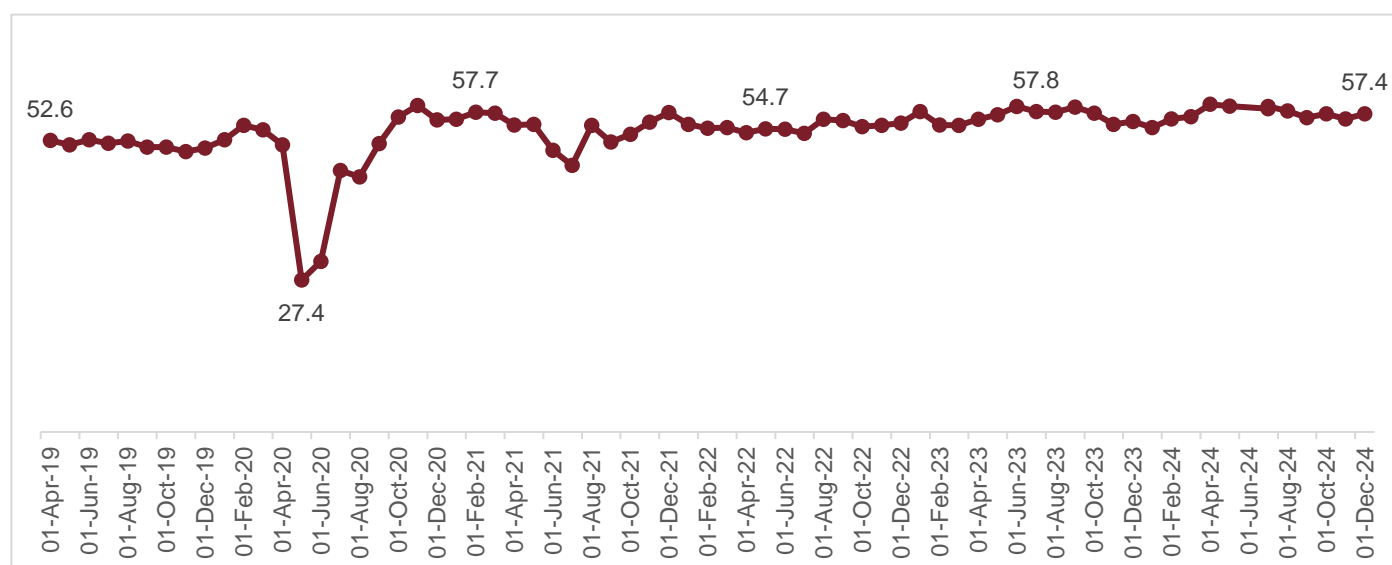
**Figure 9: Trend of Index of Industrial Production**



Source: NSO, MOSPI, Crisil Intelligence

The HSBC Flash India Manufacturing PMI – a single-figure snapshot of factory business conditions calculated from measures of new orders, output, employment, supplier delivery times and stocks of purchases – recovered from November's two-month low of 56.5 to 57.4 in December 2024. This pointed to an improvement in manufacturing sector conditions that was substantial and stronger than seen on average across the series history.

**Figure 10: Manufacturing PMI**



Source: Industry, HSBC, S&P Global, Crisil Intelligence

Industrial activity could benefit from the onset of the festive season in the third quarter of this fiscal. Domestic consumption is expected to be better this fiscal as rural demand picks up on a good monsoon and higher agricultural

production. Easing food inflation is also expected to increase purchasing power for discretionary consumption. The Reserve Bank of India's latest survey shows a pickup in consumer confidence in September. That said, the impact of excess and unseasonal rains remains monitorable. Additionally, elevated interest rates could weigh on consumption, especially in urban areas where credit penetration is higher.

High-capacity utilisation and lean balance sheets of corporates and banks remain conducive for private corporate investment. This could help sustain overall investment momentum this fiscal, even as government capex is slated to revive in the second half of the fiscal. However, a lower fiscal impulse would dampen growth this year, as the government trims its fiscal deficit.

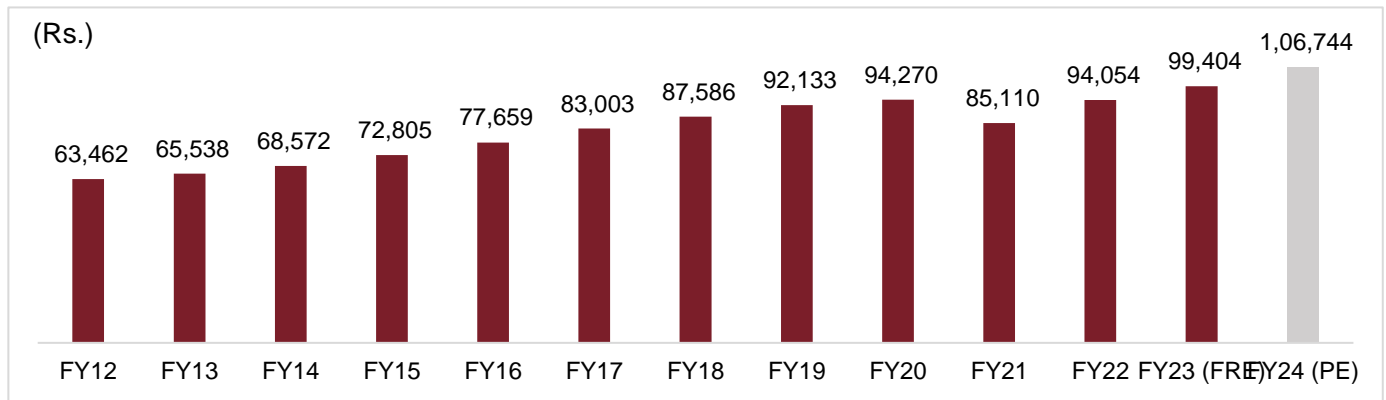
Global trade is expected to improve and support export growth this year. However, slowing demand, particularly in United States and China, will weigh on global growth. Geopolitical tensions, particularly in the Middle East, remain a risk for trade flows and supply chain pressures for industry. This, together with the impact of high interest rates, will slow GDP growth to 6.8% in fiscal 2025 compared with 8.2% in fiscal 2024.

#### 1.2.4.6 Per capita GDP

India's per capita income is expected to rise to Rs 106,744 in fiscal 2024 from Rs 68,572 in fiscal 2014 with a compound annual growth rate of 4.5%. In fiscal 2024, per capita income is expected to rise by 7.4% against 5.7% in fiscal 2023.

Some reasons for India's poor national income are its large population, largely agrarian economy, lack of industrial development as well as difference in socioeconomic conditions across the states. However, recent fiscal measures, emphasis on manufacturing through 'Make in India' and various packages for economic revival have helped India grow faster. Opportunities for employment, increased private consumption, along with positive consumer sentiments, are expected to support higher GDP growth and per capita national income in future.

**Figure 11: All-India per capita net national income (at constant prices)**



*FRE: first revised estimates; PE: provisional estimates*  
*Source: Economic Survey, NSO, MOSPI, Crisil Intelligence*

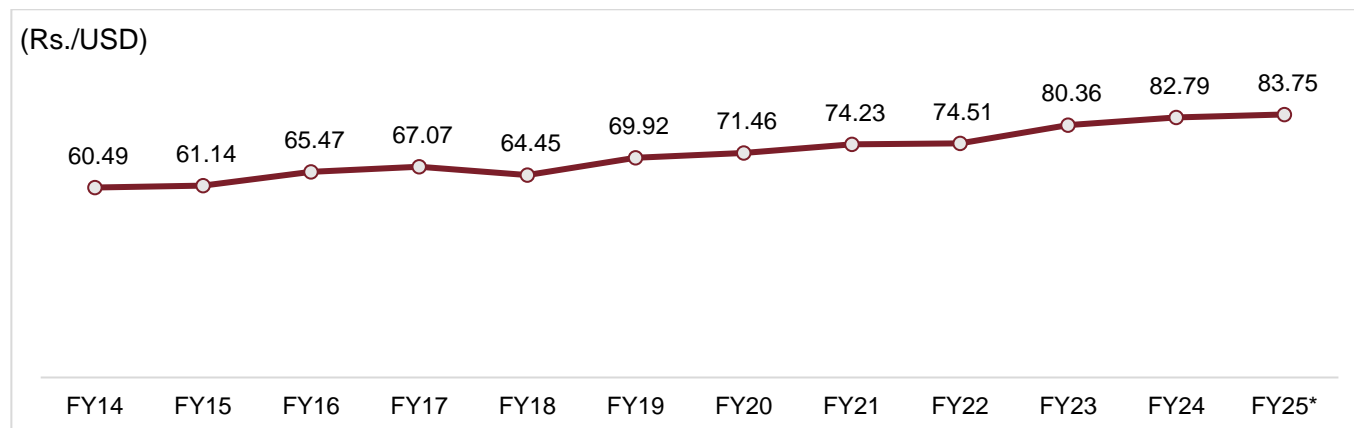
#### 1.2.4.7 Exchange rates

Since August 2023, the rupee has been hovering around the 83/\$ mark. In September 2024, the rupee remained stable at 83.8/\$ compared with 83.9/\$ a month earlier. On the supply side, a mix of factors propelled foreign investment inflows. Foreign portfolio investors net-invested \$11.2 billion in Indian markets - \$6.9 billion in equity and \$2.9 billion in debt. FPIs have been bullish in the equity market during the month. A sharp cut in key policy rates by the Fed led to the influx of funds in the equity segment.

Among advanced economies, the British pound appreciated the most. This could be because of them being slow to cut interest rates, while other major central banks like US Fed and European Central Bank have cut rates. The rupee was the least depreciating currency among global peers.

Crisil Intelligence expects the rupee to average 84 against the dollar by March 2025 compared with 83 in fiscal 2024. While the current account deficit is expected to remain manageable, it may face some risks amid the uneven global growth scenario and geopolitical uncertainties. That said, India’s healthy domestic macros will cushion the rupee.

**Figure 12: Trend in the exchange rate (annual average)**



\*FY 25 as of Nov 2024; Source: Financial Benchmarks India Pvt Ltd, CEIC, Crisil

### 1.2.5 Aatmanirbhar Bharat Abhiyan

Production Linked Incentives (PLIs) in the 14 sectors for the *Aatmanirbhar Bharat* vision received an outstanding response, with a potential to create 6 million new jobs (as per government estimates).

The five focus points of the *Aatmanirbhar Bharat Abhiyan* are economy, infrastructure, system, vibrant demography, and demand. Its five phases are:

- Phase I: Businesses including MSMEs
- Phase II: Poor, including migrants and farmers.
- Phase III: Agriculture
- Phase IV: New horizons of growth
- Phase V: Government reforms and enablers

**Table 3: Sector-wise focus of *Aatmanirbhar Bharat* Vision**

Sector	Government spends	Key schemes
Renewable energy	~Rs 1300 billion	<ul style="list-style-type: none"> <li>• Rs 45 billion Production Linked Incentive Scheme ‘National Programme on High Efficiency Solar PV Modules’. This was further increased by Rs 195 billion in the budget for fiscal 2023, taking it to Rs 240 billion; in Tranche I 8.7 GW and in Tranche II 39.6 GW capacity were allocated for domestic solar module manufacturing capacity under PLI.</li> <li>• PM Surya Ghar Muft Bijli Yojna: This scheme has a proposed outlay of Rs. 750 billion and aims to light up 10 million households (rooftop solar) by providing up to 300 units of free electricity every month.</li> <li>• Public procurement (Preference for ‘Make in India’) to provide for purchase preference (linked with local content) in respect of renewable energy (RE) sector</li> <li>• Implementation of Pradhan Mantri Kisan Urja Suraksha Utthan Mahabhiyan (PM KUSUM) scheme; MNRE, in November 2020, scaled up and expanded the PM KUSUM scheme to add 30.8 GW by 2022 with central financial support of Rs 344.22 billion. The scheme has been extended till March 31, 2026</li> </ul>

Sector	Government spends	Key schemes
		<ul style="list-style-type: none"> <li>Approved Models &amp; Manufacturers of Solar Photovoltaic Modules (Requirement for Compulsory Registration) Order, 2019</li> <li>List of manufacturers and models of solar PV modules recommended under ALMM Order</li> <li>Scheme of grid connected wind-solar hybrid power projects</li> <li>Basic customs duty (BCD) of 25% on solar cells and 40% on modules, respectively, effective April 1, 2022</li> </ul>
Power distribution companies (discoms)	~Rs.970 billion	<ul style="list-style-type: none"> <li>Rs 1.35 trillion liquidity infusion for discoms via Power Finance Corporation/ Rural Electrification Corporation (PFC/ REC) against receivables</li> <li>Rebate for payment to be received by generation companies (gencos) to be passed on to industrial customers.</li> <li>Revamped Distribution Sector Scheme (RDSS) to help discoms improve their operational efficiencies and financial sustainability by providing result-linked financial assistance; outlay of Rs 3037.58 billion over 5 years i.e., fiscals 2022 to 2026. The outlay includes an estimated Government Budgetary Support (GBS) of Rs 976.31 billion.</li> </ul>
Agriculture procurement and sales	Rs 40 billion	<ul style="list-style-type: none"> <li>Amendment in the Essential Commodities Act for deregulation of sales of agricultural produce, including field crops, onions, and potatoes.</li> <li>Working capital limit of Rs 67 billion sanctioned for procurement of food grains to state government entities.</li> <li>Rs 35 billion was allocated for the distribution of 5 kg rice/wheat and 1 kg pulses to 80 million non-card holder migrants.</li> <li>Rs 5 billion allocated under Operation Greens for facilitation of sales of horticulture produce through a 50% subsidy on storage and transport</li> </ul>
Agri-allied	Rs 725 billion	<ul style="list-style-type: none"> <li>Additional allocation of Rs 400 billion for Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA)</li> <li>Rs 200 billion for fishermen over the next five years under Pradhan Mantri Matsya Sampada Yojana</li> <li>Rs 133.43 billion for eradication of foot and mouth disease in Indian livestock population</li> <li>Rs 150 billion for Animal Husbandry Infrastructure Development Fund (AHIDF)</li> <li>Rs 40 billion for enhanced cultivation of herbal and medicinal plants</li> <li>Rs 5 billion for the Indian apiculture industry</li> <li>Rs 100 billion for the formulation of micro food enterprises</li> </ul>
Mining	Nil	<ul style="list-style-type: none"> <li>Expected to offer 500 mineral blocks, including 50 coal.</li> <li>Promoting commercial coal mining (ordinance to remove captive end-use restriction passed in January 2020); government to expedite policy formulation and auction process.</li> <li>Government to allow composite exploration/auction of coal bed methane reserves for extraction.</li> <li>Rebate offered on revenue sharing quantum to incentivise early operationalisation/ higher produce.</li> <li>Provision of Rs 500 billion for evacuation infrastructure</li> </ul>



Sector	Government spends	Key schemes
New Energy	Rs. ~388 billion	<ul style="list-style-type: none"> <li>Rs 181 billion under the PLI scheme for Advanced Chemistry Cell (ACC) Battery Storage in India launched in October to achieve 50 GWh manufacturing capacity.</li> <li>Green Hydrogen Policy was launched in February 2022 to facilitate the production of green hydrogen/green ammonia.</li> <li>PLI scheme on green hydrogen manufacturing with an initial outlay of Rs 197.44 billion with an aim to boost domestic production of green hydrogen</li> </ul>

Source: Official portal of the Government of India; various ministries, PIB press releases, Crisil Intelligence

## 1.2.6 Tailwinds for growth in manufacturing in India

Some of the tailwinds for growth in manufacturing in India are summarised below:

- **Make in India:** The Make in India initiative was launched by Prime Minister in September 2014 to encourage foreign companies to set up manufacturing units in India. The initiative's focus on developing a robust manufacturing sector promises to elevate India's economic trajectory and generate employment opportunities for its vast young workforce. Now, with the "Make in India 2.0" phase encompassing 27 sectors, the program continues to drive forward with significant achievements and renewed vigour, reinforcing India's position as a major player in the global manufacturing landscape.
- **Startup ecosystem/ Startup India:** Startup India, launched on January 16, 2016. is an initiative by the Government of India to promote entrepreneurship and startup ecosystem in the country. The initiative aims to foster a culture of innovation and entrepreneurship in India, and to create a supportive ecosystem for startups to grow and thrive. Under this initiative, eligible companies can get recognised as Startups by Department for Promotion of Industry and Internal Trade (DPIIT), to access a host of tax benefits, easier compliance, IPR fast-tracking and more.
- **Digital India:** Digital India, launched on July 1, 2015, with the vision to transform India into a digitally empowered society and knowledge economy. Digital India has been improving the lives of all citizens through the digital delivery of services, expanding the digital economy and employment opportunities.
- **PLI Scheme:** Production Linked Incentive (PLI) Schemes for 14 key sectors have been announced with an outlay of Rs. 1.97 trillion (over US\$26 billion) to enhance India's Manufacturing capabilities and Exports. The purpose of the PLI Schemes is to attract investments in key sectors and cutting-edge technology; ensure efficiency and bring economies of size and scale in the manufacturing sector and make Indian companies and manufacturers globally competitive.
- **National Manufacturing policy:** The Government of India has announced a national manufacturing policy with the objective of enhancing the share of manufacturing in GDP to 25% within a decade and creating 100 million jobs. It also seeks to empower rural youth by imparting necessary skill sets to make them employable.
- **GST Reforms:** In July 2017, India implemented the Goods and Services Tax (GST). GST replaced a fragmented and complex indirect tax regime and simplified taxation and optimised logistical costs.
- **Increasing FDI:** India remains one of the most popular FDI destinations in the world, ranking as the eighth-largest recipient of FDI in 2023, the third-highest recipient of FDI in greenfield projects and the second-highest recipient of FDI in international project finance deals according to the World Investment Report 2023.
- **R&D:** Research and development (R&D) in manufacturing in India has gained significant importance in recent years, driven by the government's initiatives to promote innovation and entrepreneurship in the country, infrastructure development, and a growing demand for innovative products and services.

- **Logistical Advantages:** Due to its strategic location, India has access to major markets, trade routes, ports. India's infrastructure is upgrading to improve logistics and warehousing. Also, with free trade agreements with various countries, there have been enhanced trade relations.

### 1.2.7 Budget 2024

The Union Budget for fiscal 2024-25 has announced several significant initiatives for boosting the manufacturing sector. Some of the areas of importance include infrastructure development, technological advancement, and sustainability. Some key budget announcements for these areas include:

#### Infrastructure development

- The government will endeavour to maintain strong fiscal support for infrastructure over the next 5 years, in conjunction with imperatives of other priorities and fiscal consolidation. For fiscal 2025, the Budget has provided Rs. 11,111.11 billion for capital expenditure (~3.4% of GDP).
- Government will facilitate development of investment-ready "plug and play" industrial parks with complete infrastructure in or near 100 cities, in partnership with the states and private sector, by better using town planning schemes.
- Twelve industrial parks under the National Industrial Corridor Development Programme will also be sanctioned.

#### Technological advancement

- The government will operationalize the *Anusandhan National Research Fund* for basic research and prototype development. Further, a mechanism will be set up for spurring private sector-driven research and innovation at commercial scale with a financing pool of Rs. 1 trillion in line with the announcement in the interim budget.
- India has successfully used technology for improving productivity and bridging inequality in our economy during the past 10 years. Public investment in digital infrastructure and innovations by the private sector have helped in improving access to all citizens, particularly the common people, to market resources, education, health and services. The Government will step up the adoption of technology towards digitalization of the economy.
- For improving data governance, collection, processing and management of data and statistics, different sectoral data bases, including those established under the Digital India mission, will be utilized with active use of technology tools.

#### Sustainability

- A taxonomy will be developed for climate finance for enhancing the availability of capital for climate adaptation and mitigation. This will support the achievement of the country's climate commitments and green transition.
- A Critical Mineral Mission will be set up for domestic production, recycling of critical minerals, and overseas acquisition of critical mineral assets. Its mandate will include technology development, skilled workforce, extended producer responsibility framework, and a suitable financing mechanism.

#### Skilling

- A new centrally sponsored scheme is announced as the 4th scheme under the Prime Minister's package, for skilling in collaboration with state governments and Industry. 2 million youth will be skilled over a 5-year period. 1,000 Industrial Training Institutes will be upgraded into hub and spoke arrangements with outcome orientation. Course content and design will be aligned to the skills needs of industry, and new courses will be introduced for emerging needs.
- Additionally, the **Model Skill Loan Scheme** will be revised to facilitate loans up to Rs.0.75 million with government-backed guarantees, benefiting 25,000 students annually.

#### MSMEs

- The budget provided special attention to MSMEs and manufacturing, particularly labour-intensive manufacturing.
- A package covering financing, regulatory changes and technology support for MSMEs to help them grow and compete globally.
- For facilitating term loans to MSMEs for purchase of machinery and equipment without collateral or third-party guarantee, a credit guarantee scheme will be introduced. The scheme will operate on pooling credit risks of such MSMEs. A separately constituted self-financing guarantee fund will provide, to each applicant, guarantee cover up to Rs. 1 Billion, while the loan amount may be larger. The borrower will have to provide an upfront guaranteed fee and an annual guarantee fee on the reduced loan balance.
- Public sector banks will build their in-house capability to assess MSMEs for credit, instead of relying on external assessment. They will also take a lead in developing or getting developed a new credit assessment model, based on the scoring of digital footprints of MSMEs in the economy. This is expected to be a significant improvement over the traditional assessment of credit eligibility based only on asset or turnover criteria. That will also cover MSMEs without a formal accounting system.
- A new mechanism announced for facilitating continuation of bank credit to MSMEs during their stress period. Credit availability will be supported through a guarantee from a government promoted fund.
- The limit of Mudra loans will be enhanced to Rs. 2 million from the current Rs. 1 million for those entrepreneurs who have availed and successfully repaid previous loans under the 'Tarun' category.
- SIDBI will open new branches to expand their reach to serve all major MSME clusters within 3 years and provide direct credit to them.
- To enable MSMEs and traditional artisans to sell their products in international markets, E-Commerce Export Hubs will be set up in public-private-partnership (PPP) mode. These hubs, under a seamless regulatory and logistic framework, will facilitate trade and export related services under one roof.

### 1.2.8 Impact of the current geopolitical situation

Geopolitical situations can have a significant impact on the manufacturing sector, affecting supply chains, labour availability, access to technology, production and ultimately, the overall economy. Some of the impacts include:

**Raw Material Availability:** Geopolitical situations can impact on the access, availability and pricing of key raw materials (specially concentrated in a certain region), such as metals and minerals. This can affect the manufacturing processes and lead to an increase in production costs.

**Supply Chain Disruptions:** Geopolitical tensions can disrupt supply chains, particularly if they involve countries with complex international relationships resulting in delays, shortages, and increased costs.

**Investment and expansion:** Geopolitical uncertainty can discourage investors/companies from investing in new manufacturing facilities, expansion projects, or research and development, as they may be hesitant to commit resources to uncertain markets.

**Workforce and Labour:** Geopolitical uncertainty can affect the availability and movement of skilled workers which may impact the manufacturing productivity and efficiency.

**Infrastructure and Logistics:** Geopolitical situations can impact the development and maintenance of infrastructure, such as ports, roads, and bridges, which are critical to manufacturing and logistics.

Some of the current geopolitical situations include:

The ongoing trade war between the West and China is changing the Global supply chain scenario. The USA and the EU employ trade policies, tariffs, and negotiations to counterbalance China's economic influence, driven by concerns over unfair trade practices, market access, and intellectual property rights. This has led to tariffs on billions of dollars'

worth of goods and disrupted global supply chains. However, this has also provided an opportunity for other Countries to increase their exports to the USA and the EU.

The conflict in Ukraine, which has led to a global supply chain disruption. The war has resulted in rising prices for energy, commodities and food, thereby leading to a rise in global inflation.

## 2 Transformer market overview and outlook

### 2.1 Global transformer market

The global transformers market is experiencing accelerated growth, driven by the increasing demand for power and rapid industrialization worldwide. As economies prioritize energy efficiency and reduced carbon emissions, the need to upgrade and expand power infrastructure has become paramount. Notably, emerging economies are witnessing significant investments in power generation and transmission, which is expected to further stimulate the transformer market.

Furthermore, government initiatives aimed at modernizing existing power grids and installing advanced power transformers are anticipated to have a positive impact on the market in the coming years. Advances in transformer design and technology, including the integration of smart grids and digital monitoring systems, are enhancing operational efficiency and reliability. Additionally, the growing demand for electric vehicles and charging infrastructure is also contributing to the increased demand for transformers.

#### 2.1.1 Growth drivers, restraints, and success factors

The industry in the recent years has witnessed growth owing to the increasing demand for electricity and favourable regulatory reforms toward the expansion of the existing grid infrastructure. The provision of affordable uninterrupted electricity has been a major thrust area for the regulators, which clearly drives the reforms and policies undertaken. Manufacturers across the globe through extensive R&D activities and inorganic strategic implications have been strengthening their market presence. Henceforth, expansive industrial strategies along with the rapid integration of cost-competitive and efficient products will steer the industry potential.

##### **Growth drivers**

##### ***Refurbishment demand for existing grid infrastructure***

The high voltage power transformer industry across the North America region is experiencing significant growth primarily due to the ongoing modernization and revamping of the existing grid infrastructure. The U.S. Department of Energy, specifically through the Office of Electricity Delivery & Energy Reliability, has been collaborating with private and public partners to strengthen, improve, and transform the energy infrastructure to ensure secure, clean, and reliable energy resources for the region.

As a result of these efforts, there is a strong inclination towards enhancing the existing grid infrastructure across North America. This commitment to grid improvement is expected to drive the growth of the transformer industry in the region, as transformers play a crucial role in power transmission and distribution within the grid. With the focus on achieving a more secure, efficient, and resilient energy system, the demand for advanced and high-quality transformers is expected to increase, creating opportunities for growth and development within the industry.

The electric infrastructure is facing the challenge of aging and being pushed to operate beyond its original design capacity. With more than 70% of the overall transmission and distribution infrastructure being over 25 years old, there is a pressing need for upgrades to enhance grid stability. As a response to this situation, the modernization of grid networks to make them "smarter" and more resilient is gaining momentum, driven by the integration of innovative equipment, technologies, and controls. These smart monitoring units and sustainable electricity networks work together to deliver electricity more reliably and efficiently. They have the potential to significantly reduce the frequency and duration of power outages, ensuring faster service restoration and minimizing storm impacts during disruptions.

##### ***Growing deployment of renewable energy***

In recent years, the European sub-continent has experienced significant growth in the renewable energy sector, driving the expansion of the industry. Growing concerns over greenhouse gas emissions and the implementation of stringent energy-efficiency norms have created a favourable business environment for renewable energy



development. The positive outlook towards renewable energy integration is further supported by regulatory initiatives aimed at establishing a sustainable energy mix across Europe.

Regulators in Europe have implemented favourable policies, such as incentives, feed-in tariffs, leveraging schemes, and subsidies, to promote the deployment of clean energy sources. These policy enactments related to renewable energy adoption are expected to propel the growth of the transformer market in the region. Furthermore, European Commission is implementing its REPowerEU Plan, launched in May 2022 to phase out Russian fossil fuel imports has also accelerated the transition to clean energy.

The Government of India is also focusing on demand substitution by promoting natural gas as a fuel, increasing the share of renewable and alternative fuels such as ethanol, biodiesel and electric vehicles to reduce dependence on fossil fuel imports.

### ***Increasing demand for electricity***

The transformer market over the years has witnessed a sheer progression on account of an exponential increase in the demand for electricity. Rising investments to establish a sustainable electrical network coupled with favourable regulatory reforms pertaining to rural electrification will fuel the product penetration across the regions.

Increasing peak load demand across the developed countries of the region is imposing concerns in line with grid stability and security of supply. Ongoing measures to refurbish conventional grid infrastructure adhered by the rapid adoption of smart transmission and distribution technologies will stimulate the product demand across the continent.

Furthermore, an exponential rise in the demand for energy accelerated by the flourishing industrial sector will escalate the expansion of high-voltage grid networks. The rapid deployment of high-voltage units to cater to the increasing demand across industries will accelerate the product demand. India, Indonesia, and China in the recent years have witnessed large-scale investments from leading manufacturers across the globe. The growing demand for manufactured products coupled with the rapid expansion of manufacturing units to cater to the demand will drive the business outlook across the nations.

In addition, the growing population and the ongoing migration across suburban areas have considerably led to an increase in the peak load demand across the regions. Rapid commercial expansion coupled with urbanization has further created a favourable business scenario. Thereby, favourable industry trends coupled with regulatory measures to sustain the rising electricity demand across the region will comprehensively augment the industry landscape.

### ***Growing investment toward expansion of electricity networks***

The energy demand in Latin America is on the rise, propelled by significant urbanization across the region. As a result, there is a considerable need for expanding and retrofitting the existing grid infrastructure to meet the growing electricity needs. In Africa, where effective grid networks are lacking, there are increasing investments from both public and private entities to enhance the domestic power industry, further driving the regional industry dynamics. Additionally, the rapid commercial expansion in the GCC, coupled with cross-border interconnection measures, has created a favourable environment for the transformer market.

Investments in regional projects will play a crucial role in driving renewable energy-related investments by entities based in the GCC. Besides direct investments in renewable energy projects, both public and private entities have also focused on developing the transmission and distribution networks within the region's renewable energy value chain.

In Latin America, industry participants have been prioritizing the expansion of transmission networks, capitalizing on a favourable regulatory environment that supports industrial growth across the region. The surging demand for electricity, driven by rapid urbanization and commercialization, has created a favourable business landscape for the power industry. As a result, the regional power industry is expected to experience substantial growth over the forecast timeline, which will drive the expansion of the transformer market.

Africa have been facing frequent power outages and significant line losses, prompting regulatory authorities to prioritize improvements in the energy sector. Governments in the region are actively working on expanding transmission networks to meet the growing energy demand and are integrating smart grid systems to enhance the security and reliability of electricity supply. The re-establishment of the power sector in war-affected Gulf nations presents immense growth potential for the industry. Additionally, leading manufacturers in the region are expanding their industrial units to avoid high export taxes, creating a favourable business environment. The combination of a positive industrial outlook and supportive regulatory measures for the expansion of transmission networks to meet the rising energy demand will significantly boost the demand for transformers in GCC and Africa. Governments' efforts to improve the energy infrastructure and ensure a reliable electricity supply will drive the growth of the transformer market in these regions.

### Restraints

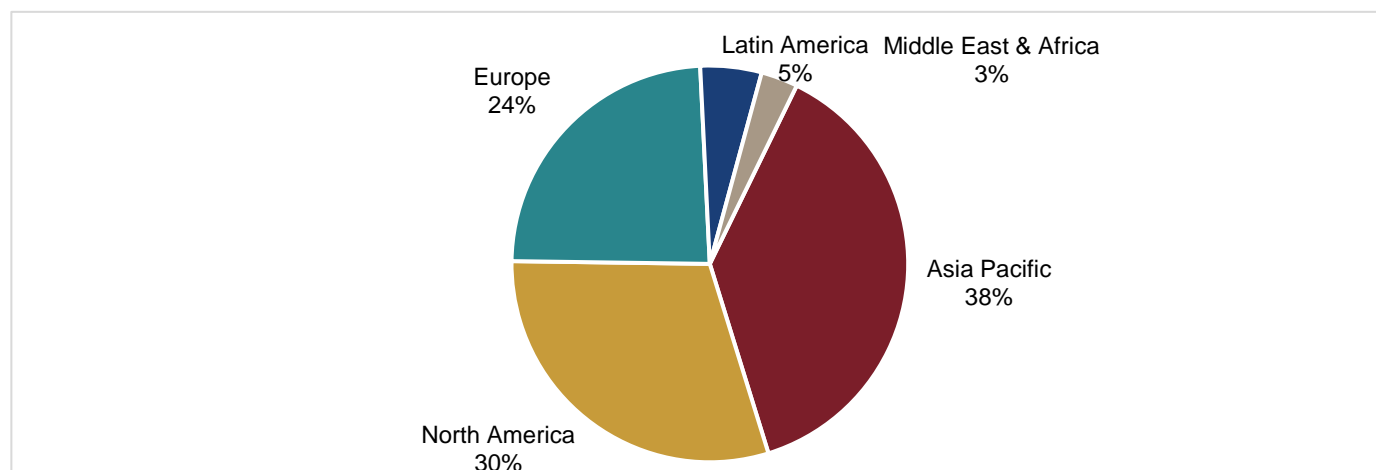
The production and installation of transformers, particularly high-voltage and specialized variants, can be a costly endeavour. The substantial upfront investment required for the procurement, installation, and maintenance of transformers can pose a significant barrier to adoption or upgrading of transformer infrastructure for certain organizations and regions. The pricing of power transformers is subject to considerable variation, influenced by a range of factors including Basic Insulation Level (BIL) rating, MVA rating, core design, assured losses, tank design, and others. Consequently, the high initial cost associated with high-voltage transformers is anticipated to hinder market growth over the forecast period.

- **Manufacturing capacity constraints** - The transformer industry faces a significant restraint in the form of manufacturing constraints, particularly with regards to the production of transformer cores. The increasing demand for grain-oriented electrical steel, a critical material used in transformer cores, from adjacent industries such as electric motors and EV chargers, has led to a diversion of supply. Furthermore, the growing demand for transformers with voltages over 100 kV, driven by factors such as aging grid infrastructure, new renewable-energy generation, and expanding electrification, has put additional pressure on manufacturers. The customized nature of large transformers, which are designed to meet specific substation or power plant requirements, slows down manufacturing and makes replacement of failed transformers more challenging.
- **Cost Pressure** – Transformers are capital-intensive equipment, and their installation often requires significant expenditure. This can deter investments, especially in cost-sensitive projects or developing economies. While newer transformer technologies like smart transformers or energy-efficient designs offer long-term savings, they often involve higher upfront costs that may not align with short-term budgets.
- **Extended Lead Times** – Transformers are highly customized products that require precision engineering, leading to extended manufacturing times. Dependence on global suppliers for critical components, along with logistics challenges, can delay project timelines. Recent disruptions, such as those caused by the COVID-19 pandemic, have exacerbated lead times.
- **Fluctuations in Raw Material Prices** – Transformers rely heavily on raw materials like copper, aluminum, silicon steel, and insulation oil. Fluctuations in the prices of these materials can significantly impact production costs and profitability. Geopolitical tensions, trade restrictions, and supply shortages can exacerbate raw material price volatility, increasing the financial burden on manufacturers and customers.

### 2.1.2 Major transformer-producing regions

The Asia-Pacific region, particularly China and India, has been a significant contributor to the growth of the transformer manufacturing industry, driven by rapid industrialization and infrastructure development. Companies like ABB, General Electric, Mitsubishi Electric, Schneider Electric, Siemens, and TBEA.

**Figure 13: Major transformer producing regions**

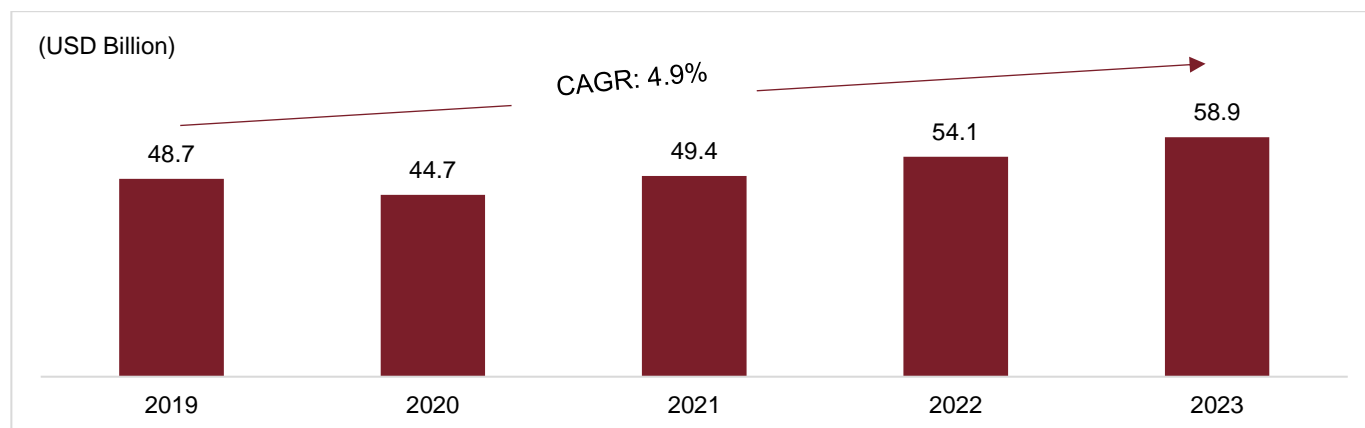


Source: Industry, Crisil Intelligence

### 2.1.3 Total market size actuals and estimates

Escalating infrastructural spending supported by favorable norms pertaining to the refurbishment and expansion of existing grid networks have instilled an upsurge in the demand for power transformers. Rapid urbanization along with ongoing industrial expansion across the developing economies will further augment business growth. Increasing demand for the upgradation and replacement of aging electric network across the North America & Europe region have instituted a favorable industrial scenario. During the last five years, the global transformer market has grown at a CAGR of ~4.9%.

**Figure 14: Global historical market size of transformers**



Source: Global Market Insights, Crisil Intelligence

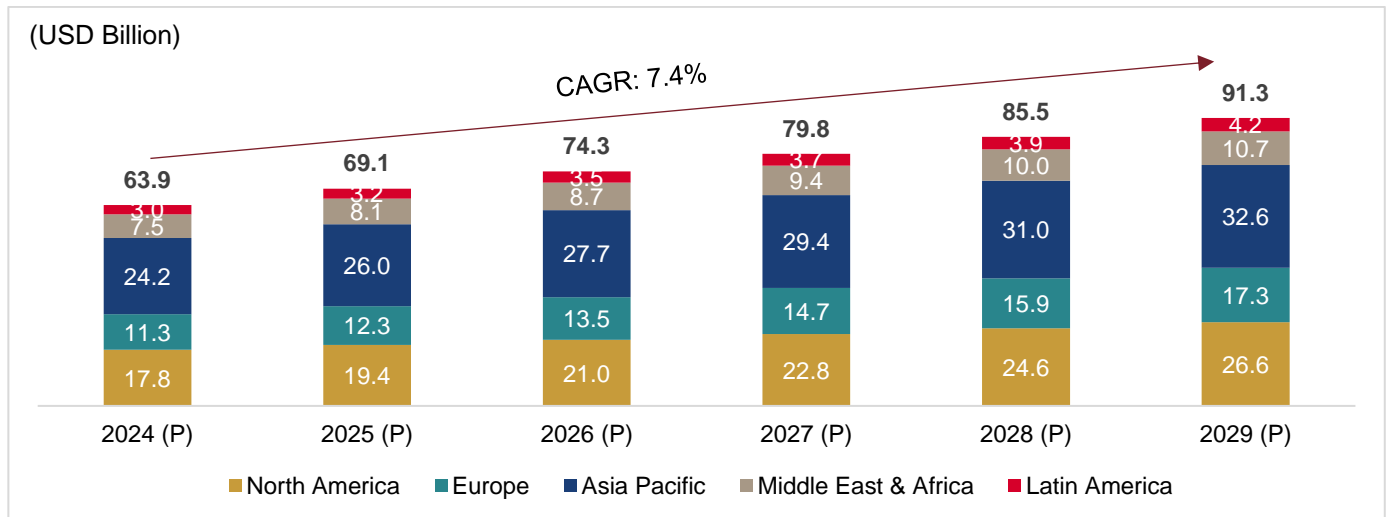
The growing focus toward replacement of the existing electrical equipment with advanced high-quality systems will further fuel the product demand. In addition, an upsurge in the electricity demand coupled with favourable regulatory reforms toward the expansion of the existing grid infrastructure will drive the transformer market. The provision of affordable uninterrupted electricity has been a major thrust area for the regulators, which clearly drives the reforms and policies undertaken. Government efforts to enhance energy efficiency coupled with an increased focus on the addition of power generation capacity will further boost the industry growth. Moreover, the U.S. government has introduced policies and incentive schemes with an aim to integrate sustainable resources and improve the conventional electrical networks across the rural areas.

Shifting trends toward energy-efficient technologies will drive the transformer market size in Europe. T&D retrofitting industry plays a vital role in raising the transformer demand across the region. Over half of the installed transformers in the region have been operating for over 25 years and need to be replaced. The rising electricity demand will

significantly impact the investments in Europe T&D retrofitting industry, which will also influence the transformer market size in the coming years.

As per the above-mentioned growth drivers the global transformer market is expected to reach over USD 90 billion by 2029 at an annual growth rate of ~7.4% between 2024 -2029. North America and Asia Pacific regions constitute over 65% of the market share and would continue to dominate the market.

**Figure 15: Global region wise transformer market outlook**



(P): Projected;

Source: Global Market Insights, Crisil Intelligence

## 2.2 Domestic transformer market overview and outlook

### 2.2.1 Growth drivers, restraints, and success factors

#### Growth drivers:

- Increasing electricity demand** – India's transformer market is driven by the relentless growth in electricity demand, with per capita consumption surging by over 50% in the last decade. As the population expands and the economy grows, the country's energy needs are on a steady upward trend. The government's efforts to electrify rural areas and provide uninterrupted power supply to urban regions have further accelerated the demand for transformers. These devices play a crucial role in transmitting power efficiently, stepping up voltage from generation stations and stepping it down for distribution to end-users. As electricity demand continues to soar, the need for reliable and efficient transformers becomes increasingly critical to ensure uninterrupted power delivery across the country.
- Rapid industrialization and urbanization** – The rapid industrialization and urbanization of India are key factors propelling the growth of the country's transformer market. As the economy continues to expand, new industries are emerging and existing ones are scaling up, creating a surge in demand for reliable power supply to support manufacturing and other industrial activities. Efficient power transmission over long distances, minimal energy losses, and grid stability are critical, making transformers an essential component. Furthermore, urbanization is driving up electricity demand in residential, commercial, and infrastructure projects, necessitating the use of advanced power transformers to manage the increasing load on the electrical grid.
- RE integration** – A significant trend shaping India's high voltage power transmission market is the increasing adoption of renewable energy sources. With the country aiming to reach 500 GW of non-fossil capacity by 2030, there is a growing requirement for high voltage power transformers that can accommodate the variable

and intermittent nature of renewable energy generation. As per Central Electricity Authority (CEA), the need for significant investments in India's transmission infrastructure to integrate over 500 GW of renewable energy capacity by 2030. Approximately 162,646 ckm of transmission lines and 1,159,805 MVA of substation capacity will be required to connect additional generation capacity including wind, solar, energy storage and potential RE zones to the grid between fiscal 2025-32 which are located in remote areas and are concentrated in a few states.. The majority of this new transmission investment will focus on long-distance RE connectivity at voltage levels above 220 kV. A total expenditure of Rs 9.16 trillion has been planned to augment power transmission infrastructure capacity in the country by 2032.

As per CEA's National Electricity Plan, the Interstate transmission system for 82.2 GW RE capacity is under construction and for 55.0 GW capacity is under bidding. Furthermore, under Green Energy Corridor scheme, a total of 52,426 MVA of substation capacity and 17,341 ckm of transmission lines have been envisaged to cater over 42 GW of RE capacity. Of this, 9,135 ckm of transmission lines have been constructed and 21,313 MVA of substation capacity have been charged as of June 2024.

As India transitions towards its renewable energy goals, the demand for advanced transformers that can efficiently manage the intermittent nature of renewable power generation is expected to rise sharply. This shift will require transformers equipped with smart grid technologies, phase-shifting capabilities, and voltage regulation features, which will significantly reshape the market dynamics for transformers in India.

- **Increasing thermal and hydro generation capacities** – As per CEA's National Electricity Plan, the projected peak demand of India to reach 277 GW by fiscal 2027 and 366 GW by fiscal 2032. To meet the rising demand, the government has planned to add over 40 GW of thermal and over 15 GW of hydro plants by 2032. This would increase the transformer requirements in India including auxiliary transformers and service transformers.
- **Government initiatives** – Government initiatives have played a crucial role in driving the growth of the transformer market in India. Schemes such as the Green Energy Corridors (GEC) initiative and the Revamped Distribution Sector Scheme (RDSS) have been instrumental in accelerating electrification, upgrading transmission infrastructure, and ensuring reliable last-mile connectivity. The GEC-II scheme aims to integrate about 19.4 GW of RE capacity into the intra-state system, thereby creating a significant demand for transformers. These initiatives not only stimulate demand for transformers but also encourage investments in modernization and capacity enhancement across the power sector value chain, ultimately driving the growth of the transformer market in India.
- **EV charging infrastructure, railways and data centres** – The Indian power sector is poised for significant growth, driven by strong demand from high-growth end markets such as data centers and EV charging networks. As these industries expand, they will place additional pressure on grid capacity and resiliency, necessitating the deployment of new, modern transformers. Furthermore, the Indian Railways' shift towards high-speed trains has created a surge in demand for transformers operating between 66 kV and 133 kV voltage levels. The accelerated roll-out of high-speed trains, metro lines, and freight corridors is expected to fuel a significant increase in transformer demand in India over the next few years, presenting opportunities for the transformer industry to grow and evolve.
- **Smart grid development** – A key trend driving the market is the focus on grid modernization and the development of smart grids. The adoption of smart grid technologies, which rely on digital communications and automation, necessitates the use of advanced transformers that can support intelligent grid management. These smart grids optimize power distribution, enable faster fault detection and response, and facilitate better power flow management. The integration of high-voltage transformers with smart grid capabilities is critical for building a resilient and responsive power infrastructure. The Indian government's national smart grid mission, for instance, aims to accelerate the deployment of smart grids across the country, further underscoring the importance of these advanced transformers.

- **Enhanced steel production targets by Government of India:** National Steel Policy (NSP) 2017 had set ambitious targets to achieve a crude steel capacity of 300 million tonnes by 2030-31, with an expected production of 255 million tonnes of crude steel and 230 million tonnes of finished steel. Additionally, Union Minister of Commerce and Industry, Shri Piyush Goyal during his address at the 5th edition of ISA Steel Conclave (September 2024) in New Delhi set a target of 500 mn tonnes of steel production by 2034. This should drive the demand for furnace transformers which are used to feed electric furnace used to melt and refine materials. With very high secondary current and wide voltage regulations, the furnace transformers are best suited for furnace requirements.
- **Increased focus on HVDS:** To improve quality (Voltage profile) of electric supply, reducing the theft and reducing the losses in the system, high voltage distribution system (HVDS) is used by the Discoms as an alternate to low voltage distribution systems (LVDS). In this system, 11 KV lines are extended up to or as nearer as possible, to the load center, and small size single phase distribution transformers ranging from 10KVA to 50KVA depending on load requirement are installed on poles to supply power to consumers. However, safety clearances are to be taken in to account during laying of 11 KV lines in the narrow streets. The HVDS system has more 11 KV Line and more DTs but virtually No LT lines or very less LT lines as compared to LVDS system. This is also expected to drive the demand for transformers.
- **Micro grid –** Microgrids are small-scale, local energy systems that can operate in isolation from the main grid, providing reliable and efficient energy to remote or off-grid communities. Microgrids have gained significant attention in recent years as a means to promote renewable energy, energy access, and rural development. The distributed energy systems, including rooftop solar and microgrids, are growing in India due to both policy incentives and economic viability. As a result, there has been a notable expansion of micro-grid networks which will drive demand for small-scale specialty transformers suited for localized applications.

**Restraints:**

- **High initial investment –** One of the key challenges hindering the growth of the Indian transformer market is the high upfront investment required for the manufacturing, installation, and maintenance of transformers. The substantial financial resources needed can be a significant barrier for smaller utilities and companies with limited budgets, making it difficult for them to adopt advanced transformer technologies. Furthermore, the long payback period associated with these investments can also deter stakeholders from committing power transformers, thereby limiting the widespread adoption of these technologies.
- **Technical and operational challenges –** Power transformers in India are susceptible to various technical and operational challenges that can compromise their performance and reliability. Common issues such as overheating, insulation failure, and electromagnetic interference can cause transformer malfunctions and outages, leading to significant disruptions. The intricate nature of these transformers demands specialized expertise for their operation and maintenance, and the shortage of skilled professionals can exacerbate these technical challenges. Furthermore, the increasing integration of renewable energy sources adds complexity to transformer operations, as they must adapt to fluctuating power loads and maintain grid stability, posing additional technical hurdles.
- **Supply chain disruptions –** The Indian power transformer market faces significant challenges due to supply chain disruptions and raw material shortages. The production of high voltage transformers relies heavily on the availability of critical raw materials such as copper, steel, and specialized insulating materials. Any disruption in the supply of these materials, whether due to geopolitical tensions, trade restrictions, or natural disasters, can lead to production delays and increased costs. Moreover, the global competition for these materials can result in price volatility, which can have a ripple effect on the overall cost structure of transformer manufacturing, ultimately impacting the industry's competitiveness and profitability.
- **Aging infrastructure –** India's power infrastructure is facing significant challenges, with many existing transmission and distribution networks being outdated and unable to support the increased load and



advanced technology required for modern transformers. The need to upgrade these aging infrastructures requires substantial investment and collaborative efforts between government agencies and private stakeholders. The slow pace of infrastructure modernization can hinder the deployment of new transformers, limiting the market's growth potential and creating a bottleneck for the adoption of advanced technologies. As a result, the power transformer market in India is constrained by the need for infrastructure upgrades, which can impact its overall development and expansion.

### 2.2.2 Key Government Initiatives to boost transformer manufacturing in India

The Indian government is giving significant attention to the transformer market. The promotion of 'Make in India,' a government initiative, encourages the manufacturing of transformer equipment within India. It aims to make India a global manufacturing hub for the transformer industry by providing numerous incentives to local and foreign manufacturers. The government is also investing in the renewable energy sector and expanding the power transmission network, which will create opportunities for the transformer market's growth.

### 2.2.3 Domestic transformer market regulatory framework

There are various regulatory authorities and standards oversee transformer safety and compliance in India, guaranteeing safe design, manufacture, and operating procedures throughout the electrical sector.

- **Bureau of Indian Standards (BIS):** In India, the mandatory BIS certification for transformers has led to a significant improvement in product quality and a reduction in failure rates. The BIS, India's national standards organization, is responsible for establishing and enforcing guidelines for various products, including transformers. By publishing standards that outline performance norms, testing protocols, and safety requirements, the BIS ensures that transformers meet rigorous quality and safety benchmarks. The implementation of BIS standards has resulted in a standardized product, which has enhanced the overall quality and reliability of transformers produced in the country. Some of the fundamental requirements are:
  - *IS 2026 (Power Transformers)* - It is a comprehensive standard that sets out the specifications for power transformers, encompassing performance, testing, design, and construction. The standard covers a range of critical aspects, including dielectric testing, temperature increase limitations, insulation levels, and short-circuit withstand capacity. By adhering to IS 2026, power transformers are ensured to meet stringent performance standards and operate safely in diverse environments, providing users with confidence in their reliability and functionality.
  - *IS 1180 (Distribution Transformers)* - This standard specifically designed for distribution transformers, outlines essential criteria for energy efficiency, insulation, temperature rise, and mechanical strength. Additionally, this standard provides guidelines for the eco-friendly design of distribution transformers, which not only enhance energy efficiency but also minimize their environmental impact.
  - *IS 3024 (Electrical Steel)* – It sets forth specifications for electrical steel used in transformer cores, emphasizing the importance of high-quality materials in achieving optimal transformer performance. By adhering to this standard, transformer core materials must demonstrate the necessary magnetic and mechanical properties, ultimately leading to improved transformer efficiency and reduced core losses.
- **Central Electricity Authority (CEA):** CEA plays a crucial role in regulating India's electrical industry, issuing rules and guidelines for the installation, operation, and maintenance of various electrical equipment, including transformers. To ensure accident-free and reliable operation, electrical installations must comply with the CEA's stringent safety regulations. The CEA's comprehensive requirements provide a framework for the safe installation, use, and maintenance of transformers, thereby guaranteeing a secure and efficient electrical infrastructure provided by the CEA's Safety Regulations which are as follows:
  - *Installation requirements:* The specifications provide detailed installation requirements for transformers, covering essential aspects such as site selection, foundation design, grounding, and clearances. Adherence

to these guidelines ensures that transformer installations are safe and reliable, minimizing the risk of electrical failures, fires, and other hazards, and thereby providing a secure operating environment.

- Operational safety: It stipulate essential operational safety precautions for transformer operation, including the implementation of routine checks, continuous monitoring of operational parameters, and the installation of protective devices such as relays and circuit breakers. By following these guidelines, potential issues can be identified and addressed proactively, preventing them from escalating into more severe problems and ensuring the safe and reliable operation of transformers.
- Maintenance practices: This involves periodic checks on oil quality, thermal performance, and insulating resistance to identify potential issues before they become major problems. By detecting and addressing issues such as oil contamination, overheating, and insulation degradation through proactive maintenance, transformer failures can be prevented, and optimal performance can be sustained.

Further, CEA had issued Guidelines for the Periodicity of Type Tests for Major Equipment used in Electrical Power System, 2022 to set uniformity in the periodicity of type tests in respect of various equipment. However, to to address inconsistencies in type test requirements for equipment across generation, transmission, and distribution segments, the CEA has released revised draft Guidelines in Nov 2024. It includes provisions for extending the validity of type test reports for equipment of similar design and stress levels, ensuring uniformity in periodicity, and rationalising the conditions under which type tests need to be repeated. The draft also outlines specific conditions under which repeated testing may be waived, such as cases where there are no significant changes in design, materials, or manufacturing processes.

#### 2.2.4 Import-exports of transformers India

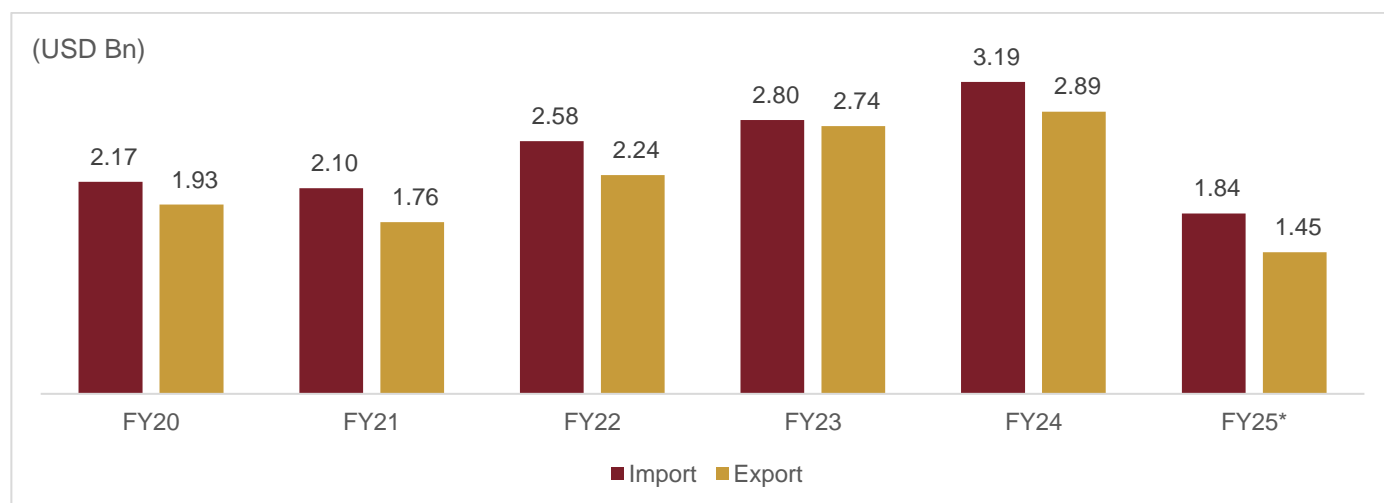
India's electrical transformer trade is a significant aspect of its economy, showcasing its dual role as a global supplier and consumer. The value of exports of transformers (incl. related HS codes) from India was USD 2.89 billion in 2024. The exports of transformers went up by 5.4% compared to 2023. During 2024, key export destinations for transformers include USA, UK, China, UAE, European Countries etc.

Similarly, the value of imports of transformers (incl. related HS codes) to India was USD 3.19 billion in 2024. The imports of transformers went up by 13.8% compared to 2023. During 2024, key import partners countries for transformers include China, Japan, European Countries, Korea etc.

This near parity in trade indicates India's robust engagement in the global transformer market, driven by domestic industrial needs and international demand for Indian-manufactured transformers. India is emerging as a preferred supplier of transformers to the US and European markets, as global tensions between Ukraine and Russia continue to escalate, highlighting the country's growing importance as a reliable and trusted transformer manufacturer.

In terms of imports, China is a significant supplier of cost-effective specialty transformers for industrial automation and renewable energy. Germany and Japan are known for high-quality, precision-engineered transformers for medical and specialized industrial applications, whereas US supplies advanced products for defence and high-end industrial requirements.

**Figure 16: Historical import export of transformers – India**



Note: \*Apr-Sep 2024

HSN Codes: 850410; 850421; 850422; 850423; 850431; 850433; 850434; 850434; 850440; 850450 & 850490

Source: Ministry of Commerce, Crisil Intelligence

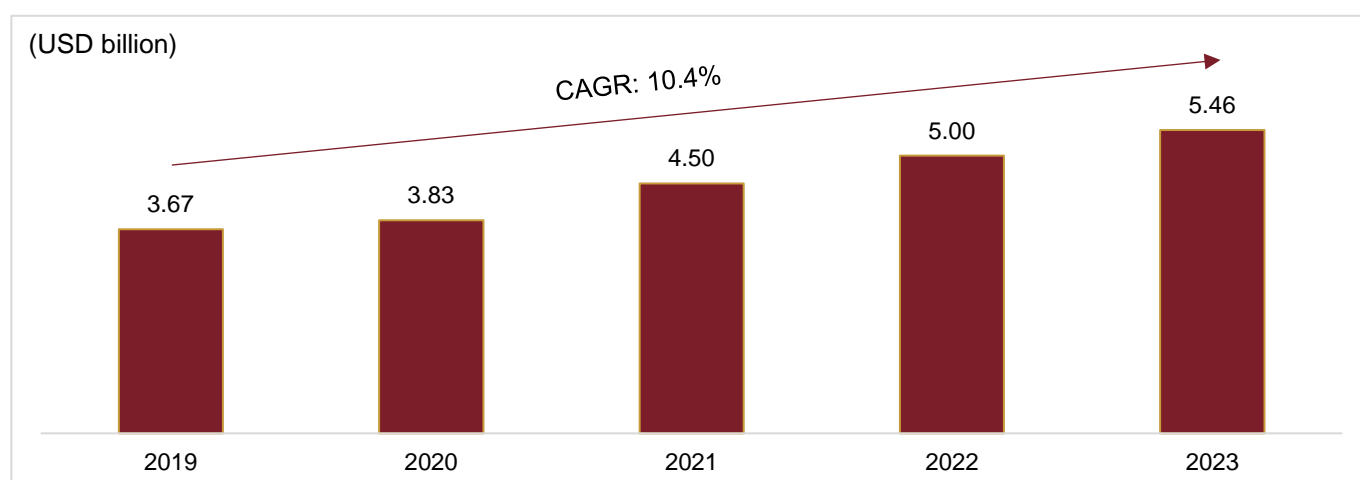
### 2.2.5 Total market size actuals and estimates

The transformer market is experiencing a significant surge in demand, primarily driven by the rapid expansion of the transmission and distribution sector. India's growing power demand, manufacturing push, and electrification efforts, as well as the country's ambitious green energy transition goal of 500 GW by 2030, are all contributing to a revival of transmission and distribution capital expenditure (capex) activity. According to the Central Electricity Authority's National Electricity Plan, the power transmission segment alone is expected to see a capex of Rs 4.25 trillion by 2027, underscoring the immense opportunities for transformer manufacturers in this space.

India's AC transformation capacity has been steadily increasing, reaching 1,217.58 GVA across the 220-765 kV levels as of March 2024. Over the five-year period from fiscal 2019 to 2024, the AC transformation capacity grew at a CAGR of 6.8%.

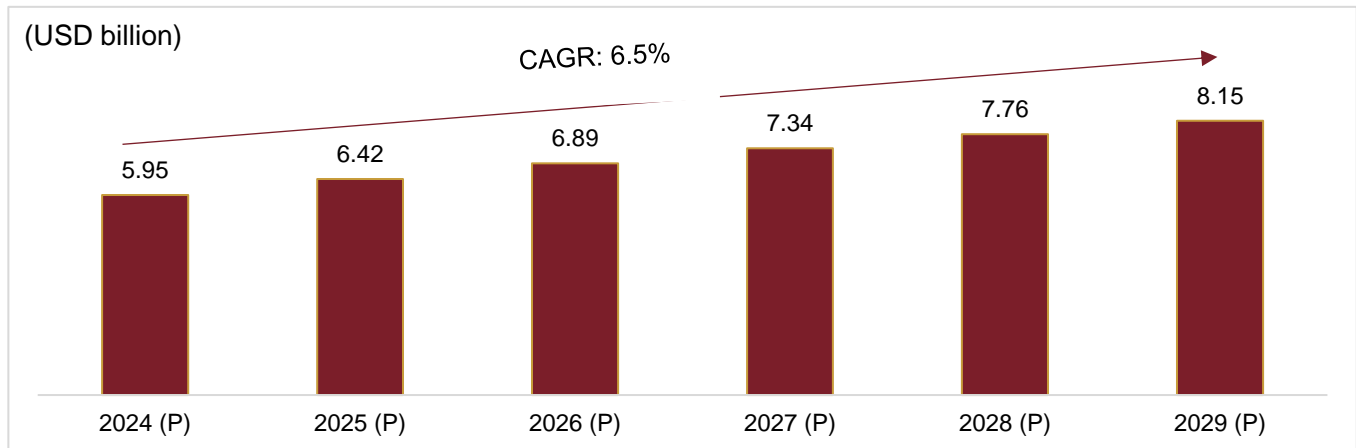
The domestic transformer market is expected to grow by 7-8% in 2024. Transformer segment has registered a growth of 10.4% in between 2019-23 and is expected to grow at CAGR of ~6-7% from 2024-2029.

**Figure 17: India historical market size of transformers**



Source: Global Market Insights, Crisil Intelligence

**Figure 18: India transformer market outlook**



(P): Projected;

Source: Global Market Insights, Crisil Intelligence

## 2.3 Transformer technology and innovations

The transformer industry is undergoing a transformative shift, driven by technological innovations that are enhancing efficiency, reliability, and grid resilience. As electricity demand continues to rise, the EHV and UHV power transformer market is poised for significant growth. These transformers play a crucial role in transmitting electricity over long distances with minimal losses, making them essential for efficient power distribution networks. HVDC transformers are particularly important for efficient long-distance power transmission, converting AC to DC in converter stations and enabling the seamless integration of renewable energy sources. By combining transformers with flexible AC transmission systems, utilities can achieve precise control and bidirectional power flow between grids and devices, such as static synchronous compensators, thereby enhancing system efficiency and stability.

Smart transformers, enabled by IoT, AI, and predictive analytics, are revolutionizing maintenance practices by providing real-time monitoring, remote diagnostics, and proactive maintenance, thereby optimizing asset performance and minimizing downtime. Advances in insulation materials, cooling systems, and design optimization techniques are also driving the development of compact, energy-efficient transformers that can operate in diverse conditions.

Energy efficiency has become a top priority for utilities and industries seeking to reduce their environmental footprint and optimize operational costs. Energy-efficient transformers and eco-friendly ester-filled transformers are gaining popularity due to their superior performance, reduced losses, and lower carbon footprint.

The transition of steel mills using glass furnaces to arc furnace transformers due to pollution regulations is also expected to drive demand for suppliers. The range of transformer types, including distribution transformers, autotransformers, and mobile transformers, ensures that utilities and industries can find the right solution for their specific needs.

As renewable energy sources continue to expand, transformers are being adapted to handle the unique challenges of variable and intermittent power generation, contributing to the integration of clean energy into the grid. Additionally, miniaturization and modularization trends enable the development of more compact and scalable transformer designs, catering to space-constrained environments and facilitating rapid deployment. Environmental sustainability considerations are shaping transformer materials and fluids, with a growing emphasis on eco-friendly solutions and lifecycle management practices.

The digital transformation of the energy sector is giving rise to a new era of transformer management, marked by data-driven decision-making, predictive maintenance, and autonomous operation. Advanced monitoring systems, integrated with supervisory control and data acquisition, and cloud-based platforms, enable utilities to tap into vast

amounts of operational data, optimizing asset utilization, enhancing grid stability, and streamlining maintenance workflows. As distributed energy resources and microgrids become increasingly prevalent, the need for agile, adaptive transformers that can dynamically manage bidirectional power flows and voltage fluctuations has become more pressing, driving the development of innovative solutions that can meet these evolving demands.

## **2.4 R&D and the importance of having a strong R&D setup**

Research and Development (R&D) facilities play a crucial role for transformer manufacturing companies in India, especially given the country's growing energy needs and rapid industrialization. The importance of R&D in this sector and ongoing progress by Indian manufacturers can be summarized as follows:

R&D enables manufacturers to design transformers with improved efficiency, reduced losses, and enhanced performance. New materials and advanced insulating materials, can be developed to meet global standards. Further, with the rapid growth of solar and wind energy in India, transformers need to be designed to handle variable loads and integrate seamlessly with renewable energy sources.

India's diverse climate, varying grid conditions, and high population density necessitate transformers tailored to local requirements. R&D helps design transformers resistant to extreme weather, voltage fluctuations, and overloading. R&D also enables the development of smart transformers equipped with sensors, IoT capabilities, and predictive maintenance technologies, essential for the implementation of smart grids.

Most of the major transformer manufacturers in India had collaborations with reputed international companies, such as Associated Electrical Industries (AEI) U.K.; Alstom, France; Hawker Siddely, U.K.; Hitachi, Japan and Siemens, Germany. Presently, Indian manufacturers have the know-how to design and manufacture transformers upto 400 kV indigenously.

## 3 Power transformers market overview and outlook

### 3.1 Global power transformer market

The global rise in infrastructural spending is significantly bolstering the power transformer market. Governments and private sectors worldwide are heavily investing in infrastructure projects, including transportation, residential, and industrial developments, which require robust electrical networks to support growing energy demands. Urbanization, particularly in emerging economies, is a key factor driving this trend. Expanding cities and the establishment of smart cities demand reliable electricity infrastructure, where power transformers are integral for efficient energy distribution and transmission.

The power transformer market is also fueled by extensive upgrades to existing grid networks. Aging infrastructure, particularly in developed regions like North America and Europe, has led to grid inefficiencies, higher maintenance costs, and increased risks of power outages. Many power systems were built decades ago and struggle to handle modern-day electricity demands due to aging equipment and outdated technology. Grid upgrades address these challenges, improving energy reliability, stability, and efficiency—qualities essential for meeting current and future energy demands.

Renewable energy sources like wind and solar energy are inherently variable, depending on weather and time of day. This intermittent nature presents challenges for grid stability, requiring sophisticated solutions to balance supply and demand. Power transformers equipped with advanced monitoring and control systems help address this by managing voltage fluctuations and maintaining a stable power flow. They also support load balancing, which is essential in grids with high penetration of renewables. This flexibility is particularly important in regions with aggressive renewable energy targets, such as the European Union, the United States, and China.

The global shift toward renewable energy is another major factor driving demand for power transformers. As countries aim to reduce carbon emissions and transition to cleaner energy sources, large-scale renewable energy projects have become increasingly common. Power transformers play a crucial role in integrating these renewable sources into existing grid networks, converting electricity generated from wind, solar, and hydro sources into voltages suitable for transmission and distribution.

In the Asia Pacific region, renewable energy integration is accelerating, with countries like India, Japan, and Australia investing in large-scale solar and wind projects. India, for instance, has ambitious plans to increase its renewable energy capacity significantly in the coming years. Power transformers that support grid stability, high voltage transmission, and efficient energy conversion are essential for these developments, as they enable seamless integration of renewable sources into the national grid. In addition, developing countries are significantly adopting clean energy solutions to combat climate change demand for advanced transformers that facilitate stable and efficient integration of renewable power will continue to rise, cementing their importance in the future energy landscape.

#### 3.1.1 Market segmentation by geography

In North America, particularly the U.S. and Canada, the demand for power transformers is driven by initiatives to modernize an aging grid infrastructure and support renewable energy integration. Increasing investment in renewable energy projects, such as wind and solar, requires transformers that can handle the intermittent and distributed nature of clean energy sources.

Europe's power transformer market is highly influenced by stringent regulatory standards targeting environmental sustainability and carbon neutrality. The European Union's Green Deal aims for carbon neutrality by 2050, pushing countries to transition to renewable energy and upgrade grid systems.

Asia Pacific, especially China, India, and Southeast Asian nations, is witnessing substantial growth in the power transformer market due to rapid urbanization and industrialization. The growing population and increasing energy consumption in countries like India drive demand for robust power transmission infrastructure.

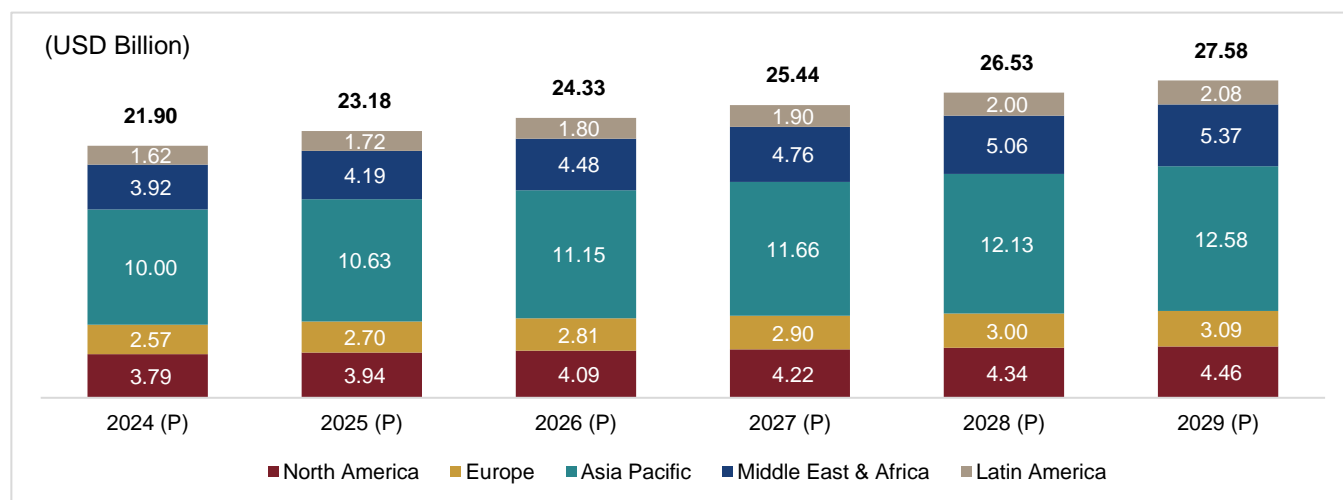


The Middle East and Africa are focused on addressing power supply challenges by investing in grid expansion and modernization, especially in regions with limited access to reliable power. African nations, with significant support from international financial institutions, aim to expand electrification and improve grid resilience. Infrastructure projects and cross-border interconnections in Africa also drive the need for new transformers to enhance power distribution efficiency and support economic development.

In Latin America, the power transformer market is driven by efforts to expand renewable energy capacity and address transmission inefficiencies. Countries like Brazil, Chile, and Mexico are scaling up their renewable energy projects to reduce dependence on fossil fuels, driving demand for power transformers that can handle diverse energy inputs. Investment from both public and private sectors supports projects that enhance grid stability and distribution efficiency.

The Asia Pacific region accounts for over 45% of the total power transformer requirement followed by MEA region at ~20%. North America and Europe cumulatively account for ~27-30% share and the rest by Latin America.

**Figure 19: Global region wise power transformer market outlook**



(P): Projected;

Source: Global Market Insights, Crisil Intelligence

### 3.1.2 Market segmentation by Power ratings (KVA/ MVA)

The growing need for power distribution in urban and semi-urban areas is driving demand for transformers with ratings of 100 MVA or lower. These transformers are ideal for small to medium-sized substations, residential complexes, commercial buildings, and localized grids. As urban areas expand, power infrastructure needs to keep pace with increased residential and commercial energy consumption. Compact and efficient, ≤ 100 MVA transformers are particularly useful in densely populated areas, where reliable, localized distribution is essential. This segment benefits from the rising electrification and urbanization, especially in developing countries, where smaller-scale infrastructure upgrades are a priority.

Power transformers in the 100 to 500 MVA range are in demand due to increasing investments in industrial infrastructure and renewable energy projects. These ratings are suitable for handling medium to high loads, making them ideal for industrial facilities, manufacturing plants, and renewable energy sources like wind and solar farms. As renewable energy integration accelerates, transformers in this category help bridge renewable sources with main grids, managing variability in power generation. Many governments are funding projects to expand renewable capacities, thereby driving demand for this transformer rating segment to ensure effective energy transmission and grid stability.

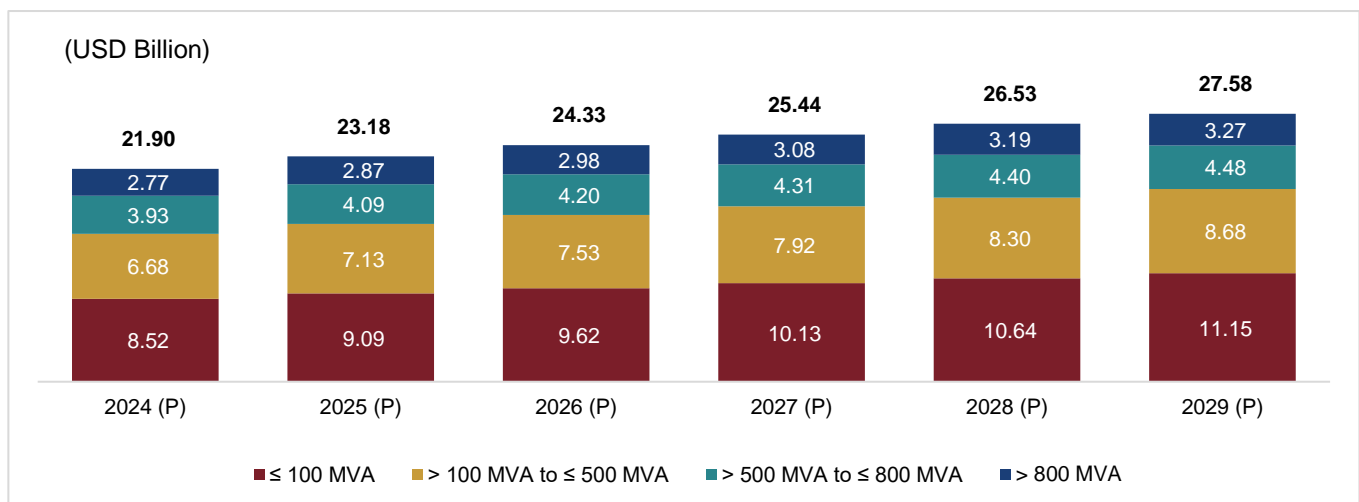
The need for efficient, long-distance transmission of high-voltage power drives demand for transformers rated above 500 MVA to 800 MVA. These transformers support large substations and facilitate cross-regional power transmission,

ensuring minimal losses and voltage stability over long distances. As economies grow and the demand for cross-border energy trade increases, power transmission networks are expanding significantly. This segment of transformers is essential for connecting power generation sites, often located in remote areas, with urban and industrial centers. Increased investment in high-voltage infrastructure, particularly in developing regions and emerging markets, contributes to the growth of the power transformer market.

Transformers with ratings exceeding 800 MVA are essential for ultra-high-voltage transmission systems required in inter-regional and cross-border electricity trade. These high-capacity transformers enable countries to exchange power, enhance energy security, and stabilize regional grids. As global energy demands increase, many regions are investing in super grids and interconnections to improve resilience and balance energy resources. For instance, Europe and parts of Asia are working on cross-border grid projects to share renewable energy resources. High-capacity transformers with > 800 MVA ratings are crucial for such ultra-high-voltage networks, thus driving the demand for this rating segment in the power transformer market.

The global power transformer market is expected to grow at a CAGR of 4.7% between 2024-29. Transformers with power rating <500 MVA would drive the market and is expected to grow at a CAGR of 5.0-6.0%. About 80% of the total market share is from power transformers of rating upto 500 MVA.

**Figure 20: Global power ratings wise power transformer market outlook**



(P): Projected;

Source: Global Market Insights, Crisil Intelligence

### 3.1.3 Market segmentation by application

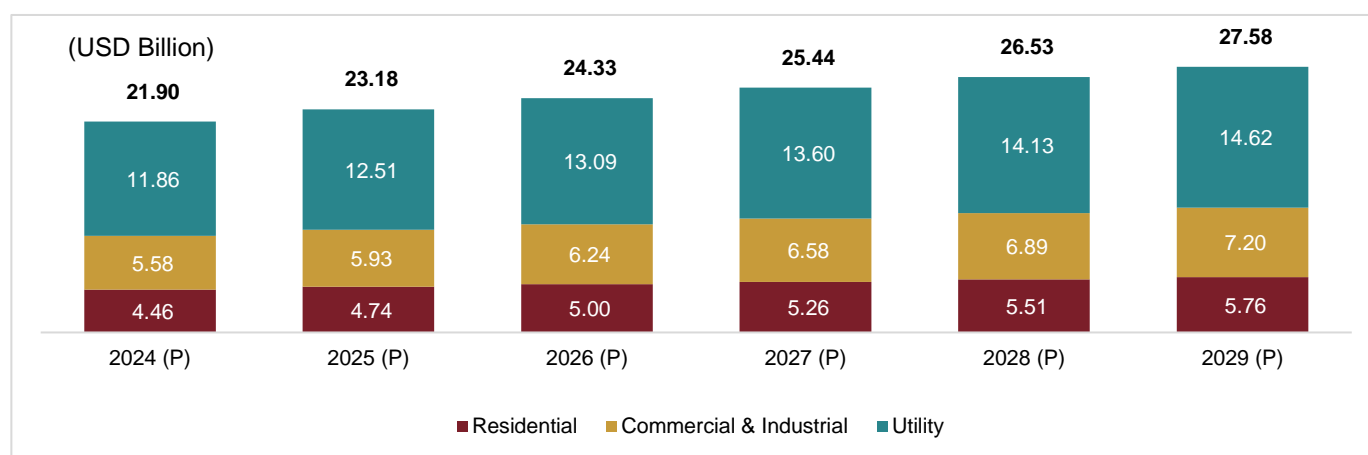
Rapid urbanization and electrification initiatives are driving demand for power transformers in residential applications. As cities expand and new housing developments emerge, particularly in developing economies, there is a rising need for transformers that can reliably manage power distribution to densely populated areas. In many regions, government programs focused on achieving universal electricity access are spurring investments in transformers suitable for residential use. Additionally, residential areas now consume more electricity due to the proliferation of electrical appliances and home energy systems, increasing the load on transformers. This surge in demand for stable, reliable residential electricity boosts the need for smaller power transformers designed for neighborhood-level distribution networks.

Expanding commercial and industrial sectors are generating a high demand for power transformers capable of supporting heavy-duty power loads. Large commercial facilities such as shopping malls, data centers, and hospitals require robust transformers to maintain uninterrupted power supply. Similarly, manufacturing plants, mining operations, and oil & gas facilities need high-capacity transformers that can handle continuous, large-scale energy demands. As more industries shift towards automation and energy-intensive processes, the need for reliable power transformers in commercial and industrial applications is rising. Additionally, the trend toward localized power

generation within industries, like combined heat and power (CHP) systems, further drives demand for specialized transformers to support these infrastructure demands.

Utility companies are heavily investing in grid expansion and modernization to meet growing energy demands and integrate renewable sources. Power transformers are critical to this effort, as they step up or down voltage levels, enabling efficient energy transmission across extensive distances. With increased adoption of renewable energy sources like wind and solar, utilities need transformers that can manage variability in power generation and maintain grid stability. Furthermore, utility investments in grid resiliency against natural disasters and energy storage for load balancing underscore the need for reliable, high-capacity transformers. Utilities in both developed and emerging economies are focusing on upgrading their aging infrastructure, making utility applications a significant growth area for power transformers.

**Figure 21: Global application wise power transformer market outlook**



(P): Projected;

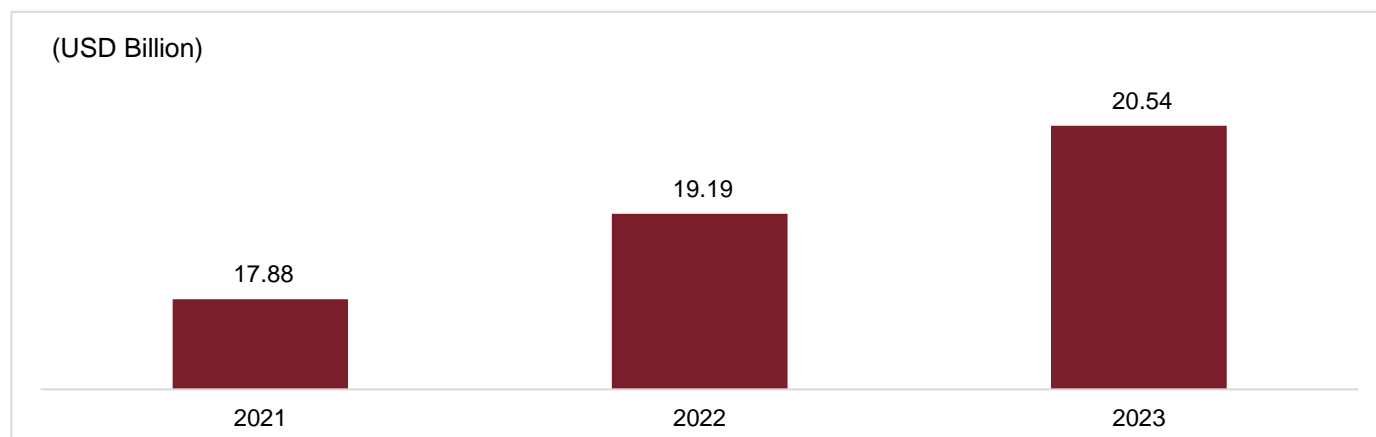
Source: Global Market Insights, Crisil Intelligence

### 3.1.4 Total market size in value

The industrial sector's growing shift towards automation and electrification, driven by Industry 4.0, increases energy demand for manufacturing, logistics, and data centers. Power transformers play a vital role in powering high-capacity machinery and ensuring stable voltage for complex industrial processes. Automation requires consistent, high-quality power supply, which transformers help achieve. Sectors like data centers, which demand large amounts of uninterrupted power, are increasingly investing in high-capacity transformers to support operations, ensuring system reliability and enhancing power distribution networks.

Technological advancements, including improved transformer designs with reduced losses, efficient cooling systems, and higher voltage capacities, are driving market growth. Transformer manufacturers are also integrating digital sensors to allow real-time monitoring, helping to detect issues early and extend the equipment's operational life. As governments and industries prioritize sustainable and high-efficiency solutions, investments in advanced transformer technology are expected to continue growing.

**Figure 22: Global historical market size of power transformers**



Source: Global Market Insights, Crisil Intelligence

## 3.2 Domestic power transformers market overview

The Indian power transformer market has grown significantly over the past decade, driven by sustained investments in electricity infrastructure, renewable energy expansion, and increasing demand for reliable power distribution. The power transformer segment forms the backbone of India's transmission and distribution (T&D) sector, with its applications spanning power generation, transmission, distribution, and industrial usage.

### 3.2.1 Market segmentation by voltage levels (KV)

In India, the Generation, transmission and Distribution happens at various voltage levels. Power generation in conventional power plants typically produces electricity at voltage level between 11 kV and 25 kV. HV and EHV transmission lines transport power from the power plant over long distances at voltages like 132 kV, 220 kV, 400 kV and 760 kV. Power from transmission network is delivered to sub-transmission network after stepping down the voltage to 66 kV or 33 kV through 220/132/66/33 kV Grid substations. The T&D system in India operates at several voltage levels:

- Extra high voltage (EHV): 765 kV, 400 kV and 220 kV
- High voltage: 132 kV and 66 kV
- Medium voltage: 33 kV, 11 kV, 6.6 kV and 3.3 kV
- Low voltage: 1.1 kV, 220 volts and below

The voltage level above 66 kV to  $\leq$  220 kV transformers serve sub-transmission and small-to-medium power transmission lines that interconnect regional grids. Industrial growth, especially in sectors like manufacturing, mining, and construction, drives demand in this category as facilities require reliable power delivery. Additionally, as urban centres expand, utilities are upgrading transmission infrastructure, often using this voltage range for effective load management. Renewable integration also drives this market, with many wind and solar farms requiring transformers in this range to transfer generated electricity into the main grid.

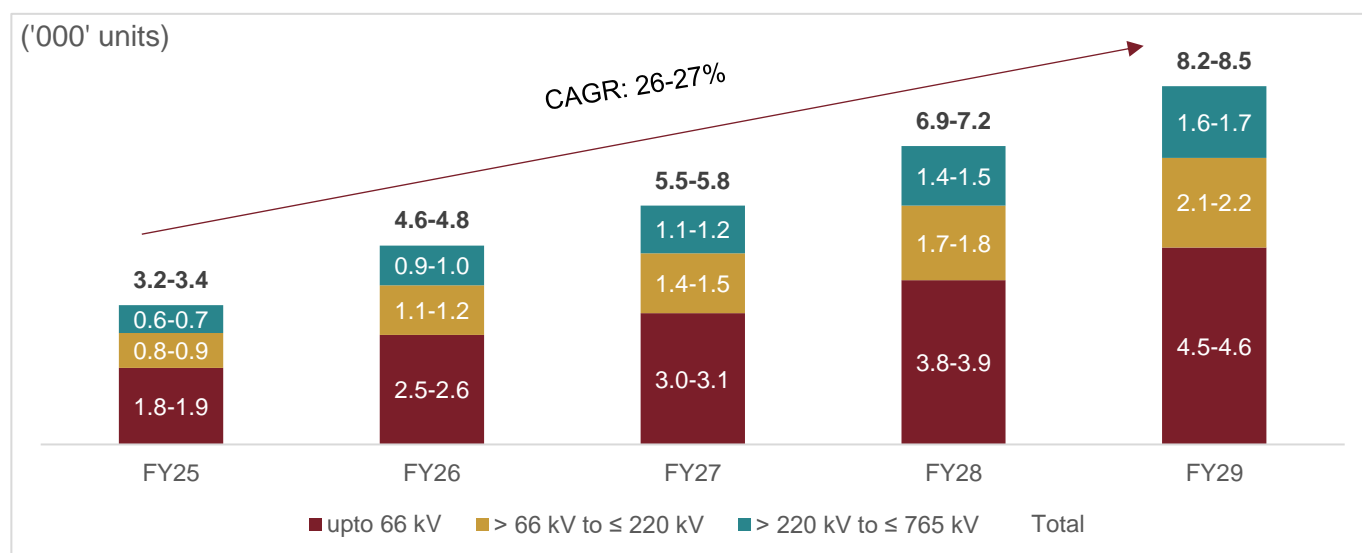
Above 220 kV to  $\leq$  765 kV transformers support major transmission networks that transport power across long distances, often from remote generation sites to urban and industrial centres. Growing investments in cross-border interconnections and regional grid stability drive demand for transformers within this range. Additionally, expansion in renewable energy capacity, particularly from offshore wind and large solar farms, contributes to the need for high-voltage transformers to transmit power efficiently over distances. Grid modernization initiatives and efforts to reduce transmission losses further support demand in this voltage category.

Transformers above 765 kV are critical for ultra-high voltage transmission (UHV), which is increasingly essential in densely populated or geographically vast regions where electricity must be transported over very long distances. The shift to large-scale renewable energy generation in remote areas drives growth in this category, as these high-voltage transformers help integrate large energy blocks into national grids. Additionally, energy demand growth in rapidly developing regions supports investment in UHV networks, helping to minimize transmission losses and ensuring reliable, high-capacity electricity supply to metropolitan centres.

Below 66 kV rated transformers is primarily used in distribution networks for local power delivery, where urbanization and expansion of residential areas drive demand. Increased electrification, especially in emerging economies, boosts requirements for distribution transformers. Growing demand for decentralized renewable energy sources like rooftop solar also supports this market segment, as these systems require lower voltage transformers to connect to local grids. Additionally, government initiatives aimed at rural electrification and improving access to reliable electricity continue to propel the deployment of  $\leq 66$  kV transformers.

As per Crisil Intelligence estimates, about 28,000- 30,000 units of total power transformers requirement are expected between fiscal 2025-29 in various sectors such as power generation, T&D, renewable energy, mobility sector, commercial & industrial segment, etc. The growth of power transformers in India is estimated at 26-27% between fiscal 2025-29.

**Figure 23: India voltage wise annual power transformer market outlook**



(P): Projected;

Source: Crisil Intelligence

### 3.2.2 Market segmentation by application

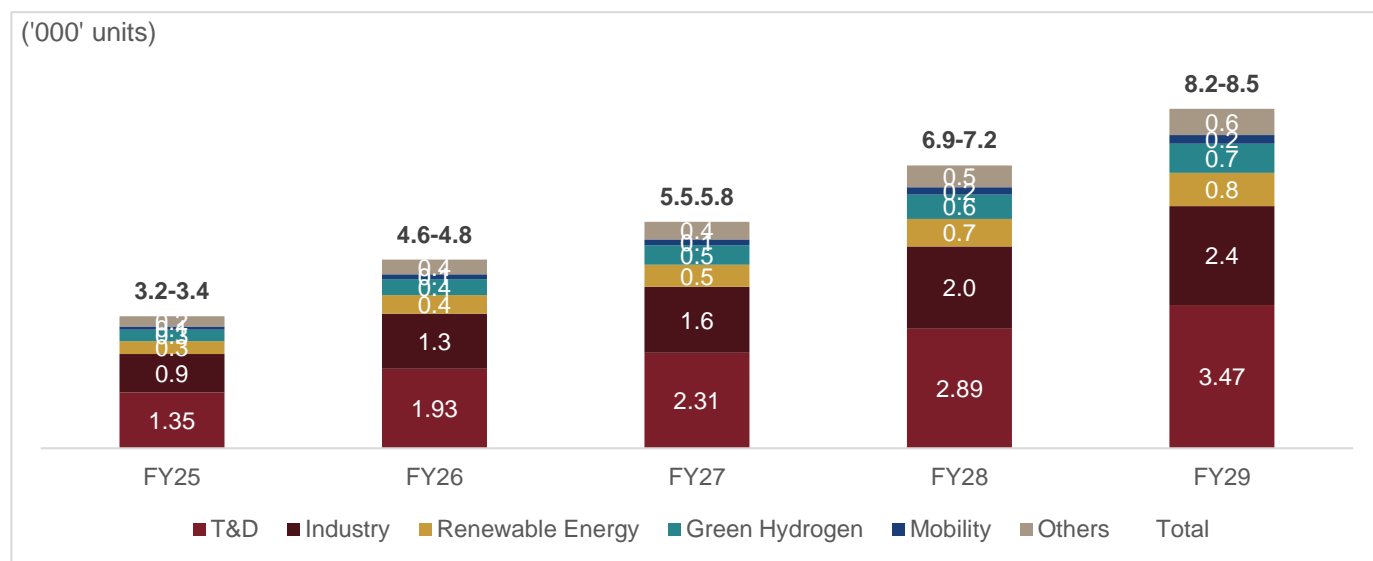
The domestic market for Power Transformers in India is segmented primarily by applications driven by the country's diverse industrial and infrastructure requirements. Major application areas include transmission & distribution (T&D), renewable energy, mobility sectors and specialized uses in the manufacturing industry for captive power and other purposes. Each segment is shaped by specific demands, technological requirements and government policies.

In the T&D sector, Transformers play a pivotal role in the National Grid supporting the high voltage transmission of electricity over the vast distances and then subsequent distribution to urban and rural areas. Power transformers in this sector are set to grow due to government schemes. Additionally, the utility sector is a major growth driver, supported by government investments in grid modernization, renewable energy integration, and rural electrification projects. Large-scale utility projects, particularly renewable energy installations like solar and wind farms, are spurring the need for high-capacity transformers capable of managing fluctuating power loads. These varied applications underline the critical role of power transformers in supporting India's economic growth and energy transition.

The industrial sector is witnessing significant growth due to advancements in manufacturing, railways, and other energy-intensive industries, requiring high-capacity transformers for consistent power supply. The Indian Railways has committed to 100% electrification as part of its objective of being a net zero carbon emitter by 2030. The capacity addition pertaining to the electrification, gauge conversion and new line addition, high speed rail corridors, addition of metro rail lines across India would increase the transformer demand in the medium term.

The industrial sector is witnessing significant growth due to advancements in manufacturing, and other energy-intensive industries, requiring high-capacity transformers for consistent power supply. The increasing demand for steel and other metals in various industries, as well as the growing adoption of electric arc furnaces over traditional methods, are key factors driving the market growth.

**Figure 24: India application wise annual power transformer requirement outlook**



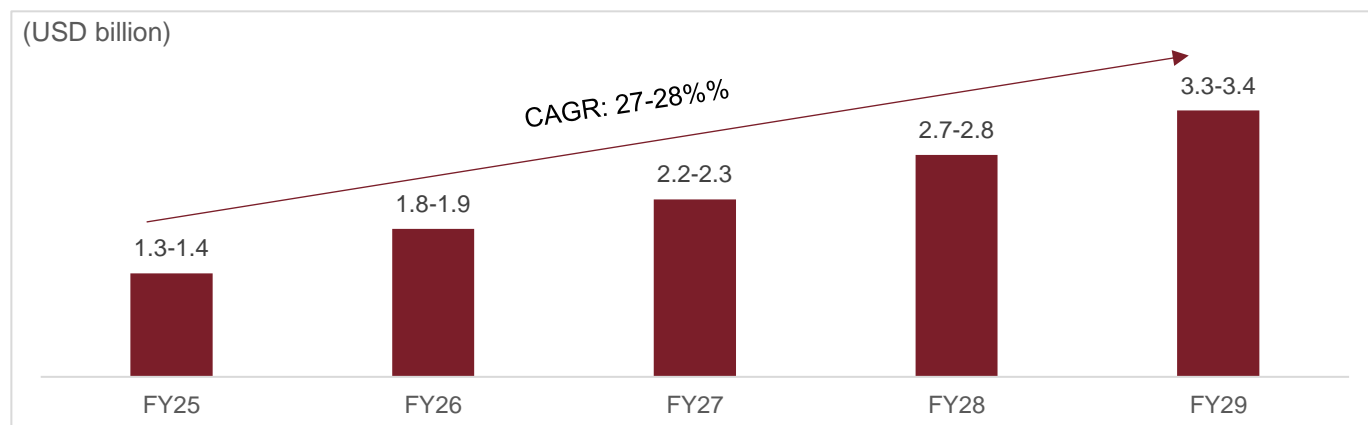
(P): Projected;

Source: IEEMA, Crisil Intelligence

### 3.2.3 Total market size in value

India's power transformer market has consistently expanded in terms of installed capacity, reflecting the growing demand for electricity and the government's commitment to infrastructure development. Total domestic power transformer market is estimated to reach USD 3.5 billion by fiscal 2029. This growth is fueled by investments in renewable energy, industrialisation, urbanization, and rural electrification programs. The annual growth rate of ~8.4% highlights the rising focus on improving transmission efficiency and addressing India's electricity deficit.

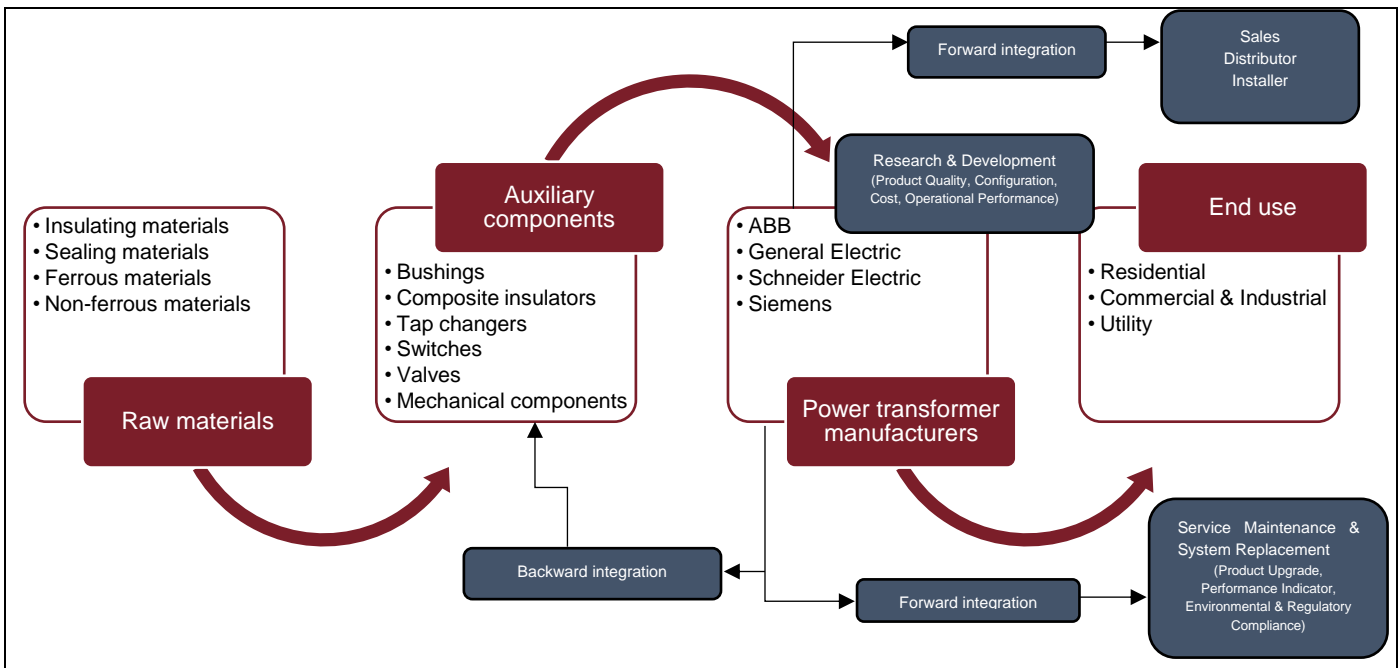
**Figure 25: India market size of power transformers**





Source: Global Market Insights, Crisil Intelligence

### 3.3 Value chain analysis



Source: Global Market Insights, Crisil Intelligence

Power transformers are essential electrical devices used to transfer electrical energy between circuits through electromagnetic induction. They play a critical role in altering alternating voltage levels for power applications by either stepping up or stepping down the voltage. The power transformer value chain begins with sourcing raw materials, which primarily include copper, steel, insulation materials, transformer oils, and other critical components like bushings and tap changers. Copper and aluminum are essential for transformer windings, while steel is used in core construction to enhance magnetic properties and reduce losses. Insulation materials and oils are used to prevent short circuits and manage heat within the transformer.

The power transformer market ecosystem includes raw material and component suppliers, manufacturers, distributors, and end-users. Key components used in transformer manufacturing include copper, aluminum, iron/steel, bushings, radiators, composite insulators, oil, switches, breathers, relays, and valves. These components are vital throughout the value chain, accounting for over 60% of the total transformer cost. Fluctuations in the prices of these materials can significantly affect the overall revenue of the power transformer market.

Manufacturers and assemblers integrate these components and assemble them based on specific requirements. In many cases, there is forward integration, with component suppliers working directly with manufacturers and manufacturers engaging with distributors. Power transformers are widely used across various sectors, including utilities, residential, commercial, and industrial applications.

Power transformers serve various end-users, including utilities, industrial facilities, commercial buildings, and renewable energy installations. The usage conditions vary significantly across these applications, with some requiring high voltage capacity and others needing specialized cooling or insulation solutions. Feedback from these end users is essential in the value chain, as it helps manufacturers innovate and refine product offerings to meet evolving needs. Additionally, the market is dominated by prominent players like Hitachi ABB Power Grids, GE, Siemens, and Schneider Electric. However, numerous regional and smaller companies also have a strong presence in several countries, thanks to their robust distribution networks.

## 4 Specialty Transformers Market Overview

### 4.1 Key segments by product type

#### 4.1.1 Furnace Transformer

- Furnace transformers are used to feed electric furnace for melting and refining materials. Furnace transformers are associated with very high secondary currents and wide output voltage regulation in order to cope with the furnace needs in the steel and cement industries. These transformers are designed to resist the high levels of electrical, thermal and mechanical stresses to which they are subject to during utilization.
- The furnace transformer is specially designed to withstand frequent short circuits on the secondary side. Currents drawn in the arc furnace are characterised by wide fluctuations and unbalanced conditions, leading to voltage drops, harmonics, etc. These effects can be reduced by supplying furnaces directly from a high capacity, high voltage transmission line through a furnace transformer.
- There are different types of furnace transformers such as Arc Furnace, Submerged Arc Furnace, Ladle Furnace and Induction Furnace. Arc Furnace demand for steel in sectors like construction and automotive has driven the adoption of electric arc furnace (EAF) technology. EAF transformers are crucial for providing the high power needed for the electric arc process, supporting market growth.
- Continuous improvements in EAF technology, including the development of more efficient transformers, have reduced energy consumption and operational costs. Innovations focus on higher energy efficiency and lower maintenance requirements, making these transformers more attractive.
- With a rise in scrap-based steel production, particularly in emerging economies, the need for reliable and efficient EAF transformers is increasing. These transformers are pivotal in managing the high voltage fluctuations typically in scrap-based steel production.
- EAF technology is seen as more environmentally friendly compared to traditional blast furnaces, generating less CO<sub>2</sub>. This shift is promoting the use of EAF transformers in the steel industry as part of sustainability efforts

#### 4.1.2 Rectifier duty transformer

- Rectifier Duty Transformers, also known as pulse transformers, are designed to handle non-linear, non-sinusoidal loads resulting from their use with a variety of power electronic applications. These are classified based on rectification system they support and their design from 6, 12, 24, 36, 48, or 60 pulse configurations.
- These transformers act as a link between the grid and the AC-DC converters. It provides the required number of phases, voltage shifts needed to realize the conversion and to adjust the rectifier input to vary the DC output voltage.
- They are usually used in various applications such as electrolysis process, aluminium smelting, graphitizing etc. India's green hydrogen mission to achieve 5 MMTPA of production by 2030 would require electrolyzers, which is the core component in green hydrogen production, operate on DC power. It requires power conditioning to feed electrolyzers, which is driving demand for specialised transformers designed for rectification.
- The growing electrochemical industries, particularly in the production of aluminum and chemical processes as well, are driving demand for rectifier transformers due to their crucial role in providing stable DC power for electrolysis processes.

- Advances in transformer design, such as the introduction of high-efficiency and compact models, have contributed to the wider adoption of rectifier transformers in industries requiring precise power conversion.

#### 4.1.3 Inverter duty transformer

- These are used to transfer electrical energy without changing the frequency and are mostly suitable for solar and wind applications. They are specialised, high-efficiency transformers with high overload capability, reduced noise and vibration levels, designed for RE applications, VFDs.
- As the inverter converts direct current to alternating current at a lower voltage, this kind of transformer is used to step up this voltage to a higher voltage level. Inverters usually produce high-frequency signals that are difficult for regular transformers to handle, it is built to handle high-frequency and high-voltage transmissions transmitted by inverters.
- Inverter transformers are essential for solar and wind power plants to convert DC into AC for grid integration. As the renewable energy sector grows, the demand for inverter transformers has surged.
- The rise in electric vehicle adoption is pushing the demand for inverter transformers, which are used in charging stations and EV power systems to ensure smooth DC to AC conversion for efficient charging.
- With advancements in inverter technology, such as the development of more compact, efficient, and reliable inverters, inverter transformers are evolving. These transformers are increasingly being designed to handle higher power outputs and improve overall system efficiency.
- As battery energy storage systems (BESS) become more widespread, the need for inverter transformers has risen. They play a critical role in managing the DC power from storage units and converting it into AC for distribution.

#### 4.1.4 Phase Shifting transformers

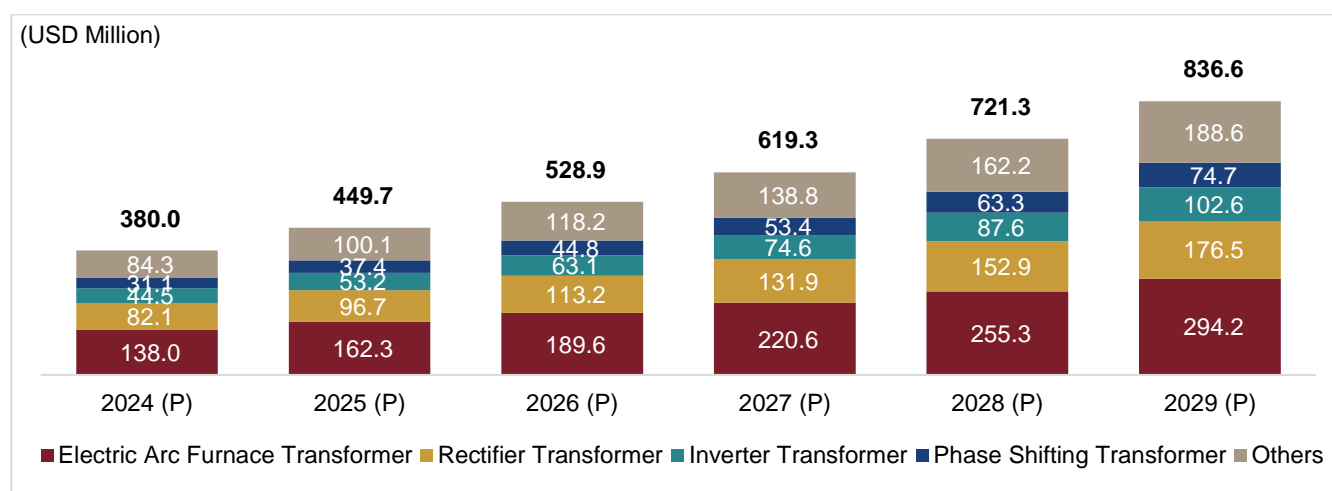
- Phase shifting transformers (PSTs) are used to enhance grid stability by controlling the flow of active and reactive power. As grid interconnections increase and more renewable energy sources are integrated, the demand for PSTs has risen to manage power flows more efficiently.
- The growing penetration of renewable energy in the power grid requires more flexible power flow management. PSTs help to stabilize power systems by adjusting phase angles between transmission lines, which is crucial for integrating intermittent renewable energy sources.
- Phase shifting transformers are part of the FACTS systems, which are becoming more essential as utilities seek to increase grid capacity and reliability. The need for such systems is pushing the demand for PSTs in power transmission networks.
- Research into improving the efficiency and size of phase shifting transformers, such as the development of digital PSTs and those capable of handling higher voltage levels, is fueling growth in the market, allowing for better integration with modern electrical grids.

#### 4.1.5 Others

- Specialty transformers such as high-voltage transformers, isolation transformers, and distribution transformers for specific industries (e.g., oil & gas, chemical, and mining) are experiencing increased demand. These sectors require transformers designed for unique operational conditions, pushing growth in the specialty transformer market.
- With the increasing need to expand power distribution into rural and remote areas, specialty transformers are being designed to withstand harsh environmental conditions. This market is growing as governments and companies invest in infrastructure development.

- Many industries are seeking custom-built specialty transformers tailored to specific power requirements. These transformers often find use in smaller-scale applications, from laboratory setups to small industrial plants, driving demand for specialized designs and higher customization.
- As industries increasingly demand long-lasting, energy-efficient transformers with low maintenance requirements, manufacturers are focusing on durable materials, advanced cooling systems, and improved efficiency to meet these needs, further driving the growth of specialty transformers.

**Figure 26: Global product type wise specialty transformer market outlook**



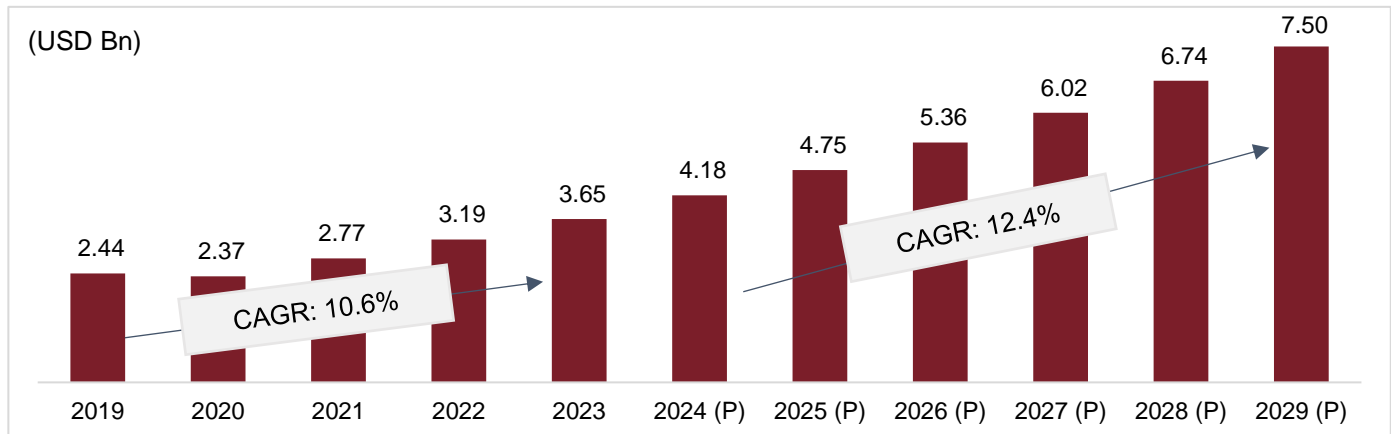
(P): Projected;

Source: Global Market Insights, Crisil Intelligence

## 4.2 Global Specialty Transformers market

The global specialty transformer market has witnessed a growth of ~10.6% (CAGR for 2019-2023). The specialty transformer market is experiencing rapid growth due to innovations across various industries. The shift towards renewable energy sources, such as solar and wind power, has created a need for customized transformers that can handle specific voltage and load requirements. The expansion of electric vehicle charging infrastructure has also driven demand for high-capacity specialty transformers that ensure reliability and efficiency. Furthermore, the adoption of smart transformers with IoT capabilities and remote monitoring is on the rise, improving energy management and reducing downtime in digital substations. Specialty transformers are also being increasingly used in industrial applications, such as data centers and oil & gas operations, due to their ability to meet specific voltage and environmental requirements. The focus on sustainability has led to the development of eco-friendly transformer designs, featuring low-loss cores and biodegradable oils. Finally, the rapid urbanization and infrastructure development in emerging economies have increased demand for compact and customized transformer solutions in utilities and commercial buildings, solidifying their importance in modern energy systems. The global specialty transformer market is expected to grow at a CAGR of 12.4% by 2029 (CAGR for 2024-2029).

**Figure 27: Global market size of specialty transformers**



Source: Global Market Insights, Crisil Intelligence

### 4.2.1 Growth drivers and restraints in the global market

The specialty transformers market is experiencing rapid growth and transformation, fueled by innovations in technology, rising industrial needs, and a worldwide transition towards environmentally friendly energy systems. The market is fueled by several key factors:

#### Growth Drivers:

- **The Rising Demand for Renewable Energy**
  - As governments and private companies globally pour investments into renewable energy sources like solar and wind power, specialty transformers have become a crucial component in connecting these sources to the grid. This is because they enable efficient transmission and distribution of energy. The demand for specialty transformers is particularly high in regions such as North America, Europe, and Asia-Pacific, where renewable energy projects are experiencing rapid growth and expansion.
- **Industrial Automation and Smart Technologies**
  - The rise of Industry 4.0 has triggered a surge in demand for specialized transformers that can support the power requirements of advanced automation systems, robotics, and IoT-integrated grids. These transformers offer precise energy management and enhanced reliability, making them a vital component in contemporary industrial infrastructure.
- **Urbanization and Infrastructure Development**
  - The rapid growth of cities in developing economies has led to a significant increase in energy consumption, driving up demand for specialty transformers. These transformers are critical components in powering large-scale infrastructure projects, including commercial developments, public utilities, and other urban facilities, ensuring reliable and efficient distribution of electricity to meet the growing needs of these areas.
- **Aging Power of Infrastructure in Developed Markets**
  - In regions such as North America and Europe, aging power grids and transformers are being replaced with advanced, energy-efficient models to meet modern performance and sustainability standards.

#### Restraints:

Despite its promising outlook, the specialty transformers market is not immune to certain challenges that could potentially slow down its growth trajectory. Some of the key obstacles that the industry needs to navigate include:

- **Variable Input Costs:**
  - The prices of essential materials like copper, aluminium, and silicon steel can fluctuate wildly, exerting upward pressure on production expenses and squeezing profit margins.
- **Global Supply Chain Instability:**
  - Geopolitical tensions, pandemics, and other disruptions can cause delays in the delivery of critical components and finished products, leading to increased costs, prolonged project timelines, and reduced customer satisfaction.
- **Prohibitive Upfront Investments:**
  - The high initial costs associated with specialty transformers can be a significant barrier to adoption, particularly in markets where cost sensitivity is a major concern.
- **Skilled Workforce Shortages:**
  - The design, manufacture, and maintenance of specialty transformers require highly specialized skills, which can be in short supply in certain regions, limiting production capacity, quality, and ultimately, market growth.

To succeed in the competitive specialty transformers market, manufacturers and stakeholders must prioritize the strategic imperatives. This involves investing in research and development to create cutting-edge, IoT-enabled transformers that cater to diverse industry needs, as well as targeting emerging markets in Latin America, Africa, and Asia-Pacific to capitalize on their growing infrastructure and industrial demands. Additionally, adopting eco-friendly materials and processes that align with global sustainability goals can boost brand reputation and market share. Finally, forming partnerships with renewable energy developers, industrial equipment manufacturers, and governments can secure long-term contracts and ensure a steady revenue stream, ultimately driving business growth and success.

#### 4.2.2 Market segmentation by geography

##### Latin America

- Countries like Brazil, Chile, and Mexico are leading renewable energy adoption in Latin America, driving demand for specialty transformers tailored to renewable applications. These transformers support efficient energy conversion and transmission in wind and solar farms, contributing to the region's sustainable energy goals.
- Efforts to modernize aging grid infrastructure and improve power reliability are encouraging investments in advanced transformer solutions. Specialty transformers with real-time monitoring and control capabilities are becoming essential for reducing power losses and enhancing grid efficiency.
- Expanding industrial bases in sectors like mining, automotive, and agriculture are fueling the demand for high-performance specialty transformers. These sectors require transformers with custom specifications to meet specific operational demands and ensure optimal energy usage.
- Growing cross-border electricity trade is increasing the need for transformers designed for high voltage transmission networks. These transformers facilitate efficient power transfer across countries, strengthening the regional power grid and enabling greater energy integration.

##### North America

- The increasing adoption of smart grid infrastructure and energy-efficient solutions is fostering innovation in specialty transformers. Advanced features, such as improved insulation materials, enhanced cooling



systems, and integration with digital monitoring technologies, are being widely incorporated to comply with stringent efficiency standards and support grid modernization initiatives.

- Rising investments in renewable energy projects, particularly in wind and solar farms, are driving the demand for custom-designed specialty transformers. These transformers are crucial for efficient energy conversion, such as step-up transformers for solar power plants and specialized units for wind turbines, ensuring seamless integration with the existing grid.
- Urban expansion and the need to modernize aging grid infrastructure are creating robust demand for specialty transformers in commercial and industrial sectors. These transformers are increasingly used in high-demand applications, including data centers, healthcare facilities, and manufacturing plants, where reliability and efficiency are critical.
- Government regulations, such as the Department of Energy (DOE) efficiency standards, are pushing manufacturers toward eco-friendly solutions. Transformers with reduced energy losses, biodegradable insulation oils, and lower carbon footprints are gaining traction as utilities and industries strive to meet environmental goals.

### **Asia Pacific (APAC)**

- Massive urbanization and industrialization across countries like China and India are escalating the demand for specialty transformers. These transformers are critical for meeting the energy needs of expanding cities, industrial parks, and infrastructure projects, especially in construction, manufacturing, and transportation sectors.
- The region's rising electricity consumption, driven by economic growth and population expansion, is encouraging investments in advanced transformer technologies. Specialty transformers designed for high reliability and efficiency are essential for optimizing transmission and distribution networks.
- Asia-Pacific leads global renewable energy capacity additions, significantly boosting the demand for transformers suited for solar, wind, and hydropower projects. Customized solutions are often required to address specific environmental and operational challenges in these applications.
- Government initiatives promoting grid modernization and rural electrification are accelerating the adoption of advanced transformer solutions. Policies encouraging renewable energy development, coupled with substantial investments in grid infrastructure, are key drivers of market growth.
- Government of India in its NDC target has committed to reduce the emissions intensity of its GDP by 45% by 2030 from 2005 level and to increase the share of non-fossil power capacity to 50% by 2030 by adding 500 GW of non-fossil-based capacity.

### **Europe**

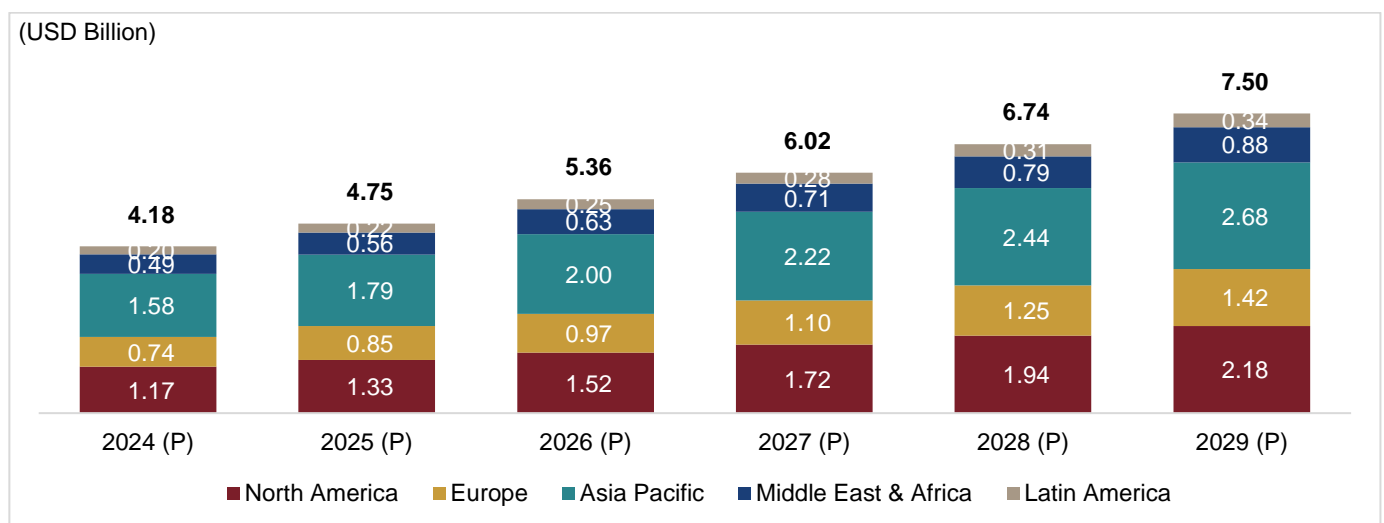
- The EU's ambitious energy transition and climate targets, including achieving net-zero emissions by 2050, are driving demand for specialty transformers tailored for renewable energy generation and storage. These transformers support wind, solar, and energy storage systems, ensuring efficient power conversion and grid stability.
- The rapid deployment of smart cities and advanced grid solutions is increasing the need for digital specialty transformers equipped with sensors and IoT capabilities. Countries like Germany, the UK, and France are leveraging these transformers for real-time monitoring and optimization of power distribution networks.
- Growth in cross-border electricity trade and the expansion of HVDC systems are fueling demand for high-performance specialty transformers. These transformers are designed to handle higher voltage levels and ensure minimal energy loss over long distances, crucial for linking renewable energy sources across nations.

- Environmental regulations are prompting manufacturers to adopt green technologies. Features such as biodegradable insulation oils, noise reduction designs, and energy-efficient operations align with Europe’s sustainability goals and attract widespread adoption.

**Middle East & Africa (MEA)**

- The region's reliance on the oil and gas sector underpins the demand for explosion-proof and highly durable specialty transformers. These transformers are essential for ensuring operational safety and reliability in hazardous environments like refineries, offshore platforms, and processing plants.
- Renewable energy projects are gaining momentum, particularly in countries like Saudi Arabia and the UAE, which are heavily investing in solar and wind power. Specialty transformers, customized for harsh environmental conditions such as extreme heat and sand exposure, play a pivotal role in these developments.
- Expanding industrial activities, including petrochemicals, mining, and manufacturing, are driving demand for high-capacity specialty transformers. These industries require transformers with enhanced cooling and high thermal stability to support energy-intensive operations.
- Africa’s electrification goals, backed by international funding and government initiatives, are spurring investments in specialty transformers for remote and off-grid applications. These transformers enable efficient power delivery in rural areas, contributing to the region’s socioeconomic development.

**Figure 28: Global region wise specialty transformer market outlook**



(P): Projected;

Source: Global Market Insights, Crisil Intelligence

### 4.3 Domestic Specialty Transformers Market

#### 4.3.1 Growth drivers, restraints, and success factors

##### Growth Drivers

- **Increasing investments in renewable energy projects**

India’s renewable energy sector is experiencing unprecedented growth, driven by the government’s commitment to reducing carbon emissions and increasing the share of clean energy in the power mix. The target of achieving 500 GW of non-fossil fuel-based capacity by 2030 has catalyzed large-scale investments in solar, wind, and hybrid energy projects. The Indian government’s Interim Budget for 2024-2025 allocated USD 1.02 billion for solar power grid

infrastructure, up from \$0.60 billion the previous year. Moreover, the Green Hydrogen Mission and the Strategic Interventions for Green Hydrogen Transition (SIGHT) Program received USD 2.10 billion, which further proliferates the market statistics. The research agency ICRA projects India's installed renewable energy capacity will reach about 170 GW by March 2025, up from 136.57 GW in December 2023, which in turn will augment the demand for these transformers in the coming years. Specialty transformers play a critical role in renewable energy infrastructure, as they are designed to handle the unique challenges posed by renewable energy sources, such as variable power generation and harmonic distortion.

Step-up transformers, for instance, are essential in solar and wind power plants to elevate the voltage of the electricity generated for transmission to the grid. Additionally, inverter duty transformers are crucial for mitigating harmonics and ensuring smooth integration with grid networks. The Indian government's flagship programs, such as the National Solar Mission and state-level renewable energy initiatives, are further driving the demand for these specialized products.

Private sector investments in utility-scale solar farms, offshore wind farms, and distributed renewable systems are on the rise, boosting the need for efficient and reliable specialty transformers. Furthermore, initiatives like the Green Energy Corridor, which focuses on strengthening the transmission infrastructure for renewable power, emphasize the importance of advanced transformer technology. As renewable energy adoption expands to remote and challenging terrains, there is also growing demand for compact, lightweight, and robust transformer solutions. The increasing penetration of renewable energy in India's energy landscape is a significant growth driver for the specialty transformer market. By supporting the integration of variable renewable energy sources into the grid and enabling efficient power transmission, these transformers are indispensable for achieving India's clean energy goals.

- **Rapid industrialization and infrastructure development**

India's ongoing industrialization and infrastructure development are pivotal in shaping the specialty transformer market. As the nation strives to become a global manufacturing hub under initiatives like "Make in India," the demand for industrial-grade transformers is increasing. Specialty transformers are critical for powering heavy machinery, industrial processes, and customized applications across sectors such as steel, cement, oil & gas, and manufacturing.

Furnace transformers, for example, are indispensable in industries like steel and aluminum, where they power high-temperature operations like arc furnaces and smelters. Similarly, rectifier transformers are widely used in processes requiring DC power, such as electrolysis in the chemical and metallurgy industries. The growth of these industries directly correlates with the demand for specialty transformers tailored to their specific needs.

Infrastructure projects, including metro rail expansions, highways, airports, and smart cities, also drive market growth. Metro systems require traction transformers to ensure efficient and reliable operation of rail networks. India's urbanization is further boosting the demand for energy-efficient, compact transformers suited to dense urban environments.

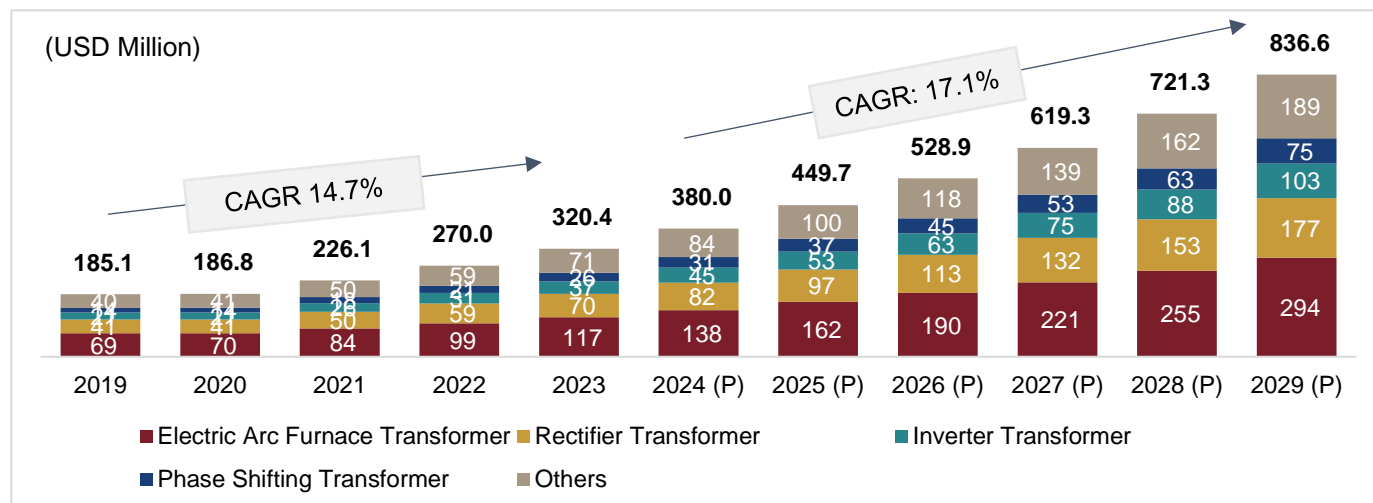
Government-backed programs such as the National Infrastructure Pipeline (NIP), aimed at attracting investments across multiple sectors, add momentum to this growth. Additionally, with rising industrial automation and the adoption of advanced manufacturing technologies, the need for transformers with high precision, reliability, and digital monitoring capabilities is increasing. Therefore, rapid industrialization and infrastructure development are key drivers of the specialty transformer market in India. The sector's growth is fueled by both public and private investments, underscoring the critical role of specialized transformers in meeting the nation's industrial and infrastructural power demands. This trend is expected to sustain as India continues its journey toward economic expansion and technological advancement.

### **4.3.2 Total market size in quantity and value**

The global specialty transformer market has witnessed a growth of ~14.7% (CAGR for 2019-2023). The country's rapid industrialization, urbanization, and increasing focus on renewable energy have created a huge requirement for specialized transformers that can cater to specific application needs. As a result, the domestic specialty transformers

market in India has been experiencing steady growth, driven by the need for efficient, reliable, and customized transformer solutions. The specialty transformer market in India is expected to grow at a CAGR of 17.1% until 2029 (CAGR 2024-2029).

**Figure 29: India historical market size and outlook of specialty transformers**



(P): Projected;

Source: Global Market Insights, Crisil Intelligence

### 4.3.3 Indian specialty transformers market split between exports and imports

India's trade dynamics in the specialty transformer sector are influenced by its rapid industrialization, electrification initiatives, and infrastructure development. Specialty transformers, including those used in specific applications like industrial machinery, railways, renewable energy systems, and medical equipment, play a crucial role in supporting the country's growing energy and industrial needs. Here is an in-depth analysis of the imports and exports of specialty transformers in India:

#### Imports of specialty transformers

India imports specialty transformers to meet the demands of advanced applications where domestic manufacturing capabilities are still developing. Key factors driving imports include:

##### Advanced technologies and applications

- Indian manufacturers primarily focus on standard transformers, leaving a gap in high-tech specialty transformers for applications like healthcare (MRI and X-ray equipment), renewable energy (solar inverters), and specialized industrial uses.
- Imported transformers from technologically advanced countries like Germany, Japan, South Korea, and the United States cater to these needs
- **Major import partners**
  - China: A significant supplier of cost-effective specialty transformers for industrial automation and renewable energy.
  - Germany and Japan: Known for high-quality, precision-engineered transformers for medical and specialized industrial applications.
  - United States: Supplies advanced products for defense and high-end industrial requirements.
- **Key applications**
  - Renewable energy integration, especially inverters and step-up transformers for solar and wind power.
  - Specialized machinery in industries like automotive, electronics, and heavy manufacturing.

- **Challenges**
  - Dependence on imports for certain high-tech products increases the trade deficit.
  - High import duties and logistical costs affect affordability for local buyers

## Exports of specialty transformers

India's exports of specialty transformers have grown as local manufacturers enhance their production capabilities and explore international markets. Key highlights include:

- **Growing export base**
  - Indian companies are leveraging cost advantages to supply competitive products to emerging markets in Asia, Africa, and South America.
  - Exported products primarily include dry-type transformers, instrument transformers, and products for renewable energy applications.
- **Key export destinations**
  - Middle East and Africa: Growing demand for transformers driven by electrification projects.
  - Southeast Asia: Rapid industrialization and renewable energy projects boost imports from India.
  - Europe and North America: While smaller in volume, niche high-quality products are finding acceptance in these markets.
- **Competitive advantages**
  - Cost-effective manufacturing combined with skilled labor and improved production standards.
  - Government support through various policies and export promotion schemes
- **Challenges**
  - Stringent quality and safety standards in developed markets.
  - Limited brand recognition of Indian manufacturers compared to established global players.

## 4.4 India- Shunt reactor market

Shunt reactors (bus reactors or line reactors) are connected to the transmission system for reactive power compensation in long high voltage power transmission lines and cables. These are also capable of controlling the dynamic over-voltage occurring in the system due to load rejection.

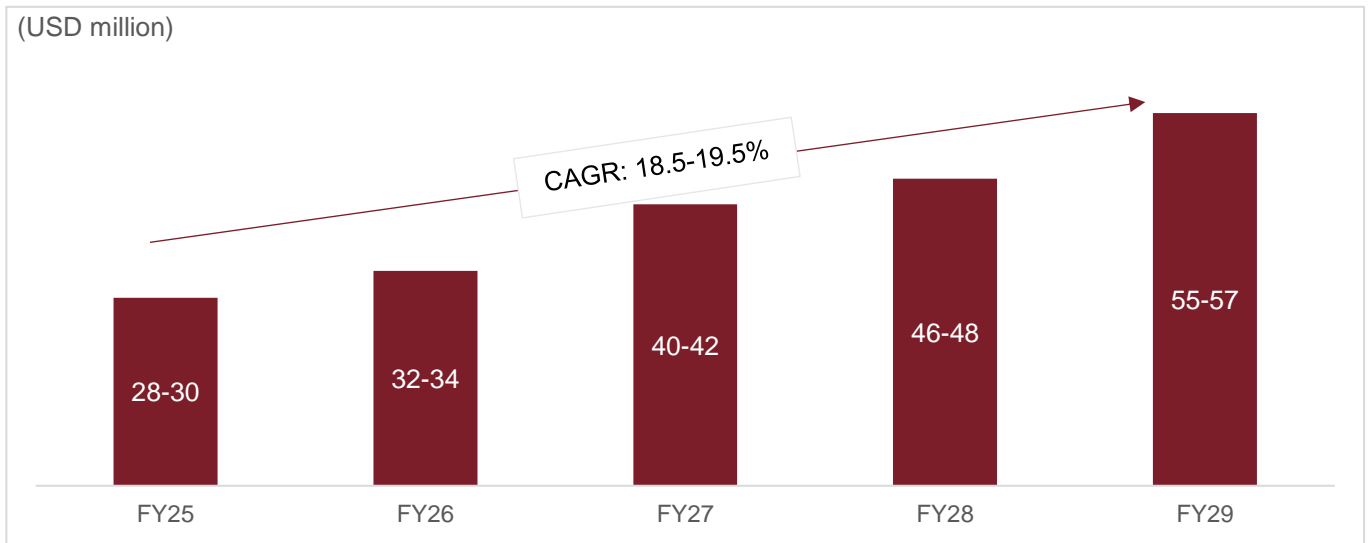
Shunt reactors increase the efficiency in overhead lines by absorbing the reactive power and also improve voltage stability within the desired limits at low loads. Variable shunt reactors are beneficial in renewable energy system like wind and solar energy. Compared to conventional power. These RE projects can experience reactive power imbalance due to long transmission distance (projects are often located in remote areas), unpredictable and fluctuating active power.

Further, modern grids have strict requirements for power quality and voltage control. Shunt reactors enable power system to comply with grid codes by ensuring proper reactive power management. It also reduces the transmission losses, enhance system capacity and provides equipment protection by mitigating overvoltage.

As per CEA's National Electricity Plan, the infrastructure addition pertaining to reactors between fiscal 2022-27 is about 123 GVAR and 61 GVAR from 2028-32 including bus and line reactors for 400 kV and 765 kV. Furthermore, as per CEA's report on Transmission system for Integration of 500 GW RE capacity by 2030, the reactive power compensation capacity addition of 67.5 GVAR has been envisaged until 2030.

As per the planned requirements, the shunt reactor market is expected to grow at a CAGR of 18.5-19.5% between fiscal 2025-29 and reach to about USD 55-57 million by fiscal 2029.

**Figure 30: Shunt reactor market forecast**



Source: CEA, Crisil Intelligence



## 5 Distribution transformers market overview

### 5.1 Introduction

The rapid urbanization and expanding rural electrification programs, especially in developing regions, are driving the demand for distribution transformers. These transformers play a vital role in bringing electricity from high-voltage transmission lines to residential and commercial end-users, supporting infrastructure expansion and economic development.

Distribution transformers are essential for integrating renewable energy sources, such as solar and wind, into the grid at localized levels. As governments and utilities focus on clean energy solutions, the demand for distribution transformers capable of handling fluctuating loads increases, further supported by subsidies and incentives.

In mature markets, many existing distribution transformers are reaching the end of their operational life. As a result, there is a strong push for replacement and upgrades to newer, more efficient models. This replacement cycle is critical to enhancing reliability and reducing transmission losses.

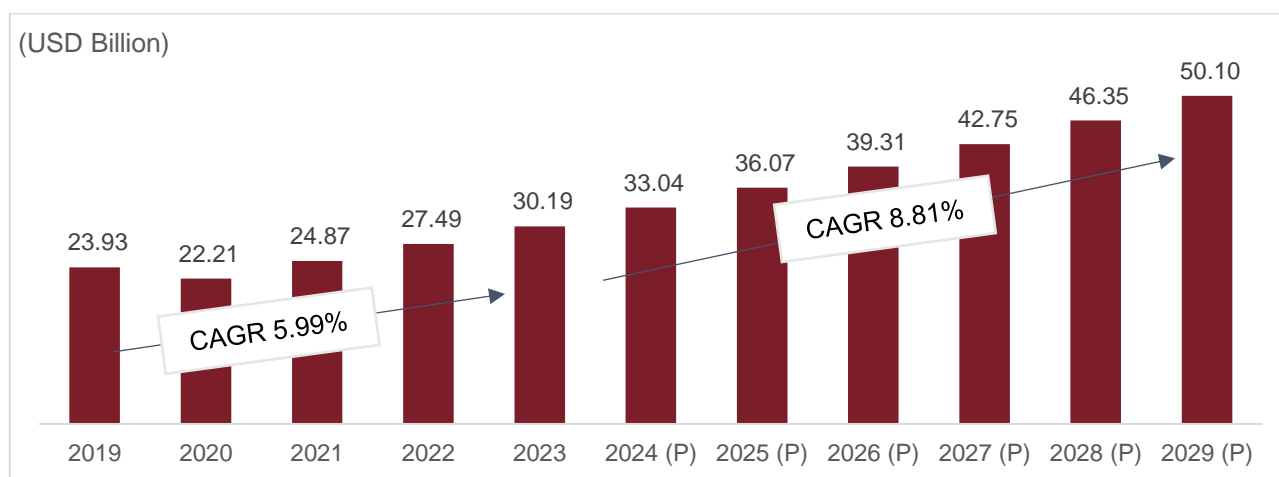
With the rise of smart grid infrastructure, there is a need for intelligent, efficient distribution transformers. These transformers support advanced monitoring and control, allowing utilities to improve load management, reduce outages, and respond swiftly to power demand variations.

### 5.2 Overview of global distribution transformer market

#### 5.2.1 Total market size in quantity and value

The global distribution transformer market has witnessed a growth of ~6% (CAGR for 2019-2023) supported by rise in demand for electricity. Urbanization and expansion of residential areas drive demand for distribution transformers. Increased electrification, especially in emerging economies, boosts requirements for distribution transformers. Growing demand for decentralized renewable energy sources like rooftop solar also supports this market segment, as these systems require lower voltage transformers to connect to local grids. Additionally, government initiatives aimed at rural electrification and improving access to reliable electricity continue to propel the deployment of distribution transformers. The global distribution transformer market is expected to grow at a rate of ~8.8% (CAGR for 2023-2029) supported by increased demand.

**Figure 31: Global market size of distribution transformers**



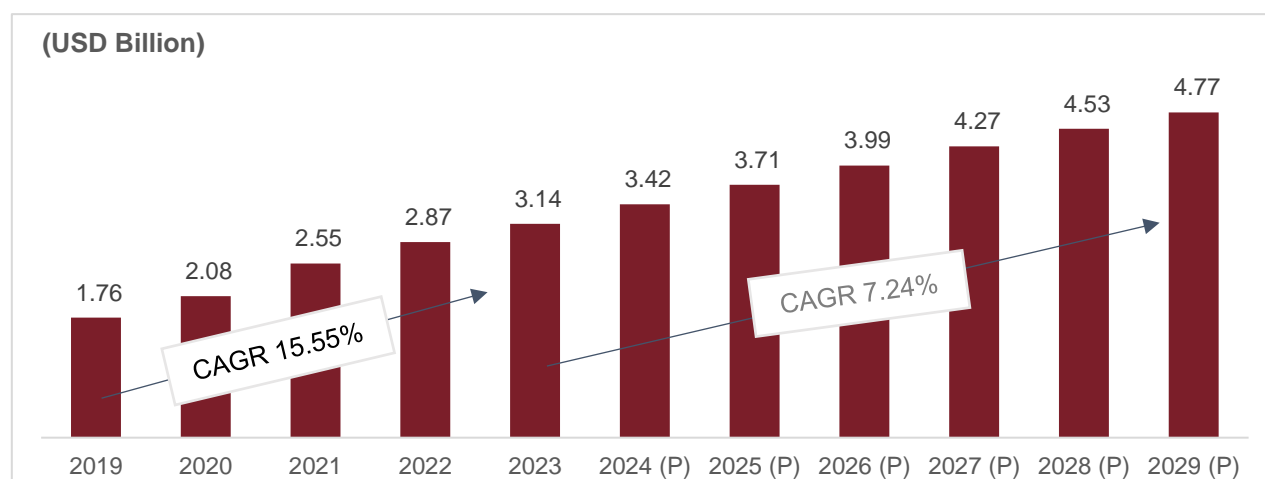
Source: Global Market Insights, Crisil Intelligence

## 5.3 Overview on Indian distribution transformer market

### 5.3.1 Total market size in quantity and value

The Indian distribution transformer market size is valued at USD ~3.14 billion registering a growth of more than 15% (CAGR 2019-2023). Increasing demand for power, rapid urbanisation and industrialisation, government's initiative to achieve 100% electrification and rapidly growing economy driving the Indian distribution transformer market. The Indian distribution transformer market is expected to grow at a rate of ~7.2% (CAGR for 2023-2029) supported by increased demand.

**Figure 32: India market size of distribution transformers**



Source: Global Market Insights, Crisil Intelligence

Rising energy requirements from industries and the expansion of transmission and distribution networks, coupled with the growth of the renewable energy sector, are anticipated to propel the Indian distribution transformer market.

## 6 Assessment of transformer components industry

### 6.1 Overview of global market size

The rise in global electricity demand, driven by rapid urbanization, industrial growth, and population expansion, has necessitated significant grid expansion and modernization. Developing economies are particularly focused on enhancing their electricity distribution networks, which boosts demand for transformer components like bushings, cores, and windings. Additionally, increasing renewable energy integration requires transformers to efficiently transmit power generated from variable sources, further driving the need for advanced components.

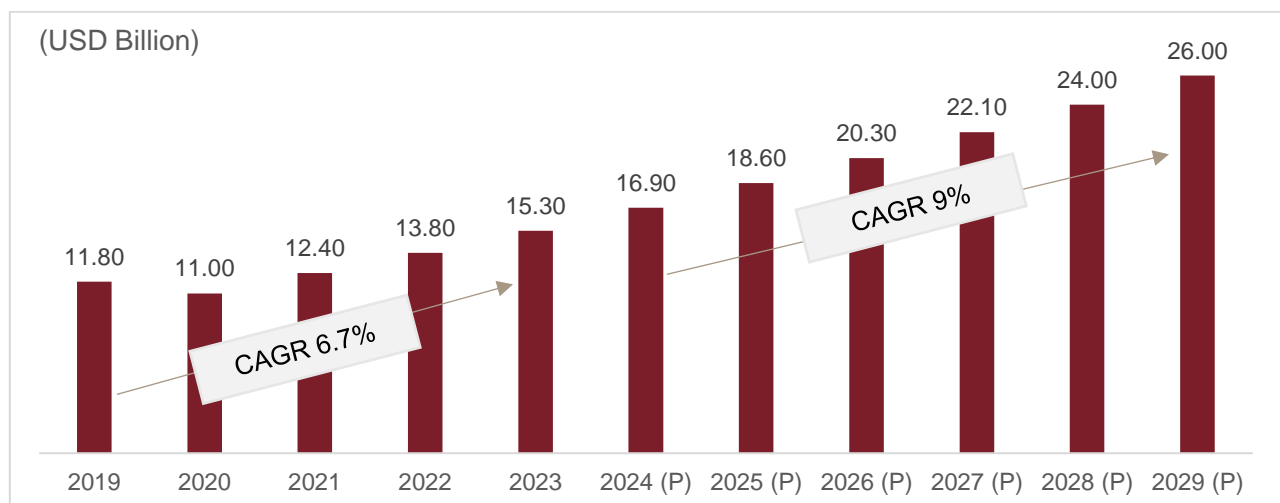
The shift towards smart grid technologies is a major growth driver for the transformer component market. Governments and utilities worldwide are investing in digital substations and advanced monitoring systems that require high-quality transformer components with integrated sensors and monitoring capabilities. These advancements enable real-time diagnostics, predictive maintenance, and improved energy efficiency, creating opportunities for manufacturers to supply innovative, smart components.

Stricter energy efficiency standards and environmental regulations are driving the adoption of transformers with reduced energy losses and lower carbon footprints. Transformer components, such as energy-efficient cores and eco-friendly insulating materials, are being developed to meet these requirements. Growing awareness of sustainability among industries and utilities is further propelling the demand for components that enhance transformer performance while adhering to environmental standards.

In developed markets, aging electrical infrastructure is a critical concern. Many transformers and their components have exceeded their operational lifespans, leading to frequent maintenance, upgrades, or replacements. Governments and utilities are allocating substantial budgets for the refurbishment of existing systems, creating a steady demand for replacement components. This trend is particularly prominent in regions like North America and Europe, where grid infrastructure modernization projects are underway.

Between 2019-23, the global transformer component market grown at a CAGR of 6.7% and reached USD 15.3 billion. It is expected to increase up to USD 26 billion between 2024 and 2029 at a CAGR of 9%.

**Figure 33: Global market size of transformer components**



(P): Projected; Source: Global Market Insights, Crisil Intelligence

## 6.2 Overview on Indian market

Unlike some of the developed countries, Indian transformer manufacturers have a low degree of backward integration making them rely heavily on component manufacturers for their production needs. This heavy dependence can increase costs and may affect the competitiveness of Indian manufacturers. Many large Indian transformer manufacturers have made significant strides in manufacturing high-voltage transformers domestically, yet the industry still faces challenges in achieving full backward integration.

Indian transformer manufacturers are heavily dependent on imports for critical components like electrical steel and insulation materials, which are primarily produced by global multinational corporations (MNCs). Many a times, these MNCs prioritize exports to the EU and US, where they can command better prices, leaving a void in the Indian supply chain and making it challenging for Indian manufacturers to access these essential components.

Since most of the products are fabricated as per the design given by transformer manufactures, the fabrication process can be easily scalable. However, due to shortage of skilled workforce, the Indian transformer Industry faces challenges in scaling up and there is restricted scaling up. The labour shortage can limit growth potential of Indian transformer manufacturers and hinder their ability to meet increasing demand.

The Indian market for transformer components, including parts of electrical transformers and inductors, is significant, reflecting the country's role as a global participant in the power and electronics industries. In 2022, India exported USD 468 million worth of these components, ranking it the 6th largest exporter globally. Key export destinations include the United States, Kuwait, and Oman, with notable growth in markets like Kuwait. Concurrently, India imported USD 538 million worth of components, primarily from China, Germany, and Vietnam. This trade highlights India's dual role as both a producer and consumer in the transformer component market.

India's ambitious programs like Saubhagya (Pradhan Mantri Sahaj Bijli Har Ghar Yojana) and the Deen Dayal Upadhyaya Gram Jyoti Yojana have accelerated rural electrification, driving the demand for transformers and their components. The push to provide electricity to the most remote areas requires the installation of new transformers and upgrading existing infrastructure, boosting the market for components like bushings, tap changers, and insulation materials.

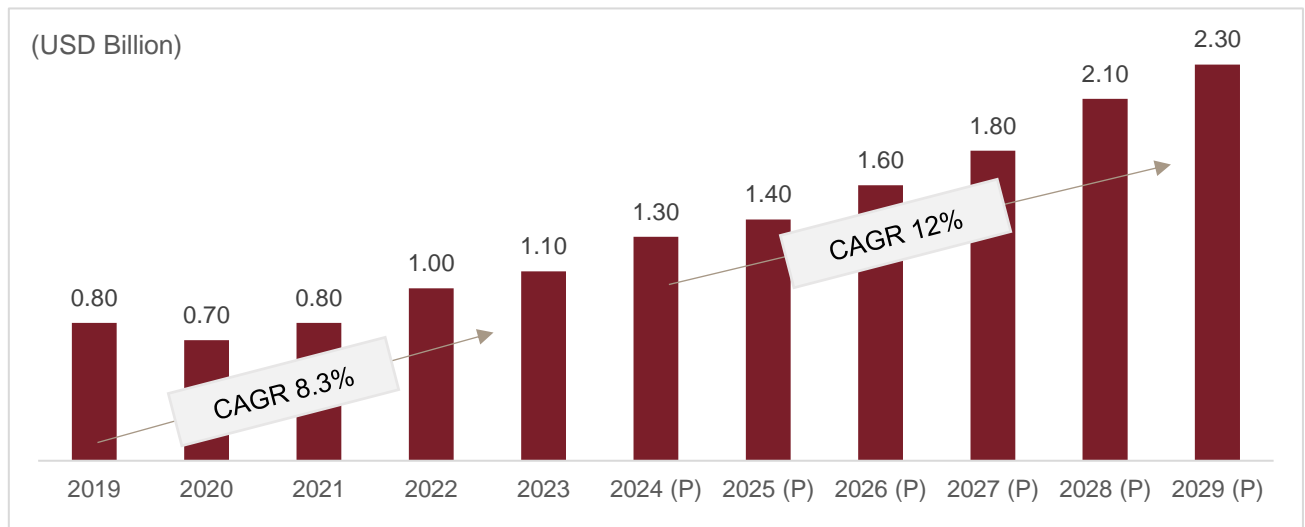
Industrial growth and urbanization are fuelling a surge in electricity consumption in India. Expanding manufacturing hubs, infrastructure projects like Smart Cities Mission, and the growth of urban centres have led to increased installation of high-capacity transformers. These developments directly impact the demand for advanced transformer components, particularly those tailored for heavy-duty and high-efficiency performance.

Country's commitment to achieving 500 GW of non-fossil fuel energy capacity by 2030 underlines its focus on renewable energy. Large-scale solar parks, wind farms, and hybrid renewable installations require transformers with specialized components for handling variable loads and voltage fluctuations. This shift drives demand for components like on-load tap changers, high-temperature conductors, and eco-friendly insulating fluids tailored to renewable energy requirements.

With increasing investments in transmission and distribution (T&D) networks under schemes like Revamped Distribution Sector Scheme (RDSS), India is focusing on reducing power losses and improving grid reliability. This requires upgrading existing substations and installing new ones, creating substantial demand for high-quality transformer components. Innovations like high-voltage bushings, advanced cooling systems, and efficient winding materials are gaining traction as part of efforts to modernize India's grid infrastructure.

Between 2019-23, the Indian transformer component market grown at a CAGR of 8.3% and reached USD 1.1 billion. It is further expected to increase up to USD 2.3 billion between 2024 and 2029 at a CAGR of ~12%.

**Figure 34: India market size of transformer components**



(P): Projected; Source: Global Market Insights, Crisil Intelligence

## 7 Vendor registration as a barrier

### 7.1 Advantages of vendor registration

Various Corporates, State and Central Government Companies conduct vendor registration as a part of their procurement process to ensure transparency, accountability, and efficiency in their dealings with external suppliers. Some of the advantages of getting registered with Government Companies include:

**Increased Business Opportunities:** Registered Vendors do get new business opportunities by participating in tenders, bids and contracts leading to substantial revenue growth. Registration can also provide vendors with opportunities for growth, both in terms of revenue and capabilities since they work on complex projects and services.

**Access to Government Contracts:** Registered Vendors, especially with State and Central Government Companies, get access to government contracts, which can be a significant source of revenue. Government Companies continuously work on various infrastructure projects. Registered vendors may have access to government-funded projects, which can provide a significant source of revenue and opportunities for growth.

**Credibility and Reputation:** Registration with reputable companies (Private or Government) enhances a vendor's credibility and reputation in the market. It also proves their ability to meet the stringent requirements and standards expected by these companies.

**Competitive Advantage:** Registration with reputable companies can be a competitive advantage, as it sets vendors apart from their competitors and demonstrates their commitment to working with reputed companies, especially government companies. Registered vendors are often given priority in the procurement process, increasing their chances of winning contracts and tenders.

**Long-term Partnerships:** Registration can also lead to long-term partnerships with government companies, providing vendors with a stable source of revenue and opportunities for growth.

**Reduced Administrative Efforts:** Registration reduces the administrative efforts of vendors, as they only need to provide documentation and information once, rather than repeatedly for each tender or bid.

**Increased Transparency and visibility:** Registration promotes transparency in the procurement process, reducing the risk of corruption and ensuring that vendors are treated fairly and equally. Registration also increases a vendor's visibility in the market, making it easier for them to attract new customers and business opportunities.

By getting registered with reputed companies (both government as well as private), vendors can unlock these advantages and improve their chances of success in the market. At the same time, the new entrants may lose some of these advantages due to lack registration with reputed companies.

### 7.2 Typical process followed for vendor registration

Normally the following process is followed for vendor registration by various companies.



**Figure 35: Typical vendor registration process**



Source: Industry; Crisil Intelligence

The interested Vendors are required to fill (online) or submit their registration forms (offline) along with necessary supporting documents. The Forms received from the vendors are scrutinized and in case of any deficiency, additional documents are sought. Typically, Government Companies may ask for some Registration Fees from interested vendors.

Once the documentation is complete, the vendors are evaluated by a committee based on the competence, capability, available infrastructure, quality assurance system, current business profile and financial status of the interested vendors. Depending on the products, if required, committee members may visit the manufacturing facility of the vendors for assessment of infrastructure, quality assurance measures and other aspects.

Once, the approval of manufacturing capabilities, the Vendors are required to submit samples along with an Internal test report / factory test report. The samples submitted by the vendors are evaluated by Quality control Department of the Company. After successful evaluation of vendor capability as well as the sample

approval by the Quality Control, registration of vendors is recommended by the committee and after due approval, vendors are registered and are accordingly conveyed by way of Vendor Registration Letter.

### **7.3 Various document requirements**

Some of the key documents required for vendor registration include.

- Partnership agreement/certificate of incorporation
- PAN Card
- Bank account details
- GST Registration certificate
- Address proof
- Directors PAN Card, DIN Certificate and Address Proof
- Factory details
- Financial details
- Quality control, Test and equipment details
- Other certifications/registrations (Accreditation/ISO/International certifications etc.)

### **7.4 Vendor registration as entry barrier**

Most of the Government agencies, large corporations conduct vendor registration for ensuring compliance with regulatory requirements, maintaining transparency and accountability, evaluating vendor capabilities, streamlining procurement process and improving overall contract management. Vendor registration provides reduced procurement costs and cycle times, improved vendor quality and performance along with enhanced transparency and accountability.

Vendor registration can act as an entry barrier for competitors by creating complexity, cost, and resource requirements that can be difficult for new entrants to overcome. Various government agencies empanel vendors for various works after following a complex and tedious process of vendor registration. Many a times, the vendor registration process can be lengthy, complex, and bureaucratic, requiring significant time and resources. Vendor registration also requires certifications, licenses, or insurance which can be daunting. With stringent qualification criteria, such as experience, revenue, or certification requirements and limited number of approved vendors, it can be difficult for new entrants to meet these requirements. Additionally, the incumbent vendors may have an advantage in understanding the registration process and meeting the necessary requirements, making it harder for new competitors to enter the market.

## 8 Competitive landscape of domestic transformer manufacturing companies

Competitive mapping covers the details of companies, their products and services within a given market to understand competitive intensity. Some of the key players in the domestic transformer manufacturing industry in India are summarised in following table. These players cater to the needs of various industries, including power, transmission, and distribution of electricity.

**Table 4: Key players in the domestic transformer manufacturing industry in India**

Company Name	<220 kV	> 220 kV	Business segments	No. of Mfg. Units	Mfg Capacity	Power	Furnace	IDT	Rectifier	Reactor	Traction
Transformers & Rectifiers Ltd.	YES	YES	<ul style="list-style-type: none"> <li>Transformers</li> <li>Switchgear</li> </ul>	3.00	Current: ~40,000 MVA Proposed: ~15,000 MVA	YES	YES	NO	YES	YES	YES
Meiden T&D (India) Ltd.	YES	YES	<ul style="list-style-type: none"> <li>3 Phase Distribution Transformers</li> <li>Vacuum Circuit breakers</li> <li>Power feeding for railway systems</li> <li>Automotive Test Systems</li> <li>Plant Construction Works</li> <li>Maintenance</li> </ul>	1.00	Current: ~15,000 MVA	YES	NO	NO	NO	YES	YES
Siemens Ltd.	YES	YES	<ul style="list-style-type: none"> <li>Energy incl. EPC</li> <li>Smart Infrastructure</li> <li>Mobility</li> <li>Digital Industries</li> </ul>	1.00	Current: ~15,000 MVA Proposed: ~15,000 MVA	YES	NO	NO	YES	YES	YES
TBEA Energy (India) Pvt Ltd.	YES	YES	<ul style="list-style-type: none"> <li>Power Transmission incl. Transformers &amp; Reactors</li> <li>Cables and wires</li> <li>Advanced Material</li> <li>New Energy</li> </ul>	1.00	Current: ~20,000 MVA	YES	NO	NO	NO	YES	NO
CG Power & Industrial Solutions Ltd.	YES	YES	<ul style="list-style-type: none"> <li>Industrial: Motors, Generators, Alternators etc.</li> <li>Power: Transformers and reactors, switchgear etc.</li> <li>Railways: Motors, Signaling etc.</li> </ul>	2.00	Current: ~35,000 MVA Proposed: ~5,000 MVA	YES	YES	YES	NO	YES	YES

Company Name	<220 kV	> 220 kV	Business segments	No. of Mfg. Units	Mfg Capacity	Power	Furnace	IDT	Rectifier	Reactor	Traction
Toshiba Transmission & Distribution Systems (India) Pvt Ltd.	YES	YES	<ul style="list-style-type: none"> <li>Energy: Thermal, Hydro and T&amp;D systems (incl. S/s, Transformer)</li> <li>Infra systems: Railway systems, battery, elevator, water treatment</li> <li>Storage: Chips</li> <li>Office: Printers etc.</li> </ul>	1.00	NA	YES	NO	YES	NO	YES	YES
Atlanta Electricals Ltd.	YES	NO	<ul style="list-style-type: none"> <li>Power, distribution and special application transformers</li> </ul>	3.00	Current: ~16,740 MVA	YES	YES	YES	NO	NO	YES
Voltamp Transformers Ltd.	YES	NO	<ul style="list-style-type: none"> <li>Transformers</li> <li>Substations</li> <li>Switchgear etc.</li> </ul>	2.00	Current: ~14,000 MVA Proposed: ~6,000 MVA	YES	YES	NO	NO	NO	NO
ECE Industries Ltd.	YES	NO	<ul style="list-style-type: none"> <li>Transformers</li> <li>Elevators</li> <li>Energy Meters</li> <li>Switchgears</li> <li>EPC etc.</li> </ul>	2.00	Current: 12,000 MVA	YES	NO	NO	NO	NO	NO
Technical Associates Ltd.	YES	NO	<ul style="list-style-type: none"> <li>Transformers</li> </ul>	1.00	Current: 20,000 MVA	YES	No	NO	NO	NO	YES
Indotech Transformers Ltd.	YES	NO	<ul style="list-style-type: none"> <li>Transformers</li> <li>Substations</li> </ul>	1.00	Current: 7,500 MVA Proposed: 2,500 MVA	YES	NO	NO	NO	NO	NO
Bharat Bijlee Ltd.	YES	NO	<ul style="list-style-type: none"> <li>Transformers</li> <li>Turnkey projects</li> <li>Motors</li> <li>Technology for elevators</li> <li>Drives and automation</li> </ul>	1.00	Current: ~18,000 MVA Proposed: ~6,000 MVA	YES	YES	NO	NO	NO	YES
Kanoohar Electricals Ltd.	YES	YES	<ul style="list-style-type: none"> <li>Power Transformers</li> <li>Gas Insulated Switchgear</li> <li>EPC Projects</li> <li>Transmission Lines</li> </ul>	1.00	Current: ~10,500 MVA	YES	YES	NO	NO	YES	YES

Company Name	<220 kV	> 220 kV	Business segments	No. of Mfg. Units	Mfg Capacity	Power	Furnace	IDT	Rectifier	Reactor	Traction
Shirdi Sai Electricals Ltd.	YES	YES	<ul style="list-style-type: none"> <li>Transformers</li> <li>EPC- S/s &amp; line works</li> <li>Distribution Systems,</li> <li>Rural Electrification</li> </ul>	2.00	Current: ~33,500 MVA Proposed: ~19,500 MVA	YES	YES	NO	NO	YES	YES
Vishvas Power Engineering Services Pvt. Ltd.	YES	NO	<ul style="list-style-type: none"> <li>Transformers</li> <li>EPC- Substations</li> </ul>	1.00	NA	NO	NO	NO	NO	NO	YES
Hitachi Energy India Ltd.	YES	YES	<ul style="list-style-type: none"> <li>Transformers</li> <li>Substations &amp; Electrification and other solutions incl. software etc.</li> </ul>	2.00	NA	YES	YES	YES	YES	YES	YES
Danish Power Ltd.	Yes	No	<ul style="list-style-type: none"> <li>Transformers</li> <li>Panels</li> <li>Substation automation services</li> </ul>	2.00	Current: 4,681 MVA Proposed ~6,319	Yes	Yes	Yes	Yes	No	No

IDT: Inverter Duty Transformer; NA: Not available, S/s: Sub-station, EPC: Engineering procurement and construction;  
Source: Industry, Company Websites, Press Releases, Crisil Intelligence

Following table summarises the competitive analysis of Atlanta Electricals with some of the leading Indian transformer manufacturers. Atlanta Electricals Ltd. competes with different players including BHEL, Siemens Ltd. CG Power and Industrial Solutions Ltd. etc. However, considering their diverse product portfolio and resultant revenue mix, they are not considered for comparison purpose.

**Table 5: Competitive analysis with leading Indian transformer manufacturers (present in less than 220 kV)**

Rs. Mn	Atlanta Electricals Ltd.				Voltamp Transformers Ltd.				Danish Power Ltd.#			
	H1 FY25 (UA)	FY24 (A)	FY23 (A)	FY22 (A)	H1 FY25 (UA)	FY24 (A)	FY23 (A)	FY22 (A)	H1 FY25 (UA)	FY24 (A)	FY23 (A)	FY22 (A)
Revenue from operations	5,701.41	8,675.53	8,738.83	6,256.62	8,258.93	16,162.23	13,851.04	11,272.09	1,633.83	3,324.77	1,887.01	1,486.34
Revenue Growth	NC	-0.72%	39.67%	NC	NC	16.69%	22.88%	NC	NC	76.19%	26.96%	NC
Operating EBITDA	871.24	1,231.61	1,431.17	893.58	2,116.14	4,113.28	2,709.52	1,819.36	320.06	579.98	169.04	111.63
EBITDA Margin	15.28%	14.20%	16.38%	14.28%	25.62%	25.45%	19.56%	16.14%	19.59%	17.44%	8.96%	7.51%
PAT	517.28	635.19	874.72	553.03	1,551.85	3,073.61	1,999.43	1,328.38	207.26	380.74	85.71	52.49
PAT Margin	9.07%	7.32%	10.01%	8.84%	18.79%	19.02%	14.44%	11.78%	12.69%	11.45%	4.54%	3.53%
ROE	18.25%	27.80%	53.05%	71.18%	10.95%	22.71%	18.06%	14.10%	20.10%	46.36%	19.45%	14.79%
ROCE	22.62%	42.34%	57.99%	55.01%	14.49%	29.55%	23.60%	18.47%	17.17%	57.53%	26.16%	16.21%
Net Working Capital	1,722.81	1,614.01	1,387.81	824.99	3,753.50	3,693.47	3,799.09	3,868.90	638.55	399.65	211.50	362.26
Net Working Capital (days)	55	68	58	48	82	83	100	125	71	44	41	89
Order Book (Rs. Mn)	12,833.25	12,713.80	5,340.62	3,164.60	10,220.10	8,406.60	NA	NA	3,712.57	NA	NA	NA
Order Book break-up												
Orders from government and public sector entities	9,471.95	9,375.23	3,306.68	2,743.95	NA	NA	NA	NA	NA	NA	NA	NA
Private sector entities	3,415.26	3,338.57	2,033.94	420.65	NA	NA	NA	NA	NA	NA	NA	NA

Rs. Mn	Technical Associates Ltd.				Indotech Transformers Ltd.				ECE Industries Ltd.			
	H1 FY25 (UA)	FY24 (A)	FY23 (A)	FY22 (A)	H1 FY25 (UA)	FY24 (A)	FY23 (A)	FY22 (A)	H1 FY25 (UA)	FY24 (A)	FY23 (A)	FY22 (A)
Revenue from operations	NA	7,060.21	5,238.84	2,574.54	2,283.80	5,036.08	3,709.05	2,800.67	NA	7,140.99	5,824.45	4,042.96
Revenue growth	NA	34.77%	103.49%	NC	NC	35.78%	32.43%	NC	NA	22.60%	44.06%	NC
Operating EBITDA	NA	1,355.95	762.61	370.68	359.60	659.01	332.41	185.76	NA	620.02	487.00	695.13
EBITDA Margin	NA	19.21%	14.56%	14.40%	15.75%	13.09%	8.96%	6.63%	NA	8.68%	8.36%	17.19%
PAT	NA	899.15	485.16	180.91	236.30	468.60	257.02	121.90	NA	283.47	376.21	478.53
PAT Margin	NA	12.74%	9.26%	7.03%	10.35%	9.30%	6.93%	4.35%	NA	3.97%	6.46%	11.84%



Rs. Mn	Technical Associates Ltd.				Indotech Transformers Ltd.				ECE Industries Ltd.			
	H1 FY25 (UA)	FY24 (A)	FY23 (A)	FY22 (A)	H1 FY25 (UA)	FY24 (A)	FY23 (A)	FY22 (A)	H1 FY25 (UA)	FY24 (A)	FY23 (A)	FY22 (A)
ROE	NA	24.97%	17.96%	8.33%	9.82%	21.58%	15.04%	8.40%	NA	8.68%	11.57%	14.48%
ROCE	NA	35.60%	22.50%	11.46%	11.68%	27.45%	15.59%	9.65%	NA	14.08%	12.98%	14.86%
Net Working Capital	NA	109.60	351.72	342.44	1,164.00	1,070.60	892.54	560.34	NA	1,963.14	1,848.49	1,606.42
Net Working Capital (days)	NA	6	25	49	92	78	88	73	NA	100	116	145
Order Book (Rs. Mn)	NA	NA	NA	NA	NA	7,000.00	4,367.00	2,614.00	NA	NA	NA	NA
Order Book break-up												
Orders from government and public sector entities	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Private sector entities	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

**Table 6: Competitive analysis with leading Indian transformer manufacturers (also present in above 220 kV)**

Rs. Mn	Transformers & Rectifiers Ltd.				TBEA Energy (India) Pvt Ltd.				Meiden T&D (India) Ltd.*			
	H1 FY25 (UA)	FY24 (A)	FY23 (A)	FY22 (A)	H1 FY25 (UA)	FY24 (A)	FY23 (A)	FY22 (A)	H1 FY24 (UA)	FY23 (A)	FY22 (A)	FY21 (A)
Revenue from operations	7,835.40	12,946.76	13,959.70	11,617.46	NA	10,483.62	13,579.06	8,784.04	NA	1,343.53	1,276.71	1,095.46
Revenue Growth	NC	-7.26%	20.16%	NC	NA	-22.80%	54.59%	NC	NA	5.23%	16.55%	NC
Operating EBITDA	1,271.90	1,399.24	1,295.63	838.77	NA	(1,429.77)	147.15	20.90	NA	(184.09)	(193.31)	(300.28)
EBITDA Margin	16.23%	10.81%	9.28%	7.22%	NA	-13.64%	1.08%	0.24%	NA	-13.70%	-15.14%	-27.41%
PAT	653.40	444.97	407.39	139.87	NA	(3,417.16)	(1,351.18)	(1,213.12)	NA	(314.87)	(337.10)	(349.33)
PAT Margin	8.34%	3.44%	2.92%	1.20%	NA	-32.60%	-9.95%	-13.81%	NA	-23.44%	-26.40%	-31.89%
ROE	6.00%	8.03%	10.34%	3.92%	NA	392.01%	-53.10%	-31.22%	NA	-34.57%	-45.28%	-33.32%
ROCE	8.40%	14.07%	14.38%	9.74%	NA	-20.56%	-3.69%	-4.68%	NA	-10.30%	-9.52%	-13.36%
Net Working Capital	10,514.60	6,246.27	5,248.23	4,585.18	NA	421.41	3,198.94	1,016.86	NA	715.71	1,089.34	954.30
Net Working Capital (days)	243	176	137	144	NA	15	86	42	NA	194	311	318
Order Book (Rs. Mn)	35,000.00	25,817.10	17,973.40	12,993.50	NA	NA	NA	NA	NA	NA	NA	NA
Order Book break-up												
Orders from government and public sector entities	19,950.00	16,756.50	10,198.60	6,554.30	NA	NA	NA	NA	NA	NA	NA	NA
Private sector entities	15,050.00	9,060.60	7,774.80	6,439.20	NA	NA	NA	NA	NA	NA	NA	NA

Rs. Mn	Toshiba Transmission & Distribution Systems (India) Pvt Ltd.*				Kanochar Electricals Ltd.*			
	H1 FY25 (UA)	FY24 (A)	FY23 (A)	FY22 (A)	H1 FY25 (UA)	FY24 (A)	FY23 (A)	FY22 (A)
Revenue from operations	NA	40,631.00	32,477.00	24,726.80	NA	3,016.38	3,108.32	2,360.57
Revenue Growth	NA	25.11%	31.34%	NC	NA	-2.96%	31.68%	NC
Operating EBITDA	NA	7,314.00	3,516.00	1,908.80	NA	374.16	376.34	317.56
EBITDA Margin	NA	18.00%	10.83%	7.72%	NA	12.40%	12.11%	13.45%
PAT	NA	5,004.00	2,024.00	1,014.50	NA	207.69	223.02	184.68
PAT Margin	NA	12.32%	6.23%	4.10%	NA	6.89%	7.17%	7.82%
ROE	NA	22.96%	12.03%	6.85%	NA	10.81%	13.00%	12.38%
ROCE	NA	31.42%	16.59%	9.26%	NA	14.81%	18.25%	18.01%
Net Working Capital	NA	13,966.10	11,193.10	8,264.70	NA	1,167.29	724.22	313.81
Net Working Capital (days)	NA	125	126	122	NA	141	85	49
Order Book (Rs. Mn)	NA	NA	NA	NA	NA	NA	NA	NA
Order Book break-up								
Orders from government and public sector entities	NA	NA	NA	NA	NA	NA	NA	NA
Private sector entities	NA	NA	NA	NA	NA	NA	NA	NA

UA: Unaudited, A: Audited; NM: Not meaningful, NC: Not computed, NA: Not available

On Consolidated basis \* On Standalone basis; #FY24 Consolidated and FY23 and FY 22 on standalone basis as per Red Herring Prospectus dated October 15, 2024

Source: Annual Reports, Company Websites, Crisil Intelligence

**Formulae used:**

EBITDA: Earnings before interest, tax, depreciation, and amortization (Profit before tax + Finance cost + Depreciation and amortization expense)

EBITDA margin: EBITDA / Revenue from operations for the period

PAT: Profit for the year attributable to owners

PAT margin: PAT / Revenue from operations for the period

ROE=Profit attributable to owners for the period /Equity excluding non-controlling interest

ROCE: EBIT/ Capital employed

EBIT=PAT + Tax+ Depreciation

Capital Employed = Total Debt + Equity

Net working capital=(Current assets- cash and cash equivalents) –(Current liabilities-current borrowings)

Net Working capital days= Net working capital/Revenue from operations\*no. of days in the period/year

- Atlanta Electricals is one of the leading manufacturers of power, auto, and inverter duty transformers in India transformers in terms of production volume as of Fiscal 2024.
- Atlanta Electricals manufactures 16,740 MVA transformers per annum up to and including 200 MVA/220 kV.

## 9 Threats and challenges for transformer Industry

### 9.1 Threats

- **Regulatory changes:** The transformer market faces significant challenges due to uncertainties in regulations and policies, affecting investment choices, market dynamics, and technological progress. Conflicting policies, regulatory hurdles, and project approval delays lead to uncertainty and impede the progress of the industry.
- **Competition:** The Indian transformer industry faces intense competition from global players, particularly from China, who offer competitive pricing and advanced technology. Competition from Unorganized Players' is another challenge, as many small manufacturers are entering the market, increasing competition and putting pressure on prices
- **Raw material availability and price volatility:** India faces issue of availability of cold rolled grain-oriented (CRGO) steel, a critical material necessary for manufacturing distribution and power transformers. Reliance on imports of CRGO can lead to delays and increased costs
- Fluctuations in the prices of raw materials such as copper, steel, and oil can also impact the industry's profitability.
- **Currency Fluctuations:** Due to various global geopolitical as well as economics activities, currency rate fluctuates. Exchange rate fluctuations can affect the industry's exports and imports, making it challenging to maintain profitability.

### 9.2 Challenges

- **Quality and reliability:** Ensuring the quality and reliability of transformers is a significant challenge, particularly in the context of India's severe environmental conditions. Another issue that poses a challenge is the high failure rate of transformers, leading to substantial losses for utilities and industries. This underscores the importance of having transformers that are both efficient and reliable.
- **Compliance with standards:** Ensuring compliance with national and international standards, such as IS, BIS, IEC, and IEEE, can be a challenge for transformer manufacturers. Adherence to predetermined performance requirements, insulation levels, and technical specifications for safe and effective functioning of transformers can be challenging with pricing pressure.
- **Technology upgradation:** The growing use of variable renewable energy sources will require the installation of advanced transformers that can effectively handle the intermittent output of renewable energy sources. With the country progressing towards its renewable energy objectives, there is anticipated growth in the demand for transformers incorporating smart grid technologies, phase-shifting abilities, and voltage regulation features. This surge is poised to alter market dynamics significantly.
- **Price sensitivity:** Presence of multiple small players including unorganized players make Indian transformer market more aggressive and price sensitive rather than quality. Being highly price-sensitive, it is challenging for manufacturers to balance quality and cost.
- **Long lead times:** Increasing demand from RE sector, Railways and Metros, power transmission and distribution requirements, issues in raw material availability, dependence on imports, and manufacturing capacity constraints contributing to longer lead times for transformers. Longer lead times can affect the industry as well as the power ambitions of India.
- **Working capital management:** The Transformer Industry requires relatively higher working capital, primarily because of the extended production cycle of transformers compared to other industrial products. Additionally, there is a requirement to incur significant expenses for raw materials such as

copper and CRGO at the initial stage of the production process. Hence, effective working capital management is essential.



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**Date: 28.01.2025**

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