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Industry Research Report on Magnet Winding Wires Market in India

22nd May 2025

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Glossary

	Abbreviations
GDP	Gross Domestic Product
IMF	International Monetary Fund
P	Projections
E	Estimated
FY	Financial Year
CY	Calendar Year
SAE	Second Advance Estimates
FRE	First Revised Estimates
FE	Final Estimates
RBI	Reserve Bank of India
GNDI	Gross National Disposable Income
PFCE	Private Final Consumption Expenditure
MOSPI	Ministry of Statistics and Programme Implementation
GVA	Gross Value Added
WEO	World Economic Outlook
IIP	Index of Industrial Production
Y-O-Y	Year- On- Year Growth
GWH	Gigawatt-Hour
HVDC	High Voltage Direct Current
ckm	Circuit Kilometers
MVA	Mega Volt-Amperes
kV	Kilovolt
MW	Megawatt
ISTS	Inter-State Transmission System
NMP	National Monetization Pipeline
DFI	Development Finance Institution
AMRUT	Atal Mission for Rejuvenation and Urban Transformation
PMAY	Pradhan Mantri Awas Yojana
PLI	Production Linked Incentives
PV	Photo Voltaic
ACC	Advanced Chemistry Cell
FTA	Free Trade Agreements
FDI	Foreign Direct Investment
BTA	Bilateral trade agreement
CAGR	Compound Annual Growth Rate
USD	United States Dollar
EV	Electric Vehicles
UK	United Kingdom
AAS	Advance Authorization Scheme
EPCG	Export Promotion Capital Goods
RoDTEP	Remission of Duties and Taxes on Exported Products
TIES	Trade Infrastructure for Export Scheme
W&C	Wires and Cables
UL	Underwriters Laboratories
ISO	International Organization for Standardization
IATF	International Automotive Task Force
IEC	International Electrotechnical Commission

	Abbreviations
RoHS	Restriction of Hazardous Substances
CTC	Continuous Transposed Conductors
DDUGJY	Deen Dayal Upadhyaya Gram Jyoti
IPDS	Integrated Power Development Scheme
RDSS	Revamped Distribution Sector Scheme
ADAS	Advanced driver-assistance systems
GW	Gigawatt
NIP	National Infrastructure Pipeline
BESS	Battery Energy Storage System
2W	Two-Wheelers
3W	Three Wheelers
FAME	Faster Adoption and Manufacturing of Hybrid and Electric Vehicles
NEMMP	National Electric Mobility Mission Plan
DFIA	Duty-Free Import Authorisation
BIS	Bureau of Indian Standards
MWW	Magnet Winding Wires
LT	Low Tension
HT	High Tension
FHP	Fractional Horsepower
BLDC	Brushless Direct Current
ICE	Internal Combustion Engine
DG	Diesel Generators
4W	Four Wheelers
IEA	International Energy Agency
NEP	National Electricity Plan
RES	Renewable Energy Resources
BCD	Basic Custom Duty
RPO	Renewable Purchase Obligations
F	Forecasted
PM-KUSUM	Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan Yojana
CERC	Central Electricity Regulatory Commission
CUF	Capacity Utilization Factor
SECI	Solar Energy Corporation of India Limited
FSA	Fuel Supply Agreements
CEA	Central Electricity Authority
BU	Billion unit
HVAC	Heating, Ventilation, and Air Conditioning
B	Budgeted
A	Actual
R	Revised
IEBR	Internal and Extra Budgetary Resources
RRTS	Regional rapid transit systems
OEMs	original equipment manufacturer
LPG	Liquid Propane Gas
OTG	Oven, Toaster, Grill
QSR	Quick Service Restaurants
PWIL	Precision Wires India Limited
MT	Metric Tonne
EBITDA	Earnings Before Interest, Taxes, Depreciation, and Amortization.

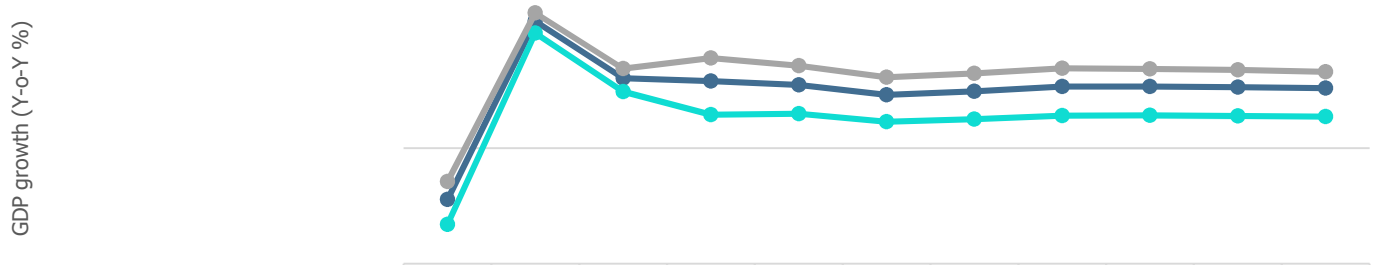
	Abbreviations
EMIS	Education Management Information System
PAT	Profit After Tax
ROE	Return on Equity
ROCE	Return on Capital Employed

1. Economic Outlook

1.1 Global Economy

Global growth, which reached 3.49% in CY23, is estimated to stabilize at 3.29% for CY24 and projected to decrease at 2.79% for CY25. Global trade is expected to be disrupted by new US tariffs and countermeasures from trading partners, leading to historically high tariff rates and negatively impacting economic growth projections. The global landscape is expected to change as countries rethink their priorities and policies in response to these new developments. Central banks priority will be to adjust policies, while smart fiscal planning and reforms are key to handling debt and reducing global inequalities.

Chart 1: Global Growth Outlook Projections (Real GDP, Y-o-Y change in %)



	CY20	CY21	CY22	CY23	CY24E	CY25P	CY26P	CY27P	CY28P	CY29P	CY30P
World	-2.67%	6.61%	3.65%	3.49%	3.29%	2.79%	2.96%	3.22%	3.22%	3.18%	3.12%
Advanced Economies	-3.96%	5.99%	2.95%	1.74%	1.80%	1.38%	1.51%	1.69%	1.72%	1.67%	1.65%
Emerging Market and Developing Economies	-1.74%	7.04%	4.13%	4.69%	4.28%	3.70%	3.89%	4.16%	4.12%	4.07%	3.97%

Notes: IMF – World Economic Outlook, April 2025; Notes: P-Projection, E-Estimated

Table 1: GDP growth trend comparison - India v/s Other Economies (Real GDP, Y-o-Y change in %)

	Real GDP (Y-o-Y change in %)										
	CY20	CY21	CY22	CY23	CY24E	CY25P	CY26P	CY27P	CY28P	CY29P	CY30P
India	-5.78	9.69	7.61	9.19	6.46	6.20	6.27	6.47	6.48	6.49	6.50
China	2.34	8.56	3.11	5.38	5.00	3.95	3.96	4.22	4.06	3.70	3.38
Indonesia	-2.07	3.70	5.31	5.05	5.03	4.65	4.67	4.85	4.95	5.11	5.13
Saudi Arabia	-3.58	5.08	7.49	-0.76	1.31	2.99	3.74	3.56	3.18	3.18	3.28
Brazil	-3.28	4.76	3.02	3.24	3.40	2.01	1.98	2.19	2.31	2.43	2.49
Euro Area	-6.02	6.33	3.53	0.40	0.86	0.81	1.19	1.35	1.30	1.20	1.13
United States	-2.16	6.06	2.51	2.89	2.80	1.83	1.74	1.98	2.12	2.12	2.12

Source: IMF- World Economic Outlook Database (April 2025)

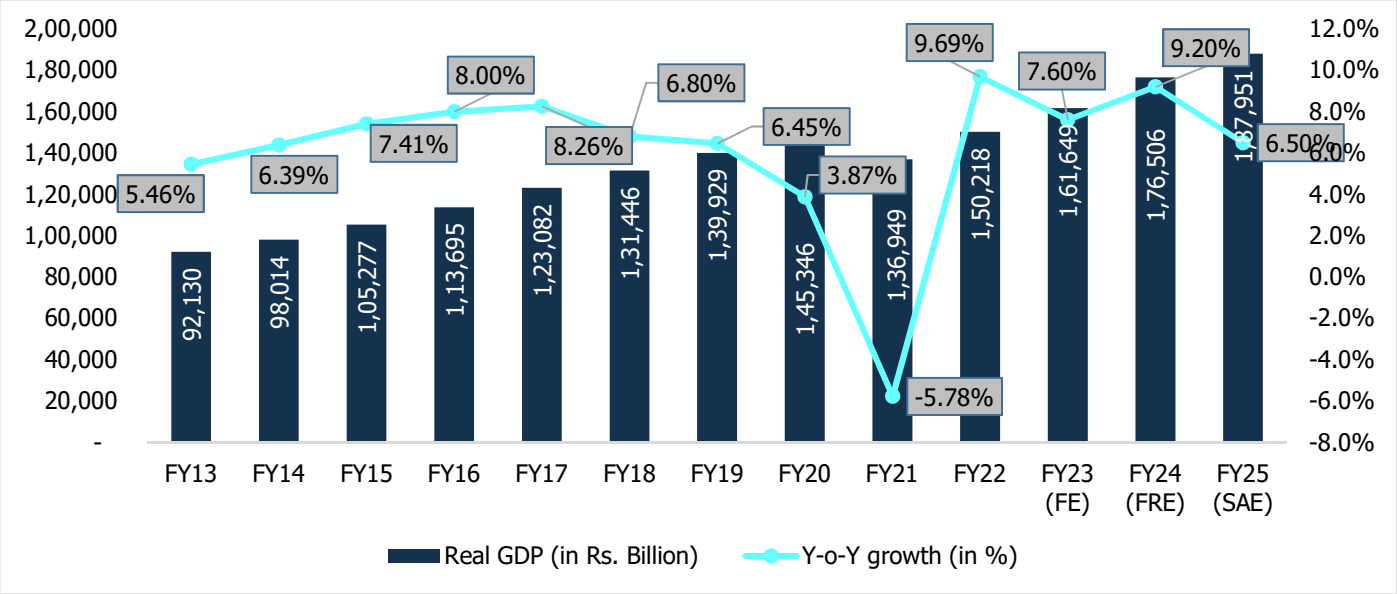
Note: P- Projections, E-Estimate; India's fiscal year (FY) aligns with the IMF's calendar year (CY). For instance, FY24 corresponds to CY23.

1.2 Indian Economic Outlook

1.2.1 GDP Growth and Outlook

Resilience to External Shocks remains Critical for Near-Term Outlook

Chart 2: Trend in Real Indian GDP growth rate



Source: MOSPI, Note: SAE – Second Advance Estimates, FRE – First Revised Estimates, FE – Final Estimate;

India's real GDP grew by 9.20% in FY24 (Rs. 176,506 billion) which is the highest in the previous 12 years (excluding FY22 being 9.69% on account of end of pandemic) and is estimated to grow by 6.50% in FY25 (Rs. 187,951 billion), driven by double digit growth particularly in the Manufacturing sector, Construction sector and Financial, Real Estate & Professional Services.

GDP Growth Outlook

FY26 GDP Outlook: Real GDP growth is projected at 6.50%, driven by strong rural demand, improving employment, and robust business activity. The agriculture sector's bright prospects, healthy reservoir levels, and robust crop production support this growth. Manufacturing is reviving, and services remain resilient, despite global uncertainties. Investment activity is gaining traction, supported by healthy balance sheets and easing financial conditions. However, risks from geopolitical tensions, global market volatility, and geo-economic fragmentation persist

Persistent geopolitical tensions, volatility in international financial markets and geo-economic fragmentation do pose risk to this outlook. Based on these considerations, the RBI, in its April 2025 monetary policy, has projected real GDP growth at 6.50% y-o-y for FY26.

Table 2: RBI's GDP Growth Outlook (Y-o-Y %)

FY26P (complete year)	Q1FY26P	Q2FY26P	Q3FY26P	Q4FY26P
6.5%	6.5%	6.7%	6.6%	6.3%

Source: Reserve Bank of India, Note: P-Projected

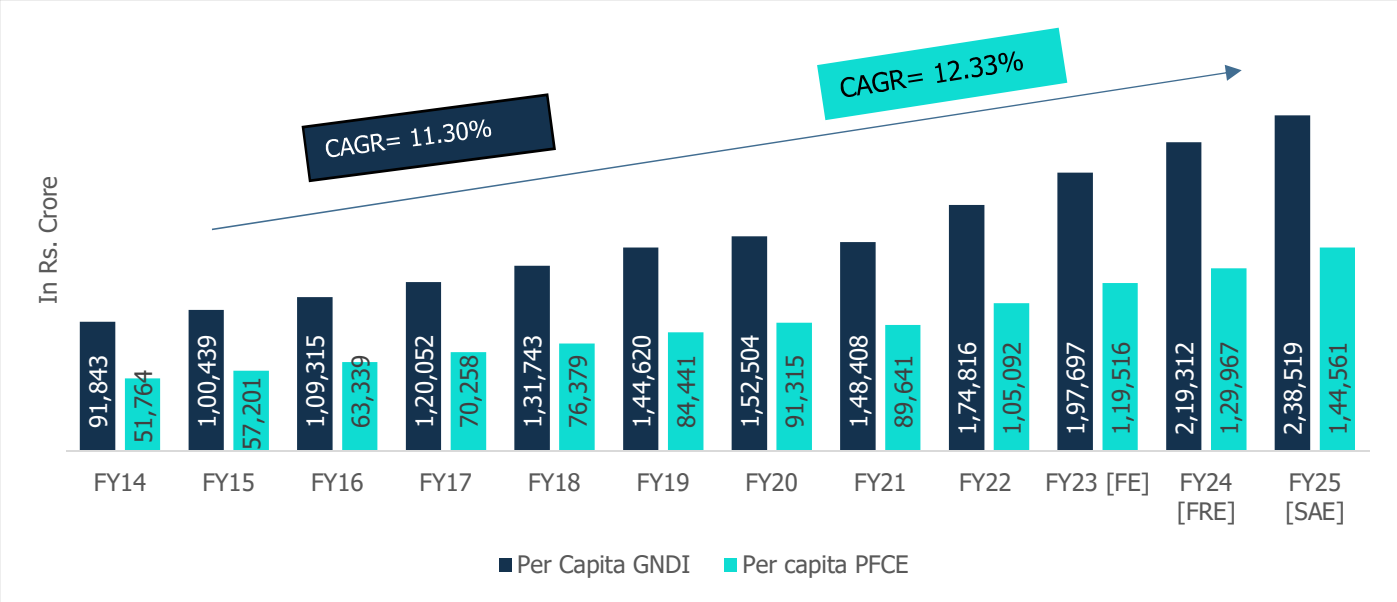
1.2.2 Per capita PFCE and GNDI

- **Increasing Disposable Income and Consumer Spending**

Gross National Disposable Income (GNDI) is a measure of the income available to the nation for final consumption and gross savings. Between the period FY14 to FY25, per capita GNDI at current prices registered a CAGR of 11.30%. More disposable income drives more consumption, thereby driving economic growth.

With increase in disposable income, there has been a gradual change in consumer spending behavior as well. Per capita Private Final Consumption Expenditure (PFCE) which is measure of consumer spending has also showcased significant growth from FY14 to FY25 at a CAGR of 12.33%.

Chart 3: Trend of Per Capita GNDI and Per Capita PFCE (Current Price)



Note: SAE- Second Advance Estimates, FRE – First Revised Estimates, FE – Final Estimate; Source: MOSPI

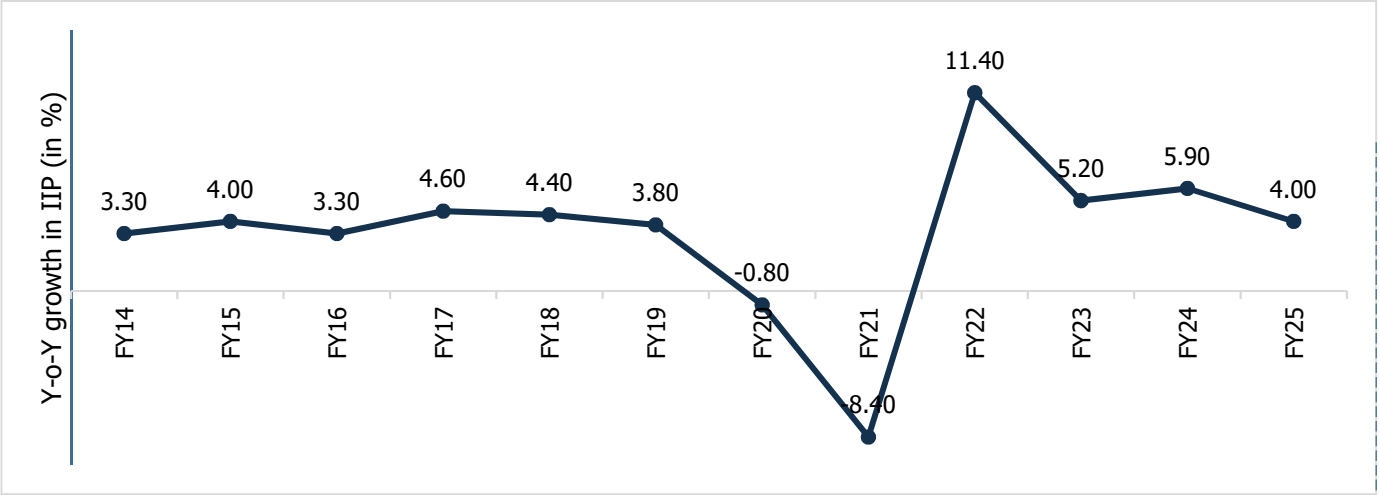
1.2.3 Industrial Growth

The Quick Estimates of the Index of Industrial Production (IIP) for March 2025 show a 3.00% growth, up from 2.90% in February 2025. The y-o-y growth for March 2025 was 4.00% down from 5.90% in March 2024, the overall growth in the industry was moderate but subdued primarily due to deceleration in consumer non-durables, infrastructure industries, intermediate goods, capital and primary goods.

In March 2025, the industrial growth saw a rise due to Manufacturing (3.00%), and Electricity (6.30%) while witnessing a decline in the mining sector (0.40%). Among the industry group of basic metals, items of flat products of alloy steel, pipes and tubes of steel and bars and rods of mild steel experienced significant growth. Use-based indices had a slowed growth in Primary Goods, Capital Goods, and Intermediate Goods.

Manufacturing growth was driven by basic metals (6.90%), motor vehicles and semi-trailers (10.30%) and electrical equipment (15.70%). While government spending and private investment support growth, declining consumer non-durables and improving rural demand highlight the need for sustained consumption and investment.

Chart 4: Y-o-Y growth in IIP (in %)

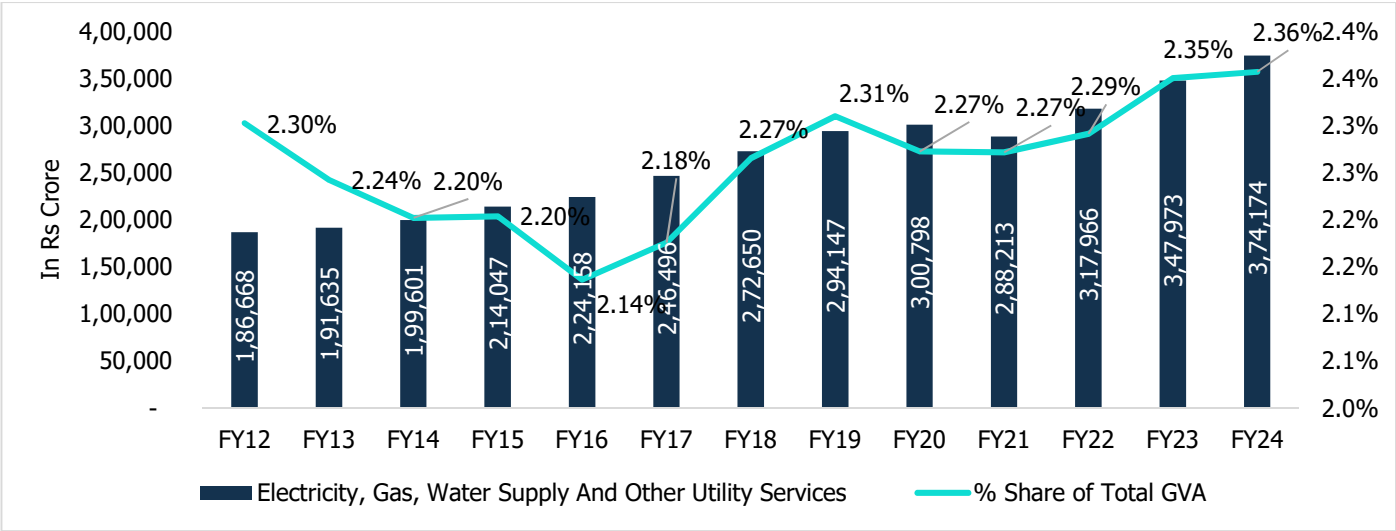


Source: MOSPI

1.2.4 GVA in Electricity, Gas, Water Supply and Other Utility Services

The data on the Gross Value Added (GVA) in the Electricity, Gas, Water Supply, and Other Utility Services sector at constant prices shows a consistent upward trajectory from FY12 to FY24. Despite this growth, the sector's share of the overall economy remained relatively stable, fluctuating between 2.10% and 2.40%. In FY23 and FY24, the sector's share reached 2.35% and 2.36% respectively, indicating a slight increase compared to previous years. This suggests that while the sector experienced healthy growth in absolute terms, its relative contribution to the overall economy remained steady over the period. The growth in this sector reflects the increasing importance of utilities in the economy, although other sectors also expanded in parallel.

Chart 5: GVA in Electricity, Gas, Water Supply and Other Utility Services

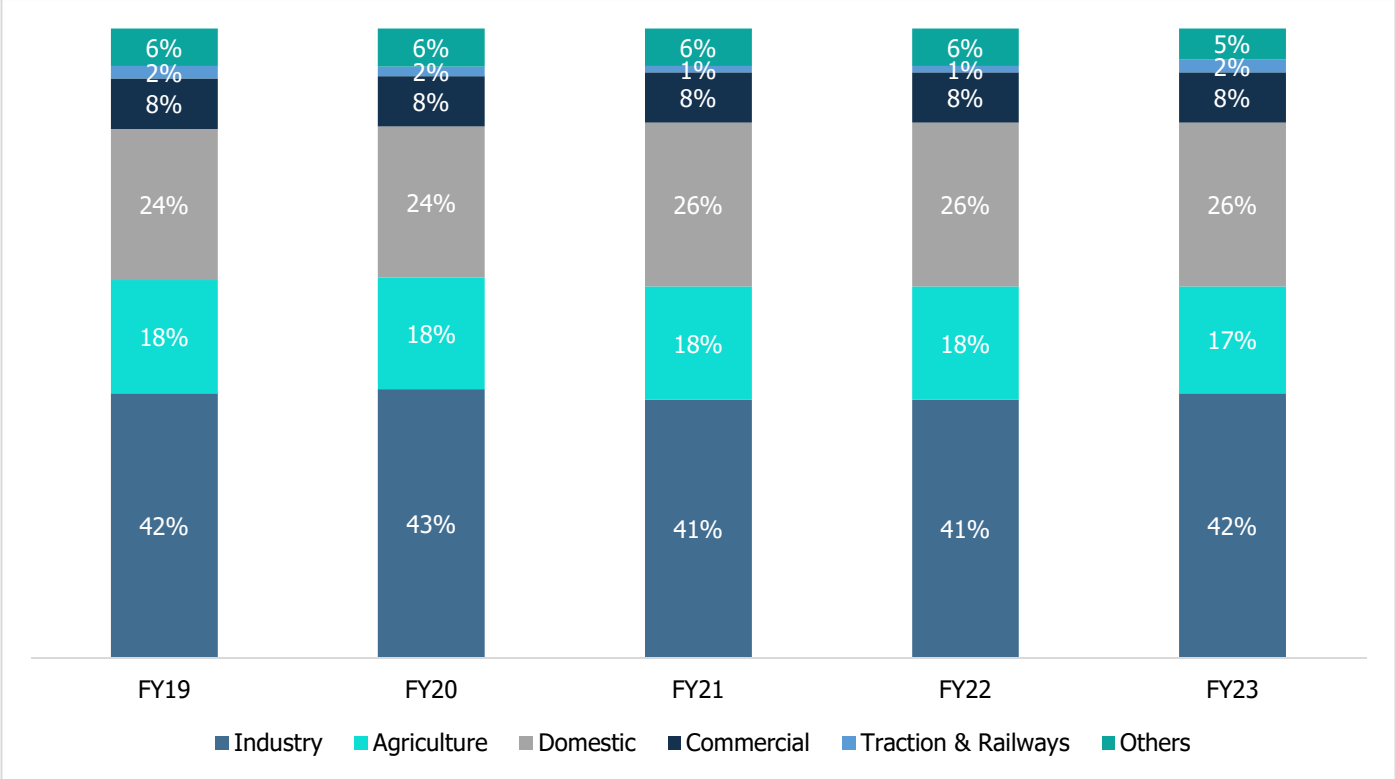


Source: NITI Aayog

1.2.5 Growth in Electricity Consumption by Segments

From FY19 to FY23, overall electricity consumption grew at CAGR of 4.92% growing from 4,86,490 GWH in FY19 to 5,89,428 GWH in FY23. The growth was seen across all sectors, with the Domestic sector leading the way at a 7.04% CAGR, driven by increased urbanization and household energy demand. The Industry and Commercial sectors both saw steady growth at 4.92%, reflecting ongoing industrialization and business expansion. The Agriculture sector experienced slower growth at 3.43%, likely due to gradual technological adoption and mechanization. Traction & Railways also grew at 4.92%, reflecting the expansion of electrified railway systems. Meanwhile, the Others category showed minimal growth, with a 0.24% CAGR, indicating stable or declining electricity consumption in those areas.

Chart 6: Electricity Consumption by Segments (FY19 – FY23)



Source: MOSPI, CareEdge Research

1.2.6 Structure of basic PowerGrid in Future

The future structure of India's power grid will be driven by the integration of renewable energy, digitalization, and decentralization. With a target to increase the share of non-fossil fuel-based power, particularly solar and wind, the grid will need enhanced flexibility to accommodate the intermittency of renewable energy. A key focus will also be on efficient power distribution, ensuring last-mile connectivity and reducing aggregate technical and commercial (AT&C) losses through network modernization and grid automation.

Smart grid technologies, including advanced sensors and real-time monitoring systems, will optimize grid operations and enable better demand-side management. The rise of decentralized energy sources, such as rooftop solar and microgrids, will reduce transmission losses and increase energy access in rural areas. Electric vehicle adoption will necessitate a robust charging infrastructure and the integration of vehicle-to-grid technology for grid support.

Additionally, large-scale energy storage systems will stabilize the grid by storing excess renewable energy and balancing supply and demand.

Transmission infrastructure will be upgraded with technologies like High Voltage Direct Current (HVDC) for efficient long-distance transmission, and increased cross-border interconnections will enhance energy security. During the 2027-32 period, it is planned to add 76,787 ckm of transmission lines and 497,855 MVA of transformation capacity in substations at voltage levels of 220 kV and above. Additionally, 32,250 MW of HVDC bi-pole capacity is also planned to be incorporated.

The planned additions to the ISTS and Intra-State Transmission Systems during this period are outlined below:

Table 3: Transmission lines and transformation capacity under ISTS and intra-state

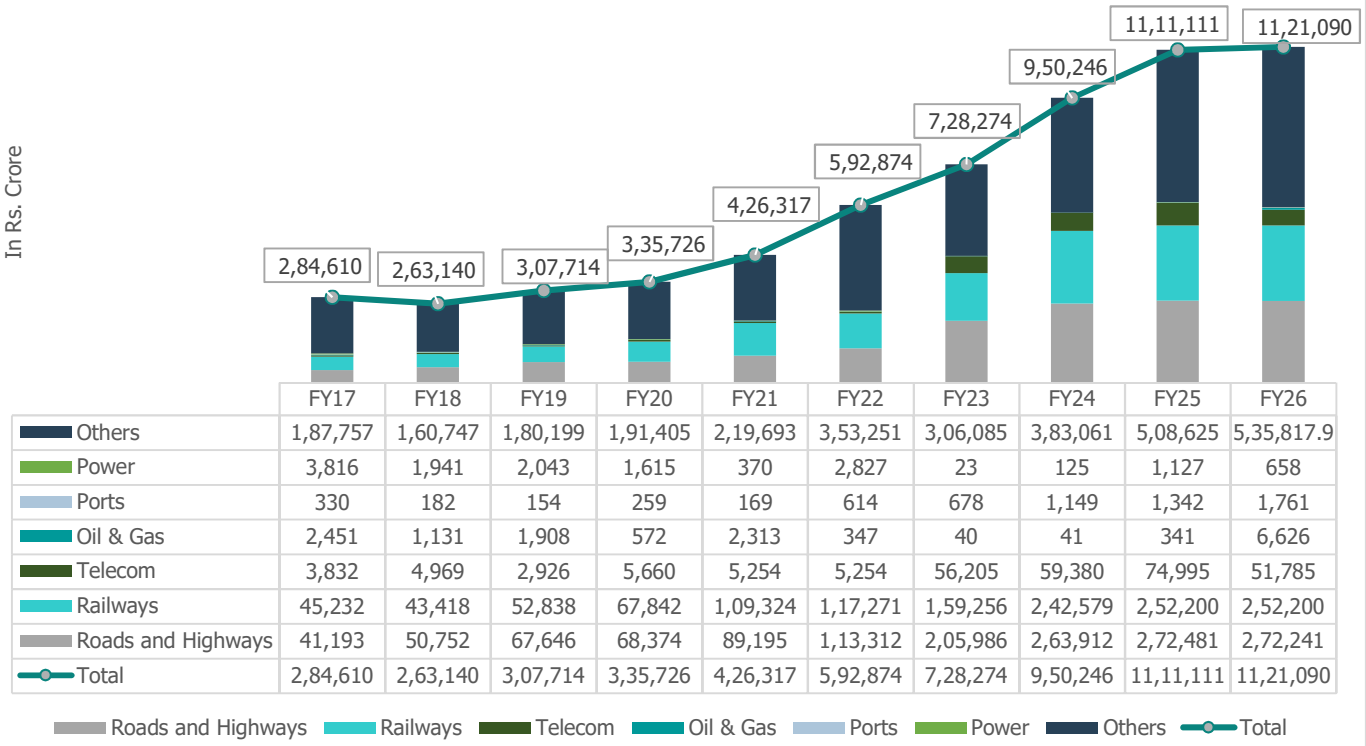
Particulars		At the end of FY22	Planned addition during FY22-27	At the end of FY27	Planned addition during FY27-32	At the end of FY32	Total
Transmission lines (ckm)	ISTS	2,00,036	51,185	2,51,221	43,324	2,94,545	6,48,190
	Intra-State	2,56,680	63,502	3,20,182	33,463	3,53,645	
Transformation capacity (MVA)	ISTS	4,60,965	4,72,225	9,33,190	3,48,165	12,81,355	24,11,885
	Intra-State	6,43,485	3,05,105	9,48,590	1,81,940	11,30,530	

Source: NEP, CareEdge Research

1.2.7 Government investment in infrastructure and improvement in infrastructure in country

With the growing population, the long-term need for robust infrastructure is necessary for economic development. This generates the need for massive investments in the development and modernization of infrastructure facilities, which will not only cater to the growing demand but will also ensure competitiveness in the global market.

Chart 7: Key Infrastructure Sectors for Capital Expenditure in Budget 2025-26



	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26
Others	1,87,757	1,60,747	1,80,199	1,91,405	2,19,693	3,53,251	3,06,085	3,83,061	5,08,625	5,35,817.9
Power	3,816	1,941	2,043	1,615	370	2,827	23	125	1,127	658
Ports	330	182	154	259	169	614	678	1,149	1,342	1,761
Oil & Gas	2,451	1,131	1,908	572	2,313	347	40	41	341	6,626
Telecom	3,832	4,969	2,926	5,660	5,254	5,254	56,205	59,380	74,995	51,785
Railways	45,232	43,418	52,838	67,842	1,09,324	1,17,271	1,59,256	2,42,579	2,52,200	2,52,200
Roads and Highways	41,193	50,752	67,646	68,374	89,195	1,13,312	2,05,986	2,63,912	2,72,481	2,72,241
Total	2,84,610	2,63,140	3,07,714	3,35,726	4,26,317	5,92,874	7,28,274	9,50,246	11,11,111	11,21,090

Source: Union Budget 2025-26 Analysis

Some of the key government infrastructure schemes include:

- The government has announced plans for the National Monetization Pipeline (NMP) and Development Finance Institution (DFI) to improve the financing of infrastructure projects
- The government has helped the growth of urbanization through a number of schemes and projects, including the **Smart Cities Mission,** the **Atal Mission for Rejuvenation and Urban Transformation (AMRUT),** and the **Pradhan Mantri Awas Yojana (Urban)**

1.2.8 Reforms undertaken by the government to boost Manufacturing Sector

A brief overview of some of the key structural reforms undertaken by the government is given below:

Production Linked Incentive (PLI) Scheme

Launched in March 2020, the PLI scheme aims to enhance domestic manufacturing capabilities, increase import substitution, and generate employment. It seeks to attract investments, boost production, and make Indian manufacturers globally competitive.

- The scheme includes an ambitious outlay of Rs. 1.97 lakh crore (over US$26 billion) to support 14 key sectors. The 14 key sectors covered are Mobile Manufacturing and Specified Electronic Components, Critical Key Starting Materials, Drug Intermediaries, and Active Pharmaceutical Ingredients, Manufacturing of Medical Devices, Automobiles and Auto Components, Pharmaceuticals Drugs, Specialty Steel, Telecom & Networking Products, Electronic/Technology Products, White Goods (Air Conditioners and LEDs), Food Products, Textile Products (MMF segment and technical textiles), High Efficiency Solar PV Modules, Advanced Chemistry Cell (ACC) Batteries, and

Drones and Drone Components. All 14 sector-specific PLI schemes have been approved and notified by the relevant Ministries or Departments and are at various stages of implementation.

- The PLI schemes are designed to attract significant investments in innovative technology, improve efficiency, and achieve economies of scale in the manufacturing sector. They are expected to significantly boost production, employment, and economic growth over the next five years.

Make in India

The Make in India initiative, launched in 2014, focuses to position India as a global manufacturing and entrepreneurial hub, transforming the business environment across various sectors. Its goal is to enhance the country's industrial capabilities and foster a culture of innovation and investment.

- It aims to reshape the relationship between the government and industry. Moving from a regulatory role to that of a facilitator, the government aims to partner with businesses to drive economic development. This shift is supported by recent policies like the Production Linked Incentive (PLI) scheme and Free Trade Agreements (FTAs), which address challenges such as high logistics costs and export competitiveness.
- The initiative has identified 25 key sectors for development, including manufacturing, infrastructure, and services. Foreign Direct Investment (FDI) has been significantly opened in areas like Defense Production, Construction, and Railway infrastructure, reflecting a strategic effort to boost industrial growth and attract global investment.
- It focuses on enhancing the ease of doing business by streamlining regulations, reducing licensing requirements, and introducing digital platforms for faster approvals. Concurrently, significant investments are being made in modern infrastructure, including the creation of industrial corridors and smart cities with advanced technology and high-speed communication. Upgrades to existing infrastructure are also in progress to improve logistics and support innovation and industrial growth.

Atmanirbhar Bharat (Self-Reliant India)

Announced in 2020, the Atmanirbhar Bharat initiative emphasizes self-reliance in manufacturing, aiming to reduce dependency on imports. It focuses on supporting domestic industries, particularly in critical sectors like defense, electronics, and pharmaceuticals, through production-linked incentives and local sourcing.

1.2.9 Concluding Remarks

Global economic growth faces headwinds from geopolitical tensions, volatile commodity prices, high interest rates, inflation, financial market volatility, climate change, and rising public debt. However, India's economy remains relatively strong, with an IMF forecast of 6.50% GDP growth in CY24 (FY25 according to the fiscal year), compared to the global projection of 3.29%. Key drivers include strong domestic demand, government capital expenditure and moderating inflation.

Public investment is expected to exhibit healthy growth as the government has allocated a strong capital expenditure of about Rs. 11.21 lakh crores for FY26. The private sector’s intent to invest is also showing improvement as per the data announced on new project investments and resilience shown by the import of capital goods. Additionally, improvement in rural demand owing to healthy sowing, improving reservoir levels, and progress in south-west monsoon along with government’s thrust on capex and other policy support will aid the investment cycle in gaining further traction.

The impact of U.S. tariffs on India’s export trade is anticipated to be minimal. The engineering goods sector will have a potential U.S. tariff impact, whereas steel industry is affected by the 10% tariffs although the impact is expected to be minimal given the volume of goods exported is less.

On February 13, Prime Minister Narendra Modi and President Donald Trump discussed enhancing the U.S.-India trade relationship, with a target to increase bilateral trade from USD 200 billion to USD 500 billion by 2030. Negotiations for a multi-sector bilateral trade agreement (BTA) are expected to commence later this year, focusing on trade fairness, national security, and job creation.

Thus, while U.S. tariffs may have a limited impact on India's exports, ongoing trade negotiations and India's competitive manufacturing advantage position it well for continued growth in global trade.

2. Indian Electrical wires and cables industry

2.1 Overview of Electrical wires and cables

Electric wires and cables are crucial components of electrical systems, responsible for transmitting power, signals, and data. They are typically made of conductive materials, such as copper, encased in insulating layers, and are engineered to ensure safe and efficient energy and information transfer across diverse applications and industries. Electric wire and cable are fundamental building blocks of modern infrastructure, serving residential, commercial, industrial, and institutional sectors. They are designed to meet specific technical requirements, such as current-carrying capacity, temperature resistance, flexibility, and environmental resilience. These components play a critical role in sectors including power distribution, telecommunications, automotive, construction, industrial machinery, and aerospace.

Types of Electric wires and cables

In India, with its rapidly growing industrial base, urbanization, and technological advancements, the demand for diverse types of wires and cables has expanded significantly. This includes applications in residential, commercial, industrial, and specialized sectors like renewable energy and electric vehicles.

The following sections categorize the types of electric wires and cables available in the Indian market based on their usage, applications, materials, and design features.

Table 4: Types of Electric Wires and Cables, End Users and their Market Size

Particulars	Description	End Use Industries	Market Size	CAGR (CY23 -28)
Power Cables	Power cables are crucial for transmitting and distributing electricity from generating stations to end-users. High-voltage cables are used for long-distance transmission, while medium- and low-voltage cables distribute power to homes and businesses.	Power Transmission and Distribution, Construction, Oil and Gas, IT, Automotive, Renewable Energy, etc.	USD 11.10 billion in CY23 to USD 17.08 billion in CY28	9.00 %
Magnet Winding Wires	Magnet Winding wire is a type of electrical wire or conductor where the base wire is either Copper or Aluminium with a thin insulation coating typically made of enamel/paper/insulating tapes such as polyester-Mica film-Aramid tapes, which is used for winding coils in various electrical and electronic devices.	Electrical Equipment & Appliances, Power Transmission & Distribution, Automotive Industry, Renewable Energy, Electronics and Telecommunications, Industrial Machinery, Railways & Metro, Consumer Durables	USD 4.22 billion in CY23 to USD 5.25 billion in CY28	4.50 %
Housing Wires	Housing wires are critical for the safe and efficient transmission of electricity within residential and commercial buildings. They are designed to manage low-voltage applications and ensure reliable power distribution for lighting, appliances, and other utilities.	Construction (Residential and Commercial)	N.A.	N.A.
Telecom Cables	Telecom cables are specialized cables designed to transmit voice, data, and multimedia signals efficiently. They are engineered to manage high-speed data transfer, durability, and resistance to environmental factors.	Telecommunications, IT, Construction	USD 0.95 billion in CY23 to USD 1.30 billion in CY28	6.50 %

Particulars	Description	End Use Industries	Market Size	CAGR (CY23 -28)
Instrumentation Cables	Instrumentation cables are specialized cables designed for transmitting low voltage signals, primarily used to connect instrumentation and control systems in industrial applications. These cables are designed to maintain signal integrity in environments with high electrical noise, vibrations, or extreme conditions.	Oil and gas, Power generation, and Manufacturing	USD 1.74 billion in CY23 to USD 2.62 billion in CY28	8.50 %
Other Special Cables	This category of cables includes coaxial cables, twisted pair cables, ethernet cables, audio cables, video cables, coil cables, and USB (universal serial bus) cables.	Telecommunications, IT, Residential and Commercial, Consumer Durables, etc.	N.A.	N.A.

Application of Electric Cables and Wires

Wires and cables are integral components across various industries and applications:

Chart 8: Industries and their applications

Electrical Power Transmission	Used to transmit electricity from power plants to substations, industrial facilities, commercial buildings, and homes
Telecommunications	Facilitate the transmission of voice, data, and video across telephone networks, internet infrastructure, and fiber optic systems
Automation and Control	Employed in industrial automation systems to transmit control signals and power machinery
Construction	Provide wiring for lighting, heating, cooling, and powering equipment in buildings and infrastructure projects
Automotive and Transportation	Used in vehicles for electrical systems, including power supply, lighting, and communication networks
Renewable Energy	Essential for connecting solar panels, wind turbines, and other renewable energy sources to the grid
Marine and Offshore	Used in ships and offshore platforms for power distribution, communication, and control systems
Aerospace and Defence	Critical for wiring systems in military equipment, aircraft, and space vehicles
Mining and Industrial Applications	Support heavy machinery and equipment in mining operations and industrial settings

2.2 Market outlook on Electrical wires and cables industry in India

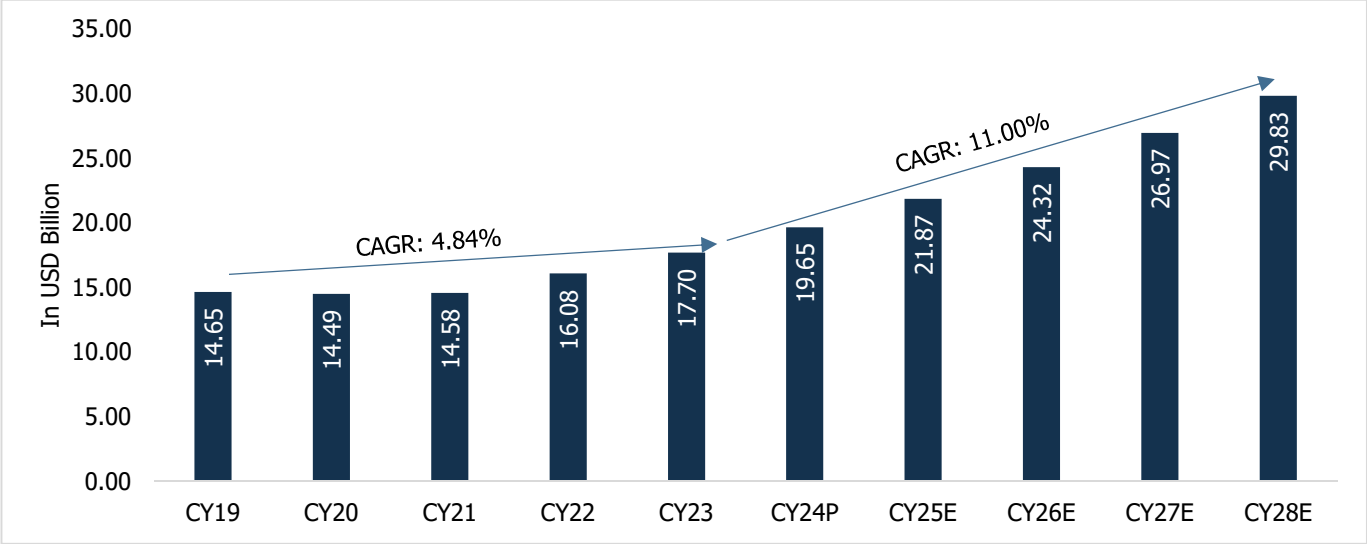
The electric wires and cables market in India is experiencing robust growth, fueled by a confluence of factors that are reshaping the industrial and technological landscape of the nation. Electric wires and cables play a pivotal role in supporting various industries, including electrical equipment, telecommunications, motor vehicles, and construction.

India's electric wires and cables market was valued at USD 17.70 billion in CY23, reflecting a CAGR of 4.84% from CY19 to CY23. The market is projected to reach USD 29.83 billion by CY28, expanding at a CAGR of 11.00% from CY23 to

CY28. This will create an incremental growth opportunity worth USD 12.12 billion between 2023 and 2028. This growth is driven by expanding infrastructure development, including enhancements in electricity generation, transmission, and distribution networks, which demand reliable and efficient cables suited for diverse environmental conditions.

The rapid growth of the real estate and construction sectors, driven by urbanization and industrialization, has significantly increased the demand for wiring solutions across residential, commercial, and industrial buildings. Smart city initiatives and sustainable infrastructure projects further drive the need for advanced, energy-efficient cables to support modern technologies. Simultaneously, the growth of digitalization and connectivity has boosted demand for high-quality cables in the telecommunications sector, with the proliferation of mobile networks, broadband services, and fiber optics requiring seamless data transmission solutions. The automotive industry, particularly the electric vehicle (EV) market, is also a key growth driver, as India's focus on sustainable transportation fuels the demand for specialized, lightweight, and efficient cables to power EVs and enable their advanced features. These factors collectively contribute to the robust expansion of the electric wires and cables market in India.

Chart 9: Indian Electric Wires and Cables Market – By Value

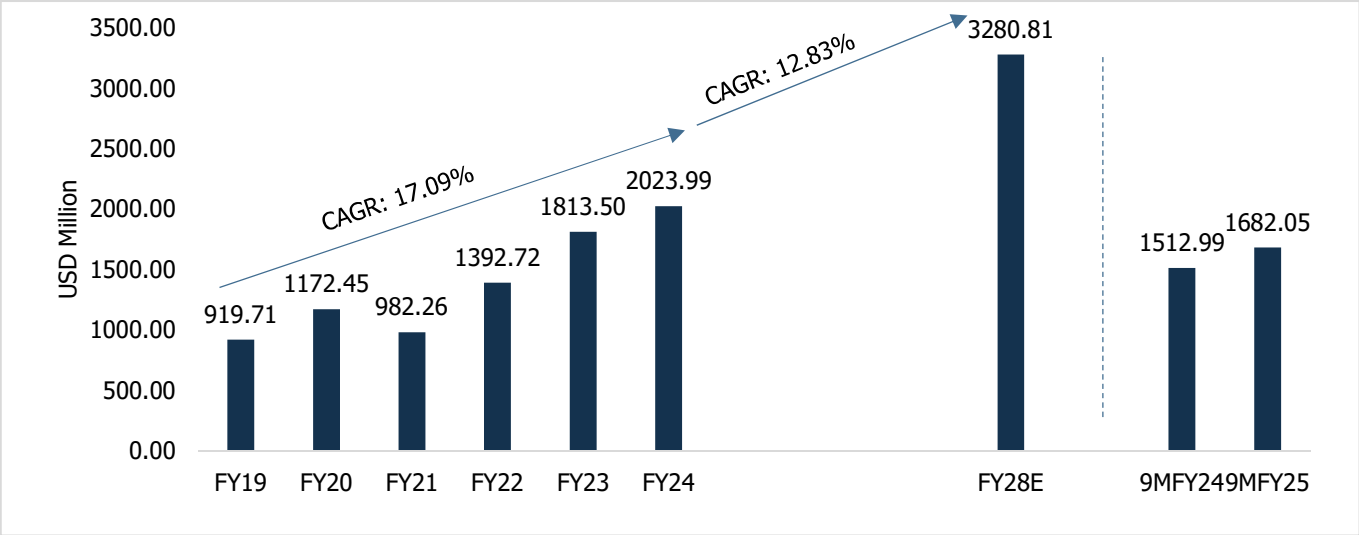


Source: Mordor Intelligence, EMIS, CareEdge Research; Note: E- Estimate, P- Projection

2.3 Overview of Export of Electrical wires & cables from India

The export of electric wires and cables (W&C) has shown a fluctuating yet strong upward trajectory from FY19 to FY24. Indian electric W&C industry witnessed rise in export from USD 919.71 million in FY19 to USD 2,023.99 million in FY24, reflecting a healthy CAGR of 17.09%. This growth has been driven by factors such as post-pandemic recovery, rising global demand for energy-efficient solutions, technological advancements in cable manufacturing, and the expansion of sectors such as renewable energy, electric vehicles (EVs), and telecommunications. Additionally, the growing preference for Indian manufacturers, known for their improved product quality and competitive pricing, has strengthened the country's position in the global market. Furthermore, lower labor costs as compared to developed economies like USA, Germany, Japan and China, Indian manufacturers benefit from reduced production expenses, especially in labor-intensive cable segments. In April-November FY24, exports reached USD 1,682.05 million, showcasing sustained momentum. This steady growth highlights India's strengthening competitiveness in the global electric wire and cable market, supported by robust industrial and infrastructure development.

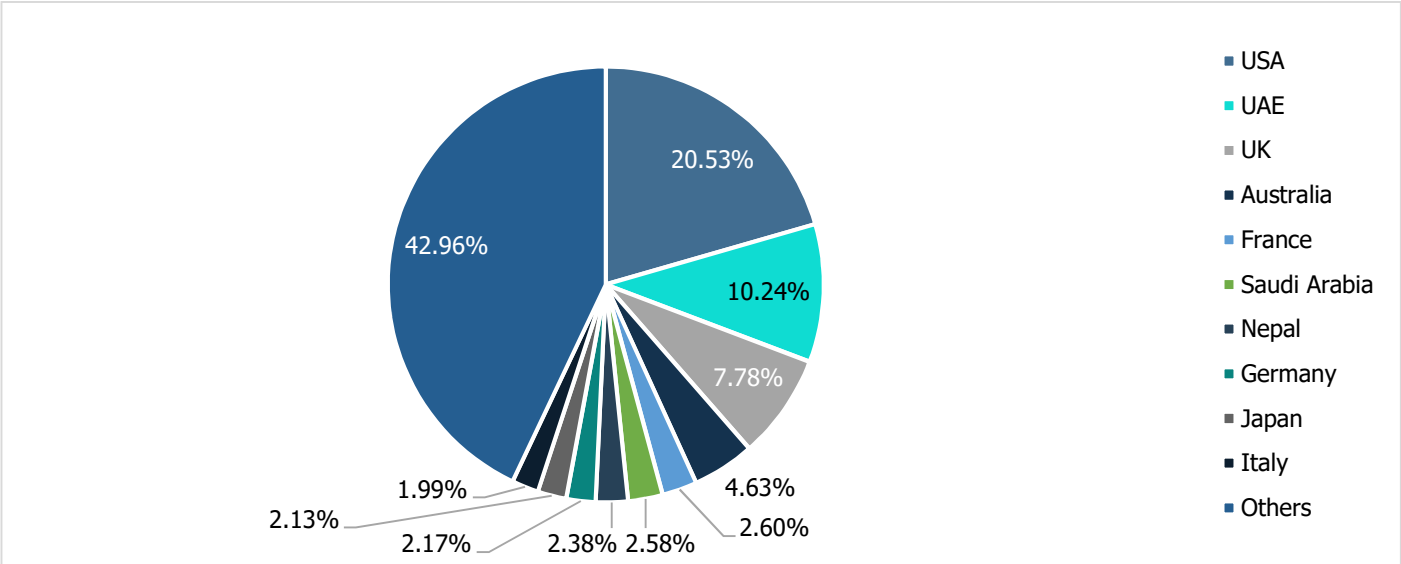
Chart 10: Export of Electric Wires and Cables by India



Source: Ministry of Commerce; CareEdge Research, HS Code: 8544

India majorly exports to USA constituting approximately 20.53% of exports, followed by the UAE (10.24%) and the UK (7.78%). Other key markets include Australia (4.63%), France and Saudi Arabia (2.60% and 2.58% respectively), Nepal (2.38%), and Germany (2.17%) and a significant 42.96% is attributed to other countries. This highlights the widespread acceptability of Indian wire and cable products in global markets.

Chart 11: Electric Wires and Cables Export Share by Countries for FY24



Source: Ministry of Commerce; CareEdge Research

Looking ahead, the export of electrical wires and cables is projected to reach USD 3,280.81 million by FY28, growing at a CAGR of 12.83% over the forecast period. This growth will primarily be driven by the rapid expansion of renewable energy projects worldwide, increasing demand for power transmission and distribution infrastructure, and the global rollout of 5G and fiber-optic networks. Additionally, this growth would also be driven by following few factors –

China plus one strategy - In the 1990s, many global manufacturing companies from regions like the US and Europe relocated their production facilities to China, drawn by its favourable production conditions, establishing the country as the hub of the global supply chain. However, in 2021, a surge in global demand following the COVID-19 pandemic, coupled with China's zero-COVID policy, and ensuing supply chain disruptions, created challenges for manufacturers in meeting demand. This has prompted businesses to consider diversifying their operations and investments away from China to alternative locations. This shift presents a significant opportunity for India, supported by its expansive manufacturing base, competitive production advantages, robust business ecosystem, and supportive government policies. These factors position India well to capitalize on this trend, driving growth in exports for its wires and cables industry.

Export Incentives: The Government of India has introduced various policy measures to promote the export of goods and services, which are expected to further strengthen the export market for wires and cables in India. Key initiatives include the Advance Authorization Scheme (AAS) and the Export Promotion Capital Goods (EPCG) Scheme, which facilitate duty-free import of raw materials and capital goods for the production of export goods. Additionally, the Remission of Duties and Taxes on Exported Products (RoDTEP) scheme offers rebates on central, state, and local duties and taxes levied on exported products, enhancing cost competitiveness in global markets. Other significant initiatives like the Trade Infrastructure for Export Scheme (TIES) aim to develop export-related infrastructure are also creating a favorable environment for the growth of W&C exports from India.

Increasing Global Demand for Energy-Efficient Products: The growing global emphasis on sustainability and energy efficiency is creating substantial opportunities for India's wires and cables industry to expand its exports, particularly in the renewable energy and electric vehicle (EV) sectors. The global push for clean energy solutions, driven by commitments such as the Paris Agreement and net-zero emission targets, has led to increased adoption of renewable energy projects worldwide. This has significantly boosted the demand for specialized cables used in wind and solar power systems. Similarly, the rapid adoption of EVs across the globe has driven demand for high-performance wires and cables critical for vehicle components such as batteries, electric motors, and inverters, as well as for fast-charging stations.

The recent imposition of a **10% baseline tariff by the United States** (possible revision post 9th July, 2025) on India is expected to have a limited impact on India's wires and cables export market, as this segment accounts for only 0.53% of the country's total exports. However, Indian companies with significant revenue exposure to the U.S. market may experience some adverse effects. Notably, tariff exclude certain items such as copper, pharmaceuticals, semiconductors, lumber articles, bullion, and energy-related minerals that are not readily available in the US. Moreover, global copper prices have declined, which is likely to benefit wires and cables manufacturers in India.

2.4 Overview on types of Magnet Winding Wires and its key end use industries in India

Magnet winding wire is a critical component in electric motors, which are found in household appliances, industrial machines, and automobiles. As these industries expand, so does the demand for enameled or magnet cables. Transformers, generators, electromagnetic components, medical devices, and consumer electronics are some of the other applications for these cables.

2.4.1 Types of Magnet Winding Wires

Magnet winding wires are broadly classified into Standard Magnet winding wires and Specialty Magnet winding wires, based on their construction, insulation type, and application in electrical and industrial sectors.

Table 5: Comparison Between Standard Magnet Winding Wires & Specialty Magnet Winding Wires

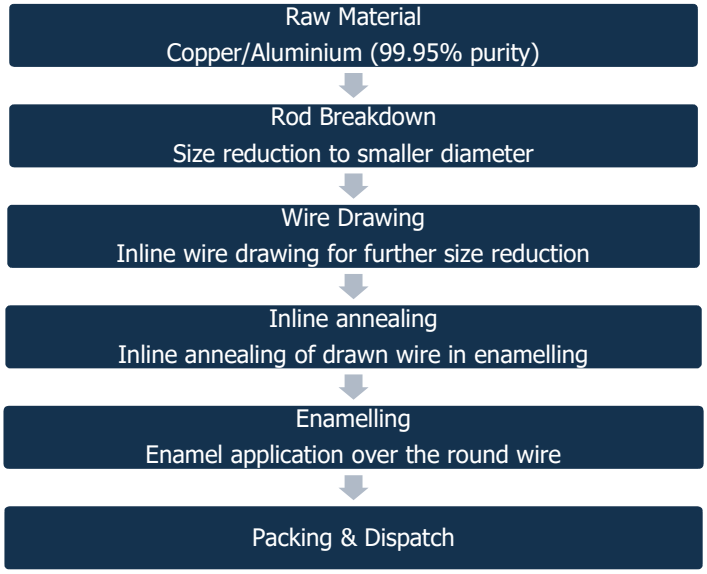
Features	Standard Magnet Winding Wires	Specialty Magnet Winding wires
Product Properties	Enamel (Polyester, Polyester amide, Polyimide)	Multi-layer insulation (paper, enamel + paper), transposed structures, bunching
Manufacturing	Simple, uniform process making it cost effective and suitable for high-volume production	Requires precision engineering, multiple processing stages which enables customization and adaptability to harsh environments
Applications	LT and BLDC motors, Distribution transformers with MVA rating of 15KVA-25MVA, Traction Motors, Consumer Electronics, DG Sets	Transformers with MVA rating of 15KVA->600MVA, 765 MVA transformer and reactors, HT Motors, Traction motors and Alternators
Performance Requirements	Standard electrical insulation	Enhanced insulation, mechanical strength, reduced eddy current losses
Pricing	Raw material and volume-based pricing	These wires are usually priced 6-7% higher than standard wires, since it involves complexity and specialized applications, performance additives, precision coating, testing, R&D costs
Validations and certifications	Along with UL, ISO, IATF certifications - IEC 60317/IS 13730 (various parts)	Along with UL, ISO, IATF certifications - IEC 60317/IS 13730 (various parts), Speciality wires also meets IS 13778, IS 19059, RoHS and c Compliance which are specific to advanced electrical equipment

2.4.1.1 Standard Magnet Winding wires

Standard magnet winding wires are widely used in general electrical applications, including motors, transformers, and coils. These wires primarily feature enamel insulation, providing electrical insulation and mechanical protection. The key types include Enamel Copper and Enamel Aluminium wires. These wires cater to all types of motors used in industrial applications like industrial machinery, automotive traction motors, BLDC motors used in home appliances like ac, refrigerators, fans, etc.

Enamel Copper Magnet Winding Wire – Round

Chart 12: Process flow of manufacturing of Enamelled Copper/Aluminium Round Magnet Winding Wires



Description: Enamel copper magnet winding wire is a highly conductive copper wire coated with a thin layer of insulation, making it ideal for electrical winding applications. Made from electrolytically refined copper, these wires are annealed to enhance their mechanical properties, including tensile strength and flexibility. The enamel coating provides essential electrical insulation while maintaining the wire's durability and flexibility, which is crucial for winding in motors, transformers, switchgear, and various consumer and industrial electronics. These wires offer superior electrical efficiency due to copper's low resistivity, ensuring minimal voltage drop and reduced energy loss, making them perfect for long distance transmission. They also exhibit excellent anti-fatigue properties, low heat generation, and high ductility, ensuring operational safety and longevity. These wires are available in different grades, with varying thicknesses of insulation, and comply with international standards, making them suitable for a wide range of industrial applications.

Usage: They are used in low voltage motors, transformers, switch gears, inductors, generators, coil windings, domestic appliances, pumps and fans, Traction Motors for EVs (2W and 3W), Compressors for ACs, etc.

Enamel Aluminium Magnet Winding Wire - Round

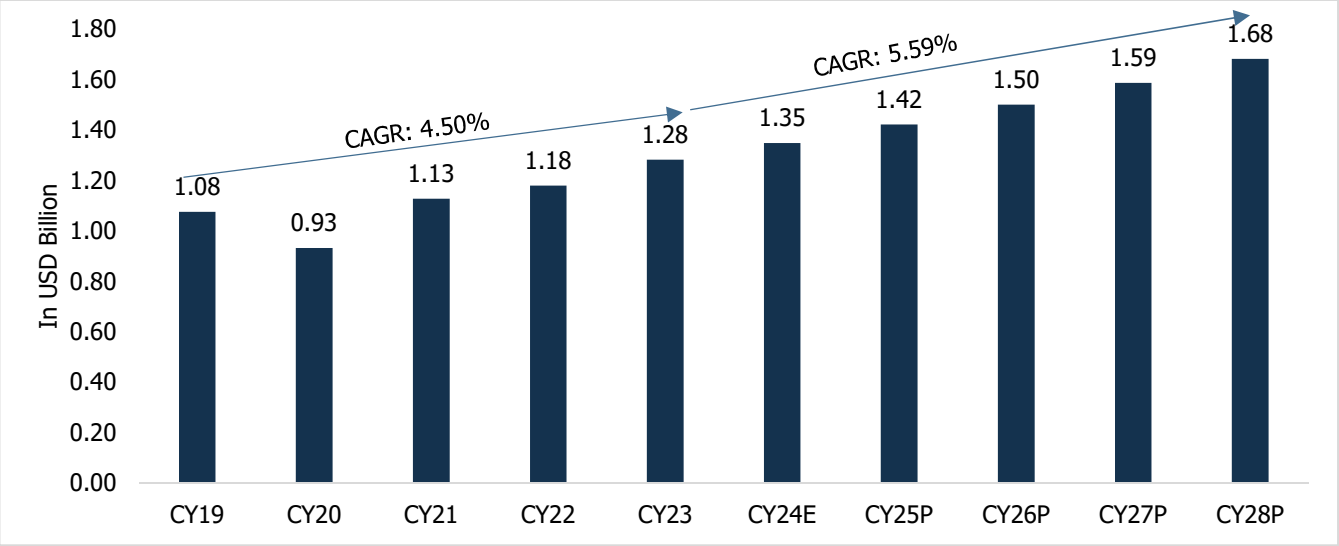
Description: Enamel aluminium magnet winding wire is a type of wire made from aluminium and coated with a thin layer of insulation, typically enamel. This insulation ensures electrical isolation while preserving the wire's flexibility and mechanical integrity, making it ideal for use in winding electrical components like transformers, motors, and generators. Aluminium offers several advantages, such as being lightweight and cost-effective compared to copper, and although it has lower electrical conductivity, its performance remains efficient due to the ability to produce larger cross-sectional areas. The enamel coating enhances the wire's durability by providing resistance to environmental factors such as oxidation, ensuring its longevity in demanding applications. Enamel-coated aluminium magnet winding wire is widely used across various industries, including automotive, consumer electronics, and industrial machinery, where its lightweight properties and high durability are crucial. It is particularly valuable in electric motors and household appliances, where space and weight are key considerations, contributing to efficient power conversion and transmission.

Usage: They are used in low voltage motors, transformers, switch gears, inductors, generators, coil windings, domestic appliances, pumps and fans, Compressors for EVs, etc.

Market size of Standard Magnet Winding wires

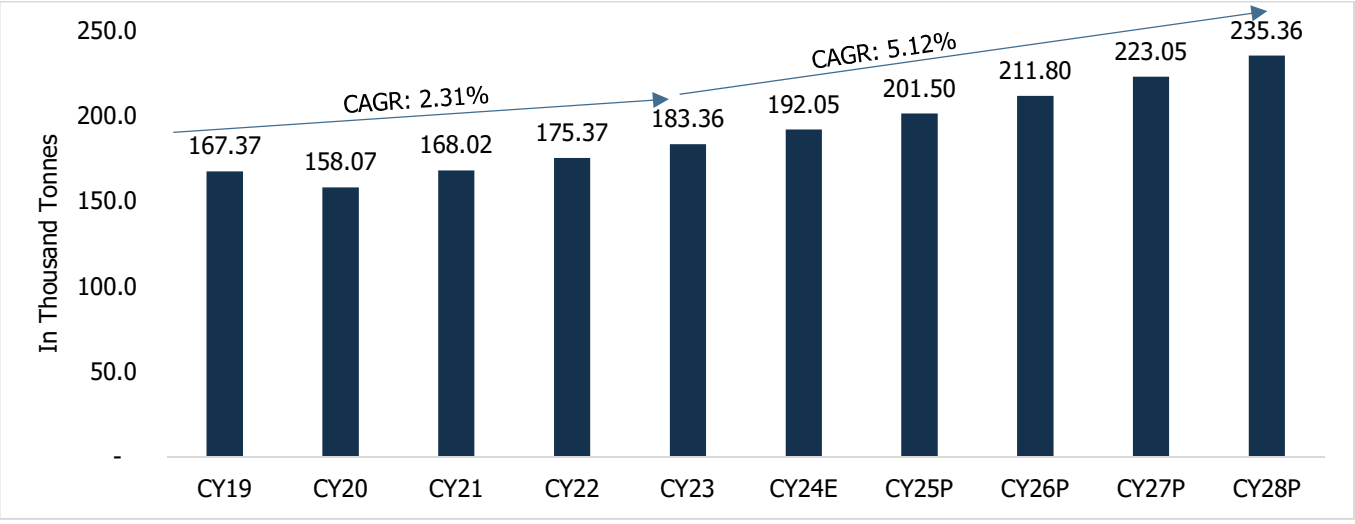
The standard magnet winding wire market has experienced steady growth, with demand increasing from USD 1.08 billion in CY19 to USD 1.28 billion in CY23, reflecting a CAGR of 4.50%. The initial decline in CY20 was likely due to disruptions caused by the COVID-19 pandemic, but the market rebounded in subsequent years, driven by growing demand from key industries such as automotive, power, and electronics. The expected growth trajectory indicates a continued rise, with projections reaching USD 1.68 billion by CY28, supported by a higher CAGR of 5.59% from CY23 to CY28. This positive outlook is attributed to the expansion of renewable energy projects, rising adoption of electric vehicles, and increased focus on industrial automation.

Chart 13: Market size of Standard Magnet Winding Wires in India - By Value



Source: CMI, CareEdge Research; Note: E- Estimate, P- Projection

Chart 14: Market size of Standard Magnet Winding Wires in India - By Volume



Source: CMI, CareEdge Research; Note: E- Estimate, P- Projection

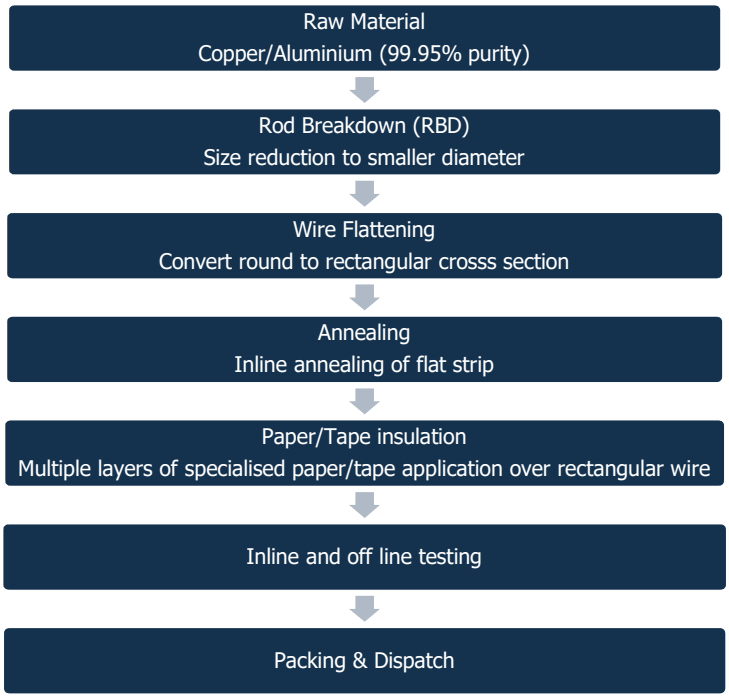
2.4.1.2 Specialty Magnet Winding Wires

Specialty Magnet Winding wires are designed for high-performance applications, offering enhanced insulation, reduced energy losses, and superior mechanical strength. These wires cater to specialized industries such as high-efficiency transformers, power reactors, and high-voltage electrical machines.

The key types include Paper insulated magnet winding wires, Rectangular Enamel Magnet Winding wires, CTCs and many more which are listed below –

Paper insulated Copper Magnet Winding wires

Chart 15:Process flow of manufacturing of Paper Insulated Copper/Aluminium Magnet Winding Wires



Description: Paper insulated Copper Magnet Winding Wires consist of copper wires wrapped in one or more layers of specially chosen insulating paper, such as Kraft, Crepe, or Nomex. These wires are primarily used in high-performance applications like transformer and heavy motor electrical winding. The insulation plays a critical role in enhancing the conductor's dielectric strength, thermal stability, and resistance to electrical surges. The type of paper and the thickness of the insulation are selected based on specific mechanical, chemical, and thermal requirements, providing tailored protection for different voltage levels. This insulation not only ensures reliable performance in demanding environments but also improves heat dissipation, making the conductors capable of withstanding high temperatures without degradation. By combining the superior conductivity of copper with robust paper insulation, these wires offer durability, efficiency, and long-term reliability for applications where high electrical performance is essential.

Usage: They are used in Distribution Transformers, Power Transformers, dry-type transformers and traction transformer for metro railways, motors, generators etc.

Paper insulated Aluminium Magnet Winding wires

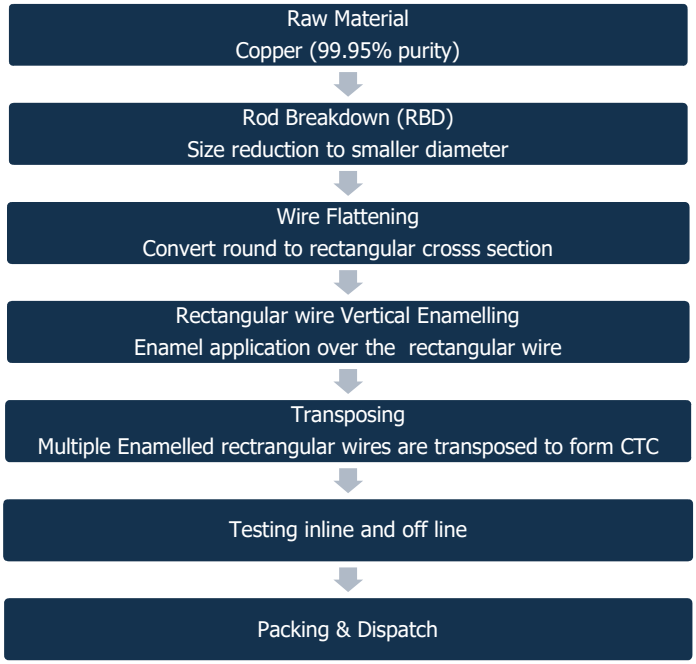
Description: Paper Covered Aluminium Magnet Winding Wires are aluminum wires insulated with layers of specially treated paper, designed for applications requiring both effective insulation and durability. The paper insulation, typically

made from materials like kraft, crepe, or impregnated paper, provides excellent dielectric strength and thermal resistance, allowing these conductors to withstand high-voltage environments. The layered paper covering enhances the conductor's ability to resist electrical stress and mechanical strain, making them ideal for use in transformers, reactors, and other electrical equipment. These wires are lightweight compared to copper conductors, offering a cost-effective solution without compromising on efficiency or reliability. Their insulation also helps dissipate heat, ensuring safe and effective transmission of electrical energy in various systems.

Usage: They are used in dry-type transformers, distribution transformers, Inverted Duty Transformers, motors, etc.

Continuous Transposed Conductors (CTC)

Chart 16: Process flow of manufacturing of Continuous Transposed Conductors (CTC)



Description: Continuous Transposed Conductors (CTCs) are highly specialized electrical conductors designed for use in windings for Power Transformers. A CTC consists of multiple rectangular enamel-insulated copper or aluminium strands, precisely arranged, and continuously transposed along their length. This transposition minimizes electrical losses by mitigating the skin and proximity effects that can otherwise cause uneven current distribution during alternating current (AC) transmission. Their compact design, excellent heat dissipation, and enhanced electrical efficiency make them ideal for applications where high-power density and reliability are essential.

Usage: These are used primarily in Power Transformers, 765 KV Transformers, HVDC Transformers, Traction Transformers, Reactors.

Enamel Copper Magnet Winding Wires - Rectangular

Chart 17:Process flow of manufacturing of Enamelled Copper/Aluminium Magnet Winding Wires

Description: Rectangular enamel copper magnet winding wires is a flat copper conductor coated with a durable enamel insulation layer, offering high resistance to electrical currents, oxidation, and physical damage while maintaining excellent conductivity. The flat structure enhances winding efficiency, space optimization, and heat dissipation, making it ideal for high-performance electrical devices such as transformers, electric motors, and inductors. Its mechanical stability and temperature resistance ensure reliable performance in demanding environments, where precise control and efficient energy transfer are essential.

Usage: They are used in high voltage motors, transformers, switch gears, inductors, generators, coil windings, Traction Motors for EVs, etc.

Enamel Aluminium Magnet Winding Wires - Rectangular

Description: Rectangular enamel aluminium magnet winding wires are flat, lightweight conductors coated with an insulating enamel layer, widely used in electrical applications like transformers, motors, and inductors. The enamel coating provides protection against oxidation and ensures safe electricity conduction, while the strip's flat profile allows for compact, efficient winding configurations. These strips offer high conductivity, corrosion resistance, and heat resistance, making them ideal for demanding environments in industries like automotive, renewable energy, and aerospace, where weight and performance are critical.

Usage: They are used in transformers, switch gears, inductors, coil windings, etc.

Multi strand Bunched Paper Covered Copper Magnet Winding wires

Description: Multi strand Bunched Paper Covered Copper Magnet Winding wires are specialized electrical conductors used primarily in applications requiring enhanced insulation and thermal resistance. These cables are constructed with multiple layers of paper insulation, typically impregnated with oils or resins, which provide excellent electrical insulation

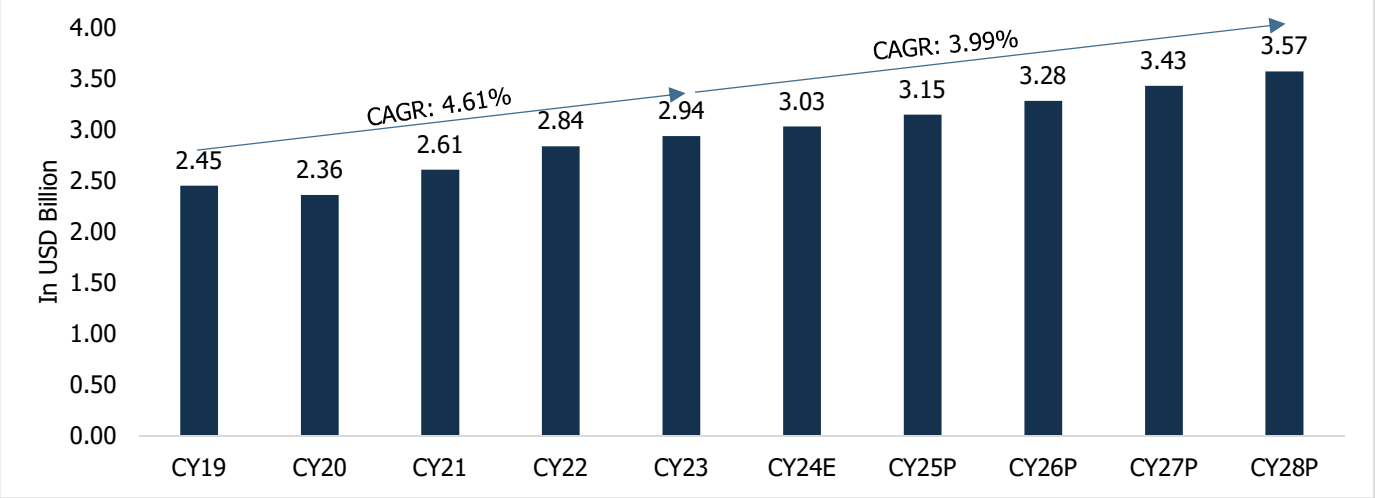
properties while also resisting heat and moisture. The use of copper as the conductor material ensures high electrical conductivity, making these cables ideal for various industrial applications.

Usage: They are used in power and distribution transformers; transmission and industrial applications particularly where high voltage and dependable performance are required.

Market size of Specialty Magnet Winding wires

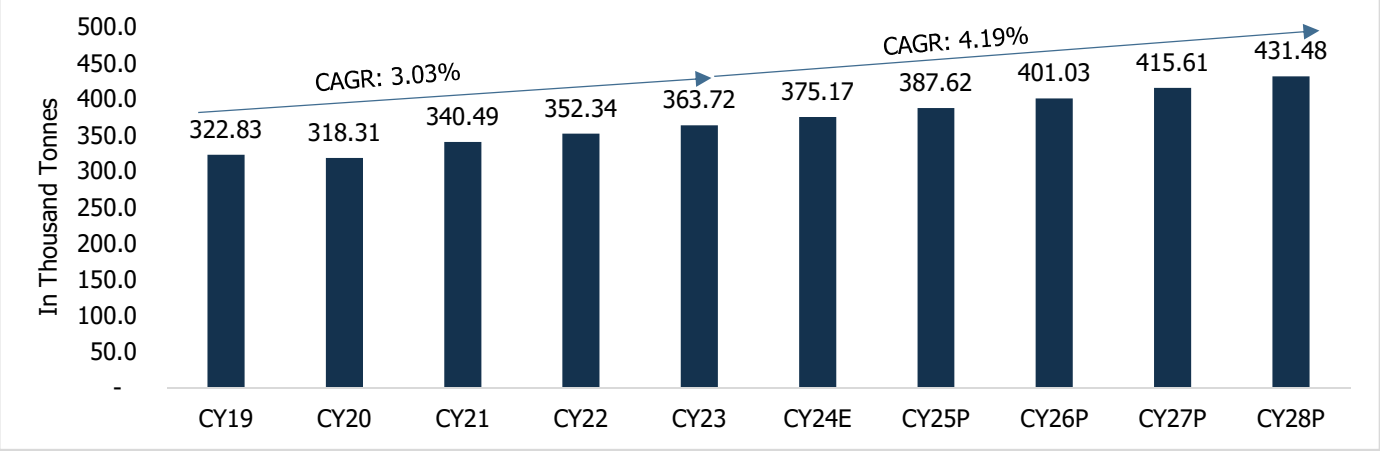
The market for Specialty Magnet Winding wires has demonstrated steady growth, increasing from USD 2.45 billion in CY19 to USD 2.94 billion in CY23, reflecting a CAGR of 4.61%. The growth was driven by the country's growing infrastructure, industrialization, and power sector expansion. The increasing need for energy-efficient transformers and motors in industries such as construction, manufacturing, and utilities spurred the use of enamel copper strips due to their superior conductivity, compactness, and heat dissipation properties. The segment is expected to maintain a strong growth trajectory, with projections reaching USD 3.57 billion by CY28 at a CAGR of 3.99% from CY23 to CY28. This growth is primarily fueled by expanding electrification initiatives, rising investments in power transmission networks, and the growing shift towards renewable energy, which requires efficient conductors for energy distribution.

Chart 18:Market size of Specialty Magnet Winding Wires in India - By Value



Source: CMI, CareEdge Research; Note: E- Estimate, P- Projection

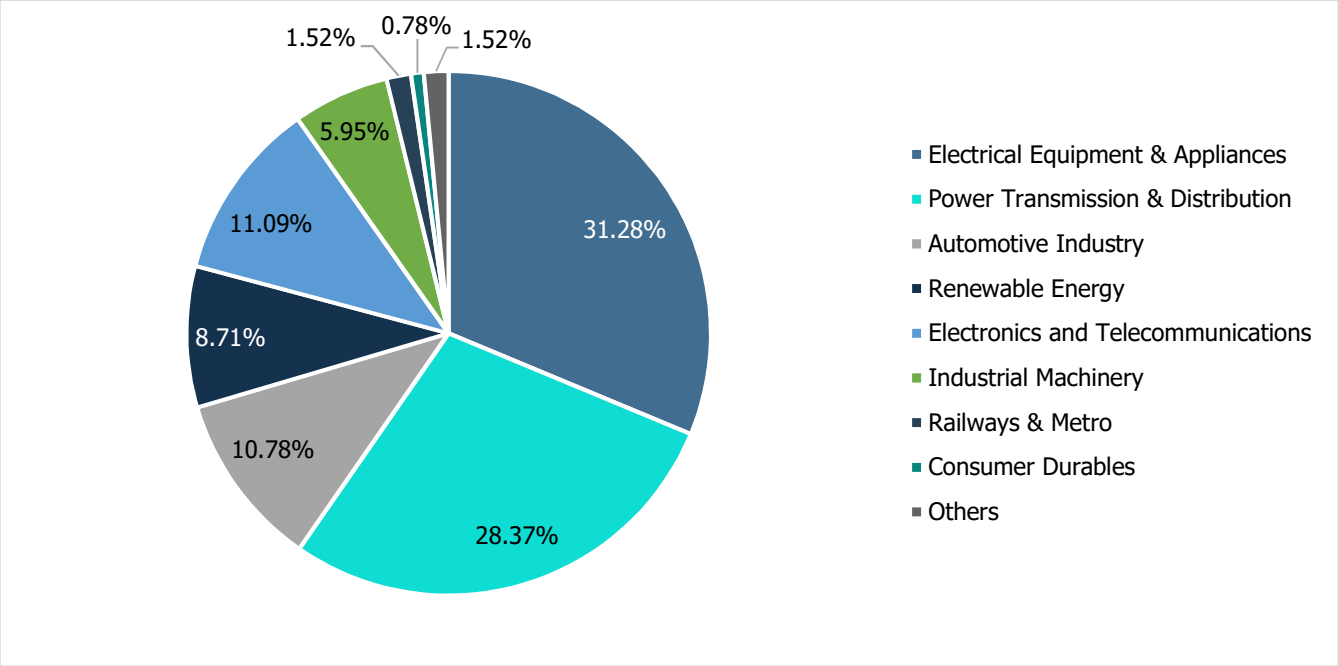
Chart 19: Market size of Specialty Magnet Winding Wires in India - By Volume



Source: CMI, CareEdge Research; Note: E- Estimate, P- Projection

2.5 Key End Use Sectors

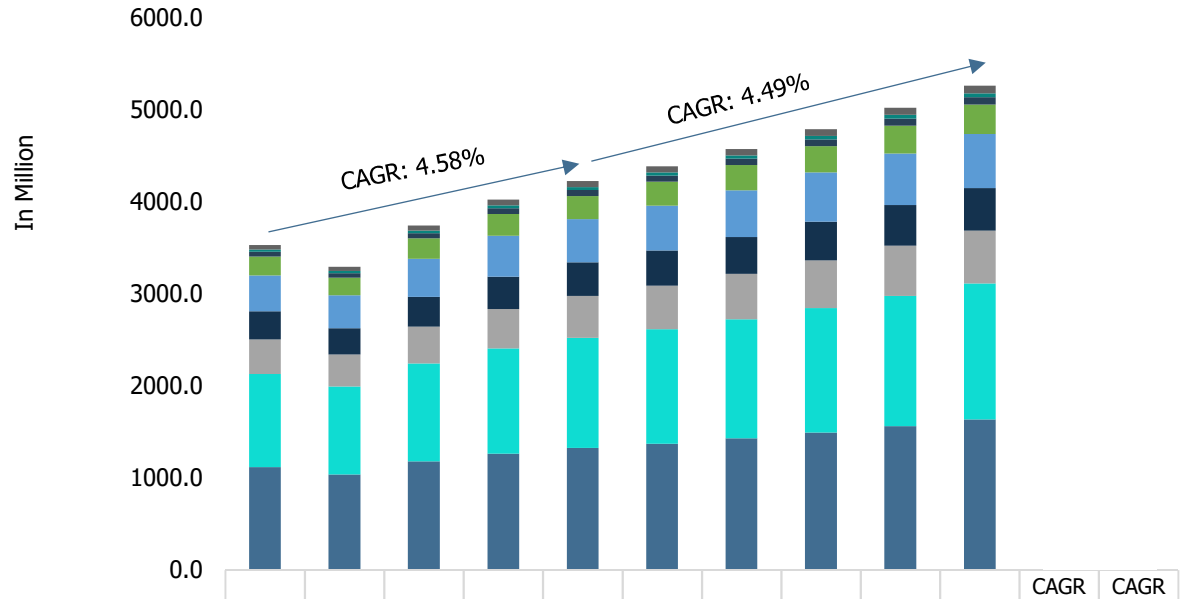
Chart 20: Share of Magnet Winding wires by End User Industry for CY24E in India



Source: CMI, CareEdge Research

The magnet winding wire market serves a variety of end-user industries, with the largest demand coming from Electrical Equipment & Appliances (31.28%) and Power Transmission & Distribution (28.37%), reflecting the essential role of magnet winding wires in energy distribution and electrical systems. Other significant contributors include the Electronics and Telecommunications (11.09%), fueled by advancements in digital technologies and consumer electronics and Automotive Industry (10.78%), driven by the growth of electric vehicles. Emerging sectors like Renewable Energy (8.71%) highlights the increasing use of winding wires in sustainable energy solutions, while Industrial Machinery (5.95%) underscores their importance in manufacturing processes. Smaller segments such as Railways & Metro (1.52%) and Consumer Durables (0.78%) cater to specialized applications, demonstrating the broad utility of winding wires. Overall, the market is characterized by its critical role in supporting modern infrastructure, industrial expansion, and technological progress.

Chart 21:Consumption of Magnet Winding wires by End User Industry in India



	CY19	CY20	CY21	CY22	CY23	CY24E	CY25P	CY26P	CY27P	CY28P	CAGR CY19-23	CAGR CY23-28
Others	49.7	47.0	54.4	60.2	63.6	66.5	70.0	74.2	78.7	83.0	6.3%	5.5%
Consumer Durables	26.2	24.4	28.4	31.4	32.9	34.1	35.7	37.7	39.8	41.9	5.8%	4.9%
Railways & Metro	52.2	48.6	56.2	62.1	64.5	66.6	69.4	72.8	76.5	80.2	5.4%	4.4%
Industrial Machinery	204.8	192.1	220.1	238.8	250.7	260.6	272.8	286.6	301.5	317.0	5.2%	4.8%
Electronics and Telecommunications	386.7	357.3	412.5	445.2	467.9	485.8	508.1	533.3	560.7	589.2	4.9%	4.7%
Renewable Energy	304.9	282.7	323.3	347.4	366.6	381.6	399.1	418.9	440.4	462.5	4.7%	4.8%
Automotive Industry	377.2	347.8	400.5	429.5	453.8	472.3	494.0	518.5	545.0	572.7	4.7%	4.8%
Power Transmission & Distribution	1011.7	957.0	1064.3	1141.9	1196.8	1242.9	1292.8	1350.8	1413.0	1475.2	4.3%	4.3%
Electrical Equipment & Appliances	1114.1	1034.6	1177.1	1261.9	1322.6	1370.0	1427.2	1491.4	1561.1	1633.1	4.4%	4.3%

Source: CMI, CareEdge Research; Note: E- Estimate, P- Projection

Electrical Equipment & Appliances Industry

The Electrical Equipment and Appliances is a vital sector, encompassing the production of a wide range of products such as transformers, switchgear, wires, cables, consumer appliances, and industrial machinery. It plays a pivotal role in supporting infrastructure development, energy generation, and industrial growth.

The Electrical Equipment and Appliances sector is the largest market for winding wires, driven by its application in motors, transformers, generators, and other electrical components. From CY19-23, the demand for winding wires in this sector grew at a CAGR of 4.38%, fueled by rapid urbanization, increasing electrification, and government initiatives promoting infrastructure and manufacturing and is expected grow at CAGR of 4.31% for CY23-28. Despite this marginal decline, the sector will remain a significant consumer of winding wires. The demand will be fueled by growing emphasis on energy efficiency, renewable energy integration, and technological advancements in electrical equipment. The shift towards smart appliances and industrial automation also presents opportunities for specific winding wires such enamel copper/aluminium winding wires, CTCs etc., designed for high-performance and sustainable applications. These trends ensure the continued relevance of winding wires within this evolving industry.

Power Generation, Transmission & Distribution

The power industry is divided into three segments:

- Generation
- Transmission
- Distribution

Generation is the process of producing electricity from various sources like thermal energy (coal, diesel etc.), nuclear and renewable sources such as sunlight and wind, natural gas, etc. in generating stations or power generation plants. Transmission utilities transport large amount of electricity from power plants to distribution substations via a grid at high voltages. The retail electricity distribution, which is the distribution of electricity to consumers at lower voltages, forms part of the distribution segment.

The Power Transmission & Distribution (T&D) sector is a crucial end-user of magnet winding wires in India, driven by the country's growing energy demands and infrastructure development. In CY23, the consumption of magnet winding wires was valued at USD 1,196.84 million, which grew at a CAGR of 4.29% from CY19 to CY23. This growth was largely driven by government initiatives such as Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY) and Integrated Power Development Scheme (IPDS) aimed at achieving universal electrification and strengthening the national grid. Additionally, increased investments in rural electrification, the expansion of transmission lines, and the integration of renewable energy sources into the grid further accelerated the consumption of winding wires.

Looking ahead, the consumption in the sector is expected to grow at a CAGR of 4.27% from CY23 to CY28. The government's focus on grid modernization to upgrade aging infrastructure and enhance efficiency and reliability will boost demand for advanced transformers and switchgear, which heavily rely on winding wires. Additionally, the integration of renewable energy sources to meet India's ambitious target of 500 GW by 2030 will require robust transmission infrastructure, further increasing winding wire usage. The adoption of smart grid technologies under the Revamped Distribution Sector Scheme (RDSS) will also contribute to the demand for specialized, high-performance winding wires. These factors will ensure steady growth in the consumption of winding wires in this sector in the coming years.

Automotive Industry

The automotive industry in India is one of the largest and fastest-growing sectors globally, playing a pivotal role in the country's economic development. It encompasses a wide range of vehicles, including passenger cars, commercial vehicles, two-wheelers, and electric vehicles (EVs). India is the second largest manufacturer of two-wheelers, the largest manufacturer of three-wheelers and 3rd largest manufacturers of passenger cars in the world. According to EMIS, the Indian automotive manufacturing industry was valued at USD 84.57 billion in 2023, growing from USD 58.80 billion in 2020, with a CAGR of 12.88%. It is projected to grow to USD 113.50 billion by 2028, at a CAGR of 6.06%. This industry is considered to be one of the major drivers of economic growth due to its linkages with multiple industries.

The automotive industry in India is a significant consumer of winding wires, primarily used in electric motors, alternators, transformers, and other critical components. In CY23, the consumption of magnet winding wires was valued at USD 453.77 million, which grew at a CAGR of 4.73% from CY19 to CY23. This growth was largely driven by the growing demand for vehicles, advancements in automotive technology, and the push toward electrification. The introduction of government initiatives such as the FAME II scheme and incentives under the PLI scheme further accelerated the adoption of electric vehicles (EVs), leading to greater consumption of winding wires.

Looking forward, the sector's consumption of magnet winding wires is projected to grow at a CAGR of 4.76% from CY23 to CY28. The transition toward green mobility, increasing penetration of EVs, and advancements in hybrid vehicle technologies will remain key drivers of demand for high-performance winding wires. Furthermore, the growing focus on connected vehicles and advanced driver-assistance systems (ADAS) will contribute to the rising need for specialized winding wires in automotive electronics. The Indian automotive industry's transition to electric and smart mobility solutions will sustain the demand for winding wires, making it a critical end-use segment.

Renewable Energy

Renewables, including solar, wind, hydropower, biofuels, and others, are at the centre of the transition to less carbon-intensive and more sustainable energy systems. India's renewable energy sector is one of the fastest-growing globally, driven by the government's commitment to sustainability and energy security. As per the National Electricity Plan Vol-1 (October 2024), the installed power generating capacity from renewable sources was 193.5 GW and is projected to reach 612.7 GW by 2032, growing at a CAGR of 15.50%.

The renewable energy sector in India is an emerging consumer of magnet winding wires, driven by the rapid expansion of solar, wind, and hydroelectric power projects. In CY23, the consumption of magnet winding wires was valued at USD 366.61 million, which grew at a CAGR of 4.72% from CY19 to CY23, driven by increasing investments in renewable energy infrastructure. Government initiatives like the National Solar Mission, the Green Energy Corridor project, and incentives under the PLI scheme for renewable energy components have played a vital role in accelerating the sector's expansion.

Looking ahead, the sector's consumption of magnet winding wires is projected to grow at a CAGR of 4.76% from CY23 to CY28. This is supported by India's ambitious target of achieving 613 GW of renewable energy capacity by 2032**,** which will drive the demand for advanced and reliable winding wires for critical applications. The increasing integration of renewable energy into the national grid and the development of battery storage systems will further enhance winding wire requirements.

Telecommunications and Electronics

India's telecommunications and electronics industry is a cornerstone of the country's digital transformation and economic growth. With over 1.2 billion mobile subscribers and a rapidly expanding internet user base, India is the second-largest telecommunications market globally. The electronics sector, encompassing consumer electronics, semiconductors, and telecom equipment, is witnessing robust growth driven by increasing demand for smartphones, IoT devices, and 5G infrastructure. According to EMIS, the Indian telecom market was valued at USD 85.80 billion in CY23, and is projected to grow to USD 143.30 billion in CY28, at a CAGR of 10.80%.

The telecommunications and electronics sector in India is a growing consumer of magnet winding wires, essential for the manufacturing of various telecom and electronic components. In CY23, the consumption of magnet winding wires was valued at USD 467.94 million, which grew at a CAGR of 4.88% from CY19 to CY23, driven by the rapid expansion of telecommunications networks and the increasing adoption of consumer electronics. The rollout of 4G and 5G infrastructure and a surge in demand for IoT-enabled devices and smartphones significantly boosted winding wire consumption during this period.

Looking forward, the consumption in the sector is expected to grow at a CAGR of 4.72% from CY23 to CY28, reflecting sustained demand driven by advancements in technology and infrastructure. The deployment of 5G networks, expansion of data centers, and rising adoption of smart devices will remain key growth drivers. Moreover, the increasing focus on semiconductor manufacturing and the domestic production of telecom equipment will contribute to higher demand for

specialized winding wires. This factor will ensure a steady rise in winding wire consumption in this sector over the coming years.

Industrial Machinery

The industrial machinery consists of sales of CNC machines, steel mills, semiconductor manufacturing machinery, sawmill, and woodworking machinery (except handheld), machinery for making paper and paper products, printing and binding machinery and equipment, textile making machinery, and machinery for making plastics and rubber products, etc. According to EMIS, the Indian industrial machinery market was valued at USD 13.10 billion in 2023, growing from USD 10.60 billion in 2019, with a CAGR of 5.44%. It is projected to grow to USD 19.34 billion by 2028, at a CAGR of 8.10%.

The industrial machinery sector in India is one of the key consumers of magnet winding wires. From CY19 to CY23, the consumption of the magnet winding wires in this sector grew at a CAGR of 5.19%, driven by rapid industrialization, increased automation, and infrastructure development. The growth was further supported by government initiatives such as Make in India, the Atmanirbhar Bharat campaign, and incentives under the PLI scheme, which boosted domestic manufacturing and the adoption of advanced machinery.

Looking ahead, the consumption in the sector is expected to grow at a CAGR of 4.81% from CY23 to CY28. The adoption of Industry 4.0 technologies, including IoT, AI, and robotics, is expected to drive the demand for high-performance winding wires in automation systems and smart machinery. Additionally, investments in infrastructure and manufacturing under the National Infrastructure Pipeline and the continued focus on localizing production will sustain the sector's growth, leading to greater consumption of the winding wires.

Railways and Metro

India's railways and metro industry is a critical driver of urban mobility and national infrastructure development. Indian railways span thousands of kilometers practically covering the entire nation, making it the fourth largest in the world after the US, China, and Russia. According to EMIS, the Indian railway market was valued at USD 2.50 billion in CY23, and is projected to grow to USD 2.80 billion, at a CAGR of 2.29%.

The railways and metro sector in India is a growing consumer of magnet winding wires, which are essential for manufacturing traction motors and other electrical components. The consumption of the magnet winding wires in this sector grew at a CAGR of 5.43% from CY19 to CY23, driven by the accelerated electrification of rail lines and the expansion of metro networks across major cities. Key initiatives such as the Mission Electrification program, which aims to achieve 100% electrification of broad-gauge railways, and increased investments in metro rail infrastructure under the National Infrastructure Pipeline significantly boosted demand.

Looking forward, the consumption is expected to grow at a CAGR of 4.44% from CY23 to CY28, reflecting sustained demand as electrification projects near completion and metro rail expansions continue. Additionally, the push for green mobility and energy-efficient systems, coupled with modernization efforts in rail signaling and infrastructure, will sustain the sector's growth, leading to the greater consumption of winding wires.

Consumer Durables

The consumer durables industry can be broadly classified into consumer electronics (brown products like TVs, laptops, audio & video systems, personal computers, and other electronic accessories) and consumer appliances (white goods like air conditioners, washing machines, refrigerators, and other appliances).

The consumer durables sector in India is one of the significant consumers of magnet winding wires. From CY19 to CY23, the consumption of winding wires in this sector grew at a CAGR of 5.83%, by rising disposable incomes, increased urbanization, and growing penetration of appliances in rural areas.

Looking ahead, the consumption in the consumer durables sector is expected to grow at a CAGR of 4.92% from CY23 to CY28. The factors such as the increasing demand for energy-efficient and smart appliances, government initiatives like the PLI scheme, and the expansion of the rural electrification network will continue to drive demand. Additionally, the shift toward premium and eco-friendly appliances will support the adoption of high-performance winding wires.

2.6 Review and Market outlook on Magnet Winding Wires industry in India

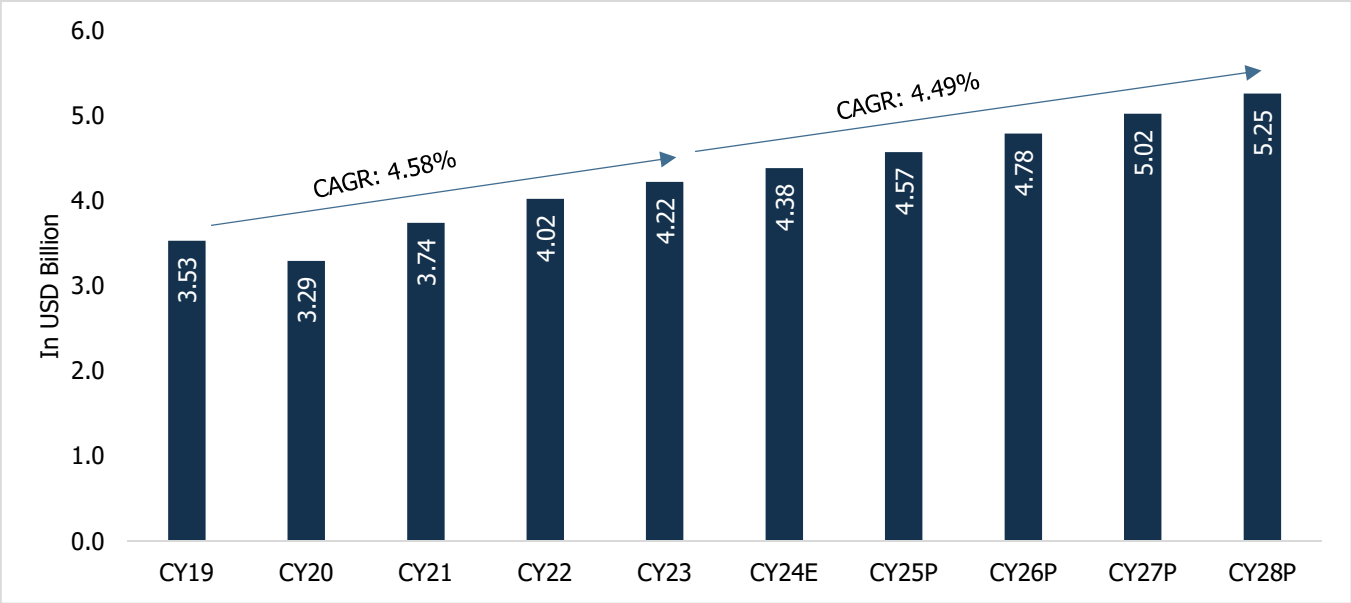
The magnet winding wires industry in India has demonstrated robust growth, driven by its critical role in powering various end-use industries such as power transmission and distribution, electrical equipment, and appliances, automotive, telecommunications and industrial machinery. The Indian magnet winding wire market was valued at USD 4.22 billion in CY23, growing from USD 3.53 billion in CY19, with a CAGR of 4.58%. By volume, the winding wire market grew at a CAGR of 2.78% from CY19 to CY23 reaching volume of 547.09 thousand tonnes in CY23. This growth was largely fueled by infrastructure development, rising electrification across sectors, and the rapid adoption of renewable energy solutions. Additionally, government initiatives such as Make in India, Atmanirbhar Bharat and sector-specific policies further boosted demand across multiple applications.

Looking forward, magnet winding wire market in India is expected to reach USD 5.25 billion by CY28, growing at a CAGR of 4.58% from CY23 to CY28. By volume, the market is expected to grow at a CAGR of 4.04% from CY23-CY28 reaching volume of 666.84 thousand tonnes in CY28. This growth will be fueled by the country's efforts to enhance power transmission capacity, investments in grid modernization, increasing adoption of electric vehicles (EVs), and the rising demand for energy-efficient appliances. The power transmission and distribution sector will be a major growth driver, with India aiming to expand its transmission line network from 4.85 lakh cKm in 2024 to 6.48 lakh cKm by 2032, alongside a transformation capacity increase to 2.38 million MVA by the same year. These developments will significantly boost the consumption of winding wires, which are essential components in these applications.

Additionally, the electrical equipment and appliance sector, driven by the expanding middle class, urbanization, and growing consumer electronics penetration, will further accelerate demand for winding wires. The renewable energy sector will also play a critical role, as India strives to achieve its ambitious target of 500 GW of renewable energy capacity by 2030, increasing the demand for winding wires in solar and wind energy installations.

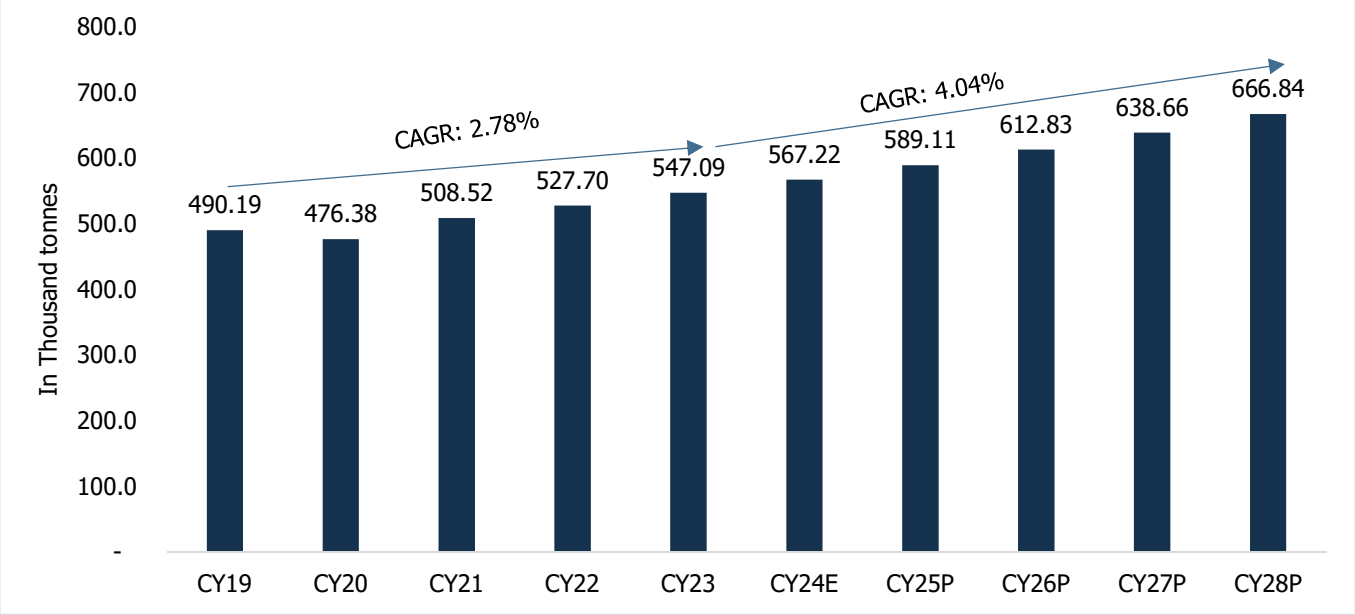
The automotive sector, particularly the shift towards EVs, will contribute significantly to winding wire consumption. The Indian EV market is forecasted to grow from USD 3.20 billion in 2022 to USD 113.90 billion by 2029, with a remarkable CAGR of 66.58%, offering substantial opportunities for the winding wire industry. Furthermore, the expansion of telecom infrastructure, advancements in industrial automation, and increased investments in metro and railway infrastructure are expected to boost growth in the winding wires market.

Chart 22:Indian Magnet Winding wires Market – By Value



Source: CMI, CareEdge Research; Note: E- Estimate, P- Projection

Chart 23: Indian Magnet Winding wires Market – By Volume



Source: CMI, CareEdge Research; Note: E- Estimate, P- Projection

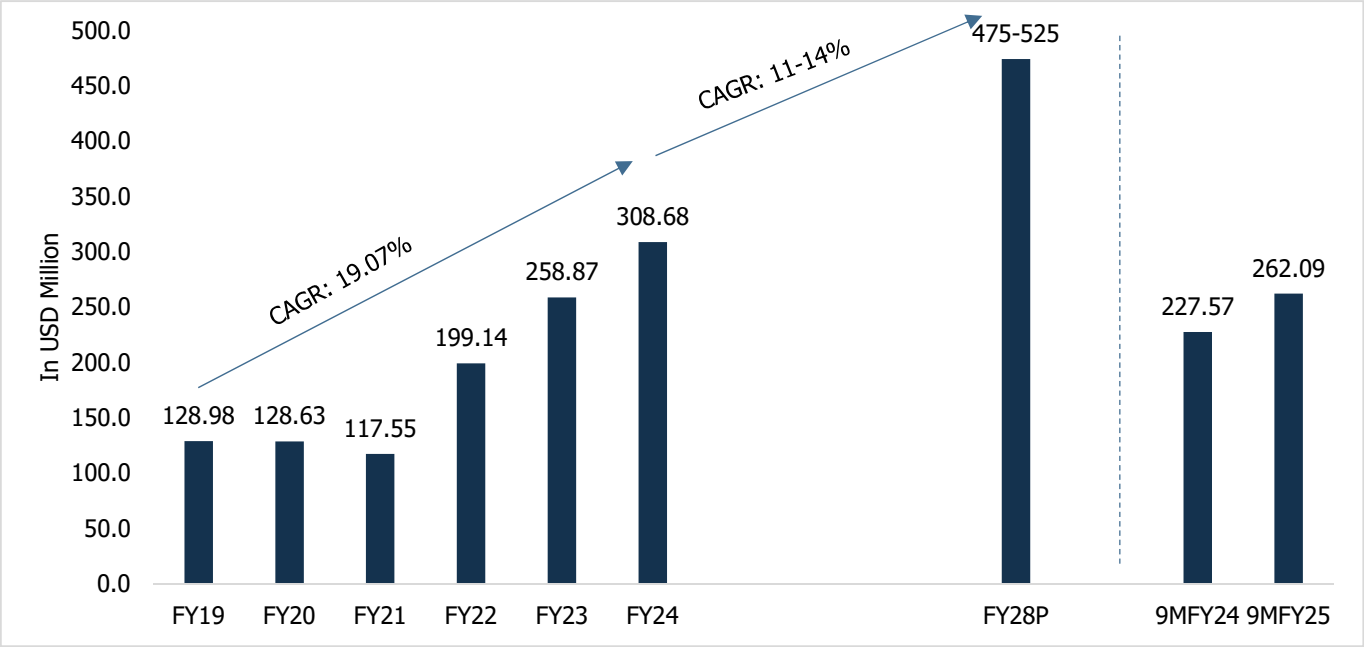
2.7 Overview of Export of Magnet winding wires from India

India's magnet winding wire export market has witnessed significant fluctuations over the years, reflecting the dynamic global demand and domestic production capabilities. Indian magnet winding wires industry witnessed significant rise in export from USD 128.98 million in FY19 to USD 308.68 million in FY24, reflecting a healthy CAGR of 19.07%. Despite a dip in FY21 to USD 117.55 million due to the COVID-19 pandemic, which disrupted supply chains and global economic activity, the market rebounded strongly in FY22, reaching USD 199.14 million. The upward trend continued in FY23 and

FY24, with exports reaching USD 258.87 million and USD 308.68 million, respectively. This growth was driven by increasing global demand for winding wires in sectors such as renewable energy, automotive (especially electric vehicles), and power transmission. India's competitive manufacturing ecosystem, enhanced by government support through initiatives like the PLI scheme, further strengthened its position as a major exporter.

In 9M FY25, exports amounted to USD 262.09 million, indicating sustained momentum. The performance in this period suggests continued global reliance on India for high-quality winding wires, supported by increasing investments in electrification, energy efficiency, and infrastructure modernization globally. Looking ahead, the export of electrical wires and cables is projected to reach USD 475-525 million by FY28, growing at a CAGR of 11%-14% over the forecast period. With the rising global adoption of electric vehicles and renewable energy systems, India's magnet winding wire exports are expected to maintain their growth trajectory, provided the country continues to enhance its manufacturing capabilities and adapt to evolving international standards and market demands.

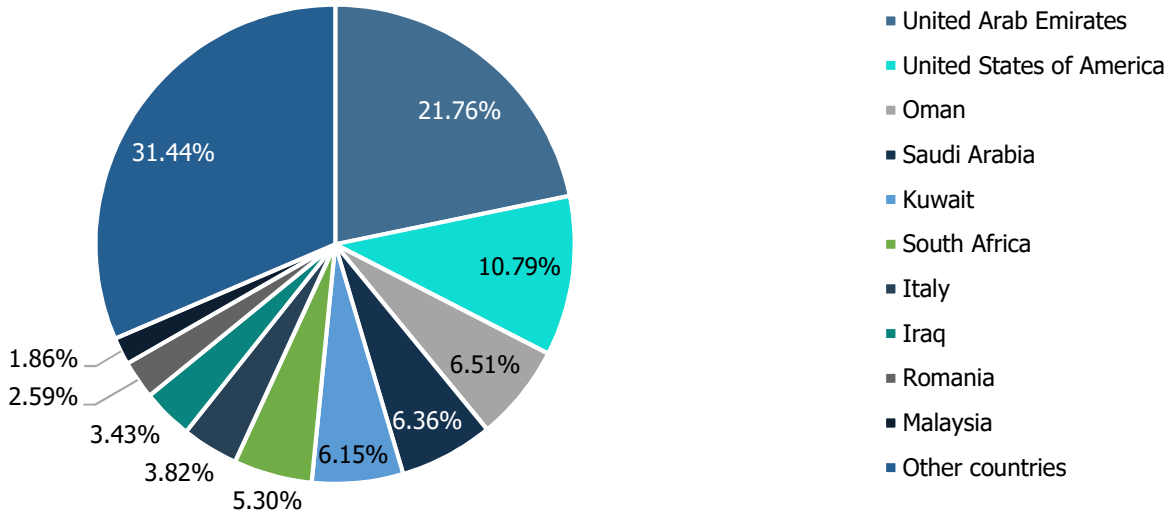
Chart 24: Export of Magnet Winding wires by India



Source: Ministry of Commerce; CareEdge Research, HS Code- 854411, 854419

India majorly exports to UAE constituting approximately 21.76% of exports, followed by the USA (10.79%) and Oman (6.51%). Other key markets include Saudi Arabia (6.36%), Kuwait and South Africa (6.15% and 5.30% each), Italy (3.82%), and Iraq (3.43%) and a significant 31.44% is attributed to other markets. This highlights the widespread acceptability of Indian magnet winding wires in global markets.

Chart 25: Magnet Winding Wires Export Share by Countries for FY24



Source: Ministry of Commerce; CareEdge Research

2.8 Key growth drivers for Magnet winding wires industry in India

- **Infrastructure Development**

Key Point	Details
Infrastructure Development Plans	The Government of India's infrastructure development plans are consistently increasing across sectors such as highways, railways, airports, and power.
Budget Allocation Growth	The budgetary allocation for infrastructure has grown at a CAGR of 26.1% over the past four years (FY22 to FY25).
Interim Union Budget 2024-25 Allocation	Rs 11.11 trillion allocated for infrastructure capital expenditure, an 11% increase over the previous year's budget.
National Infrastructure Policy (NIP)	The NIP has expanded to cover over 9,000 projects (up from 6,835 projects).
National Monetisation Pipeline (NMP)	The government has announced plans for the NMP and Development Finance Institution (DFI) to enhance infrastructure project financing.
NIP Investment Details	The NIP involves investments of Rs 111 lakh crore from central and state governments, as well as the private sector (FY20-25).
PM Gati Shakti National Master Plan	Alignment with NIP will help accelerate project execution by removing bottlenecks.
Impact on Winding Wire Demand	The increased pace of infrastructure development will drive greater demand for winding wires.

- **Rising expansion of Transmission and distribution network**

Aspect	Details
Power Generation Capacity	Expected to double from 442 GW in March 2024 to around 900 GW by March 2032.

Battery Energy Storage System (BESS)	Expected to reach 9 GW of installed capacity by 2027 and 47 GW by 2032.
Transmission Line Network	Projected to increase from 4.85 lakh cKm in 2024 to 6.48 lakh cKm by 2032.
Transformation Capacity	Set to expand to 2.38 million MVA by 2032.
Investment in Transmission Sector	Expected investments of Rs 9.16 trillion, representing a multi-decade growth opportunity.
Impact on Winding Wire Demand	Expansion will drive demand for winding wires, crucial for transformers, electrical motors, and power transmission infrastructure.

- **Transition towards Renewables**

India's ambitious transition towards renewable energy is a major growth driver for the winding wires industry. With the goal of achieving 500 GW of renewable energy capacity by 2030, the country is witnessing significant investments in solar, wind, and other green energy projects. Winding wires play a critical role in renewable energy systems, including generators, transformers, and inverters used in solar and wind installations. Additionally, the advancement of smart grids, which utilize digital communication technology for monitoring and managing electricity distribution, also demands for specialized and durable winding wires.

- **Automobile Sector**

India was the third-largest automobile market in 2022. After the pandemic's impact, the sector rebounded, with domestic sales growing by 20.36% year-on-year in FY23. This growth was driven by strong urban demand, rising replacement needs, increasing utility vehicle sales, the vehicle scrappage policy, and higher infrastructure spending.

Despite inflationary pressures, preponed purchases before the new fuel emission norms (BS-VI Phase II), easing semiconductor chip shortages, and pent-up demand supported sales. In FY23, all categories saw double-digit growth: two-wheelers (+16.89%), passenger vehicles (+26.71%), commercial vehicles (+34.17%), tractors (+12.20%), and 3-wheelers (+86.99%).

In FY24, domestic sales growth was 13.21% for two-wheelers, 8.46% for passenger vehicles, and 0.62% for commercial vehicles. Total domestic sales (excluding tractors) grew by 12.50%. The positive trend is expected to continue due to strong demand and government initiatives for rural and urban development.

The automobile sector will further benefit from the increasing adoption of electric vehicles (EVs). The Electric Mobility Promotion Scheme 2024 (EMPS 2024), with Rs 7,780 million allocated, aims to boost EV manufacturing and adoption. This scheme, extended to 30th September 2024, supports 5,60,789 EVs and is expected to drive sales, increasing the demand for winding wires, as EVs require more than conventional vehicles.

- **Growth in Industrialization**

The rapid growth of industrialization in India is a significant driver for the winding wires industry, with the manufacturing sector playing a crucial role. The expansion of industries such as automotive, steel, and cement increases the demand for robust power infrastructure to support their operations, subsequently boosting the consumption of winding wires. These wires are vital for transformers, motors, and other electrical equipment that ensure a reliable power supply in industrial settings.

Additionally, the proliferation of data centers and IT hubs, fueled by India's growing digital economy, has further strengthened the demand for winding wires. The establishment of these facilities requires advanced power systems and energy-efficient equipment, where winding wires are integral components. As data storage and processing needs escalate, the winding wires industry stands to benefit from the growing infrastructure investments. Together, these

factors highlight the essential role of industrialization in driving the growth and future potential of the winding wires market.

- **Government Initiatives and Policies**

Government initiatives and policies play a pivotal role in driving the growth of the winding wire industry in India.

- **Production-Linked Incentive (PLI)** scheme for sectors like electronics, automotive, and renewable energy manufacturing encourage local production, boosting demand for motors, transformers, and other equipment that rely on winding wires.
- Initiatives like the **National Electric Mobility Mission Plan (NEMMP)** and **Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME)** accelerate electric vehicle adoption, directly increasing the need for winding wires in EV motors and charging infrastructure.
- The **Smart Cities Mission** and **UDAY Scheme**, focusing on urban modernization and improving electricity distribution, further drive demand for electrical equipment utilizing winding wires.
  Initiatives like "Saubhagya" (Pradhan Mantri Sahaj Bijli Har Ghar Yojana) aim to provide electricity to all households, significantly increasing the demand for power cables.

- **Export Policies and Trade Incentives**

India's winding wire market is poised for strong export-driven growth, supported by favorable government policies and global trade dynamics. Key initiatives include:

- **Remission of Duties and Taxes on Exported Products (RoDTEP) scheme** aims to refund embedded taxes and duties that were previously non-recoverable, such as VAT on fuel used in transportation and electricity duties. This ensures that exported products are zero-rated, enhancing their competitiveness in the global market.
- **Zero Duty Export Promotion Capital Goods (EPCG) Scheme** allows exporters to import capital goods at zero customs duty, provided they commit to an export obligation equivalent to six times the duty saved, to be fulfilled over six years. This facilitates technological upgrades and capacity expansion for exporters.
- **Advance Authorisation (AA) and Duty-Free Import Authorisation (DFIA)** schemes provide duty exemptions on raw materials required for export production, reducing input costs and improving cost competitiveness.

Additionally, evolving global trade policies, such as U.S. tariffs on Chinese imports, present significant opportunities for Indian winding wire exporters to capture new market share. These measures include reciprocal tariffs designed to match the rates that other countries impose on U.S. products. Such policies can lead to higher costs for Chinese goods in the U.S. market, creating opportunities for Indian exporters to fill the gap with competitively priced winding wires

2.9 Threats and Challenges

Threats

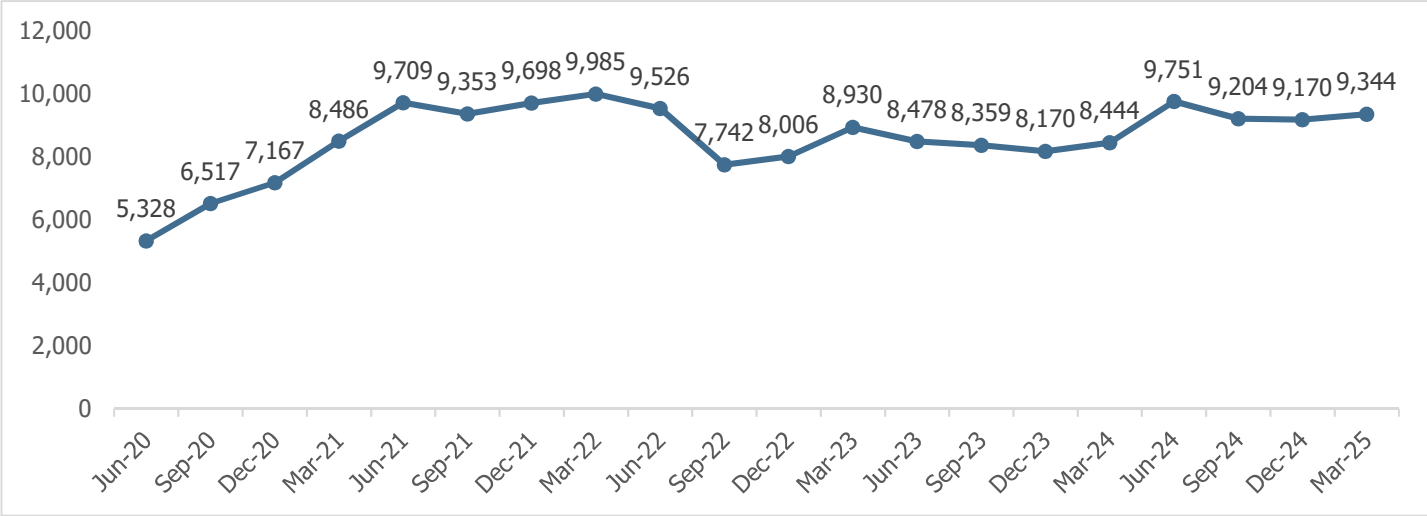
- **Raw material prices**

The magnet winding wire market in India heavily rely on materials like copper and aluminium for conducting electricity efficiently. These raw materials are subject to global market dynamics, influenced by factors such as supply-demand imbalances, geopolitical tensions, and economic conditions. The prices of copper and aluminium have experienced significant volatility in recent years. Copper prices rose from USD 6,114 per ton in June 2019 to USD 9,344 per ton in March 2025, with a peak of USD 9,985 per ton in March 2022. However, copper prices also saw a sharp decline, dropping from USD 9,985 per ton in March 2022 to USD 7,742 per ton in September 2022. Similarly, aluminium prices increased

from USD 1,794 per ton in June 2019 to USD 2,629 per ton in March 2025, reaching a high of USD 3,267 per ton in March 2022.

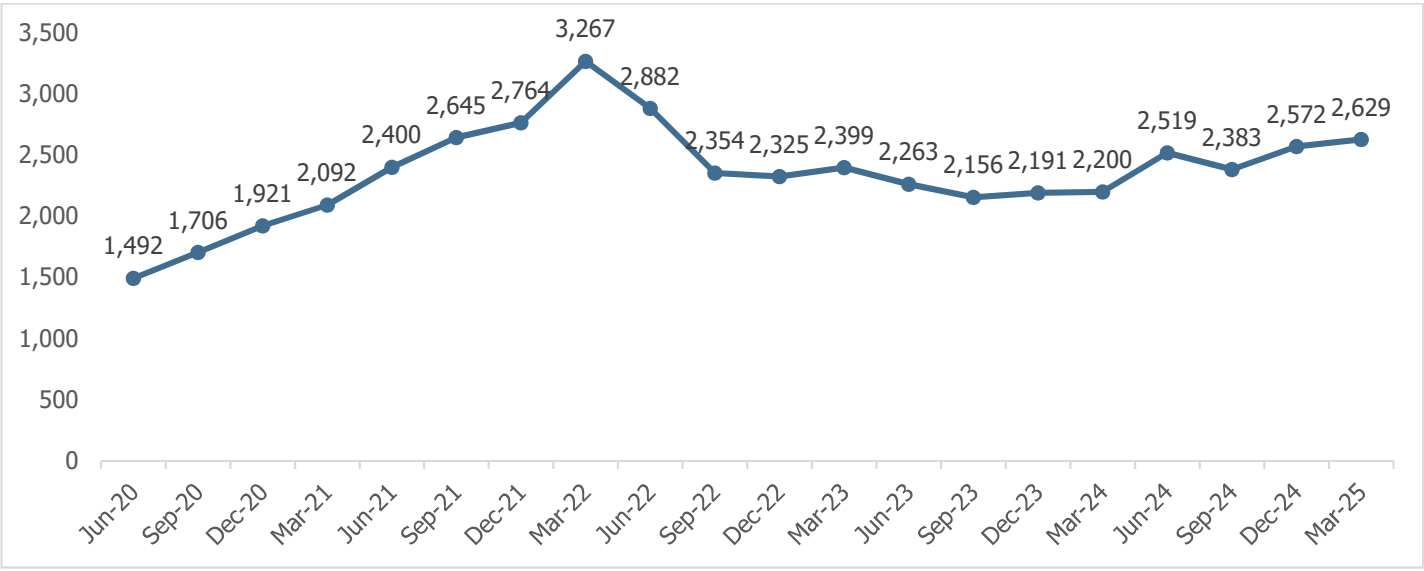
During the last three fiscals, the prices of copper and aluminium have experienced a compounded annual growth rate (CAGR) of 3.08% and 0.48% respectively, leading to increased input costs. Manufacturers typically pass these price increases on to consumers, though this is often done with a delay. However, such price hikes can lead to reduced sales volumes. Given the broader industry trends and macroeconomic factors, the revenue and profitability of industry players are likely to be affected. The raw material price trends will affect the inventory-based companies.

Chart 26: Copper Price Trends



Source: CMIE

Chart 27: Aluminium Price Trends



Source: CMIE

- **Fluctuation in currency exchange rate**

Fluctuations in the rupee-dollar exchange rate present a significant challenge for the winding wire industry. The exchange rate averaged Rs. 74 per USD in CY 2021, rose to Rs. 79 in CY 2022, Rs. 83 in CY 2023, and has reached Rs.

85 as of December 2024. Many industry players rely on imports for raw materials such as aluminium and insulation materials to leverage cost and quality advantages. However, exposure to currency fluctuations can drive up overall costs, thereby impacting profit margins. The currency fluctuations will affect the inventory-based companies.

- **Supply chain power shift**

The winding wire industry faces significant challenges due to power imbalances within the supply chain. Manufacturers often deal with dominant raw material suppliers, such as those providing copper, aluminium, and insulation materials, who have substantial control over pricing and terms. On the other side, they serve large, consolidated customers, including wholesalers, energy operators, and industrial clients, who exert considerable negotiating power due to their scale. Additionally, manufacturers typically have limited direct interaction with end consumers, which restricts their ability to influence market dynamics or demand trends. This lack of leverage on both ends of the supply chain makes it difficult for winding wire manufacturers to control costs, optimize pricing, or achieve higher margins.

- **Regulatory Compliance**

The magnet winding wire industry faces stringent regulatory requirements related to safety, product quality, and environmental sustainability. Key compliances include the Bureau of Indian Standards (BIS), Electrical Equipment (Quality Control) Order, RoHS India (Restriction of Hazardous Substances Directive), Electrical Safety Standards (Central Electricity Authority Regulations). Adhering to these regulations demands significant investments in research and development to design and manufacture compliant products. Meeting these standards often necessitates adopting advanced technologies, implementing rigorous testing protocols, and obtaining certifications, all of which increase production costs. Non-compliance can result in financial penalties, reputational damage, and restricted market access, making regulatory adherence a critical yet challenging aspect for manufacturers in this industry.

- **Competitive pressure**

The magnet winding wire industry is characterized by intense competition, driven by the presence of established global and regional players, upcoming manufacturers, and a significant unorganized sector. Leading companies like Precision Wires and Ram Ratna Wires capitalize on their scale, advanced technology, and brand reputation to dominate the market. Simultaneously, companies like KSH, Vidya Wires are expanding their capacities and introducing innovative, cost-effective solutions, disrupting traditional pricing and supply dynamics. Adding to the competitive pressure, the unorganized sector, with its low-cost manufacturing and minimal regulatory compliance, poses a significant challenge. This high level of competition often leads to price wars, reducing profit margins for all industry participants.

Challenges

- **High Investment**

One of the key challenges hindering the growth of the Indian magnet winding wires market is the high upfront investment required for ordering specialized equipment needed for the manufacturing and testing of magnet winding wires. The substantial financial resources needed can be a significant barrier for small and large wire manufacturers and companies with limited budgets and cash flows. Additionally, setting up production facilities requires capital-intensive machinery, as high-quality enameled and insulated wires demand advanced manufacturing processes. The cost of raw materials, primarily copper and aluminum, fluctuates based on global market trends, necessitating strong financial planning and working capital management. Regulatory compliance with domestic and international standards further increases costs, as manufacturers must invest in testing facilities and R&D. The high capital requirements create entry barriers for new businesses and put pressure on existing manufacturers to balance costs while maintaining profitability, making strategic investments and government incentives crucial for sustaining growth in the industry.

- **Technical and Operational Challenges**

The magnet winding wire industry faces several technical and operational challenges that impact production efficiency, product quality, and overall market dynamics. Winding wires, especially Continuously Transposed Conductors that go into large Power Transformers (765 Kv, HVDC) which are used by Powergrid Corporation, NTPC, etc. 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 Magnet Winding Wires have to adhere to stringent National/International standards and pass key tests such as at KEMA High Voltage Labs in the Netherlands, with a Short-Circuit test.

- **Capacity Utilization**

Excess capacity in certain segments leads to underutilization of plants, reducing operational efficiency. Underutilization also prevents companies from optimizing their production planning and resource allocation, further straining cash flows. When capacity remains idle, manufacturers are often tempted to reduce prices to stimulate demand, triggering price wars in the market. This results in an unhealthy competitive environment, undermining the overall value chain. Additionally, prolonged underutilization can lead to deterioration of machinery, increasing maintenance costs and reducing the long-term operational lifespan of equipment.

- **Global price competition and Price Volatility**

Indian exporters face competitive pressures from global low-cost manufacturers, limiting pricing flexibility in international markets. Compliance with stringent technical standards and certifications in developed markets requires process improvements and quality assurance systems. Fluctuations in currency exchange rates introduce financial uncertainty and impact export profitability. Logistics inefficiencies and trade barriers in certain regions further restrict market access and raise transaction costs.

- **High Barriers to Entry**

The magnet winding wire industry presents significant barriers to entry, primarily due to stringent pre-qualification requirements imposed by corporate, state, central government, and international organizations during their procurement processes. These pre-qualification standards are designed to ensure transparency, accountability, efficiency, and quality control when selecting external suppliers. While established vendors enjoy several advantages, new entrants often struggle to overcome the complexities, costs, and resource requirements associated with pre-qualification. Pre-qualified vendors benefit from increased revenue opportunities and market visibility, as they can participate in tenders, bids, and contracts, enabling substantial business growth. Additionally, registration with government entities or their approved vendors provides access to lucrative infrastructure projects, which serve as a major revenue source. Another key barrier is the credibility and reputation factor, as companies prefer working with recognized suppliers that have a proven track record of meeting strict quality and regulatory standards.

3. End User Markets

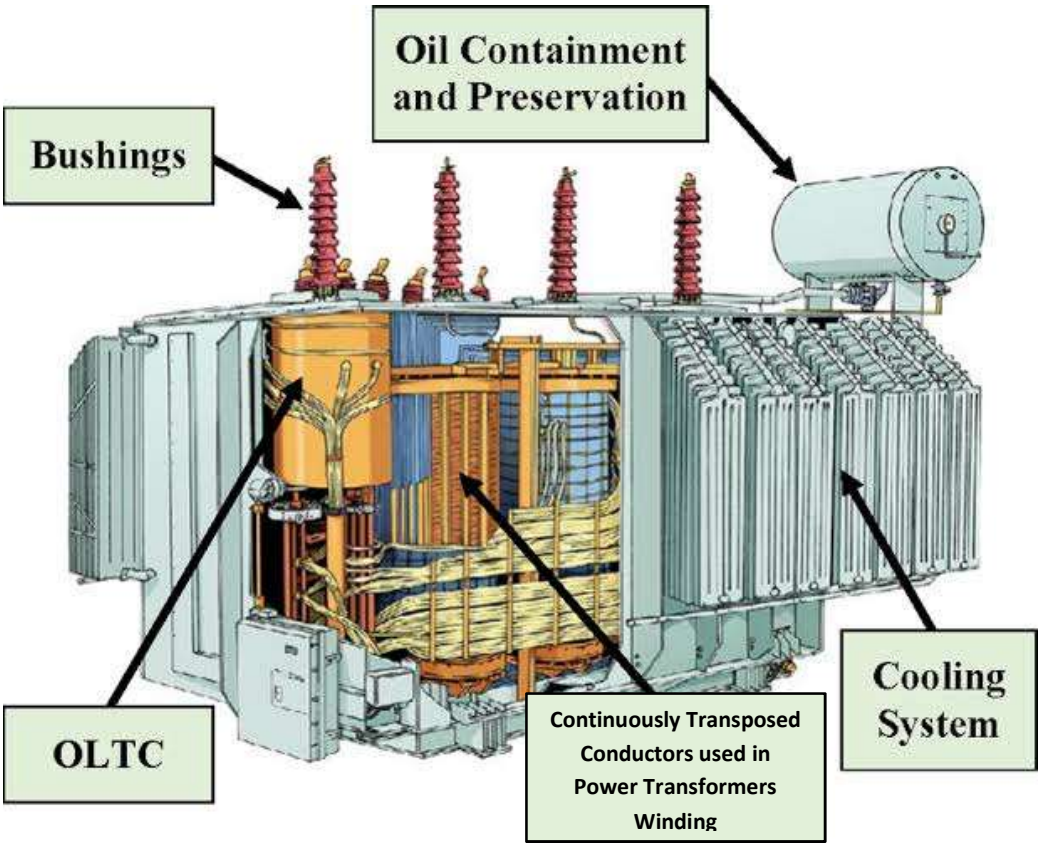
Table 6: Product - Application Mapping

Applications	Standard - Magnet Winding Wires (MWW)		Specialised - Magnet Winding Wires (MWW)					
	Round Enamelled Copper MWW	Round Enamelled Aluminium MWW	Paper Insulated Rectangular Copper MWW	Paper Insulated Rectangular Aluminium MWW	Continuously Transposed Conductors (CTC)	Rectangular Enamelled Copper MWW	Rectangular Enamelled Aluminium MWW	Bunched Paper Insulated Copper Wires
Power Transformers			✔		✔	✔		✔
Distribution Transformers	✔	✔	✔	✔		✔	✔	✔
Loco-Traction Transformers			✔		✔	✔		✔
HVDC Transformers			✔		✔	✔		✔
765 Kv Transformers			✔		✔	✔		✔
765 Kv Reactors			✔		✔	✔		✔
LT/FHP Motors	✔	✔						
HT Motors			✔			✔		
BLDC Motors	✔	✔						
EV Traction Motors - 4W/Off Highway	✔					✔		
EV Traction Motors - 2W/3W	✔					✔		
Drone Motors	✔							
Compressors and hermetic compressors for AC/Refrigerators	✔	✔						
Microwaves	✔	✔						
Ceiling Fans	✔	✔						
Mixers/Grinders/TV/Electronics	✔	✔						
Wind Generator/ Turbo and Hydro generator Rotor/Stator	✔		✔					
ICE Starters/Alternators	✔					✔		
DG Set Alternators	✔		✔			✔		
Motors for Metro Coach	✔							
Motors in Automobiles (Wiper/ABS etc)	✔							

Source: Company Disclosures

3.1 Global Power (Transformer) Sector

Figure 1: CTCs used in Power Transformers

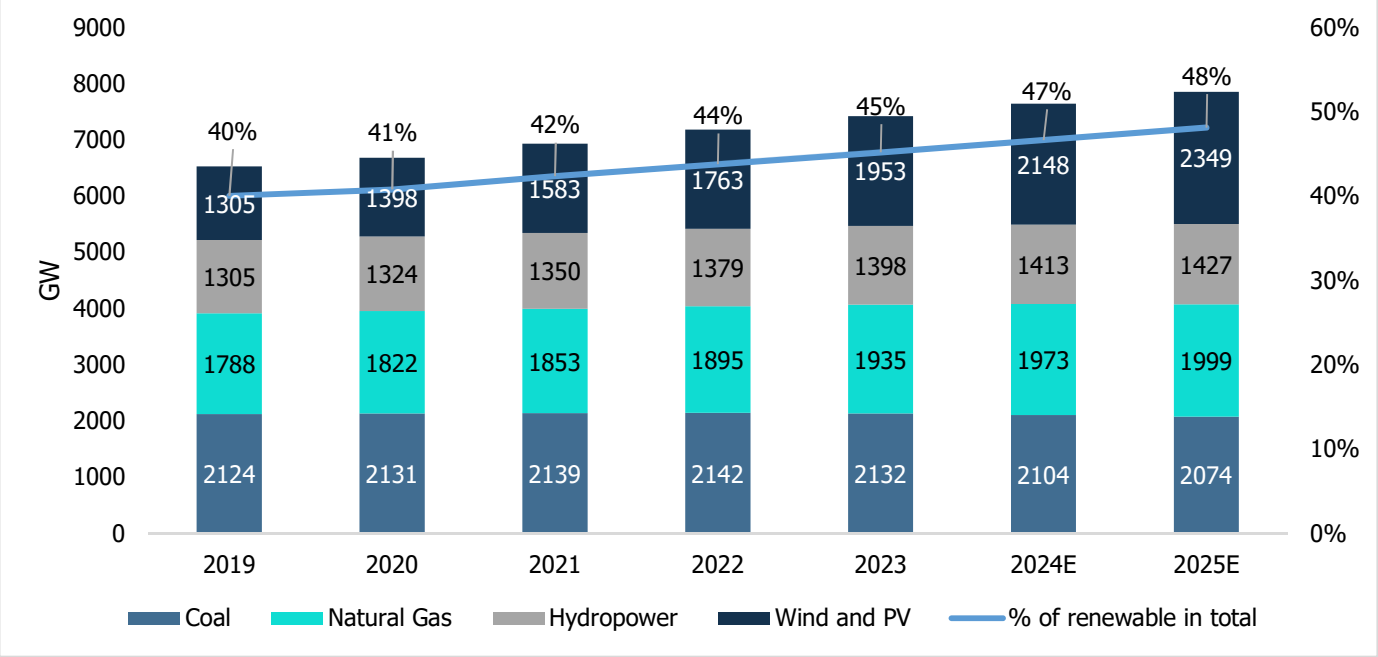


The global power scenario encompasses various facets, including energy production, consumption, sources, and sustainability. This analysis highlights key statistics and trends that define the current global energy landscape.

Fossil fuel prices have decreased from their peaks in 2022, yet markets remain tense and volatile. The ongoing conflict in Ukraine, over a year after Russia's invasion, is now compounded by the potential for a prolonged conflict in the Middle East. The overall economic sentiment is pessimistic, marked by persistent inflation, rising borrowing costs, and high debt levels. Currently, the global average surface temperature is approximately 1.2 °C above pre-industrial levels, resulting in heatwaves and other extreme weather events, while greenhouse gas emissions have yet to reach their peak. The energy sector is the main contributor to the air pollution that affects over 90% of the world's population, which is associated with more than 6 million premature deaths each year. Additionally, positive trends in access to electricity and clean cooking have either slowed or reversed in some countries.

According to IEA, Renewable electricity capacity additions achieved an estimated 507 GW in 2023, marking an increase of nearly 50% compared to the previous year, 2022. The substantial growth is attributed to ongoing policy support in over 130 countries, prompting a significant shift in the global growth trend. The global acceleration in 2023 was primarily fueled by the year-on-year expansion of China's thriving market for solar PV (+116%) and wind (+66%). The trend of increasing renewable power capacity additions is expected to persist over the next five years, with solar PV and wind collectively representing a record 96% of the total. This dominance is due to their lower generation costs compared to both fossil and non-fossil alternatives in most countries, coupled with sustained policy backing.

Chart 28: Global Power Sector Installed Capacity

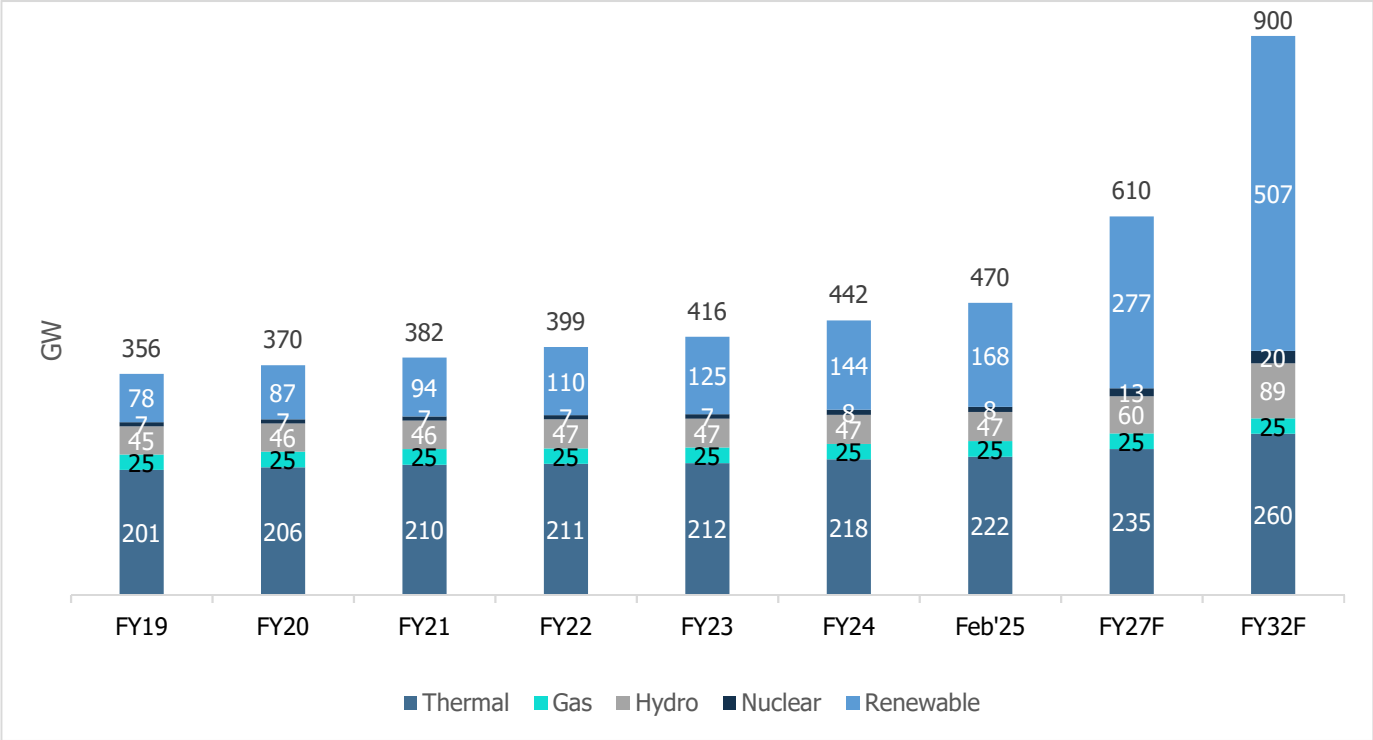


Source: IEA

3.1.1 India's Thermal and Renewable potential

Thermal power primarily relies on coal, lignite, gas, and diesel, with coal dominating at 72.50% of the total generation share, followed by gas at 1.80%, lignite at 1.95%, and diesel at 0.02%. The western region of India holds the largest thermal installed capacity at 96,597.50 MW, accounting for 39.12% of the total, followed by the northern region with 22.61%.

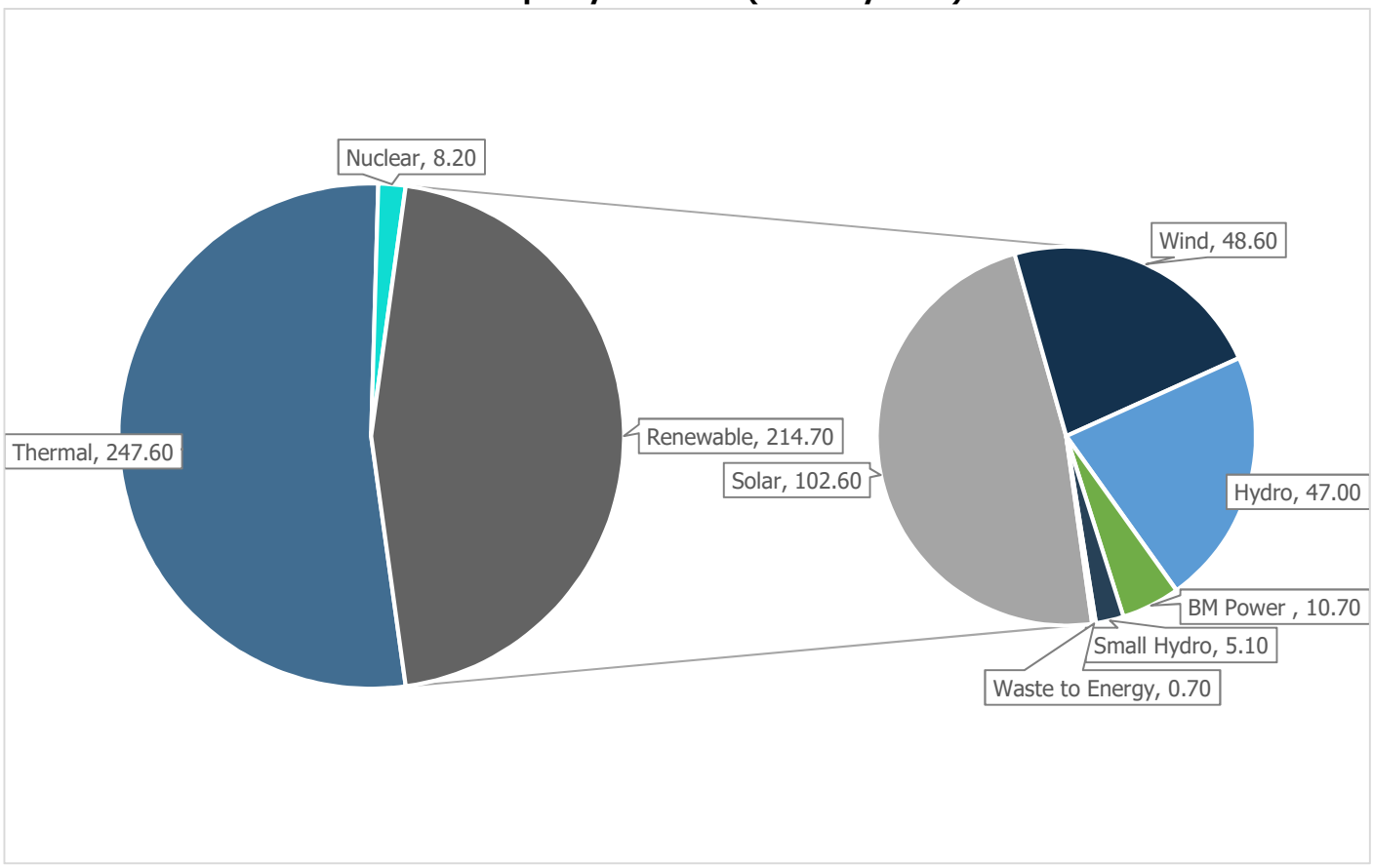
Chart 29: All India Installed Capacity



Source: CEA, CareEdge Research

Renewable energy is originating from naturally replenished resources, such as the sun, tides, and wind. It is used for electricity generation, space and water heating and cooling, and transportation. The share of renewable energy has grown from 23.51% in FY20 to 32.58% in FY24, showing the noteworthy progress in the transition toward cleaner energy sources. For FY35 total installed capacity is expected to reach 900 GW, with solar capacity of 507 GW and Thermal installed capacity of 260 GW (excluding Gas). This highlights the continued investments in renewable technologies such as solar and wind, alongside government initiatives and policy frameworks aimed at reducing carbon emissions and promoting sustainable energy. The shift towards renewables underscores the growing competitiveness and cost-effectiveness of these sources compared to traditional fossil fuels. Furthermore, it highlights India's commitment to achieving environmental objectives, aligning with global trends towards decarbonization, and fostering the development of a more resilient and sustainable energy system.

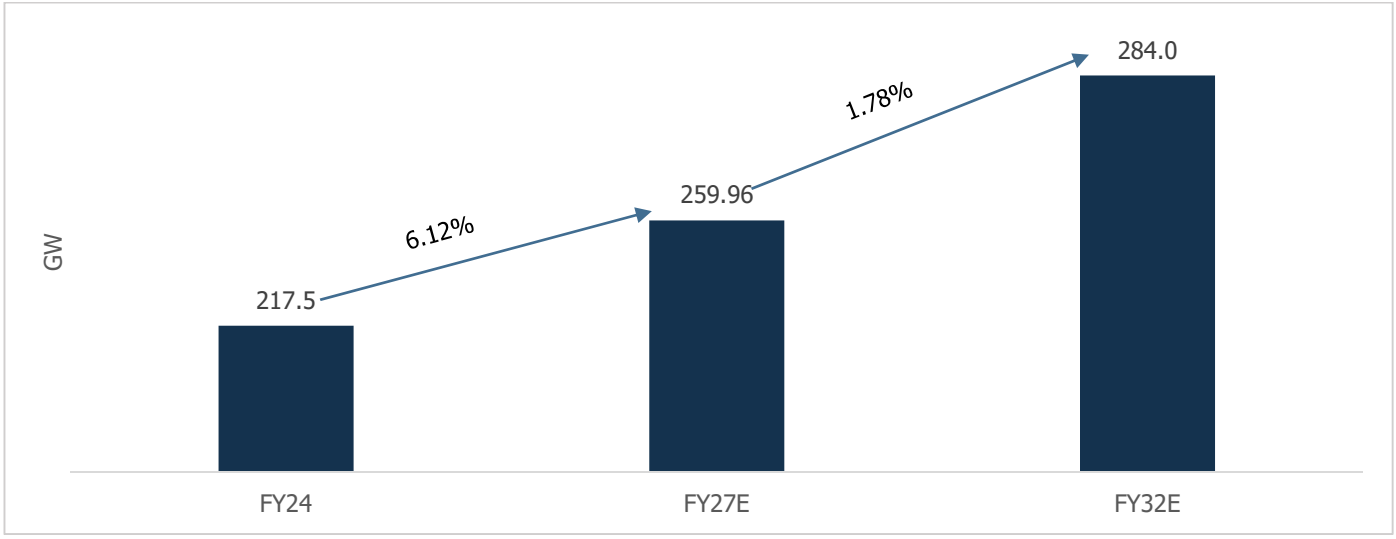
Chart 30: Mode-Wise Total Installed Capacity – 470 GW (February 2025)



Source: CEA, CareEdge Research

3.1.2 Outlook on Thermal Power in India

Chart 31: Coal Installed Generation Capacity addition likely by 2031-32



Source: NEP Volume – II, CareEdge Research

The total installed coal power capacity is expected to be 284 GW while the non-fossil-fuel-based capacity (includes Wind, Hydro, and Solar) is expected to rise to approximately 613 GW by 2031-32

To meet the estimated electricity demand by the year 2031-32 the Government of India proposes to set up an additional minimum 80 GW coal-based capacity by 2031-32. Currently, 26,380 MW of thermal capacity is under construction, 11,960 MW has been bid out and 19,050 MW is under clearance.

According to the National Electricity Plan, the estimated capital cost for developing new coal-based thermal capacity stands at Rs 8.34 Cr/ MW (at 2021-22 price level). Consequently, the planned thermal capacity expansion is expected to require a minimum investment of Rs. 6,67,200 crores by 2031-32.

To reduce the dependency on coal-based power plants, Government has planned to augment non-fossil fuel based installed electricity generation capacity to over 500 GW by 2029-30.

India ranks as the world's third-largest producer and second-largest consumer of energy. The country's installed power capacity grew from 356 GW in FY19 to 453 GW in FY24. Currently, conventional sources account for 59% of the installed capacity, while renewable energy sources (RES), including hydro, contribute 41%. Among RES, solar energy holds the largest share at 16%, followed by hydro at 11% and wind at 10%

3.1.3 Outlook of Solar Capacity Additions

The Indian power sector is witnessing a major transformation in terms of demand growth and energy mix. To ensure that everyone has access to reliable power and sufficient electricity, investments are being conducted to increase the installed capacity and clean energy transition.

Government policies such as the Basic Customs Duty (BCD) on imported solar modules and the Production-Linked Incentive (PLI) scheme are expected to enhance domestic manufacturing, leading to accelerated capacity additions. In FY25, solar capacity growth will remain robust, driven by significant drop in equipment prices, continued policy support and continued investments to drive growth.

Table 7: Capacity Additions- review and forecast (GW)

	From FY22 to FY27			From FY27 to FY32		
	Under Construction	Additional Capacity Requirement	Total Capacity	Under Construction	Additional Capacity Requirement	Total Capacity
Solar	92.60	38.97	131.57	0	179.00	179.00

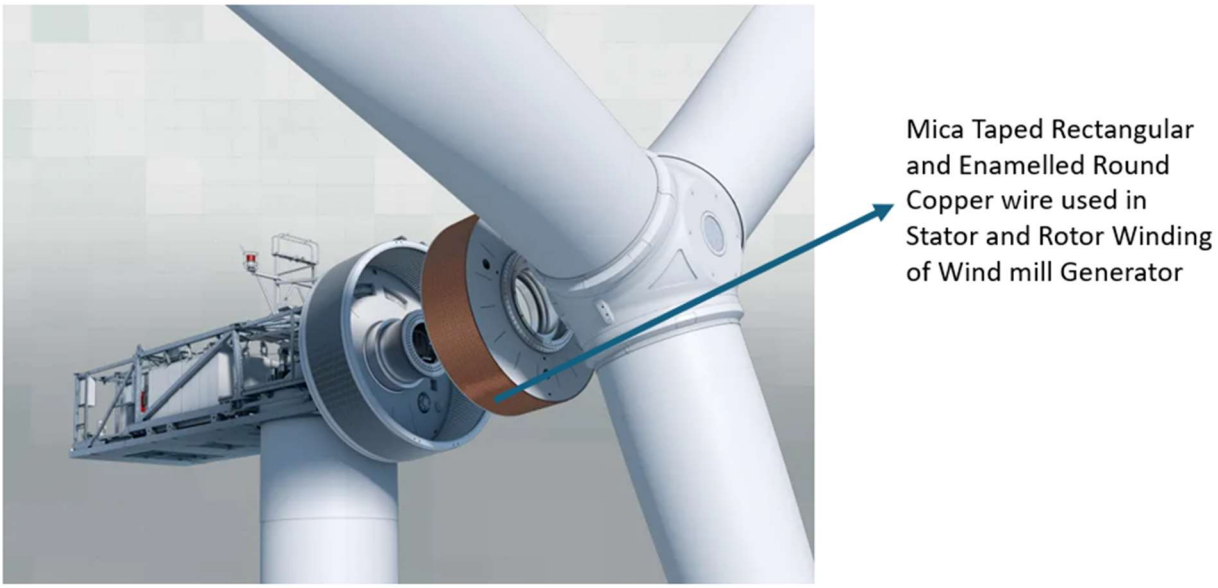
Source: National Electricity Plan (NEP) Vol-1, CareEdge Research

In India's energy outlook, the solar sector is set to become the dominant source of power by FY32, with its share projected to rise from 16% in FY23 to 40%. This significant growth is driven by ongoing policy initiatives like the Production-Linked Incentive (PLI) scheme, large-scale solar park developments, and increased domestic manufacturing of solar modules. The push toward solar aligns with India’s broader renewable energy goals of reaching 280 GW of solar capacity by 2030, as part of its clean energy commitments. Solar will play a crucial role in reducing dependency on thermal power, which is expected to decline sharply over the same period.

3.1.4 Outlook for Wind Capacity Addition

Offshore Wind and Solar-Wind Hybrid to provide Pace Going Forward

Figure 2: Use of Winding Wires in Turbine Generator



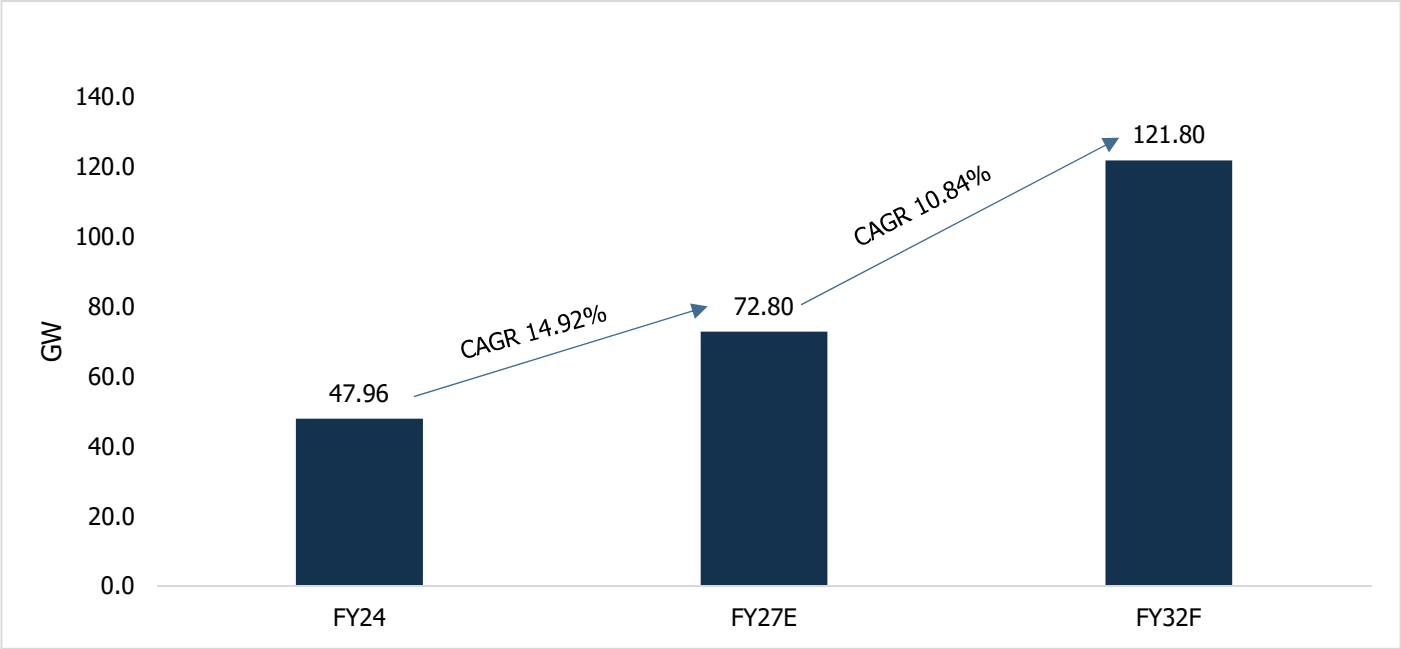
Wind capacity additions have slowed down in the recent past, due to challenges in pricing, grid availability, scarce availability of windy sites, land availability, and payment delays. While wind remains cost-competitive compared to conventional power and the government is promoting capacity additions through wind-solar hybrids, storage, and round-the-clock supply, land and transmission infrastructure constraints are likely to affect near-term capacity expansion. The government's announcement of ultra-mega power parks for wind could potentially alter the deployment strategy in the future.

Currently, India's wind power accounts for 10.12% of the country's total installed capacity and 25.77% of its total renewable capacity. India ranks fourth in the world in terms of installed wind capacity. The government plans to allocate approximately 10 GW of wind projects annually, starting in fiscal year 2024, to help achieve the ambitious target of 500 GW in renewable capacity by 2030. India aims to meet nearly half of its electricity demand from renewable energy sources by 2030.

Moreover, India has a strong wind potential of around 302 GW at 100m and around 695 GW at 120m. The wind potential is mainly concentrated in the top 7 windy states including Andhra Pradesh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan, and Tamil Nadu.

As per the National Electricity Plan Vol-1 (March 2023), 72.90 GW of installed wind power capacity is expected to be achieved by FY27 and 121.90 GW by FY32.

Chart 32: Wind Power Projections



Source: National Electricity Plan Vol-1 (March 2023), CareEdge Research

Over the medium term, wind capacity additions are expected to be driven by capacity additions in wind-solar hybrids and offshore wind projects. Apart from favorable project economics, hybrid projects play a key role in round the clock generation of renewables. In addition, the change in policy from the reverse auction and the increasing renewable purchase obligations (RPO) are some of the positive steps to rejuvenate the wind sector that has been stagnant for several years.

Further, India has set a target of 500 GW of non-fossil fuel installed capacity and fulfil 50% of its energy requirements by renewable sources by 2030. India expects to create 30 GW of offshore wind electricity by 2030. However, development has been slow due to a lack of developed port infrastructure and transmission infrastructure and increased expenses of placing turbines in the sea.

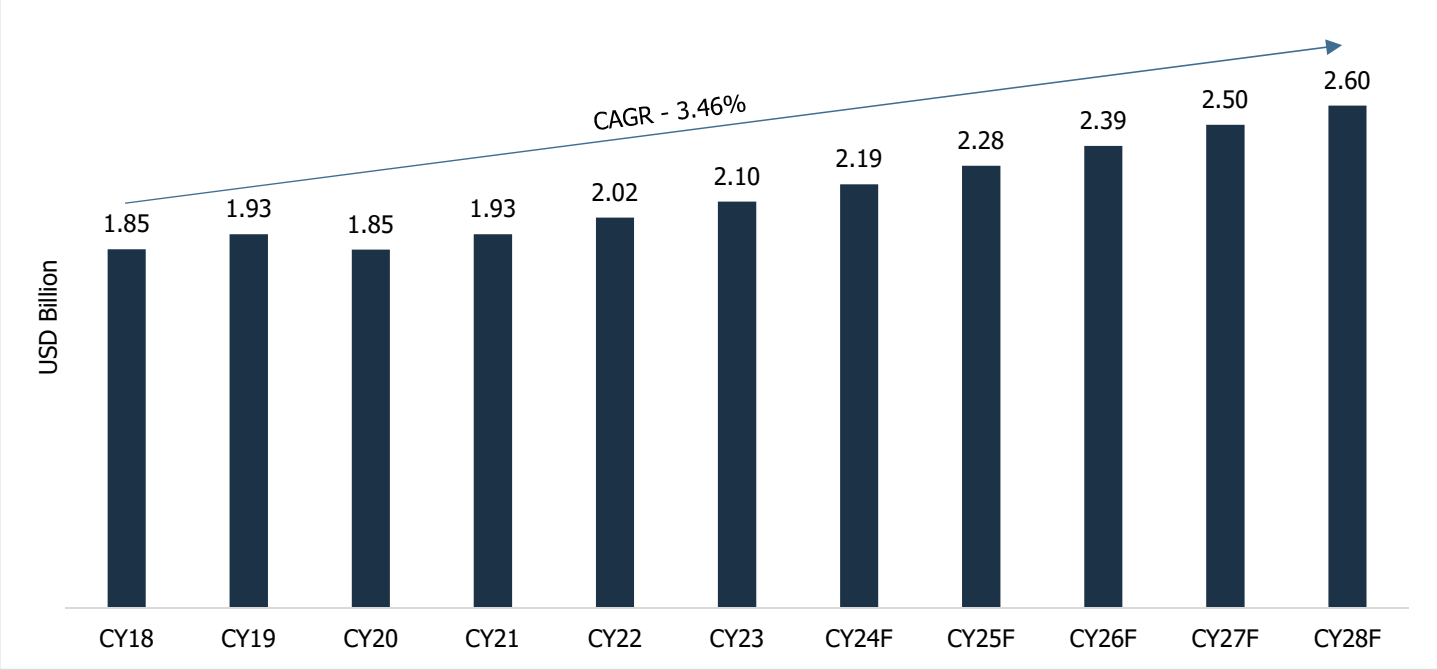
Key innovations such as wind solar hybrid and offshore wind farms, ultra-mega renewable energy parks, repowering, and round-the-clock supply are expected to be the key drivers for wind capacity additions.

Wind Turbine Generator Market

A wind turbine generator, or simply wind turbine, is a device that converts the kinetic energy of wind into electricity using blades that rotate, turning a rotor connected to a generator.

India was the 4th-largest segment in 2018 and continued to be the 4th-largest segment of the market in CY23. This segment witnessed an incremental growth opportunity worth USD 0.25 billion between CY18 and CY23. As per the market disruptions during the historical period, the segment grew at a CAGR of 2.57%.

Chart 33:Wind Turbine Generator Market in India



Source: Technavio, CareEdge Research

The wind turbine generator market is projected to experience steady growth from CY25 to CY28. This upward trend reflects a consistent annual growth rate, indicating a positive outlook for the industry over the forecast period. The market's expansion is likely driven by increasing investments in renewable energy and advancements in wind turbine technology.

3.1.5 Transformer Market

A transformer is an electrical device that transfers energy between two circuits through electromagnetic induction. Its main functions include adjusting voltage and current levels, modifying capacitor values, blocking direct current between circuits, and isolating circuits. Transformers are crucial in power systems, enabling efficient voltage conversion and reducing energy losses. They work through magnetic coupling and are easy to manufacture and maintain, making them essential in power generation, transmission, and distribution. These devices are used in both power distribution systems and electronic applications to either lower high transmission voltages at substations or increase current for end-users. Transformers come in various types, such as distribution and power transformers, each designed for specific applications. They transfer power via electromagnetic induction between circuits at the same frequency, with minimal energy loss.

The transformers market is segmented by transformer type into power transformer, and distribution transformer.

Power Transformer

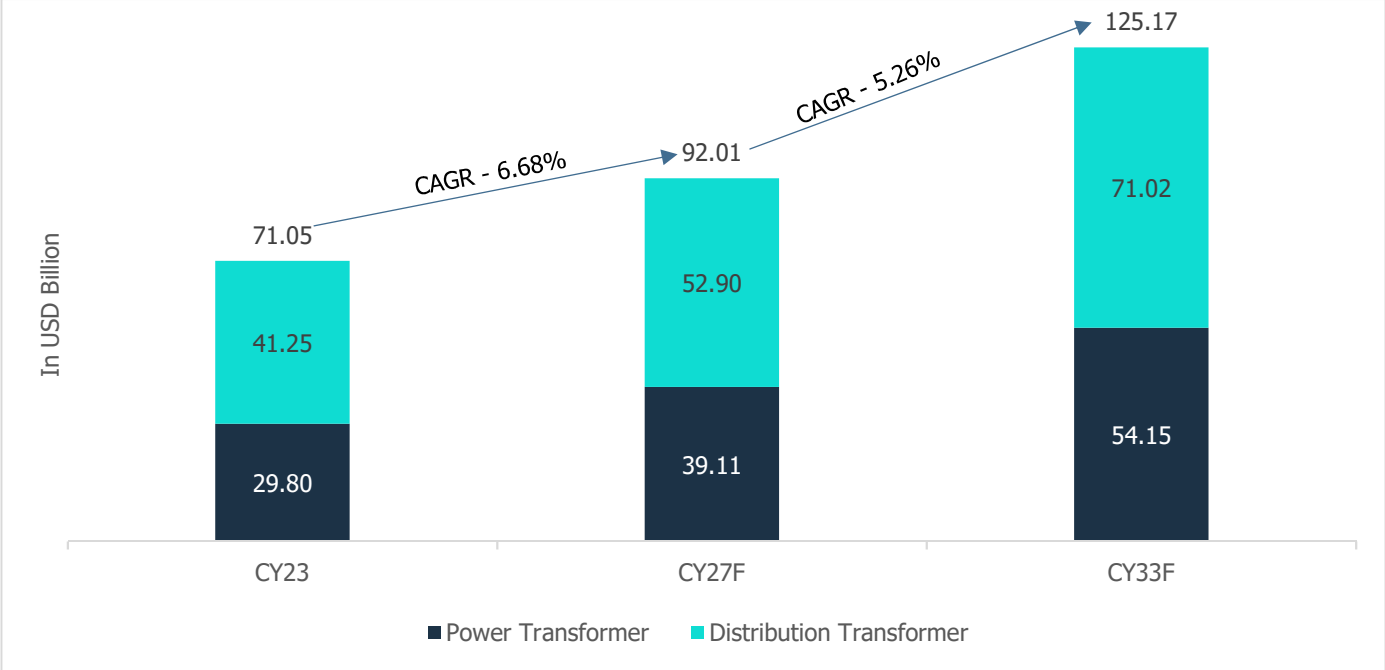
The power transformer market includes the sale of transformers by companies, sole proprietors, and partnerships that are used to step up or step-down voltage in high-voltage transmission networks. Power transformers transmit electrical power without changing its frequency, relying on electromagnetic induction. They are vital for reducing energy losses and enabling the transmission of large amounts of power over long distances by converting it into high-voltage current,

which is then reduced to a safer, low-voltage current. These transformers are commonly found in power plants, industrial facilities, and electric utility companies.

Distribution Transformer

The distribution transformer market involves the sale of transformers by various entities, such as organizations, sole traders, and partnerships, which are used to lower voltage for final transformation in power distribution systems. A distribution transformer reduces high-voltage electricity to usable levels for homes and businesses. These transformers are essential for delivering power to remote areas and ensuring efficient, reliable power distribution from power plants to end consumers

Chart 34: Global Transformer Market - Split by Transformer Type



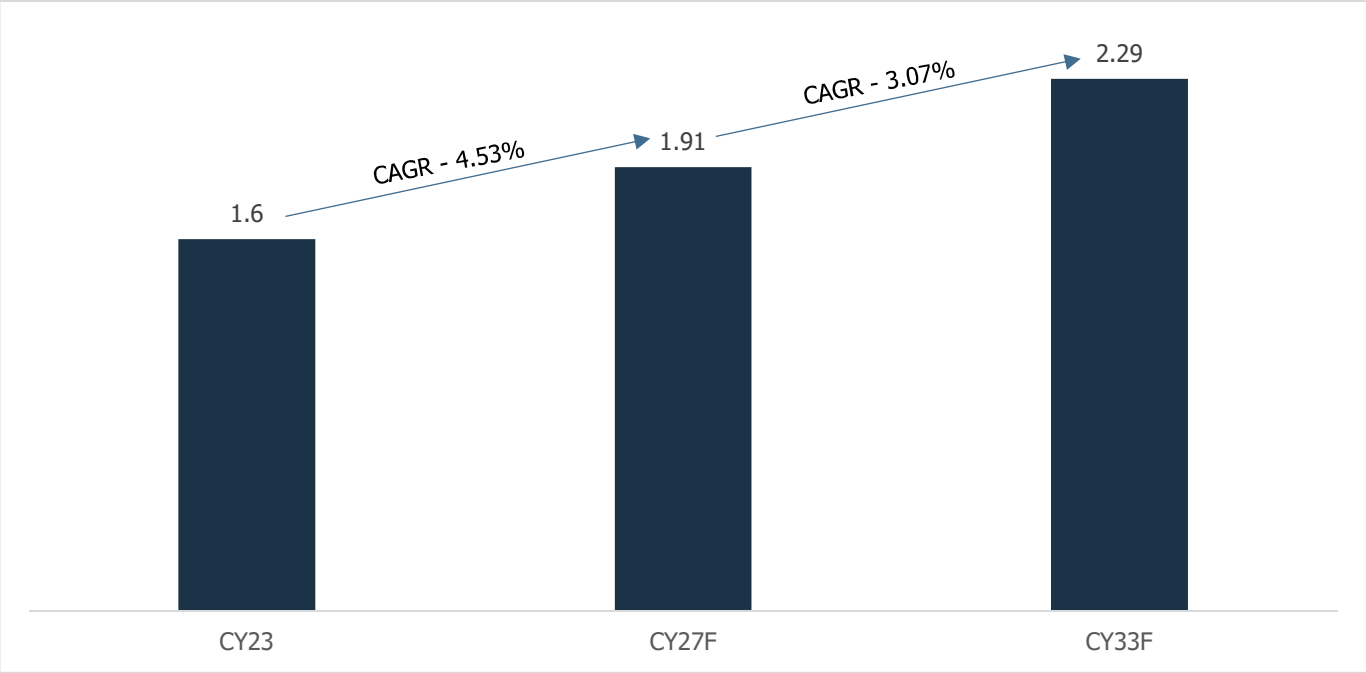
Source: The Business Research Company, CareEdge Research

Distribution Transformer is the largest segment in global transformer market. The market is then expected to grow at a CAGR of 5.58% from CY23 to reach USD 71.02 billion in CY33.

Power Transformer was the smallest segment in global transformer market. The market is then expected to grow at a CAGR of 6.15% from CY23 to reach USD 54.15 billion in CY33.

Global transformer market grew is expected to grow at a CAGR of 5.83% from CY23 to reach USD 125.17 billion in CY33. As of CY23 India contributes ~2.25% of global Transformer market.

Chart 35: Indian Transformer Market



Source: The Business Research Company, CareEdge Research

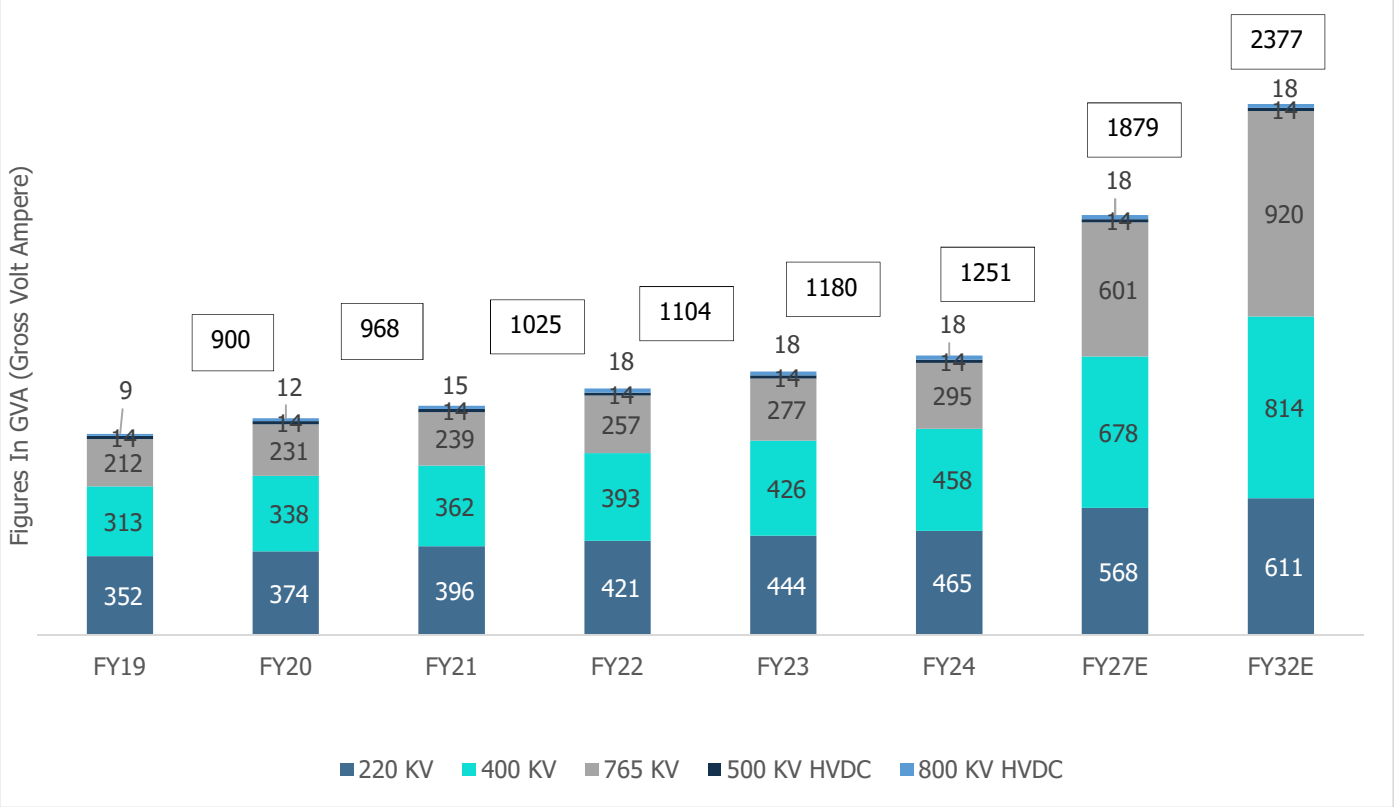
The global transition to renewable energy is a key driver of increasing demand for power transformers. As nations strive to lower carbon emissions and embrace cleaner energy, large-scale renewable energy projects are becoming more widespread. Power transformers are essential in incorporating these renewable sources into existing grid systems, converting electricity generated from wind, solar, and hydro sources into voltages that are suitable for transmission and distribution. Renewable energy sources, such as wind and solar power, are naturally variable, influenced by weather conditions and time of day. This intermittency creates challenges for grid stability, necessitating advanced solutions to balance supply and demand. Power transformers with cutting-edge monitoring and control systems play a key role in managing voltage fluctuations and ensuring a steady power flow. They also aid in load balancing, which is crucial for grids with significant renewable energy integration. This adaptability is especially vital in regions with ambitious renewable energy goals, such as India, the United States, and China.

The demand for transformers is on the rise, primarily due to the expansion in the transmission and distribution (T&D) sector. Transformers find diverse applications in both traditional and renewable energy installations, as well as in railway and metro infrastructure.

3.1.6 Details on Transformation capacity growth

The transformation (Substation) capacity (in MW) for various voltage levels in India's electricity transmission network from FY19 to FY32E, includes 220 kV, 400 kV, 765 kV, and HVDC systems (500 kV and 800 kV). The capacities for 220 kV, 400 kV, and 765 kV show steady growth to meet the rising electricity demand and support the integration of renewable energy. Projections indicate these will reach 611 MW, 814 MW, and 920 MW, respectively, by FY32E. HVDC systems, which are crucial for long-distance transmission, exhibit stable or slow growth, with 500 kV HVDC at 14 MW and 800 kV HVDC gradually increasing to 18 MW. Overall, the transformation capacity is expected to grow significantly, especially in higher voltage categories, to support India's energy goals. Transformation capacity includes overall Intra and Inter transmission capacity.

Chart 36: Transformation (Substation) Capacity (220 kV & Above)



Source: Central Electricity Authority, NEP, CareEdge Research

Table 8: Inter- State Transformation Capacity (Substation)

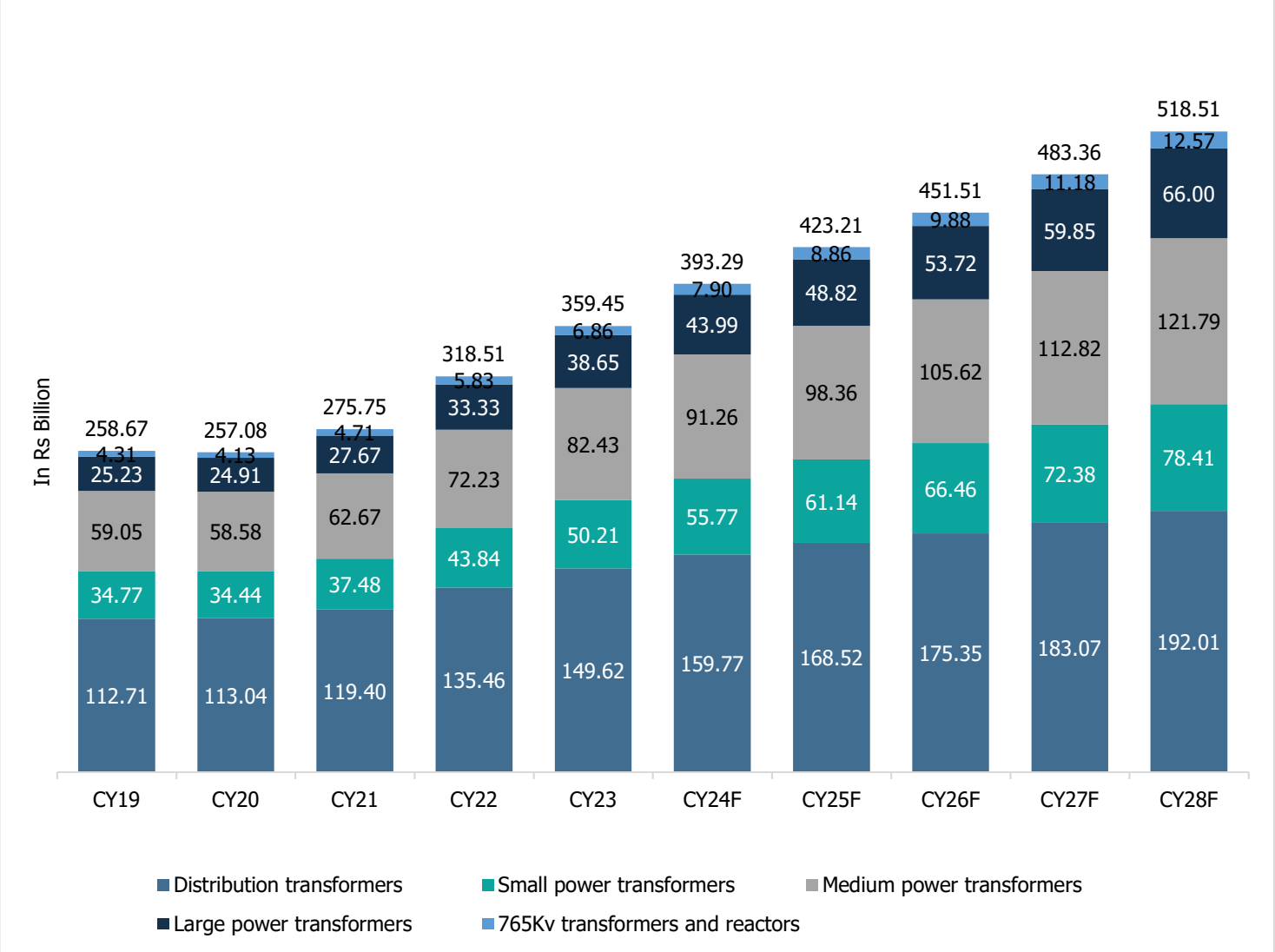
Transformation Capacity (MVA) ISTS	At the end of 2017	At the end of 2022	At the end of 2027	At the end of 2032
	284.20	460.97	933.19	1,281.36

Source: NEP, CareEdge Research

India aims to achieve 500 GW of renewable energy capacity by 2030. As of July 2024, there are 54 transmission projects constructed, and 53 projects are under construction. These include various projects of transmission systems associated with renewable projects and conventional projects in Rajasthan, Karnataka, Maharashtra, etc. These projects are being executed by PGCIL along with private players like Sterlite Power Transmission Limited, Adani Transmission Limited, ReNew Transmission Ventures Private Limited, etc.

Furthermore, the substation line network grew at a CAGR of approximately 7% to 1.25 million MVA as of March 2024 from 0.8 million MVA as of March 2019.

Chart 37: India Custom Transformers Products Value (CY19 – CY28F)



Source: Maia Research

From CY19 – CY29F, Distribution transformers are expected to grow at a steady rate of 6.10%, while power transformers are projected to see a stronger increase of 9.40%. Smaller transformer categories, such as small and medium power transformers, are also experiencing notable growth, with CAGRs of 9.50% and 8.38%, respectively. The large power transformer segment is set to grow at a remarkable CAGR of 11.28%, and specialized products like 765kV transformers and HVDC transformers are forecasted to grow even faster, at CAGRs of 12.63% and 8.70%. This consistent growth reflects a strong demand across the various transformer categories in India.

Table 9: MVA Rating of Transformers

Transformer Type	MVA Rating
Distribution transformers	15KVA-25MVA
Small Power Transformer	<60MVA
Medium Power Transformer	60MVA-600MVA
Large Power Transformer	>600MVA

765Kv transformers and reactors	750MVA
High Voltage Direct Current transformers	200MVA-600MVA

Source: Maia Research

3.1.7 Growth Drivers

Table

- **Declining Prices of Modules and Other System Components**

Solar module costs have decline sharply over the past decade. Further, the balance of system cost has also reduced due to advancement of technology, better designs leading to low material consumption, product standardization, economies of scale etc. The decline in cost has led to lower funding requirement and improvement in overall project economics of the solar power projects.

The module prices were witnessing an upward trend in second half of 2021 due to shortage of raw materials in China such as silicon and solar glass coupled with production cuts due to power crisis. However, the prices declined in 2023 due to increase in raw material production and inventory buildup in China.

- **Fiscal and Regulatory Incentives and Government Support**

India's present electricity generation is highly reliant on non-renewable natural resources like coal. Government initiatives such as subsidy programmes and laws, are pushing power production firms to engage in this industry. Various government schemes like Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan Yojana (PM-KUSUM), Rooftop Phase-II, Atmanirbhar Bharat- PLI scheme in Solar PV manufacturing, imposition of Basic Customs Duty of 25% on solar cells and 40% on solar modules, 100% FDI, waiver of ISTS charges, setting up ultra-mega RE parks, grid connected rooftop solar scheme. To ensure timely payment to the RE generators, government has issued orders that power shall be dispatched against letter of credit (LC) or advance payment.

PLI Scheme: In November 2020, the government approved the PLI scheme for High Efficiency Solar PV Modules (Tranche-I) with a proposed outlay of Rs 4,500 crore. The allocation under this scheme was fully utilized. Subsequently, the government approved Tranche – II of PLI scheme in September 2022 with an outlay of Rs 19,500 crore. Under this scheme, PLI will be disbursed for 5 years post commissioning of solar PV manufacturing plants on sales of high efficiency solar PV modules from the domestic market. The scheme envisages 65,000 MW per annum manufacturing capacity of fully and partially integrated solar PV modules at an investment of Rs 94,000 crore and import substitution of Rs 1.37 lakh crore.

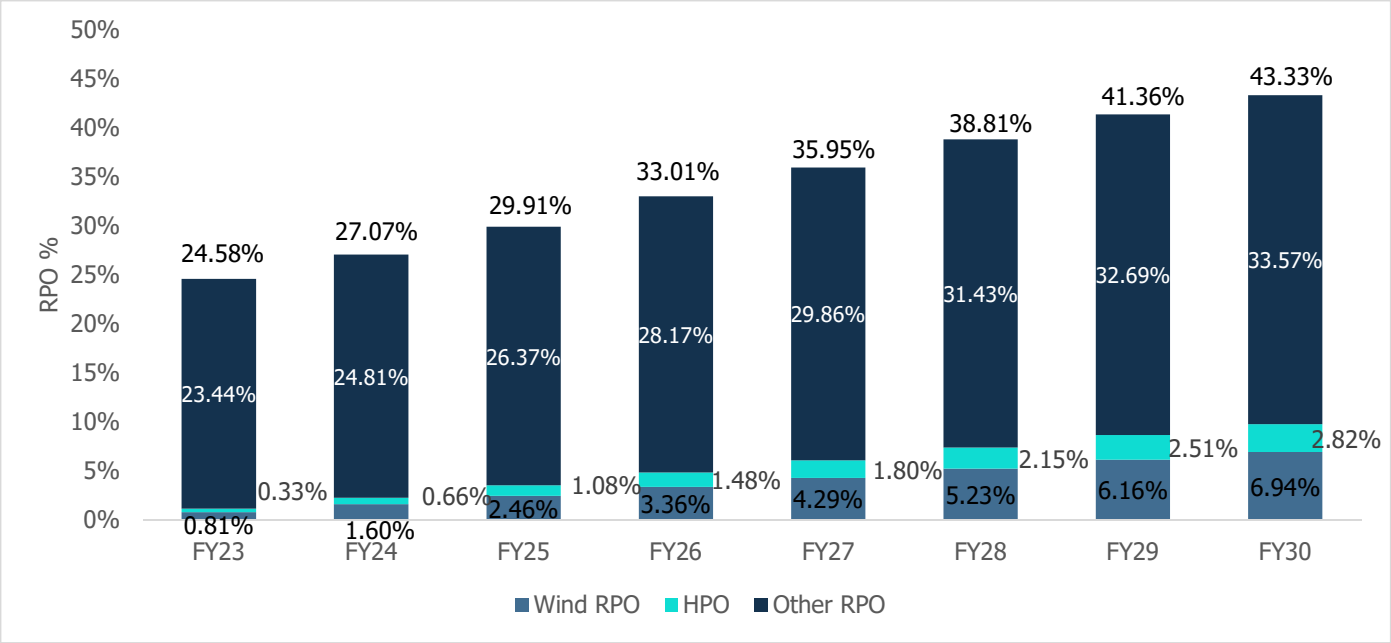
The PLI scheme will lead to significant increase in the domestic module manufacturing capacity thereby reducing import dependence which will allow the solar power producers to have more control over their costs and reduce risks related to supply chain and currency fluctuations.

Infrastructural support: MNRE is implementing the scheme for the development of solar parks and ultra-mega solar power projects, under which, the infrastructure such as land, roads, transmission system (internal and external), pooling stations, etc., is developed with all statutory clearances/approvals. Thus, the solar project developers have plug-and-play benefits.
Further, under Mode 8 of the Solar Park Scheme, a facilitation charge of Rs. 0.05/unit of power being generated from the projects in the parks is provided to the States in order to encourage the State Governments to provide necessary assistance to the Solar Power Park Developers (SPPDs) in identification and acquisition of land, to facilitate in obtaining all required statutory clearances, etc.

- **Renewable Purchase Obligation (RPO)**

The Ministry of Power has declared the RPO target till FY30 by which the obligated entities are obliged to purchase certain percentage of electricity from renewable energy sources, as a percentage of the total consumption of electricity or buy, in lieu of that, renewable energy certificates (REC) from the market. As per the targets set, RPO of 43.33% is proposed to be achieved by FY30.

Chart 38: RPO Trajectory from FY23 to FY30



Source: MNRE, CareEdge Research

The Other RPO, which is expected to increase from 23.44% in FY23 to 33.57% in FY30, will mainly be sourced from solar power. This requirement is expected to increase the solar power installations in the country.

Waiver of ISTS Charges: The Ministry of Power first announced the waiver of the inter-state transmission system (ISTS) charges on the transmission of electricity generated from solar and wind projects in 2019. The ministry has been extending the deadline to encourage further development of renewable energy projects.

The CERC has extended the commissioning deadline of solar and wind projects to be eligible for waiver of ISTS charges to October 1, 2023, from June 30, 2023. The ISTS charges waiver shall be applicable for a period of 25 years from the date of commissioning for the transmission of power to entities having RPO.

Further, the CERC has notified the CERC (Sharing of ISTS Charges and Losses) (First Amendment) Regulations, 2023 which shall come into effect from October 1, 2023. Under this regulation, the ISTS charges shall be waived for a period of 25 years for renewable energy generating stations, renewable energy hybrid generating stations and pumped hydroelectric stations which shall commence operations up to June 30, 2025.

- **Traction in C&I segment & Green-term Ahead Market (GTAM)**

The C&I segment is increasingly looking at procuring solar power for their operations either through rooftop solar projects or through open access. This preference is being driven by the following factors:

- Commitment of corporates to decarbonizing their operations and supply chains, driven by environmental, social, and governance (ESG) considerations
- Improvement in economic viability given the decline in project costs

Considering that the C&I segment consumes more than half of the power consumed in the country, the growing preference of this segment towards renewable energy will drive solar capacity additions.

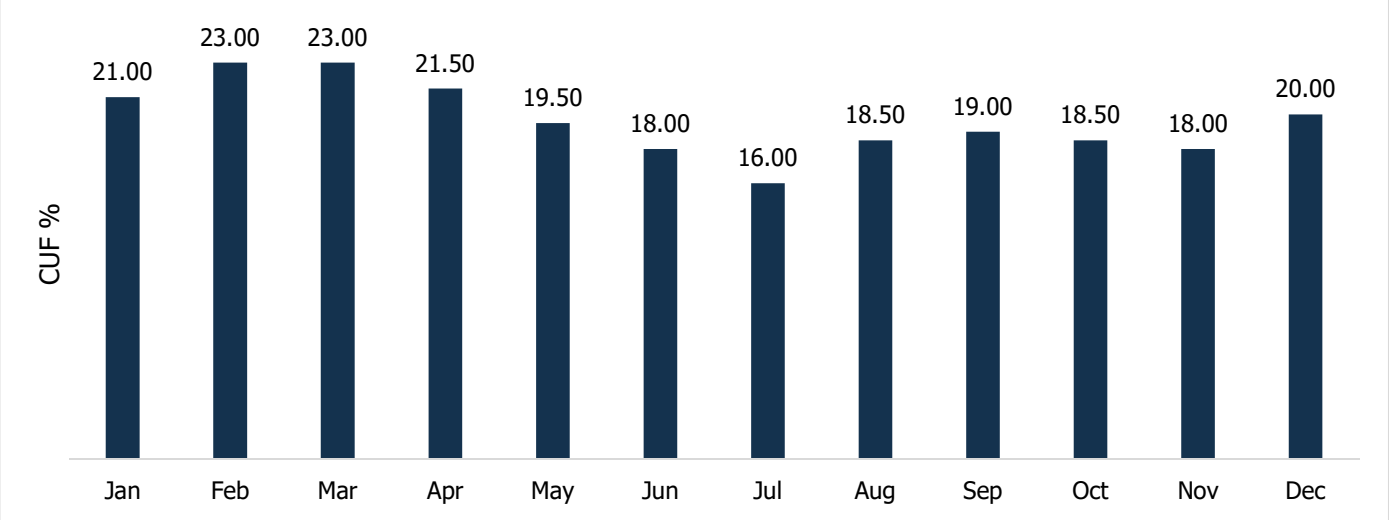
Green-term Ahead Market: GTAM platform was launched in September 2020 to enable bulk electricity buyers (DISCOMs and corporates with more than 1MW contracted load) to procure renewable energy on a short-term basis from sellers (merchant RE producers, DISCOMs having excess RE beyond RPO etc.). This platform is targeted at encouraging RE-rich states to develop RE beyond their RPO. Further, it would also encourage more merchant power capacities.

- **Advancement of Module Technology & Implementation of New Technologies**

The performance of solar power plants is defined by the Capacity Utilization Factor (CUF), which is the ratio of the actual electricity output from the plant to the maximum possible output during the year. There has been improvement in performance of the module technology with more projects achieving projected PLF levels. In addition, innovations such as wind-solar hybrid, floating PV Projects and storage technologies, etc. are key drivers supporting the improvement in CUF.

India has been experimenting with new techniques to place solar power in agricultural lands, canals, and other bodies of water. These new and novel technologies, such as agrivoltaics, canal top PV, and floating PV, are still in their initial stages of development and have higher installation prices, however, they present significant opportunities for future growth.

Chart 39: Typical month wise CUF variation of Solar



Source: National Electricity Plan Vol-1, CareEdge Research

- **Strong Wind Potential**

India has a strong wind potential of around 302 GW at 100m and around 695 GW at 120m. The wind potential is mainly concentrated in the top 7 windy states including Andhra Pradesh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra,

Rajasthan, and Tamil Nadu. Comparing the installed capacity of wind to the potential, it is only 5% and India has huge untapped potential.

- **Hybrid Plants**

Solar Energy Corporation of India Limited (SECI) began conducting solar/wind hybrid auctions in 2018 to enhance the dependability of renewable energy. In May 2018, the MNRE released the National Wind-Solar Hybrid Policy. Hybrid plants provide good potential for future growth of wind capacities as they provide relatively less intermittent and more stable power supply and do not solely depend on wind for power generation.

SJVN issued a wind-solar hybrid tender of 1500 MW capacity to be set up anywhere in India. SECI also invited bids for setting up of 1200 MW ISTS-connected wind-solar hybrid (Tranche VIII) tender.

As on 31st December 2023, a total RE Capacity of 87461.55 MW is under-construction which comprises of 54772.48 MW of Solar Projects, 19185.75 MW of Wind projects, 13192.82 MW of Hybrid projects, 83.15 MW of Small Hydro projects and, 227.35 MW of Others (Waste to energy and Cogeneration) projects.

- **Offshore Wind Energy**

In 2018, the Indian government set the target to achieve 30 GW of installed offshore wind energy capacity by 2030. Light detection and ranging (LiDAR) measurements and geotechnical/geophysical investigations for a 1 GW offshore project in Gujarat have been completed, and preliminary licenses have been obtained. According to the National Institute of Wind Energy (NIWE), a total of 71 GW of offshore wind potential exists in India. Out of which, 35 GW exists off the coast of Gujarat and nearly 35 GW off Tamil Nadu. As on February 2024, SECI invited bids for setting up 4 GW of offshore wind energy projects off the coast of Tamil Nadu. The last date for bid submission is 2nd May 2024.

- **Improved Turbine Technologies**

The wind turbine generator technology is evolving, and the country now possesses state-of-the-art wind turbine manufacturing technology. With significant domestic manufacturing capability for wind energy turbines and their components, the country has been able to attain around 75% localization. The unit size of the largest machine has gone up to 3.46 MW.

- **Availability of Resources**

India's thermal power sector, largely reliant on coal, meets base load power demands. While gas-based generation is limited by fuel scarcity, coal reserves ensure energy security. However, challenges for renewables include land availability for solar and limited wind corridors. Additionally, renewable technologies depend on imported raw materials, facing supply chain risks.

- **Power Demand-Supply Scenario**

As India's economy grows, thermal power remains essential to meet rising electricity demand, especially during periods of low renewable generation. It provides a stable supply, ensuring grid reliability.

- **SHAKTI Yojana**

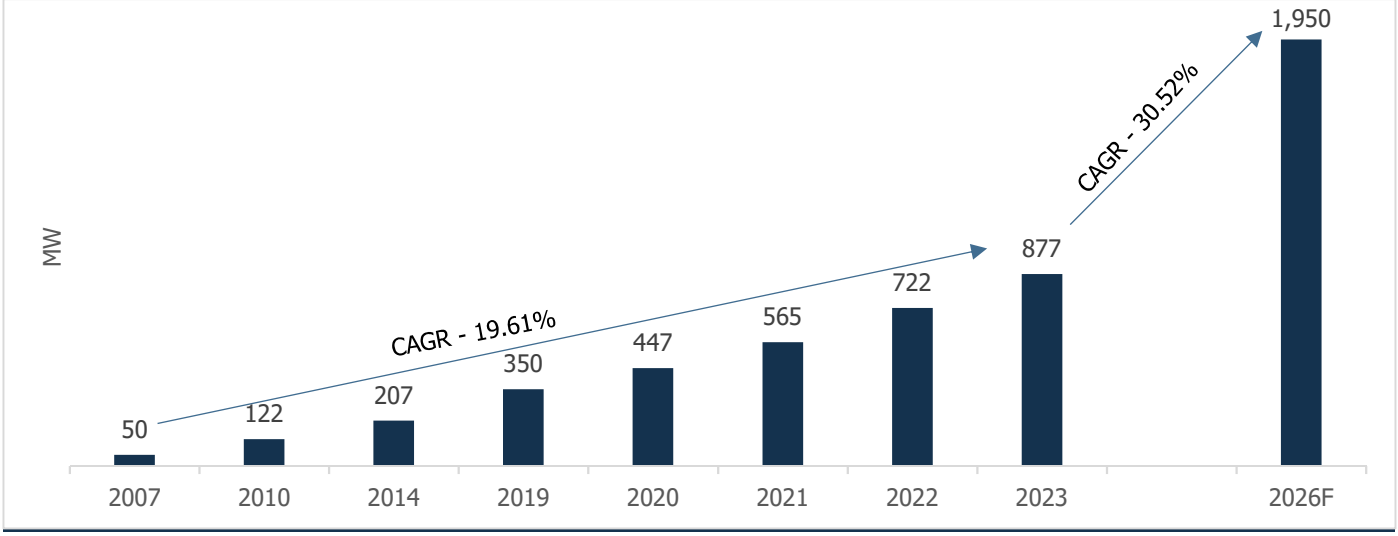
The Government introduced Scheme for Harnessing and Allocating Koyala (Coal) Transparently in India (SHAKTI), 2017, which was issued by the Ministry of Coal on 22.05.2017. SHAKTI Policy is a transparent way of allocating coal to Power Sector. The primary objective of the Yojana is to ensure long-term fuel security for power plants by allocating coal directly to power producers, reducing dependence on coal imports and fostering a transparent process for coal allocation. It aims to streamline the coal supply process to power plants, minimize coal shortages, and enhance the efficiency of the power generation industry. Prior to the implementation of SHAKTI, coal was typically allocated to power plants through Linkage Agreements or Fuel Supply Agreements (FSAs), which were often inefficient and led to supply

inconsistencies. Many power producers in India, particularly those in the private sector, struggled due to irregular coal supply or high coal costs. SHAKTI ensures more predictable and reliable coal availability, reducing the risk of plant underperformance due to fuel shortages.

- **Increase in Power demand due to Data Center**

The power consumption for AI in India is a significant concern, especially with the rapid growth of data centers required to support AI technologies. The first commercial Data Center was set up in India in the year 2000 with the industry growing at a snail's pace, reaching a mere 122 MW by 2010 i.e. average addition of 12 MW per year. Thereafter the capacity witnessed swift addition with growth of almost 3x till 2020 i.e. average addition of 32 MW per year. The industry witnessed per year addition of 100 to 150 MW during the three years 2020 to 2023 and within 3 years, the capacity reached close to 900 MW. It has entered a growth phase and CareEdge estimates that capacity is expected to double to around ~2000 MW by 2026. The growth plans have also created substantial investment prospects and CareEdge Ratings estimates a capex of Rs.50,000 crore in this space over the next three years till 2026.

Chart 40: Data Center Capacity (MW)

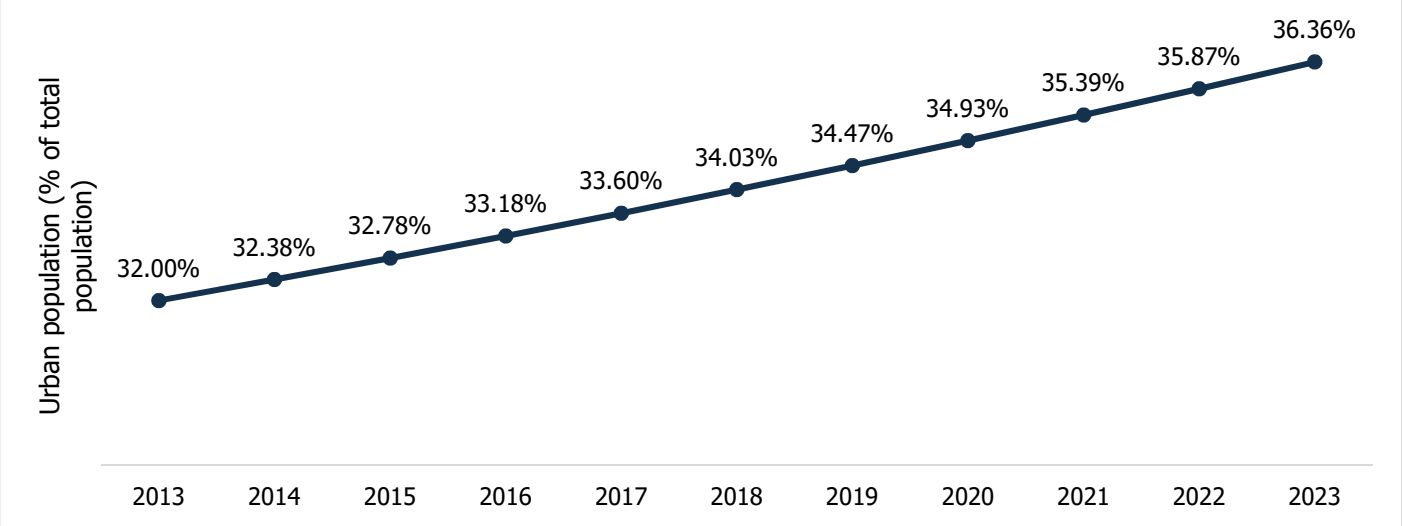


Source: Industry Sources; CareEdge Research

- **Increasing Urbanization and Industrialization**

The urban population is significantly growing in India. The urban population in India is estimated to have increased from 413.00 million (32.00% of total population) in 2013 to 519.50 million (36.36% of total population) in the year 2023. People living in Tier-2 and Tier-3 cities have greater purchasing power.

Chart 41: Urbanization Trend in India



Source: World Bank Database

Power demand forecasting in India is a critical aspect of ensuring a reliable and efficient electricity supply, particularly as the country experiences rapid economic growth and urbanization. With increasing industrialization and a rising population, the demand for electricity is projected to rise significantly in the coming years. Various agencies, including the Central Electricity Authority (CEA), employ advanced modeling techniques to predict future demand patterns, considering factors such as demographic trends, economic indicators, and seasonal variations. The integration of smart grid technologies and real-time data analytics is enhancing the accuracy of these forecasts. However, challenges such as regional disparities in power consumption and the need for infrastructure upgrades remain. Accurate demand forecasting is essential for optimizing generation capacity, reducing outages, and ensuring that the power sector can meet the evolving energy needs of the nation.

Table 10: All India Peak Demand and Energy Requirement

Region	Peak Demand (MW)		Energy Requirement (BU)	
	FY27	FY32	FY27	FY32
Northern	97,898	1,27,553	592.31	773.54
Western	89,457	1,14,766	596.79	763.19
Southern	80,864	1,07,259	460.85	596.55
Eastern	37,265	50,420	232.97	308.10
North-Eastern	4,855	6,519	24.90	32.37
All India	2,77,201	3,66,393	1,907.84	2,473.78

Source: CEA, CareEdge Research

3.1.8 Key manufacturers for Power Transformers in India

- **Hitachi Energy India Ltd**: Hitachi Energy India Ltd serves utility, industry, and infrastructure customers with solutions and services across the value chain. The company is engaged in the business relating to products, projects, and services for Power technology. It manufactures and supplies systems, equipment, devices, and accessories products such as disconnectors, cable accessories, electric motors, semiconductors, transformers, and

others. The company also provides project and service engineering, installation, commissioning, and support services.

- **Schneider Electric Infrastructure Ltd:** Schneider Electric Infrastructure Ltd is an India-based company that is engaged in businesses related to products and systems for electricity distribution. It has a single primary business segment which is products and systems for electricity distribution. The company's products and services include transformers, substations, switchgear, automation systems and products, installation services, switchboard modernization services, and others. Schneider Electric Infrastructure generates almost all of its sales from the domestic Indian market. The majority stake in the company is owned by Indian private company Energy Grid Automation Transformers and Switchgears India Private Limited**.**
- **Atlanta Electricals Limited:** Atlanta Electricals Limited manufactures electrical power equipment. The Company offers power, distribution, furnace, neutral earthing, dry type, and specialty transformers. Atlanta Electricals serves customers in India.
- **Voltamp Transformers Ltd:** Voltamp Transformers Ltd is an India-based company engaged in the manufacture of electrical transformers. Its products include Oil-filled transformers, Cast resin transformers, Unitized sub-station, Induction furnace transformers, and lighting transformers. The company also offers repair, overhauling, conversion, and maintenance services for transformers; and supply spares for transformers.
- **Transformers & Rectifiers (India):** Transformers & Rectifiers (India) Ltd is a holding company that manufactures a range of transformers and rectifiers. The firm's products are Transformer including Power Transformer, Distribution Transformer, Furnace Transformer, Rectifier Transformer, Speciality Transformer, and Reactors, Switch gear including Instrument Transformer and Condenser Bushing.
- **CG Power & Industrial Solutions Ltd:** CG Power & Industrial Solutions Ltd is an India based company engaged in providing products, services, and solutions to utilities, industries, and consumers for the management and application of sustainable electrical energy. It has two business segments. Power Systems segment includes products and services from ultra-high-voltage, high voltage, medium voltage and low voltage like transformer, switchgear, and turnkey projects whereas the Industrial Systems segment include rotating machines of power and ratings, automated AC, DC, and variable frequency drives and control systems like electric motors, alternators, drives, traction electronics, and SCADA. It operates in India and internationally
- **Siemens Energy:** Siemens Energy manufactures a wide range of equipment used to generate and transmit energy. The company engages in transformers which are crucial catalysts in adjusting voltage levels, paving the way for a sustainable and energy-efficient tomorrow.
- **Kanohar Electricals Ltd:** Kanohar Limited is a manufacturer of Power Transformers and Gas Insulated Switchgear as per IEC, ANSI, BS and various other standards. The company is focused on serving quality-conscious customers across diverse sectors: TD Utilities, Power Generation, EPC Contractors, Railways and Industry.
- **Transformers and Electricals Kerala:** Telk is provider of manufacturing and repair of heavy-duty transformers services based in Cochin, India. The company aims to design and manufacture extra high voltage electrical equipment and its products includes power transformers, current transformers, voltage transformers and transformer bushings.
- **BHEL:** Bharat Heavy Electricals Ltd (BHEL) is manufacturer of power plant equipment and an engineering company based in India. It provides products and services across various sectors, including power, transportation, energy, oil and gas, defence, and other industries. The company operates through three primary segments: Power (which generates the majority of its revenue), Industry, and International Operations. BHEL's product range includes heavy industrial equipment and components such as turbines, valves, pumps, boilers, and insulators.
- **Toshiba Corporation:** Toshiba Corporation manufactures and markets electrical and electronic products. The company produces digital products such as personal computers and televisions, flash memories, large scale

integrated devices, and others. It also produces infrastructure systems, medical equipment, printing solutions, and other products. The company also manufactures power transformers and switchgears.

- **GE Vernova Inc:** GE Vernova, in the electric power industry, with products and services that generate, transfer, orchestrate, convert, and store electricity. They design, manufacture, deliver, and service technologies to create a more reliable, secure, and sustainable electric power system, enabling electrification and decarbonization. The company also has high-voltage direct current transmission (HVDC) products, power transformers, switchgear, and grid automation related products and services.

Table 11: Types of Transformers Manufactured

	Hitachi Energy India Ltd	Schneider Electric Infrastructure Ltd	Atlanta Electricals Limited	Voltamp Transformers Ltd	Transformers & Rectifiers (India)	CG Power & Industrial Solutions Ltd	Siemens Energy	Kanohar Electricals Ltd	Transformers and Electricals Kerala	BHEL
765 KV Transformers	■				■	■	■			■
765 KV Reactors					■	■	■			
400 KV Transformers	■				■	■	■	■		■
STATCOM							■			
500 MVA Auto S. ckt	■							■		
HVDC	■									
400 KV Reactors	■					■		■		
Variable Shunt Reactors										
<220 KV Transformers	■	■	■	■	■	■	■	■	■	■
Trackside Transformers						■		■		
Scott Connected Transformers								■		
V-Connected Transformers										
Trackside Auto								■		

Source: Company Websites

3.2 Overview of ICE and EV Technologies

3.2.1 Internal Combustion Engine

An Internal Combustion Engine (ICE) vehicle refers to a vehicle powered by an engine that burns fuel—such as gasoline, diesel, or natural gas—inside its combustion chamber to produce energy. This energy is then converted into mechanical power, which drives the vehicle. ICE vehicles are widely used in automobiles, trucks, motorcycles, and other forms of transportation.

The engine operates by igniting the fuel-air mixture within the combustion chamber, causing a controlled explosion that generates power. This power is transferred to the wheels via a transmission system. ICE vehicles have been the cornerstone of the automotive industry for over a century, owing to their efficiency, ease of refueling, and established infrastructure for fuel distribution.

Despite their widespread use, ICE vehicles have a significant environmental impact due to their emissions of greenhouse gases, including carbon dioxide (CO2), and pollutants like nitrogen oxides (NOx), contributing to air pollution and climate change. This has led to increasing calls for cleaner alternatives. Nonetheless, ICE vehicles remain dominant globally, particularly in regions where infrastructure for alternative fuel vehicles is not yet fully developed.

3.2.2 Electric Vehicle

An **Electric Vehicle (EV)** is a vehicle that is powered entirely or partially by electricity, instead of traditional internal combustion engines that rely on gasoline or diesel. EVs use electric motors for propulsion, drawing power from rechargeable batteries. These vehicles are typically classified into three types:

1. **Battery Electric Vehicles (BEVs):** These vehicles are powered solely by electricity stored in onboard batteries, which are charged through an external electric power source. They produce zero tailpipe emissions, making them an environmentally friendly alternative to conventional vehicles.
2. **Plug-in Hybrid Electric Vehicles (PHEVs):** These combine a traditional internal combustion engine with an electric motor. PHEVs can operate on electric power alone for shorter distances, and when the battery is depleted, the gasoline engine kicks in to extend the vehicle's range.
3. **Hybrid Electric Vehicles (HEVs):** These vehicles use both an internal combustion engine and an electric motor, but unlike PHEVs, they cannot be plugged in to charge. The battery is charged through regenerative braking and the internal combustion engine.

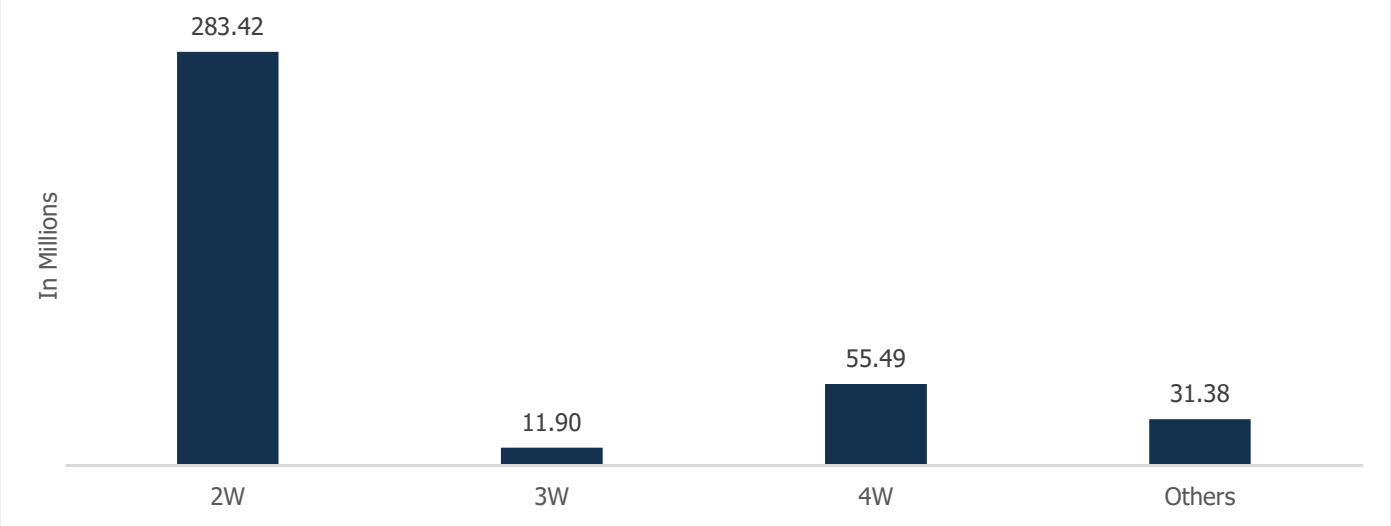
The main benefits of electric vehicles include:

1. **Reduced emissions:** EVs produce little to no tailpipe emissions, which helps reduce air pollution and greenhouse gases.
2. **Lower operating costs:** EVs typically have fewer moving parts and are cheaper to maintain than traditional vehicles.
3. **Energy efficiency:** Electric motors are generally more efficient than internal combustion engines at converting energy into motion. The growing adoption of EVs is being driven by concerns about climate change, air quality, and the need for sustainable transportation solutions. As technology advances, the range of EVs continues to improve, making them more practical for everyday use. Additionally, expanding charging infrastructure and government incentives are further encouraging the shift toward electric mobility.

3.2.3 Number of Vehicle Registered

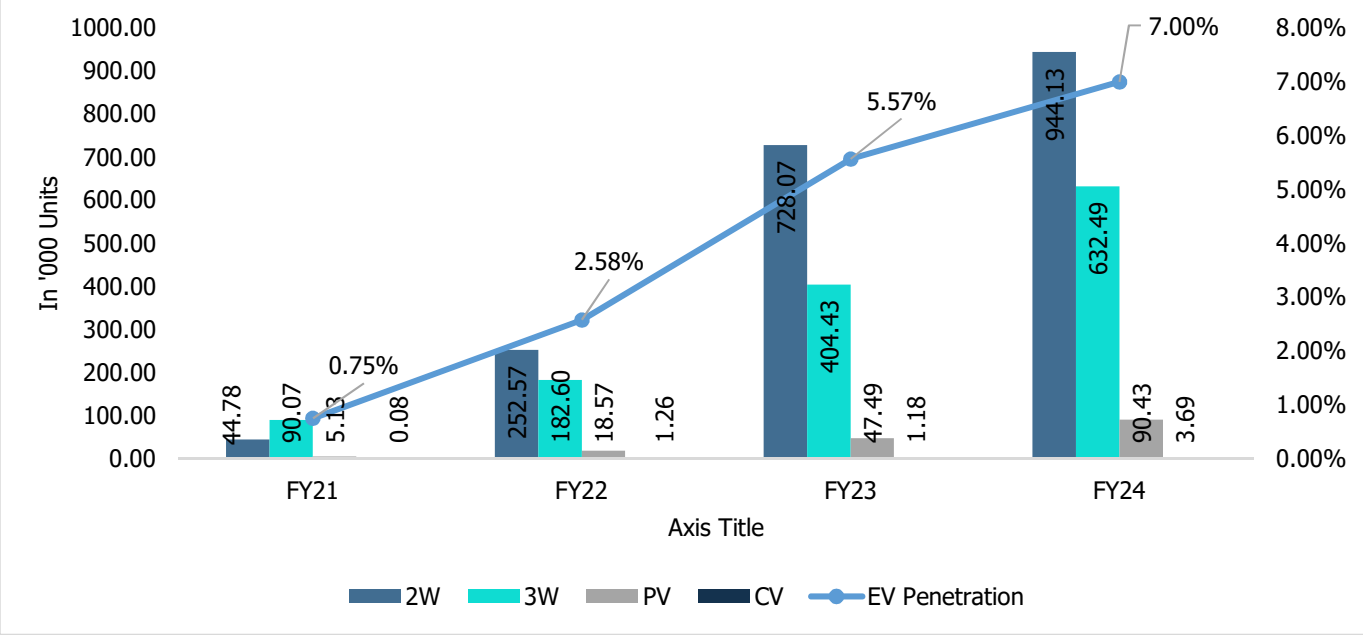
The overall vehicle registrations till CY24 is 382.19 million. The two-wheeler 2W segment dominates, with 283.42 million registrations, representing 74.08% of the total registered vehicles. Three-wheelers (3W) account for 3.14%, with 11.90 million registrations, while four-wheelers (4W) contribute 14.39%, amounting to 55.49 million registrations. The remaining 8.12% is comprised of other vehicle (ambulance, construction equipment vehicle, goods vehicle, public service vehicle, special category vehicle, tractor and trailer) with 31.38 million registrations. Amidst the overall increase in domestic automobile registrations, it is projected that this number will grow by 9% to 11% by the end of FY31.

Chart 42: Number of ICE Vehicles Registered



Source: Vahaan Dashboard

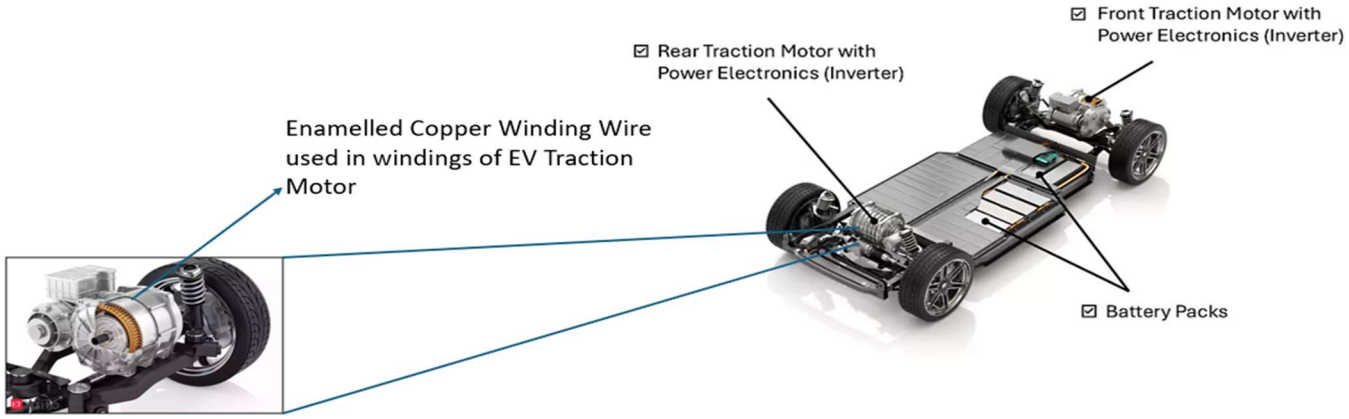
Chart 43: Number of EVs Sold - Segment Wise



Source- SMEV, SIAM, CMIE

3.2.4 Traction Motors used in different vehicles

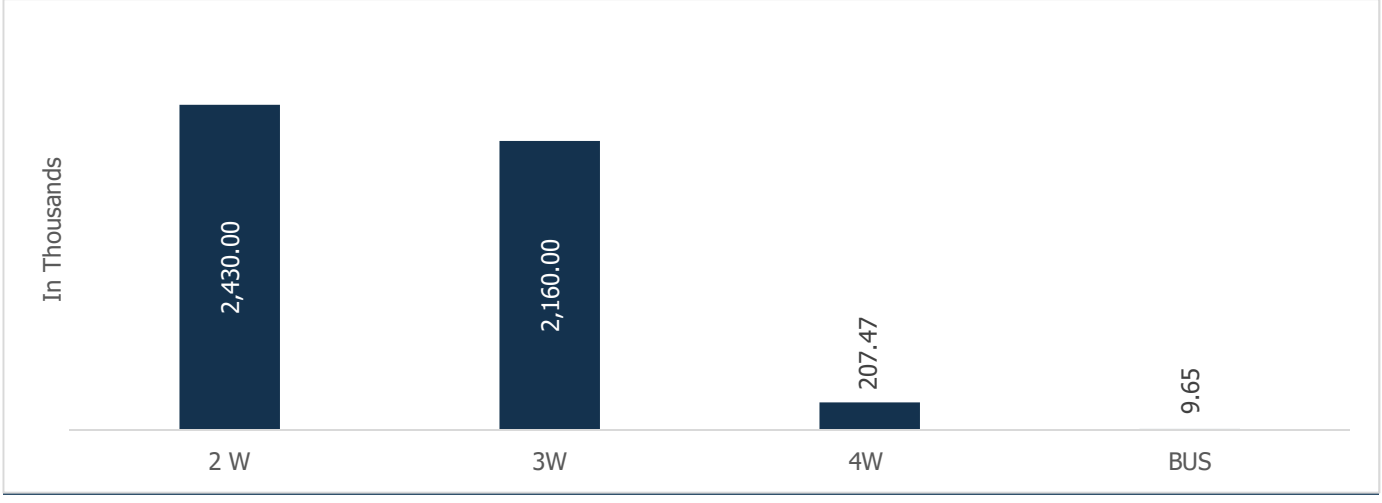
Figure 3: Enamelled Copper MWW used in windings of EV Traction motor



Traction motors are electric motors that convert electrical energy into mechanical energy to drive the wheels, enabling movement. These motors are essential for propulsion in electric and hybrid vehicles. However, ICE vehicles do not use traction motors as they are powered by internal combustion engines, which generate mechanical power directly. The transition from ICE vehicles to EVs is expected to positively impact the winding wire industry, since magnet winding wires are significantly used in traction motors.

Other motors commonly found in EVs and ICE include the Electric Power Steering (EPS) Motor, HVAC (Heating, Ventilation, and Air Conditioning) Motor, Water Pump Motor, Vacuum Pump Motor, Cooling Pump Motor, AC Compressor Motor, Window and Seat Motors, Active Suspension Motors, Windshield Wiper Motors, and in some cases, Regenerative Braking Motors.

Chart 44: Number of Traction Motors and Other Electric Vehicle



Source: Industry Sources

Note: This is based on the assumption that the majority of the models in each segment utilize only a single traction motor. (Data is from CY13-CY24)

Traction motors are extensively used in electric vehicles across various segments. The total number of traction motors in the EV segment is 4,950 thousand. Of this, the two-wheeler segment has 2,430 thousand, the three-wheeler segment has 2,160 thousand, and the four-wheeler segment has 207 thousand traction motors. In addition to their use in electric vehicles, traction motors are also employed in locomotive trains. The number of traction motors used on passenger and freight trains depends on the type of train, its configuration, and how many motors are assigned to each train.

As per NITI Aayog (National Institution for Transforming India), overall electric vehicle (EV) adoption rates in India are projected to reach 10-12% by FY26 and 30-35% by FY30. It is estimated that between 11-13 million EVs will be sold annually in India by FY30, with electric two-wheelers (E2W) leading the charge, as their penetration is expected to reach 35-40% by FY30. Additionally, electric three-wheelers (E3W), electric four-wheelers (E4W) in shared mobility, and electric buses are also expected to experience significant EV adoption over the next decade, with adoption rates ranging from 15-25%. This growth will be driven by favorable economics, a wider variety of vehicle options, and a strong government push towards electrification.

The shift from ICE vehicle to EV will lead to a sharp increase in the demand for traction motors, along with the government planning to expand the Vande Bharat fleet by 2040. As a result, the market for traction motors is expected to grow substantially in the coming years, driven by the rising need for them in trains and other EVs.

3.2.5 Growth Drivers of The EV industry

India’s electric vehicle industry is expanding swiftly, supported by government initiatives like FAME and a growing focus on sustainability and technological advancements. The country is targeting significant EV adoption across multiple segments by 2030.

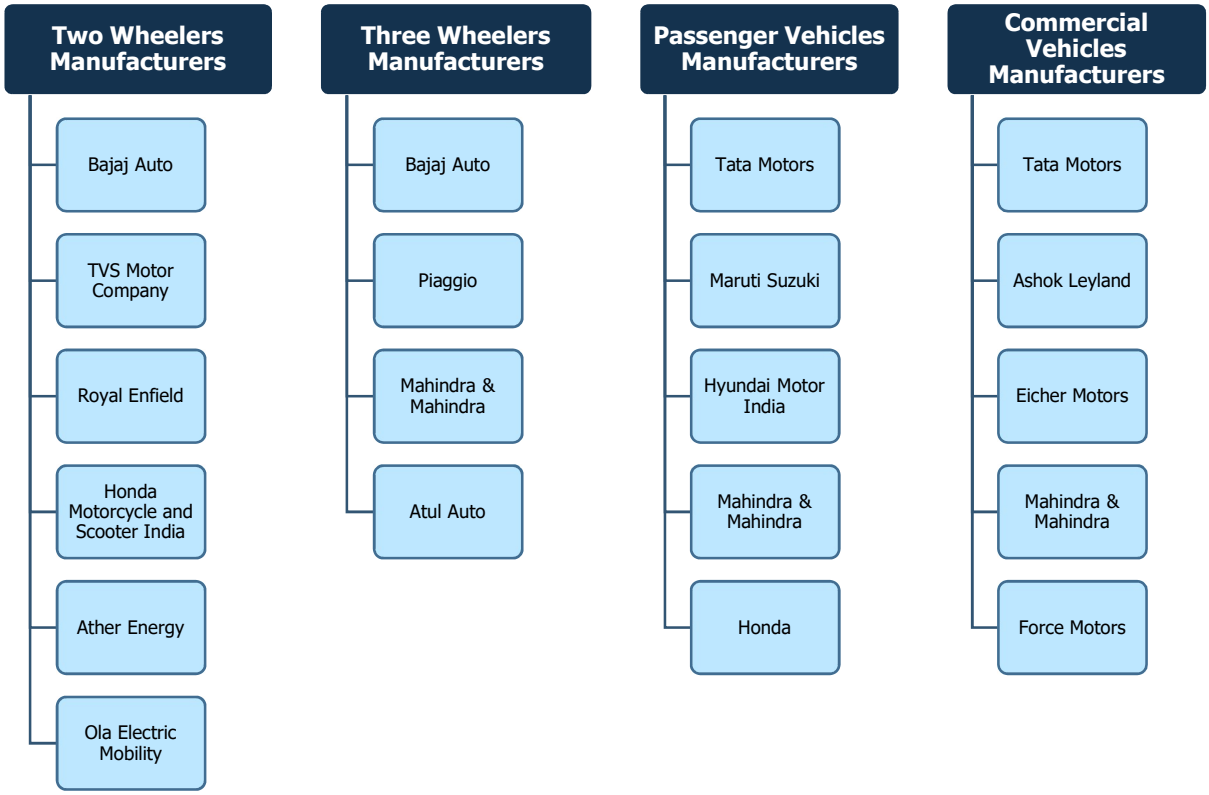
1. **Government's Commitment to EV Adoption:** India has set ambitious goals for EV adoption in private cars, commercial vehicles, buses, and two-wheelers, with plans to have millions of EVs on the roads by 2030. The 'Make in India' initiative focuses on fostering domestic EV production.

2. **FAME II and Infrastructure Development:** Phase-II of the FAME scheme is focused on promoting electric buses, three-wheelers, cars, and two-wheelers, alongside the establishment and upgrading of EV charging infrastructure to support the transition.

3. **Promotion of Electric Buses:** The government plans to replace a significant number of diesel buses with electric buses in the next several years, aiming to reduce emissions and boost the adoption of sustainable public transport.

4. **State-Level EV Policies:** Various states, such as Bihar, have introduced policies to boost EV adoption, offering incentives like subsidies and tax exemptions, and supporting the procurement of electric buses to strengthen the EV ecosystem.

3.2.6 Key Manufacturers in this segment



3.3 Railways and Metro

Indian Railways, the fourth-largest railway network in the world, operates a vast system spanning over 68,584 route km and 7,364 stations as of FY23. With an impressive annual ridership of 6,480 million passengers and ~1500 million tonnes of cargo in FY24. it plays a crucial role in the nation's economy and transportation. Over the past decade, Indian Railways has witnessed significant advancements, including the introduction of semi-high-speed trains like the Vande Bharat Express, which have improved travel times and passenger comfort. The expansion of metro rail networks and the ongoing redevelopment of over 1,300 stations under the Amrit Bharat scheme are set to further enhance infrastructure and amenities for passengers. As part of its modernization efforts, Indian Railways is undertaking a large-scale capacity expansion, with ambitious targets for decongestion. In FY24, the railway network aimed to add 17,000 km of new lines, doubling, and gauge conversion work, and achieved a significant milestone of 5,243 km in FY23. The government has committed robust financial backing, with a budgetary allocation of INR 2,520 billion for FY25, alongside an increase in freight revenue, which reached INR 1,610.50 billion in FY24. The ongoing efforts to enhance locomotive technology, expand dedicated freight corridors, and focus on safety and operational efficiency demonstrate Indian Railways' commitment to transforming into a modern, efficient, and passenger-friendly network.

To address the supply side issues, the Indian Railways is expanding its track network as well as other railway infrastructure such as well as the rolling stock to be well equipped to handle the increase in freight volumes. Total capital expenditure of Rs. 8.45 Trillion has been earmarked over FY23-27 under Mission 3000 MT to address the capacity constraints.

Table 12: Projected Capex under Mission 3000 MT (Rs. Billion)

Sr No.	Works	Total Capex	Year wise Capex				
			FY23	FY24	FY25	FY26	FY27
1	Doubling (DL)	2,130.68	319.6	319.6	532.67	532.67	426.14
2	New Line (NL)	1,760.47	264.07	264.07	440.12	440.12	352.09
3	Gauge Conversion (GC)	207.91	31.19	31.19	51.98	51.98	41.58
4	Traffic facility and yard remodeling work	241.72	36.26	36.26	60.43	60.43	48.34
5	Last mile connectivity to Mining, Ports, Industrial Hubs etc.	220.10	33.02	33.02	55.03	55.03	44.02
6	Automatic Signaling	130.45	19.57	19.57	32.61	32.61	26.09
7	Upgradation to 2 X25KV	1,51.83	22.77	22.77	37.96	37.96	30.37
8	25T axle load	102.13	15.32	15.32	25.53	25.53	20.43
9	Multi-tracking (Doubling, 3rd / 4th/ 5th Line)	1,647.43	247.11	247.11	411.86	411.86	329.49
10	Transmission lines	108.33	16.25	16.25	27.08	27.08	21.67
11	Wagons	701.42	105.21	105.21	175.36	175.36	140.28
12	Locomotive	1,052.1	157.82	157.82	263.03	263.03	210.42
	Total	**8,454.58**	**1,268.19**	**1,268.19**	**2,113.64**	**2,113.64**	**1,690.92**

Source: Ministry of Railways, Report of the Committee on Mission 3000 million tonnes

In the Union Budget FY25-26, the government has allocated INR 2.52 trillion towards railways. The projects like track doubling, new lines, track renewable, gauge conversion etc. have also seen significant growth in budget allocation over FY19 to FY26.

Table 13: Budgetary Outlay toward Railway Projects (Rs. Billion)

Railway Projects	FY19 (A)	FY20(A)	FY21(A)	FY22(A)	FY23(A)	FY24 (A)	FY25(R)	FY26 (B)
Doubling	6.10	6.78	3.79	86.82	256.2	368.06	310.32	320.00
New Lines (Construction)	56.48	98.71	10.58	207.84	243.77	337.02	314.59	322.35
Track Renewals	96.90	93.87	0	106.95	165.58	178.50	226.70	228.00
Gauge Conversion	25.9	33.13	1.17	18.03	23.43	44.88	45.37	45.5
Rolling Stock	45.72	39.63	8.39	68.15	134.93	440.29	462.52	455.3
Passenger Amenities	15.86	19.03	17.88	28	19.96	96.18	163.52	129.51
Road Safety Works	47.33	48.74	0.17	64.00	46.76	88.49	122.95	109.72
Signaling and Telecom	15.38	16.23	0.06	24.48	21.45	37.51	60.06	68.00
Leased assets - Payment of Capital Component	91.12	104.62	119.48	194.59	145.81	207.41	249.2	279.05
Investments & Others	423.28	465.8	305.23	694.73	620.15	3,186.07	829.55	327.44
Manufacturing Misc.	342.81	398.54	311.03	400.97	467.45	529.23	592.98	624.24
Total	1,166.88	1,325.08	777.78	1,894.56	2,145.49	5,452.95	3,285.23	2,909.11

Source: Budget Documents. Note: B – Budgeted, A – Actual, R – Revised and Includes Internal and Extra Budgetary Resources (IEBR)

The Metro Rail system in India has become a crucial component of urban transportation, offering a fast, efficient, and environmentally friendly alternative to road transport in many of the country's largest cities. The introduction and

expansion of metro networks across India have been driven by the need to reduce traffic congestion, lower pollution levels, and provide reliable public transportation to rapidly growing urban populations. The expansion of metro rail systems in India is transforming urban mobility, making cities more accessible, reducing environmental impact, and contributing to the overall quality of urban life. As more cities adopt and expand metro networks, the benefits of this modern, efficient, and sustainable mode of transport are set to grow. There is a lot of opportunity for players doing ballastless tracks and the same as all station tracks and majority metro tracks are ballastless.

3.3.1 Metro and Electric Trains expansion plans

Expansion of Metro Rail

As of August, 2024, about 945 Km of metro lines have been operationalized across 21 cities. The metro network, including regional rapid transit systems (RRTS) is proposed, to be expanded to 1,700 Km across 27 cities by 2025 and subsequently to 50 cities. The government is also proposing Metro Lite and Metro Neo lines which are suitable for smaller cities with lower peak traffic. Currently, approximately 2,500 coaches have been deployed in the operational metro lines roughly costing Rs. 325 Billion. As the operational metro lines are expected to increase by more than 2x over the next 4-5 years, domestic demand for metro rail rolling stock is expected to witness significant increase. Majorly the metro rail network is consisting of Ballastless tracks, given that new metro projects are upcoming in the country. This is expected to also add to the demand for ballastless tracks.

Table 14: Metro Rail Network Under Construction

Sr No	Name of Metro Rail Project	Under Construction Length (Km)
1.	Delhi Metro Extension from Dwarka Sector 21 to India International Convention & Expo Centre (IICC), Dwarka	2.03
2.	Delhi Metro Phase IV (03 Priority Corridors)	65.20
3.	Patna Metro Rail Project	32.51
4.	Bangalore Metro Rail Project Phase II	58.48
5.	Bangalore Metro Rail Project Phase 2A & 2B	58.19
6.	Kanpur Metro Rail Project	23.38
7.	Agra Metro Rail Project	29.40
8.	Mumbai Metro Line 3	33.50
9.	Pune Metro Line III	23.33
10.	Mumbai Metro Line 2B	23.60
11.	Mumbai Metro Line 4	32.30
12.	Mumbai Metro Line 4A	2.70
13.	Mumbai Metro Line 5	24.90
14.	Mumbai Metro Line 9(7A)	13.72
15.	Navi Mumbai Metro Line 1	11.10
16.	Kochi Metro Rail Project Phase 2	11.20
17.	Chennai Metro Rail Project Phase II	118.90
18.	Kolkata Metro East-West Corridor	85.16
19.	Other Metro Rail Projects in Kolkata	
	TOTAL	**953.49**

Source: PIB

Expansion of Electric Train

The expansion of electric trains in India is gaining momentum, with 136 Vande Bharat train services currently operational on the Broad-Gauge electrified network of Indian Railways, catering to short and medium-distance journeys. In addition, 10 Vande Bharat Sleeper trains are under production for long and medium-distance travel, with the first prototype undergoing field trials. The manufacturing of 200 Vande Bharat Sleeper Rakes has been awarded to technology partners, and the timeline for their rollout depends on successful trial completions. The Vande Bharat Express trains, which have achieved over 100% occupancy as of October 2024, are a testament to India's commitment to modernizing its rail infrastructure with world-class, energy-efficient electric trains.

3.3.2 Electrification of Trains and Metro

Indian Railways is undergoing a major transformation, with electrification playing a pivotal role in its modernization efforts. As of 2024, over 95% of its routes are electrified, and the goal is to achieve complete electrification by 2030. Currently, 97% of the broad-gauge network is electrified, with plans to electrify the remaining routes through a budget allocation of INR 80,700 million for FY23-24. The increase in electric locomotives is improving operational efficiency, speed, and reliability, contributing to higher track capacity and reduced carbon emissions.

Indian Railways is also focusing on renewable energy to power its operations. The goal is to become a net-zero carbon emitter by 2030, with plans to source 1,000 MW of solar power and 200 MW of wind power across its network. The shift from diesel to electric locomotives is a significant step towards this target. As electric locomotives are faster, more efficient, and environmentally friendly, they support the overall goal of improving the railway system while reducing the country’s carbon footprint.

In addition to rail electrification, India is expanding its metro rail networks, which are also powered by electricity. As of July 2023, the entire broad-gauge network in 14 states and union territories has been electrified, marking significant progress toward India's ambition to become the world’s largest green railway by 2030. This comprehensive electrification plan will not only help reduce dependency on fossil fuels but will also significantly enhance the efficiency and sustainability of India’s railway and metro systems.

3.3.3 Number of motors required in Metro Rail

Traction motors are specialized electric motors designed for drive or propulsion in applications where high torque and low speed are essential. These motors are widely used in electric vehicles (EVs), locomotives, and metro coaches, providing the necessary power to move heavy loads efficiently. Traction motors can be either DC or AC types, with modern systems favouring multiphase AC drives due to their efficiency and control. In metro coaches, traction motors, such as AC induction motors and permanent-magnet synchronous motors (PMSM), are commonly employed for their reliability, durability, and ability to handle variable speeds. These motors ensure smooth acceleration, efficient braking, and overall energy-saving performance, making them crucial for the operation of metro systems, where reliability and safety are paramount.

Table 15: Motors Required per Metro Car

Metro Line	Number of Traction motors	Motorisation
Kolkata Metro Rail Corporation Limited	6 cars with 16 traction motors	66%
Bangalore Metro	6 cars with 16 traction motors	66%
Delhi Metro Rail Corporation	6 cars with 12 traction motors	50%

Source: Ministry of Urban Development

Table 16: Metro Coach Manufacturing Facilities in India

Sr. No.	Company	Location	Coaches supplied/Contract under Execution
1	Bharat Earth Movers Limited	Bangalore	Delhi, Bangalore, and Mumbai Metro Rail
2	Alstom Transport	Sricity	Chennai, Lucknow, Agra, Kanpur, and Mumbai Metro
3	Bombardier Transportation (acquired by Alstom)	Savli	Bangalore, Ahmedabad, Mumbai, and Delhi Metro
4	CRRC India	Sricity	Noida, Mumbai, Kolkata, Nagpur, and Navi Mumbai Metro
5	Indian Railways (Integral Coach Factory)	Chennai	Maharashtra Metro Rail Corporation
6	Titagarh Rail Systems	Uttarpara	Pune

Source: Industry Sources

3.3.4 Number of motors required in Railways

Traction motors are specialized electric motors designed for propulsion in applications requiring high torque and low speed, such as in electric locomotives and trains. These motors are essential for driving heavy loads efficiently, particularly in railway systems. In railways, traction motors, typically AC induction motors or permanent-magnet synchronous motors (PMSM), provide the power needed for smooth acceleration, reliable braking, and energy-efficient operation. AC motors are commonly preferred due to their efficiency, durability, and ability to handle variable speeds. Traction motors are crucial in ensuring the safe and reliable movement of trains, making them integral to modern rail systems where performance and safety are key priorities. The number of traction motors used in passenger and freight trains depends on the type of train, its configuration, and how many motors are assigned to each train.

Table 17: Motors Required in Railways

Type of Train	Number of Traction motors
Passenger Train	6
Freight Train	4

Source: International Trade Administration

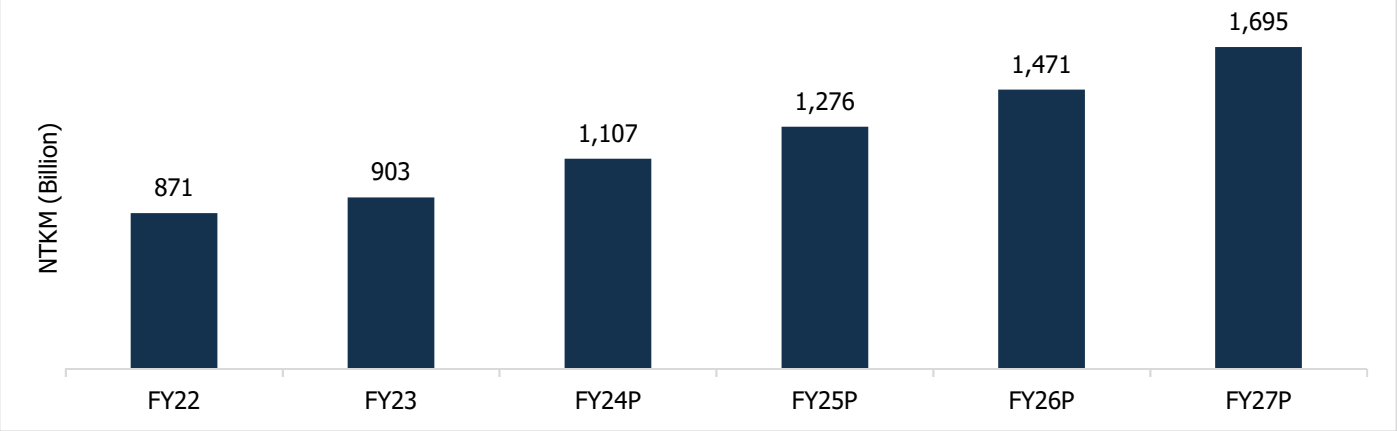
3.3.5 Market Drivers contributing to Growth

- **Government thrust on rail infrastructure improvement:**

The Government of India has identified railways as a key focus area to boost GDP and make India more export competitive by reduction in freight costs. The budgetary outlay towards Indian Railways has been on a rise over the past few years and the government has introduced various schemes such as DFC, NLP, GPWIS, PM Gati Shakti & GCT, LWIS, AFTO, multi-modal logistics parks etc. to boost railway infrastructure and share of railways in freight traffic. The passenger segment has also seen multiple developments through initiatives like High Speed Rail Corridors, Vande Bharat Express etc.

Under the NRP, the railway's share in freight transport is expected to increase to 45% by 2030 from existing 26%. This implies that the total freight transported by Indian Railways will increase to 3,000 million tonnes by FY27 and 3,600 million tonnes by FY30 from 1,588 million tonnes in FY24. Further, railway freight traffic measured in Net Tonne Kilometres (NTKM) is expected to double to 1,695 billion NKTM by FY27 from 903 billion NKTM in FY23.

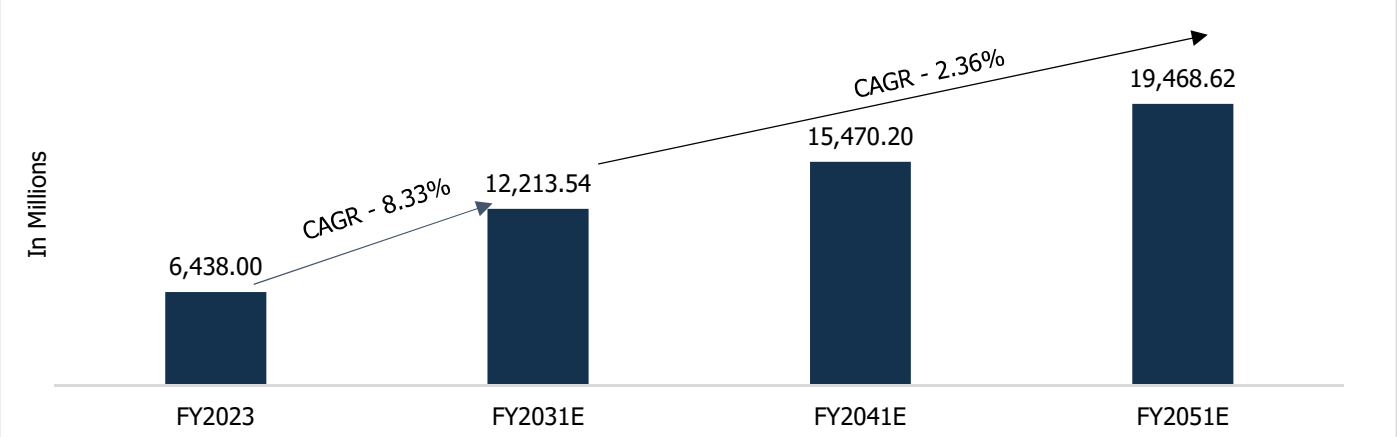
Chart 45: Trend in Indian Railway Freight Traffic



Source: Indian Railways, Report of the Committee on Mission 3000 million tonnes

The passenger traffic is expected to grow at a CAGR of 8.33% between 2023 and 2031 driven by population growth and growing workforce.

Chart 46: Projected Growth in Passenger Traffic



Source: Indian Railways, National Railway Plan

Indian Railways is expected to source additional rolling stock to cater to rising volumes.

Locomotives: Under NRP, approximately 20,700 locomotives will be required by 2031 to cater to the increasing traffic compared to 12,734 locomotives in FY21.

Table 18: Locomotive Demand (Units in Nos.)

	2026E	2031E	2041E	2051E
Coaching Locomotives	3,494	4,782	8,687	13,498
Freight Locomotives	13,305	15,957	22,894	31,519
TOTAL	**16,799**	**20,739**	**31,581**	**46,017**

Source: Indian Railways, NRP

Wagons: The ordering and procurement of wagons by the Indian Railways is expected to increase significantly as evident from the recent tenders which have been awarded. The wagon fleet is expected to increase to 5.40 lakh wagons by FY31 from 3.20 lakh wagons in FY22 including the replacement demand.

- **Rising participation of private sector:**

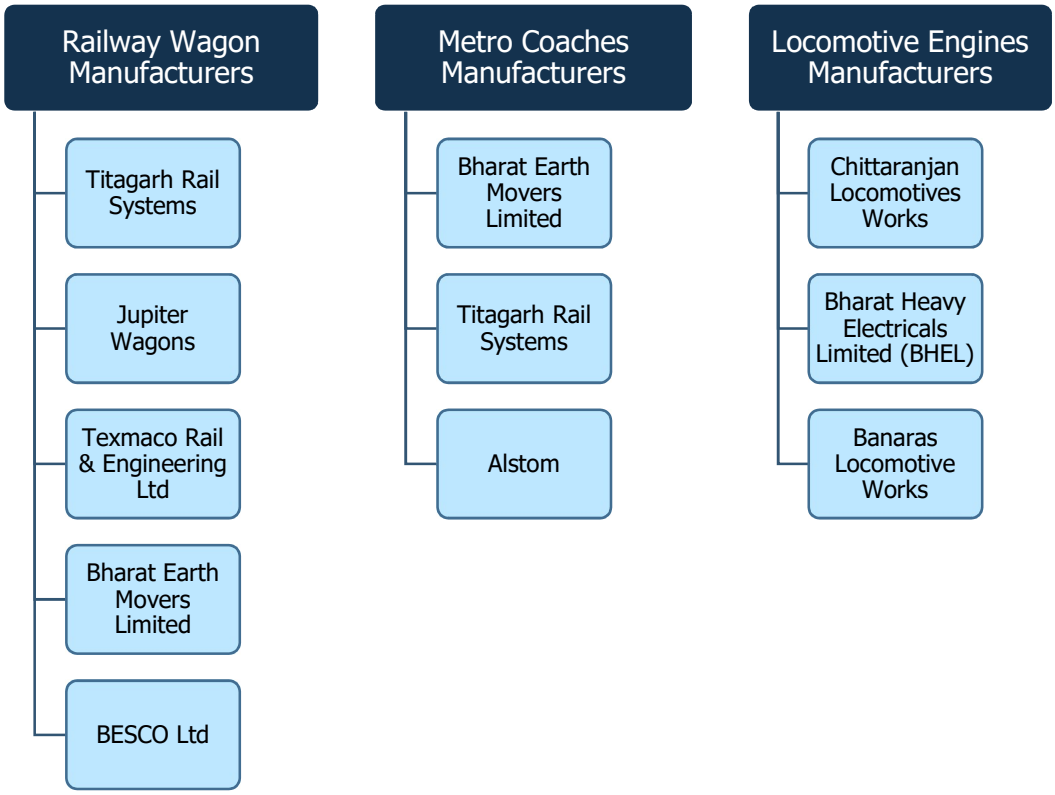
Private sector ownership of wagons was on a rise driven by some of the recent schemes announced by the Indian Government. Industries such as cement, coal, steel, automobiles, logistics etc. which have a large freight movement through rail procured wagons from domestic manufacturers. However, the Indian Railways is currently not accepting any new applications for private sector wagons under some of the schemes due to concerns over network congestion, especially in mineral-rich states where the majority of the privately-owned wagons are deployed. This hiatus is expected to be temporary till the various network expansion projects, such as DFC, are completed.

The demand from private sector companies, especially the logistics players and the metal and mining companies is expected to be robust in the medium-long term. There is significant scope for an increase in demand from the cement, coal and steel industries on the back of growing domestic demand. Further, currently, the auto industry is using the railways mainly for transportation of passenger vehicles. There is also potential to transport CV parts and two-wheelers through the railway network which will add to wagon procurement by automobile manufacturers and logistics companies. Further, defense services are also proposing to procure wagons for transportation of utilities etc. However, the Indian Railways will continue to be the largest procurer of wagons.

- **Expansion of Metro Rail:**

As of October 2023, about 874 km of metro lines have been operationalized across 20 cities. The metro network, including regional rapid transit systems (RRTS) is proposed, to be expanded to 1,700 km across 27 cities by 2025 and subsequently to 50 cities. The government is also proposing Metro Lite and Metro Neo lines which are suitable for smaller cities with lower peak traffic. Currently, approximately 2,500 coaches have been deployed in the operational metro lines roughly costing 32,500 Cr. As the operational metro lines are expected to increase by more than 2x over the next 4-5 years, domestic demand for metro rail rolling stock is expected to witness significant increase.

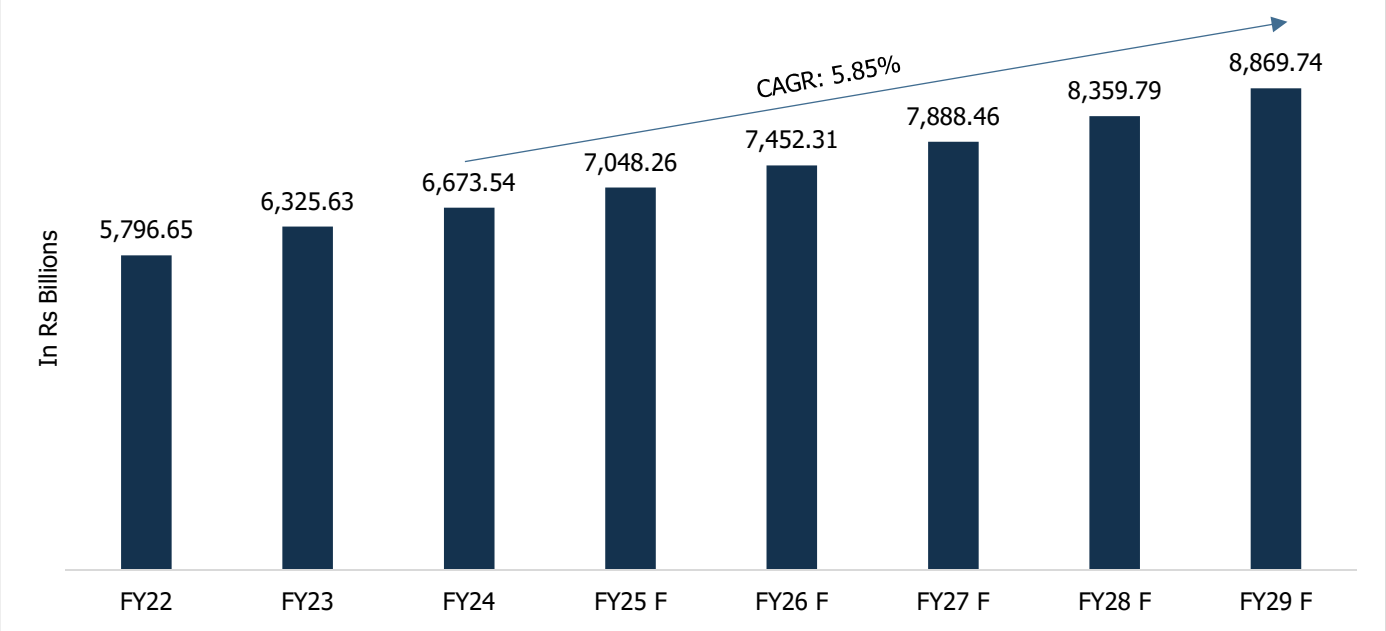
3.3.6 Key manufacturers in this segment



3.4 Consumer Durables Market

In 2023, the Indian consumer electronics market was valued at Rs 6,325.63 Billion. It is expected to reach Rs 8,869.74 Billion by 2029, expanding at a compound annual growth rate (CAGR) of 5.85 during the 2024 – 2029 period. Initiatives like Make in India, the Electronic Development Fund Policy, and the Production Linked Incentive Scheme have boosted local manufacturing by rationalizing duties and offering subsidies, which are attracting global players. A 46.8% rise in the sale of consumer electronics and appliances was recorded in FY23. The growth of India's consumer electronics market is driven by rising household demand, changing lifestyles, easier access to credit, and increasing disposable income.

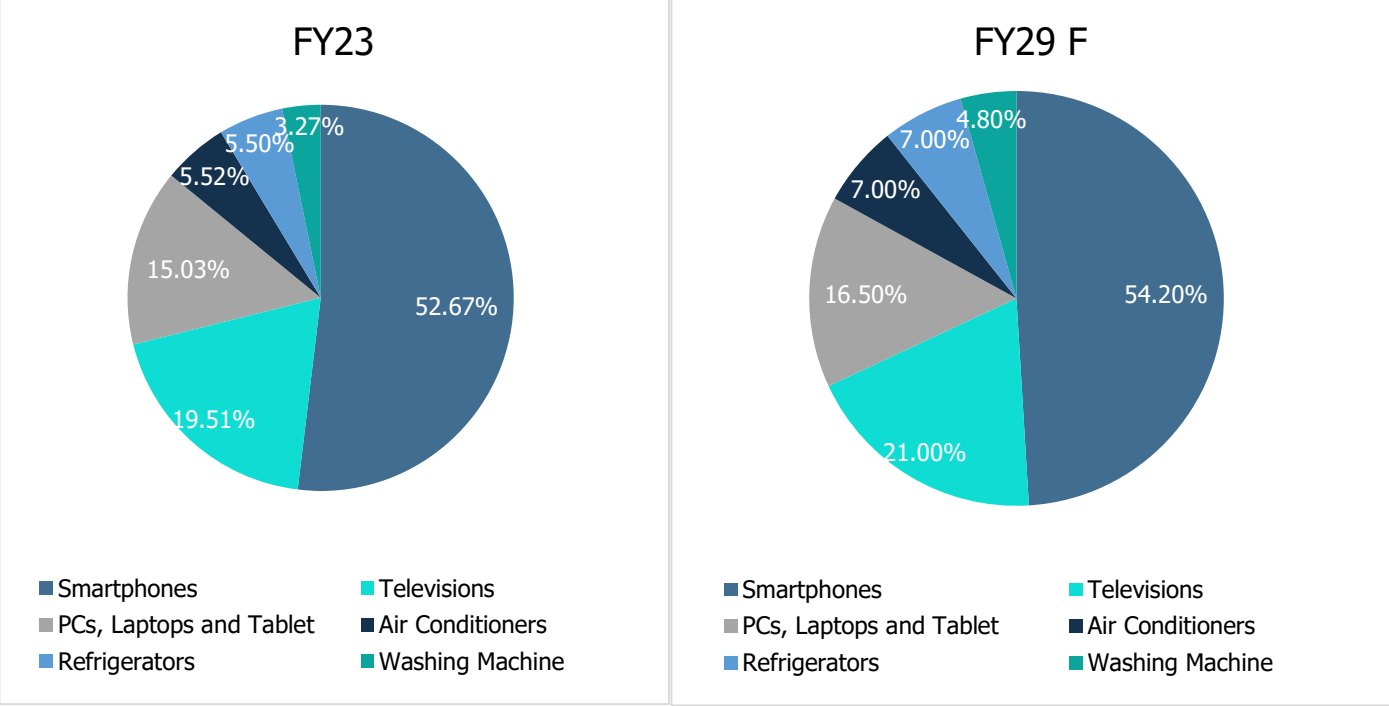
Chart 47: Market Size and Growth Forecast Based on Value (FY22 – FY29F)



Source: NetScribes, EMIS, CareEdge Research

The growth in local manufacturing of electronics such as vibrator motors and charger adapters has led to a decline in the import of these items. Additionally, the rise in domestic consumption of electronics contributed to a reduction in exports of such products during FY23.

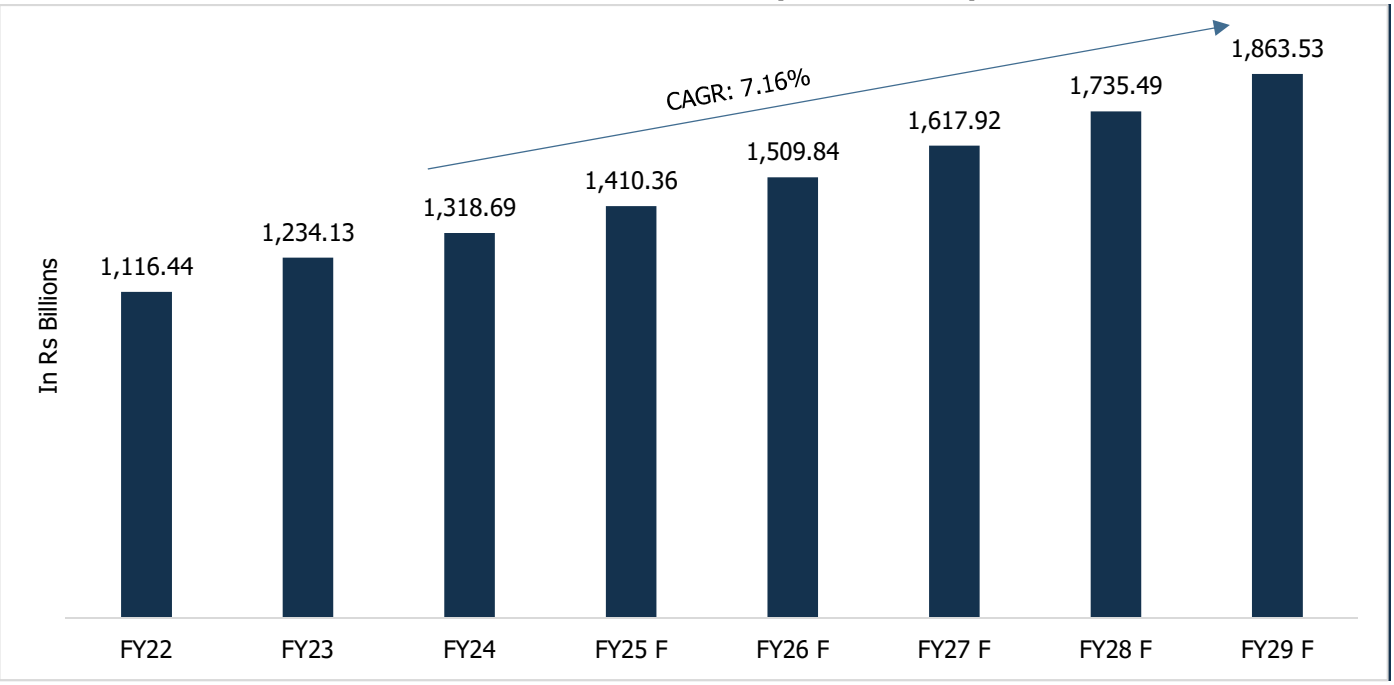
Chart 48:Market Segmentation Based on Product Type (FY23 vs FY29 F)



Source: NetScribes, EMIS, CareEdge Research

Mobile phone production accounts for a sizeable portion of India's consumer electronics manufacturing, making 52.67% of the total in FY23. Segments such as washing machines, refrigerators, and air conditioners are emerging as key growth areas. These sectors are crucial for the overall development of the electronics manufacturing ecosystem in India. Government initiatives like Make in India and Production Linked Incentive (PLI) schemes have played crucial roles in boosting the domestic manufacturing of consumer electronics.

Chart 49: Televisions – Market Size and Growth Forecast (FY24 –FY29 F)



Source: NetScribes, EMIS, CareEdge Research

Consumers are increasingly choosing affordable smart TVs over retrofitting older models that need streaming devices, which are gradually losing favor. While traditional cable and satellite television still hold considerable shares, the rise in the adoption of smart TVs and the easy availability of affordable internet have reshaped content delivery and viewing patterns. The market for Smart TVs is driven by the increasing preference for digital content on OTT platforms. Overall, the key growth factors include frequent e-tailer sales, the launch of new models, and the clearance of older inventory, particularly ahead of festive seasons. In 2024, leading brands such as Xiaomi, Samsung, LG, TCL, and OnePlus dominated the Indian television market, catering to the demand for smart and feature-rich TVs at competitive prices. This trend reflects a broader move towards integrating advanced features and seamless access to OTT platforms into television sets, further boosting market growth.

Figure 4: Winding Wires used in Compressor/Motor of AC's and Refrigerator

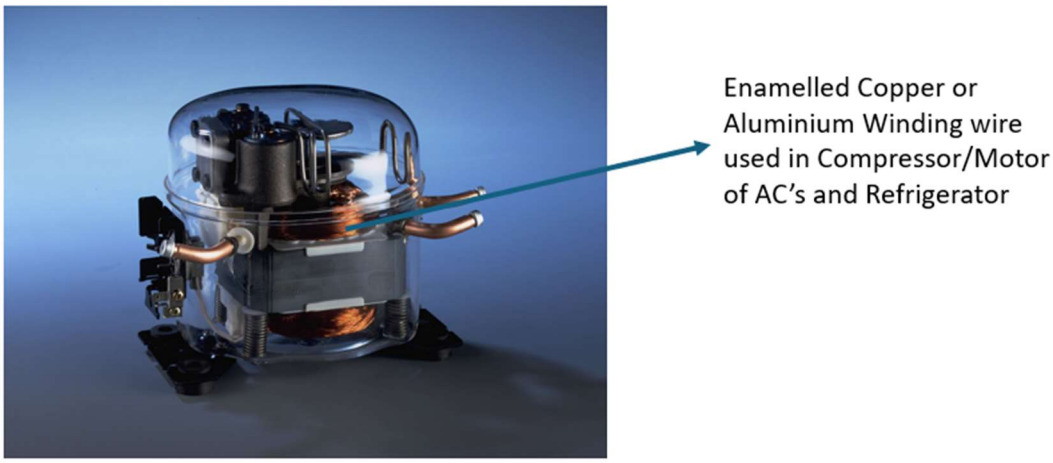
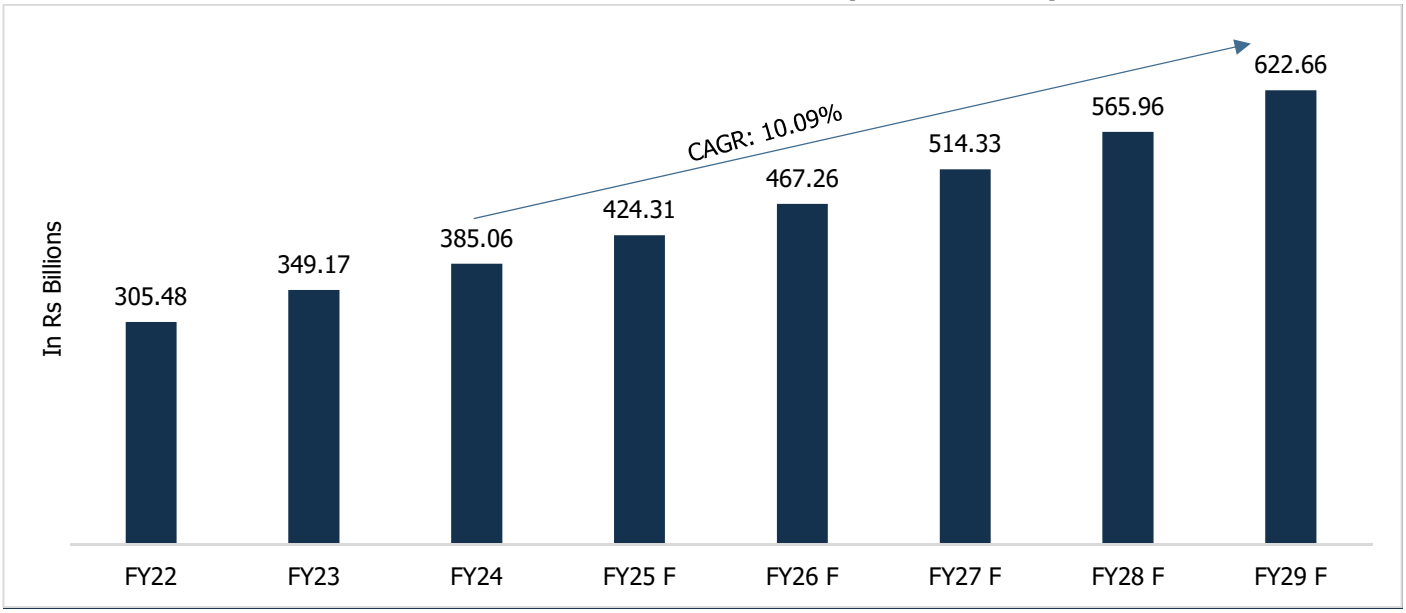


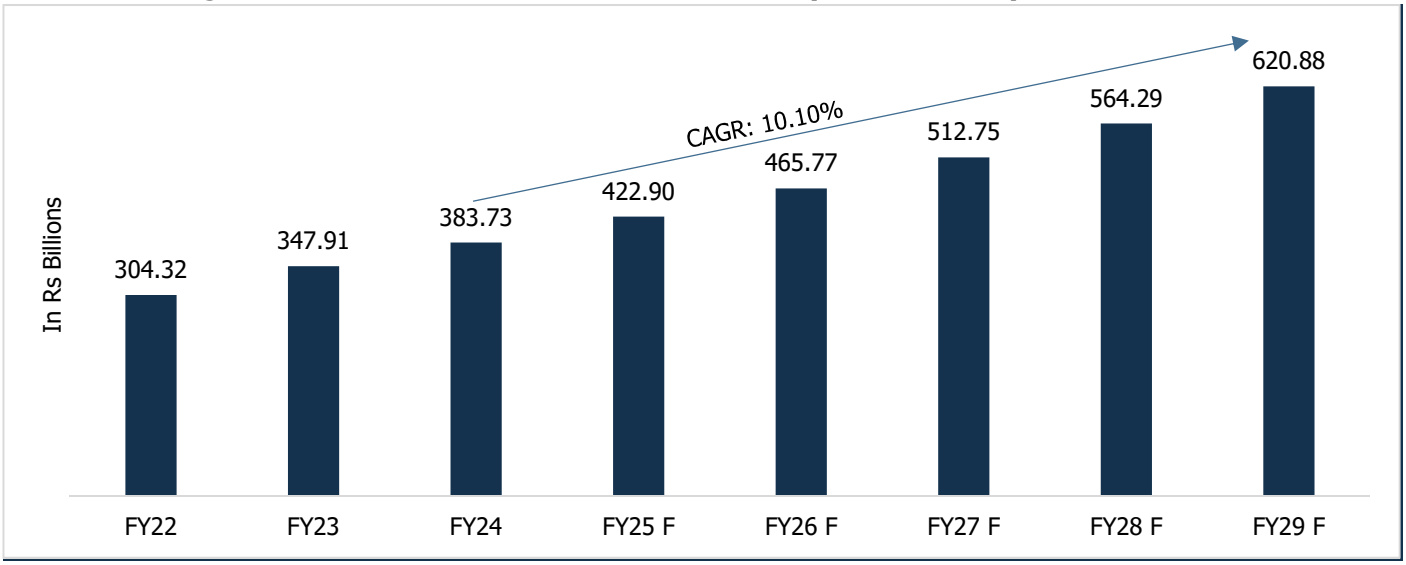
Chart 50: Air Conditioners – Market Size and Growth Forecast (FY24 – FY29 F)



Source: NetScribes, EMIS, CareEdge Research

AC segment in India is poised for intense competition, fueled by rising temperatures during the summer months, increasing disposable incomes, and improved access to financing. Demand for commercial air conditioning is also on the rise, driven by the growing need for comfort and energy-efficient solutions across industries and commercial spaces. notable challenge the industry faces is its heavy reliance on imports, with 65% – 70% of the component value being sourced internationally. This dependency underscores the need for advancements in domestic manufacturing to enhance supply chain resilience and reduce costs. The market's growth trajectory is supported by evolving consumer preferences for sustainable and feature-rich air conditioning solutions, fostering innovation and investments from both domestic and global players.

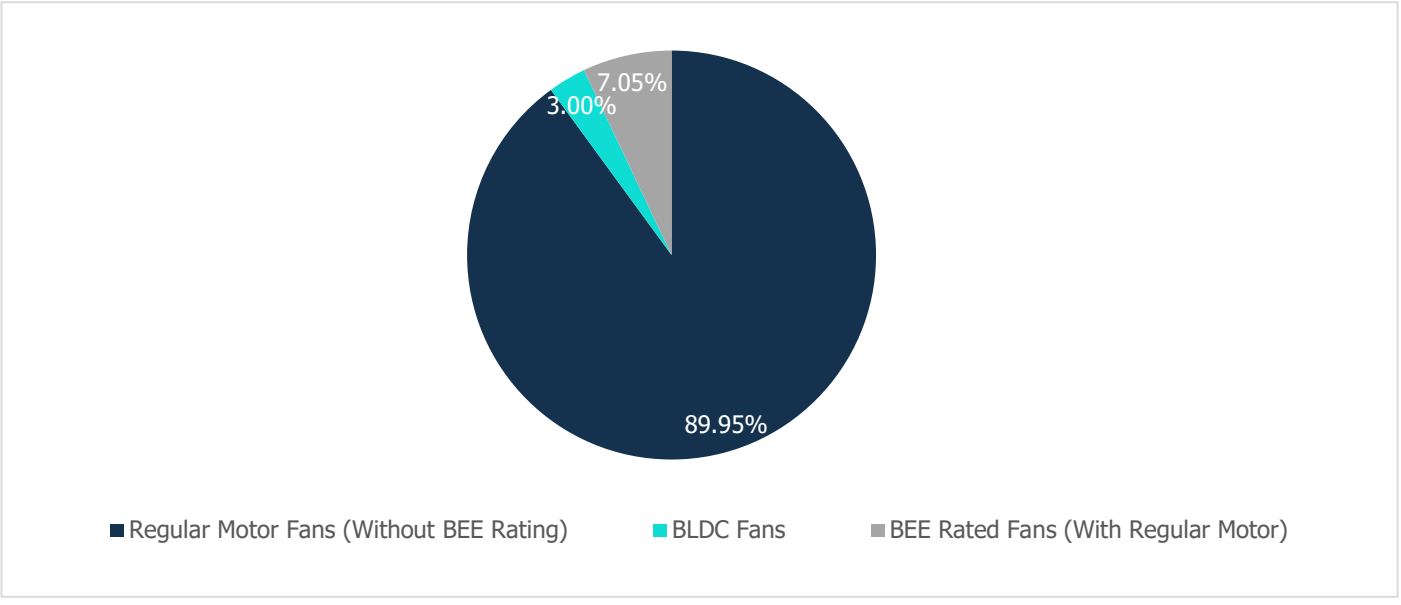
Chart 51: Refrigerators – Market Size and Growth Forecast (FY24 – FY29 F)



Source: NetScribes, EMIS, CareEdge Research

The Indian refrigerator market has evolved from catering to luxury buyers to becoming a necessity, driven by rising disposable incomes and the availability of easy financing options. These factors have contributed significantly to the growth of the market, with a substantial portion of sales taking place in urban areas. An increasing urban population and shifting lifestyles are resulting in the adoption of smart refrigerators, particularly among high-income households. Refrigerators have become an essential appliance for preserving perishable goods, food, and beverages, with demand increasing as consumption of such items rises. Manufacturers are leveraging free delivery services, festive discounts, and promotional offers to attract urban consumers. Additionally, state governments' incentives, including capital subsidies, tax reimbursements, and exemptions on electricity duties, are fostering the expansion of the market.

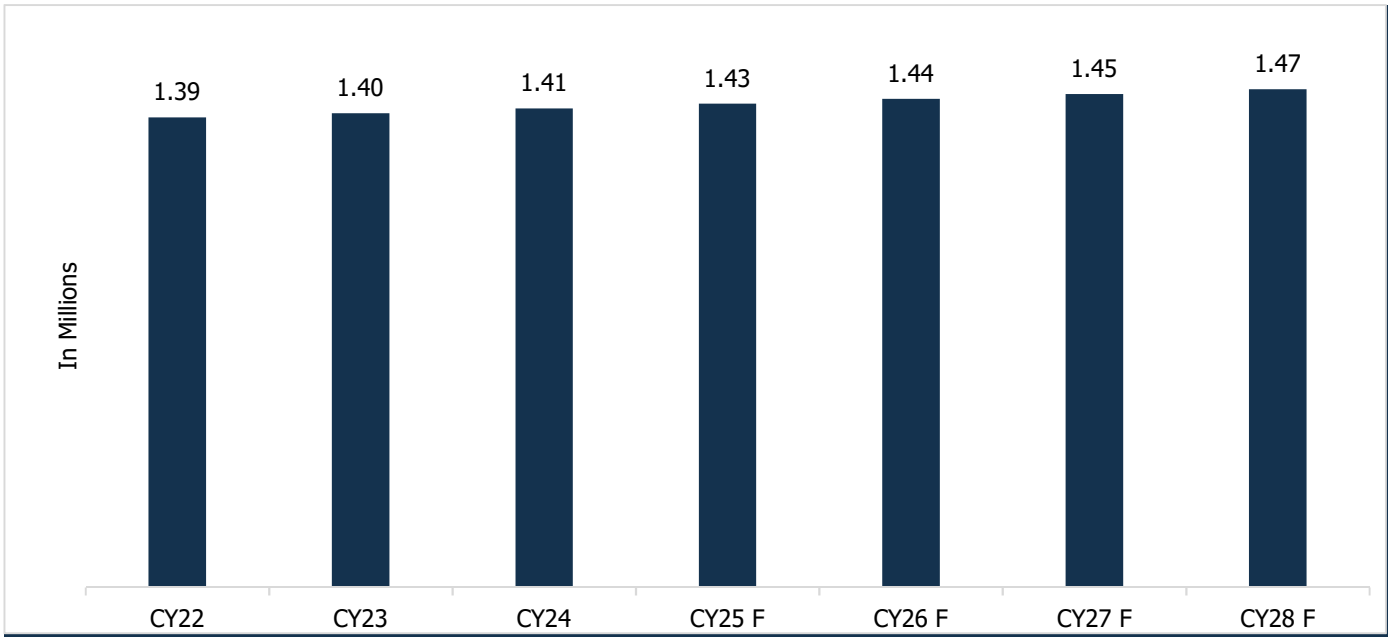
Chart 52:Segment wise market share Ceiling fans (%)



Source: International Copper Association of India

Annual market for fans is 100 million units in India, and ceiling fans account for 70% of it. The types of fans are classified into economy, standard, premium and lifestyle based on price point. The market is dominated by the economy and standard fans. The market for BLDC and BEE-rated fans is increasing in metro and tier 1 cities (75% and 90% respectively) It is yet to capture tier 2 and tier 3 cities/ towns. The BEE Super-Efficient Equipment Program (SEEP) program covers appliances such as ACs, refrigerators, washing machines, fans, etc. under which financial stimulus is provided to manufacturers for introducing energy-efficient appliances. This scheme has pushed new startups and existing OEMs to introduce more BDLC fans, thereby increasing the market penetration.

Chart 53: Volume of Microwaves in India CY23 – CY28 F



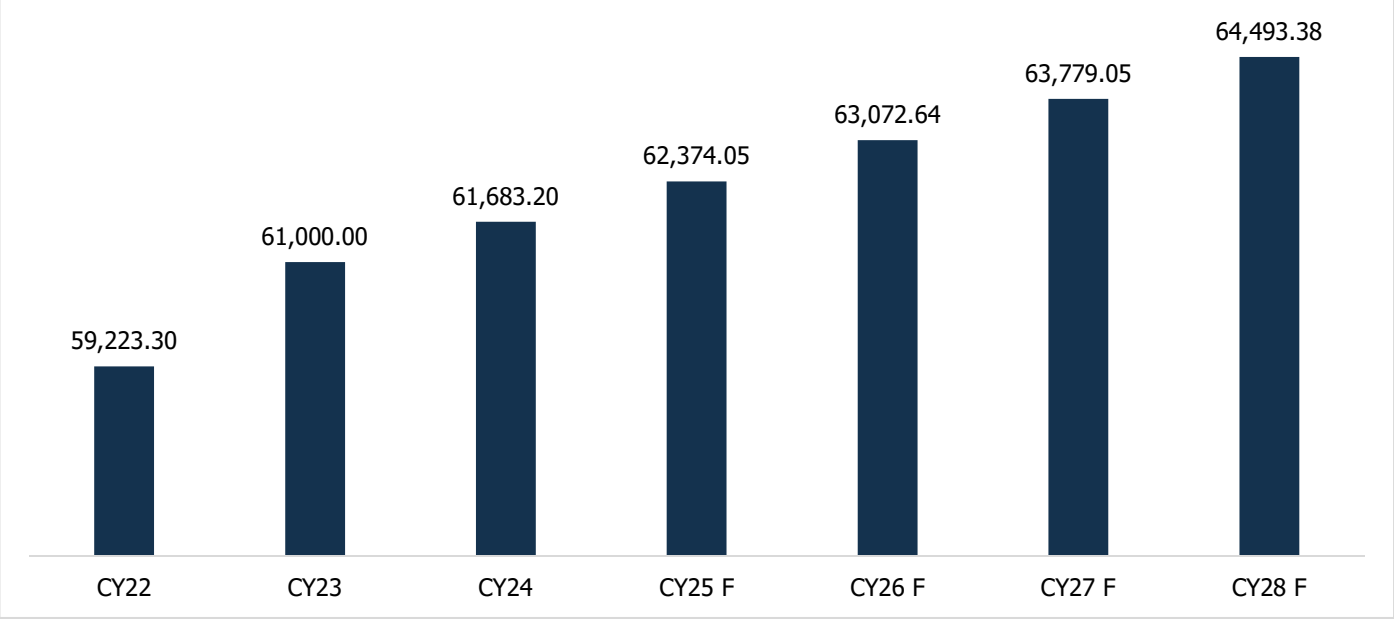
Source: Euromonitor International, EMIS, CareEdge Research

Retail volume sales grow by 0.71% in 2023 to 1.40 million. Freestanding microwaves is the best performing category in 2023, with retail volume sales rising by 1% to 1.40 million. Retail volume sales are set to rise at a CAGR of 1.05% over the to 1.47 million by 2028.

Microwaves in India continued to experience muted demand in 2023, as consumers restricted their expenditure during a period of economic uncertainty. There were several other factors, such as the return of domestic help, reopening of restaurants, growing reliance on takeaway/delivery, and inflationary concerns that also impacted growth of the category.

Indian cuisine relies heavily on the use of LPG stoves (liquid propane gas) or induction on hobs for frying and/or sautéing, for which microwaves remain unsuitable. The easy availability of domestic help and cooks also means that local consumers have access to hot, readymade food, further reducing the need for microwaves. Post-pandemic, as consumers returned to spending greater time outside of the home and the baking/cooking trend eased, the need for microwaves also slowed. Lastly, with inflation impacting the economy, consumers are becoming increasingly cost-conscious and restricting spending on discretionary products that do not add specific value to their lives. The category also faces competition from products such as light fryers and OTG ovens (oven, toaster, grill), that are multi-functional and offered at significantly lower prices.

Chart 54: Retail Volume of Mixers in India CY23 – CY28 F



Source: Euromonitor International, EMIS, CareEdge Research

Among Food Preparation Appliances in India Mixers is the best performing category in 2023, with retail volume sales increasing by 2.98% to 61,000.00. The primary factor anticipated to propel market growth for mixers over the long run is the expanding food processing industry along with rising consumption of bread and dairy food products in developing nations.

3.4.1 Market drivers and of Consumer Electronics sector in India

- **Growing number of Nuclear Families**

The shift from joint families to nuclear family is a significant driver of the consumer durables market. As more individuals and couples establish independent households, the total number of homes increases, each requiring its own set of essential appliances such as televisions, refrigerators, washing machines, and air conditioners. This trend leads to a rise in multi-unit purchases within extended families and contributes directly to the sustained demand for consumer durables across urban and semi-urban regions.

- **Increase in Per-Capita Income**

As individuals enjoy greater disposable income, they are more inclined to spend on home improvement and lifestyle-enhancing products. This has led to increased demand not only for basic appliances but also for premium, feature-rich, and energy-efficient models. The willingness to upgrade to smarter, more durable goods reflects a shift in consumer preferences toward quality and convenience, thereby expanding the market across both urban and rural segments.

- **Expansion of Quick Service Restaurants**

The rapid expansion of Quick Service Restaurants (QSRs) and food delivery platforms is driving the demand of commercial appliances. With the increasing need for high-efficiency, large-capacity equipment to support fast-paced kitchen operations, there is growing demand for commercial-grade appliances such as deep freezers, convection ovens,

food processors, and display refrigeration units. As more QSR chains and cloud kitchens continue to scale, this sector is significantly contributing to the demand for durable, high-performance kitchen equipment.

- **Surge in Sales in the Rural Sector**

Improved availability and affordability of electronic devices, coupled with enhanced infrastructure and connectivity, have made these products more accessible for rural consumers. Additionally, changing lifestyles and preferences, coupled with rising disposable incomes in rural areas, have led to an increased demand for consumer electronics. The expansion of e-commerce services into rural markets has further facilitated the purchase of electronic goods, contributing to the overall surge in sales in the rural sector. Further, there has been increasing demand for smartphones that have improved network connectivity in rural areas, given that the Indian government continues to focus on transitioning to a digital economy where several types of transactions can be conducted using smartphones.

- **Rise of No-cost EMIS and Buy-now-pay-later**

Buy-now-pay-later and no-cost EMIs play a significant role in purchasing choices. With these payment options, customers can purchase goods and pay later in instalments over time. As a result, the expansion of India's retail industry is driven by the increasing popularity of flexible payment methods. Flipkart Pay Later (by Flipkart), Amazon Pay Later (by Amazon), ePayLater (by ePayLater), ZIP Paylater (by MobiKwik.), Axio mockup (by Axio), Simpl (by One Sigma Technologies Private Ltd.), and LazyPay (by LazyPay.) are a few of the top Buy-Now-Pay Later options in India. The growth of such players is largely driven by low credit card penetration and limited access to formal credit, coupled with a booming e-commerce market in the country.

- **Government Initiatives**

Make in India & Atmanirbhar Bharat: The government's push for manufacturing electronics locally is reducing import costs, making products more affordable for consumers and fostering domestic production.
GST and Tax Reforms: Simplified tax structures like GST have made it easier for businesses to operate, which in turn drives the availability of consumer electronics at competitive prices

3.4.2 Key manufacturers for Consumer Electronics in India

Top Consumer Durables manufacturers in India								
Samsung India Electronics	LG Electronics India	Sony India	Voltas Limited	Amber Enterprises India Limited	Bajaj Electricals Ltd	Whirlpool of India	Godrej Appliances	Havells India Ltd

3.5 Industrial Motors

3.5.1 Overview

Industrial electric motors are essential machines that convert electrical energy into mechanical energy, driving motion through the interaction between the motor's magnetic field and an electric current. These motors are designed to generate torque, which is applied to the motor's shaft to perform work in various applications. Industrial motors are used in a wide array of industries and sectors, providing reliable power for machinery in agriculture, marine, mining, oil and gas, food production, data centres, healthcare, and more. They are also widely used in general industrial equipment and excel in hazardous environments where safety is critical. There are different types of industrial motors, including DC motors, AC motors, and specialized types like servo motors and linear motors. DC motors are commonly used in small to medium-sized applications due to their simplicity and ease of control, while AC motors, such as induction and synchronous motors, are favoured in industrial settings for handling larger loads and higher speeds. Servo motors, which can be either DC or AC, are used in applications requiring precise control of speed and position. Additionally, linear motors convert electrical energy directly into linear motion instead of rotary motion, useful for specialized applications. These motors can be powered by either direct current (DC), typically from batteries, or alternating current (AC) from sources like power grids, inverters, or generators. Depending on the power source, internal construction, and type of motion, industrial motors are classified to meet the specific demands of their applications, ensuring efficiency, reliability, and safety across a diverse range of industries.

Industrial motors can be of various types:

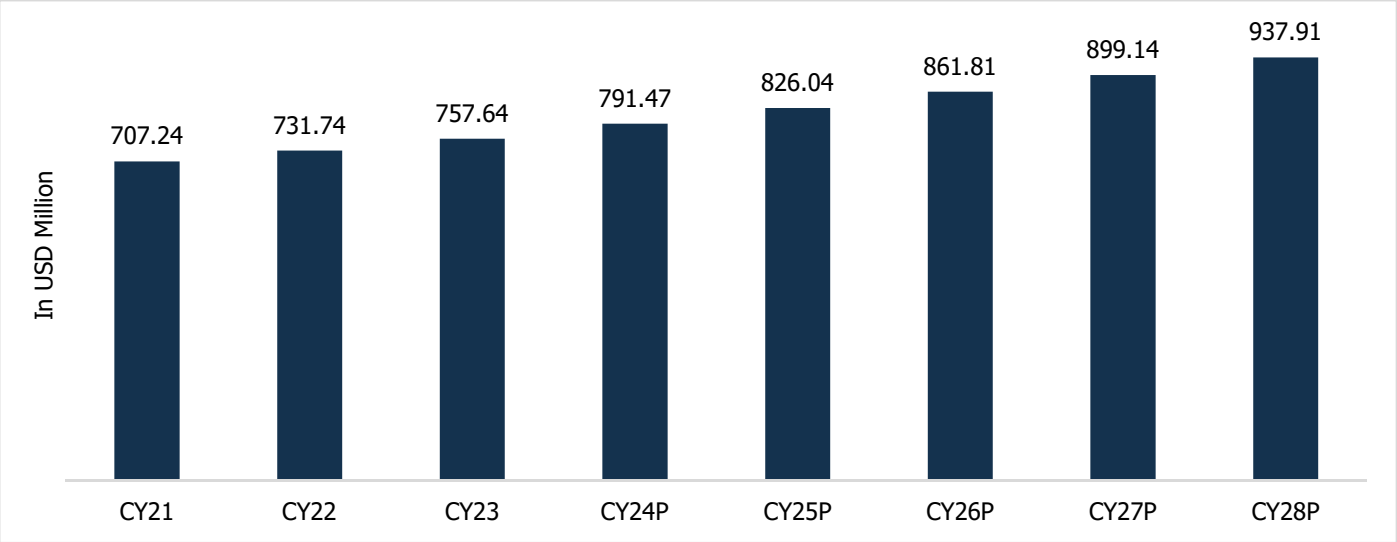
- **Low Tension Motors (LT):** Low tension (LT) motors operate on lower voltage levels, typically ranging from 230 V to 690 V. These motors are commonly used in applications where the power requirements are relatively modest, such as small machinery, household appliances, and light industrial equipment. LT motors are known for their compact design, cost-effectiveness, and ease of control. They are ideal for operations where the load is not too high, offering reliable performance in a wide range of domestic and industrial applications.
- **High Tension Motors (HT):** High tension (HT) motors are designed to operate at higher voltage levels, typically from 3.3 kV to 11 kV. These motors are used in large-scale industrial applications that require higher power outputs, such as heavy machinery, pumps, compressors, and large-scale manufacturing operations. HT motors are built to handle significant loads and are often used in industries like power generation, mining, and chemical plants. Their robust construction and high efficiency make them essential for high-demand environments where substantial energy is required.
- **Brushless Direct Current (BLDC):** BLDC motors are advanced electric motors powered by direct current (DC) voltage and electronically commutated, unlike conventional DC motors that rely on brushes for commutation. BLDC motors offer several advantages, including higher efficiency, better controllability, and greater durability. They can maintain maximum torque throughout the rotation and deliver precise control over speed and torque, reducing energy consumption and heat generation. These motors are ideal for applications requiring continuous operation, such as in washing machines, air conditioners, and vacuum cleaners. Their low noise and minimal wear make them highly reliable for long-term use in devices like hard disk drives.

3.5.2 Indian Market Size and Outlook

The Industrial motor market grew from USD 707.24 million in CY21 to USD 757.64 million in CY23 growing at a CAGR of 3.50%. It is expected to grow from USD 757.64 million in CY23 to USD 937.91 million in CY28 at a CAGR of 4.36%. The demand for industrial motors, including stepper motors, induction motors, and others, is experiencing notable

growth due to the expansion of key sectors like textiles and pharmaceuticals in India. The textile industry, a vital contributor to India's economy, has seen significant growth, driven by rising investments, and government initiatives like "Make in India". This growth is expected to increase the demand for various motors in textile machinery and manufacturing. Similarly, the pharmaceutical industry's expansion, fuelled by increasing exports and domestic production, will drive further demand for motors, particularly stepper motors, in automation and processing applications.

Chart 55: Indian Market Size of Industrial Motors (CY21-CY28)



Source: Mordor Intelligence, EMIS, CareEdge Research; Note: P-Projected

3.5.3 Market Drivers contributing to Growth

- **Industrial Growth and Government Support:**

India's robust push towards industrial growth has been a major catalyst for the expansion of the industrial motor market. Government initiatives like "Make in India" and "Atmanirbhar Bharat" have focused on enhancing domestic production capabilities, encouraging investments in manufacturing, and reducing reliance on imports. These efforts have not only stimulated the growth of manufacturing sectors but also driven the need for reliable and efficient industrial motors. Applications such as material handling, HVAC systems, and automation have seen a significant rise in demand, as industries aim to modernize their operations and meet the growing expectations for productivity and competitiveness. Furthermore, policies like the "Production Linked Incentive (PLI)" scheme have provided financial incentives for manufacturers to innovate and adopt advanced technologies, further boosting the market for industrial motors.

- **Technological Advancements and Automation:**

The advent of Industry 4.0 has transformed the industrial landscape, leading to an increased emphasis on automation, digitalization, and smart technologies. Industrial motors are now expected to do more than just provide power; they must integrate seamlessly with automated systems and offer features like IoT connectivity, predictive maintenance, and enhanced energy efficiency. Motors embedded with smart sensors and advanced control systems enable real-time monitoring and diagnostics, ensuring optimized performance and reduced downtime. As industries embrace machine learning and artificial intelligence for process automation, the demand for cutting-edge motor technology continues to grow. Sectors like automotive, consumer electronics, and pharmaceuticals are at the forefront of this transformation, driving the adoption of motors that align with the requirements of automated and intelligent production systems.

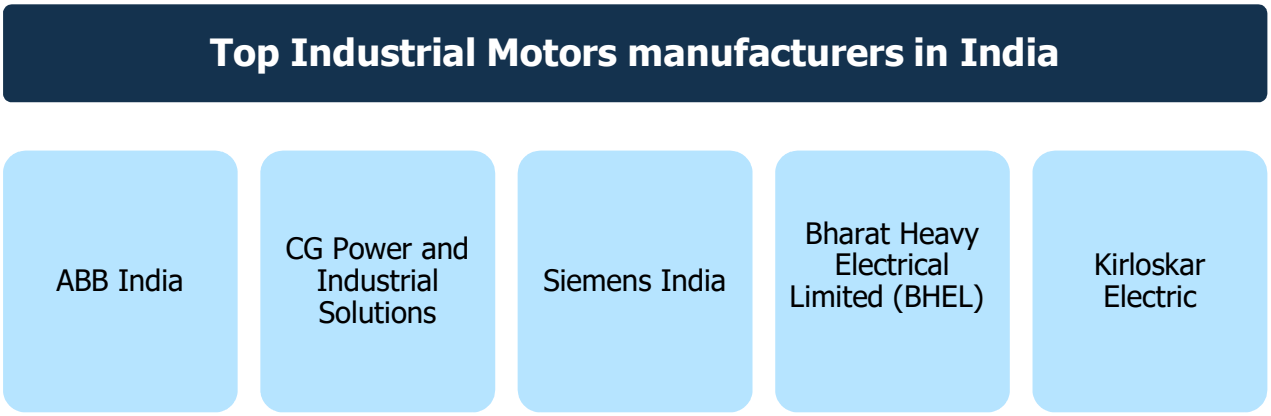
- **Energy Efficiency and Sustainability:**

Sustainability has emerged as a critical factor in industrial operations, with energy efficiency being a key component. Industrial motors are among the largest consumers of electricity in manufacturing processes, making their energy performance a priority. Companies are increasingly adopting energy-efficient motors to reduce operational costs, lower their carbon footprint, and comply with stringent environmental regulations. In India, government mandates such as the Bureau of Energy Efficiency (BEE) star ratings for motors and energy conservation guidelines have accelerated the transition to more efficient technologies. This trend is further supported by the growing availability of advanced motors designed to deliver high performance while consuming less energy, contributing to long-term cost savings and environmental benefits.

- **Expansion of End-Use Industries and Electric Vehicles (EVs):**

The growth of end-use industries such as automotive, construction, food and beverage, and mining is playing a pivotal role in driving the demand for industrial motors. These sectors require motors for diverse applications, including material handling, conveyor systems, and automated production lines. Additionally, the electric vehicle (EV) revolution in India has created a new avenue for the industrial motor market. EVs rely on specialized motors that combine efficiency, durability, and advanced control features to meet the evolving demands of manufacturers and consumers. With India's automotive industry increasingly pivoting towards electrification, the demand for these high-performance motors is expected to rise sharply. Similarly, the construction and infrastructure sectors' rapid expansion is fueling the need for motors in heavy machinery and building systems, further contributing to market growth.

3.5.4 Key manufacturers in this segment



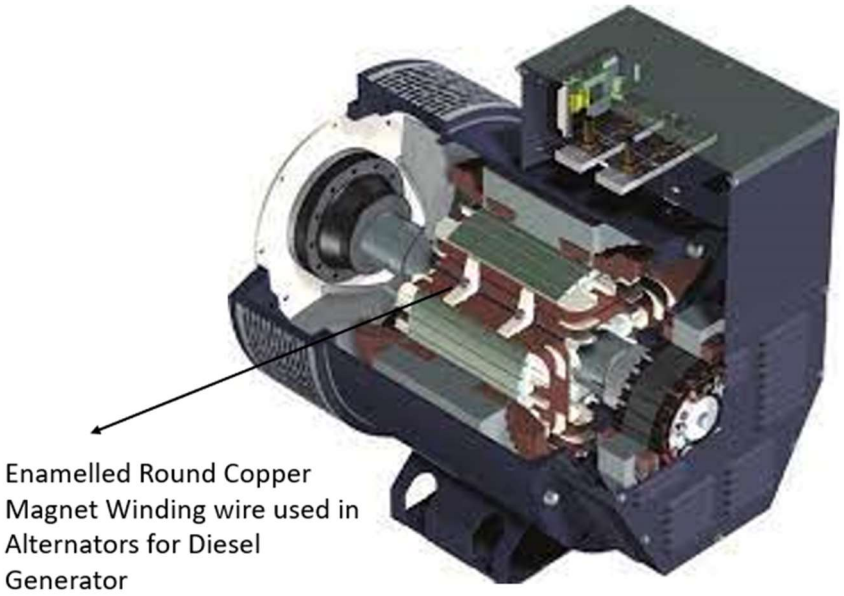
3.6 Diesel Generator (DG) Sets

3.6.1 Overview

A Diesel Genset (Diesel Generator Set) is a power generation system that converts diesel fuel into electricity using a combination of a diesel engine and an alternator. It is widely used as a backup power source in critical sectors like hospitals, data centers, and industries to ensure continuous operations during grid failures. In remote locations or off-grid areas, diesel gensets serve as primary power sources, providing electricity where the main grid is unavailable. They also support power grids by managing peak loads during high-demand periods and play a crucial role in emergency and disaster relief operations. There are different types of industrial motors, including Standby Generators, Prime Generators and Continuous Generators. Standby generators are backup power generators that automatically activate during grid failures, whereas Prime generators are designed for regular use to supply electricity in areas with unreliable grid power.

On the other hand, Continuous generators are used for constant power supply in off-grid locations, industrial sites, and remote areas. These DG sets are generally categorized based on their power rating, which determines their capacity and application. Low power gensets, 5kVA - 75kVA are commonly used for residential backup, small businesses, and telecom towers, ensuring uninterrupted power supply during outages. The 76kVA – 375kVA, are suited for mid-sized commercial buildings, hospitals, hotels, and small industrial facilities that require stable electricity for critical operations. Whereas, 376kVA – 750kVA cater to large-scale industries, data centers, and infrastructure projects, providing reliable backup or prime power solutions. For heavy duty applications, 750kVA – 1MW gensets are utilized in power plants, large industrial complexes, mining sites, and major infrastructure projects, offering continuous power for high-load demands.

Figure 5: Magnet Winding wires used in Alternators in DG sets



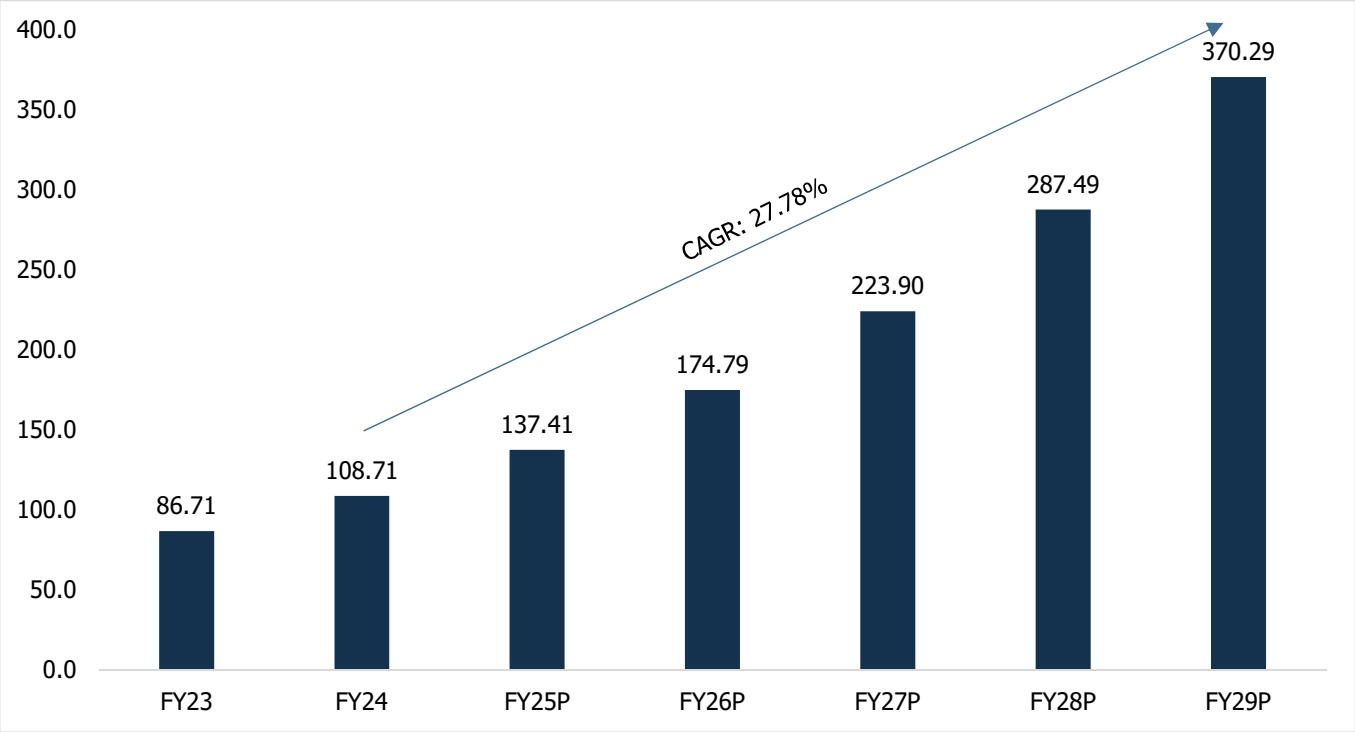
3.6.2 Indian Market Size and Outlook

The diesel generator market in India is witnessing significant growth, with market size expected to rise from Rs. 86.71 billion in FY23 to Rs. 370.29 billion in FY29, reflecting a robust expansion driven by key structural and economic factors. The primary drivers of this growth include unreliable power supply, rapid industrialization, and increasing demand for backup power solutions across various sectors. The frequent power outages and load shedding, particularly in rural and semi-urban areas with underdeveloped energy infrastructure, continue to fuel the adoption of diesel generators. Businesses, residential complexes, hospitals, and critical infrastructure facilities rely on these gensets to ensure uninterrupted operations during grid failures and peak load periods.

Additionally, regulatory and technological advancements are shaping the market dynamics. Stricter emission norms and growing environmental concerns are driving manufacturers to invest in cleaner and more efficient diesel generator technologies. Innovations aimed at minimizing emissions and improving diesel engine efficiency are becoming a strategic focus. Furthermore, the integration of hybrid systems that combine diesel generators with renewable energy sources, such as solar and wind power, is gaining traction. These hybrid solutions help reduce dependency on fossil fuels and align with sustainability objectives.

As a result, the Indian diesel generator market is expected to experience sustained growth, with increasing investments in eco-friendly technologies and a rising demand for reliable power backup solutions across commercial, industrial, and residential sectors.

Chart 56: Market Size of Diesel Generators in India (Rs. Billion)



Source: Netscribes, EMIS, CareEdge Research

3.6.3 Market Drivers contributing to Growth

- **Rapid Urbanization and Infrastructure Development**

India is witnessing accelerated urbanization, leading to a growing demand for robust infrastructure to support the expanding population. This rapid development is significantly contributing to the growth of the diesel generator (DG) market, as reliable power solutions become essential for both construction activities and operational needs. The increasing number of residential complexes, malls, IT parks, and smart cities requires a stable power backup system, particularly in regions where grid electricity remains inconsistent or insufficient. Diesel gensets play a crucial role in ensuring uninterrupted power supply during construction phases and in the continued operation of such developments. Government-led initiatives such as the Smart Cities Mission and metro rail projects have further boosted demand for high-capacity gensets, making them indispensable in large-scale urban projects. With urban areas in India expanding at an estimated rate of 2.3% annually (UN World Urbanization Prospects, 2024), the reliance on diesel gensets is expected to continue rising.

- **Expansion of the Manufacturing sector**

India's manufacturing sector is experiencing rapid expansion, driven by government initiatives such as 'Make in India' and the rising global demand for Indian exports. Industries including automotive, textiles, and pharmaceuticals require continuous and reliable power to sustain productivity, ensure equipment integrity, and prevent operational disruptions caused by power failures. Diesel gensets play a critical role in mitigating grid instability and load-shedding issues, which

can significantly impact manufacturing processes. As industrial power demand rises, leading genset manufacturers in India have stepped up to meet these needs by providing high-capacity and fuel-efficient diesel generators tailored for industrial applications. Beyond reliability, modern diesel gensets now comply with stringent emission norms, making them a sustainable energy solution for industries transitioning toward greener operations.

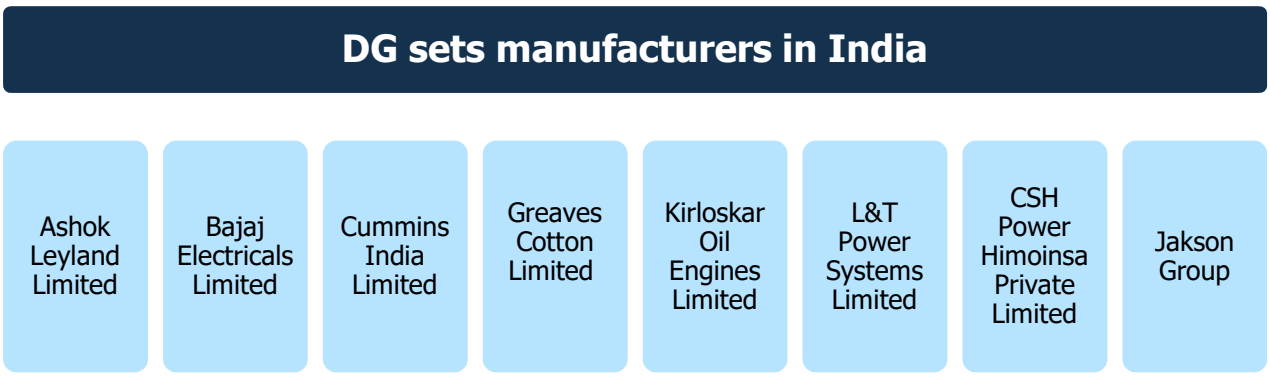
- **Growth of the Telecom sector**

The telecom sector in India is expanding rapidly, fueled by increasing internet penetration and the nationwide rollout of 5G networks. As telecom operators extend their reach, ensuring uninterrupted power supply to telecom towers, particularly in rural and remote areas, has become a priority to maintain seamless connectivity. Diesel gensets play a crucial role in powering telecom infrastructure, serving as primary backup power sources in locations where grid electricity is unreliable or unavailable. The demand for gensets has grown significantly, with the 3.84% rise in telecom towers in 2024 (Department of Telecommunications). These installations require efficient and reliable power backup solutions to prevent service disruptions. Leading industry players like Kirloskar Oil Engines Limited (KOEL) have developed specialized gensets tailored for telecom applications, featuring low noise levels, compact designs, and high fuel efficiency. These gensets are essential for ensuring uninterrupted connectivity, which is critical for industries such as e-commerce, healthcare, and IT, all of which depend on a stable telecom network.

- **Unreliable Grid Power Supply in Rural Areas**

Despite significant progress in rural electrification, many parts of India continue to face unreliable grid power supply, with frequent power outages disrupting daily life and economic activities. This inconsistency affects households, agricultural operations, and small businesses, making diesel gensets a critical alternative for ensuring steady energy availability. Diesel gensets are widely used in rural areas to power irrigation systems, small-scale industries, and essential services such as schools and health centers. In the agricultural sector, gensets play a crucial role in running water pumps during power failures, ensuring farmers can maintain irrigation schedules without relying solely on the grid. Additionally, government schemes like the Deen Dayal Upadhyaya Gram Jyoti Yojana, which aims to improve rural power infrastructure, are indirectly supporting the growth of the diesel generator market by promoting rural electrification and development.

3.6.4 Key manufacturers in this segment



4. Competitive Benchmarking

4.1 Magnet Winding Wires Players

4.1.1 KSH International Limited

- **Year of Incorporation:** 1979
- **Headquarters:** Pune, India
- **Description:** KSH International Limited is one of the leading manufacturers for Paper insulated copper conductors (PICC) or Paper Insulated Winding wires, Continuously Transposed Conductors (CTC) and Round and Rectangular Enamelled winding wires in India and supplies its products both locally and internationally to global large equipment OEMs. Kushal S Hegde promotes the company. KSH has three manufacturing plants near Mumbai and Pune – Maharashtra - India
- **Production Capacity:** 28,436 MT
- **Expansion Plan:** The company plans to expand its capacity by 30,000 MT in next two years, reaching a total capacity of 59,045 MT by end of Q4 FY27.
- **No of Manufacturing Facilities:** 3
- **Key Products Manufactured:** Paper Insulated Round/Rectangular Copper/Aluminium Winding wire, Tape Insulated Round/Rectangular Copper Winding wire (Nomex, Mica, Kapton), Enamel Insulated Round/Rectangular Copper/Aluminium Winding wire, CTCs, Bunched Paper Insulated Rectangular Copper Winding wire, Bare Round/Rectangular Copper/Aluminium Winding wire
- **Exporting Revenue:** Rs. 4,863.35 million in FY24 (35.17% of Revenue)
- **Exporting Countries:** USA, Germany, Hungary, Romania, Japan, Saudi Arabia, Kuwait, Dubai, Abu Dhabi, Oman, Bangladesh, Brazil, Malaysia, Sri Lanka etc.

4.1.2 Precision Wires India Limited (PWIL)

- **Year of Incorporation:** 1989
- **Headquarters:** Prabhadevi, Mumbai, India
- **Description:** PWIL produces products that are essential for both rotating and static electrical equipment. It operates manufacturing facilities in Silvassa, Dadra Nagar Haveli, and Palej, Gujarat. PWIL serves various industries, including power, automotive, consumer durables, transformers, and construction. It is one of the largest producers of Winding Wires in South Asia. Their major clients include CG Power and Industrial Solutions, Lucas TVS Ltd, Highly Electrical Appliances Ltd, and Mitsuba India Private Limited.

- **Production Capacity:** 48,000 MTPA
- **Expansion Plan:** On 8th February 2024, the company announced a new 6000 MTPA expansion/modernization project for various Winding Wires for FY 2024-25, estimated at Rs. 63 crores with equipment orders in progress. The company is expected to increase its capacity to ~60,000 MT by Q2 FY27
- **No of Manufacturing Facilities:** 4
- **Key Products Manufactured:** Copper winding wires, Continuously Transposed Conductors (CTC), and Paper Insulated Copper Conductors (PICC), Submersible Winding Wire
- **Exporting Revenue:** Exports for FY24 Rs. 3,810.99 million (11.54% of Revenue)
- **Exporting Countries:** 20

4.1.3 Ram Ratna Wires Ltd

- **Year of Incorporation:** 1992
- **Headquarters:** Worli, Mumbai, India
- **Description:** Ram Ratna Wires Limited is a prominent manufacturer of winding wires, especially enamelled copper wires. Its manufacturing facilities are located in Silvassa, Dadra and Nagar Haveli, and Daman and Diu. The company offers enamelled copper wires from 18 microns to 4.876 mm. Their key clients include FCC Clutch, Taco Prestolite (Tata Group), and Honda Motors. The company also serves industries such as power, automotive, consumer durables, transformers, and construction, supplying 70-75% of its products to large OEMs.
- **Production Capacity:** 45,222 MT
- **Expansion Plan:** The company is establishing a 24,000 MTPA copper tube manufacturing plant in Bhiwadi, Rajasthan, expected to be fully operational by Q3 FY25. Additionally, its subsidiary, Epavo Electricals, is setting up a new facility for Brushless DC motors
- **No of Manufacturing Facilities:** 3
- **Key Products Manufactured:** Aluminium wires and strips, Submersible winding wires, Fiberglass-covered copper and aluminium strips, and Paper-covered round wires
- **Exporting Revenue:** Rs. 2,713.02 million in FY24 (9.09% of Revenue)
- **Exporting Countries:** -

4.1.4 Vidya Wires Limited

- **Year of Incorporation:** 1982

- **Headquarters:** Gujarat, India
- **Description:** Vidya Wires Limited is an Indian manufacturer specializing in insulated copper and aluminium winding wires and strips. The company caters to various OEM manufacturers across different sectors and is recognized as one of the prominent exporters of these products. Vidya Wires operates two manufacturing facilities, located in Anand and Dadra.
- **Production Capacity:** 19,380 MT
- **Expansion Plan:** - The company is planning to increase their capacity in various products with another 18,000 MT at Narsanda, District Nadiad, Gujarat.
- **No of Manufacturing Facilities:** 3
- **Key Products Manufactured:** Enameled Copper Winding Wires, Enameled Copper Rectangular Strips, Fibre Glass Covered Copper/Aluminium Conductors, Paper Insulated Copper/ Aluminium Conductors (Rectangular & Round), Twin/Triple Bunched Paper Insulated Copper Strips, Cotton Covered Ropes, PV Ribbon (Rectangular Strips)/ PV Bus Bar, Copper Busbar, Bare Copper Strips/Flat Conductor, Soudronic / Bare Copper Wires, and Bunched Copper Ropes / Earthing Cables
- **Exporting Revenue:** Rs 1,617.89 million in FY24 (13.64% of Revenue)
- **Exporting Countries:** US, Canada, Europe, Middle East, and South East Asia

4.1.5 SH Haryana Wires Ltd

- **Year of Incorporation:** 1981
- **Headquarters:** New Delhi
- **Description:** Incorporated in 1981 and formerly known as Haryana Insulated Wire Ltd, SH Haryana Wires Limited specializes in the production of enameled copper and aluminium wires. The company operates two manufacturing facilities, one in Haryana and the other in Telangana.
- **Production Capacity:** 11,000 MT
- **Expansion Plan:** -
- **No of Manufacturing Facilities:** 2
- **Key Products Manufactured:** Enameled copper wire and enameled aluminium wire.
- **Exporting Revenue:** N.A.
- **Exporting Countries:** N.A.

4.1.6 Asta India Private Limited

- **Year of Incorporation:** 2005
- **Headquarters:** Vadodara, Gujarat
- **Description:** Asta India Private Limited (AIPL) is a prominent player in the energy and power industry, incorporated in 2005. It is part of ASTA Energy Solution AG, headquartered in Austria. ASTA ETC has a global presence in the field of Copper and Copper products and specializes in manufacturing Continuously Transposed Conductors (CTC) for large power transformers located in Vadodara, Gujarat.
- **Production Capacity:** 6344 MT as on FY23
- **Expansion Plan:** -
- **No of Manufacturing Facilities:** 1
- **Key Products Manufactured:** Continuously Transposed Conductors (CTC) and Paper insulated copper conductors (PICC)
- **Exporting Revenue:** N.A.
- **Exporting Countries:** N.A.

4.2 Diversified Wires and Cables Players

While there are other companies operating within the broader wire and cable industry, such as Apar Industries and KEI Industries, their primary focus remains on cables, with a comparatively smaller presence in the magnet winding wire segment, hence they are included separately in our analysis and presentation in this report.

4.2.1 Apar Industries Ltd

- **Year of Incorporation:** 1958
- **Headquarters:** Chembur, Mumbai, India
- **Description:** Apar industries founded by Mr. Dharmsinh D. Desai is one of the major Indian players with a global presence. Apar pioneers' solutions like HEC reconductoring and live line installation with OPGW. Apar serves various industries, including railways, renewable energy, defence, mining, transformers, nuclear, industrial, motors and generators, power transmission and distribution, shipping, telecommunications, and data communication. As of FY24, it has manufacturing facilities at Rabale (Maharashtra), Silvassa, Athola and Rakholi (Dadra and Nagar Haveli), Umbergaon and Khatalwad (Gujarat), Jharsugoda and Lapanga (Orissa), and Hamriyah (Sharjah).
- **Production Capacity:** 12,000 MT for CTC/PICC conductors
- **Expansion Plan**: The company plans to expand its annual production capacity for CTC by Q3 FY26. Post the expansion, capacity will be 20,490.

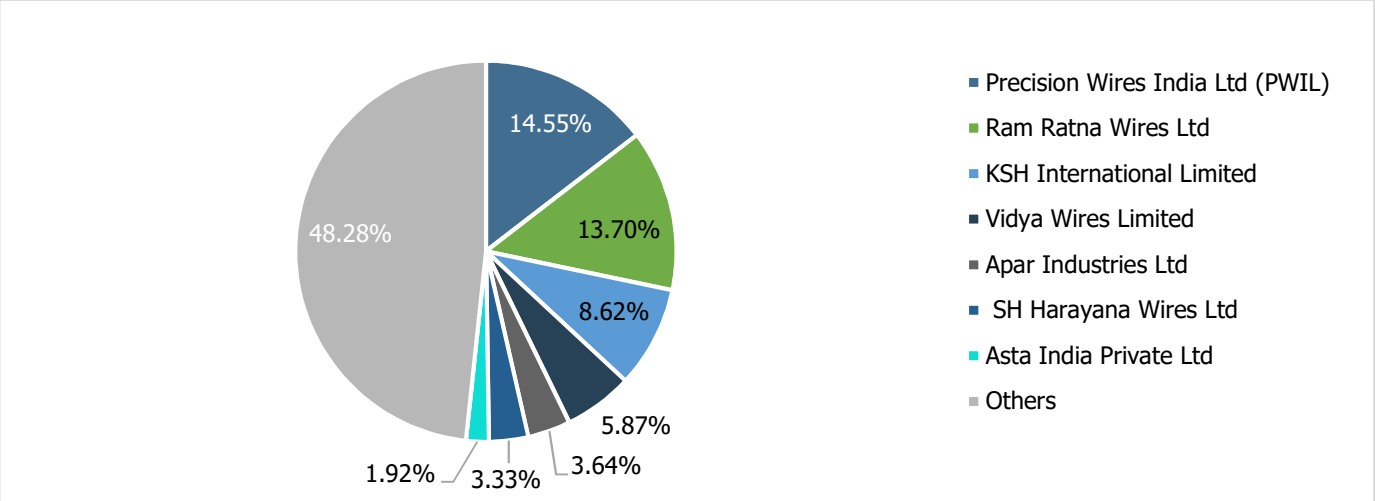
- **No of Manufacturing Facilities:** 10
- **Key Products Manufactured:** Power transmission cables, Conductors, Transformer and Specialty Oils (TSO), and Power/Telecom Cables
- **Exporting Revenue:** Export revenues were Rs. 72,762.90 million in FY24 (45.05% of overall revenues)
- **Exporting Countries:** 140+ countries, with a focus on Southeast Asia, Middle East, Africa & South America

4.2.2 KEI Industries

- **Year of Incorporation:** 1968
- **Headquarters:** New Delhi, India
- **Description:** KEI Industries Ltd manufactures power cables, serving both retail and institutional markets. They also provide Engineering, Procurement, and Construction (EPC) services for GIS and AIS substations, power transmission and distribution systems, and railway electrification. They cater to sectors like power, oil refineries, and railways, with major clients including HSBC and Infosys.
- **Production Capacity:** 18,18,400 kms for winding, flexible and house wires
- **Expansion Plan:** The company is planning spend around Rs. 1,100-1,200 crores on greenfield project in Sanand, Gujarat
- **No of Manufacturing Facilities:** 8
- **Key Products Manufactured:** Extra-High Voltage (EHV), Medium Voltage (MV), and Low Voltage (LV) power cables, Control cables, House wire, Communication cables, Instrumentation cables, Solar cables, Rubber cables, Single Core / Multicore Flexible Cables, Thermocouple Extension/Compensating, Fire Survival / Resistant Cables, Marine & Offshore Cables, Winding Wires, and Stainless-Steel Wires
- **Exporting Revenue:** Exports for the FY24 Rs. 10,970 million (13.54% of the overall sales)
- **Exporting Countries:** 60+

4.3 Operational Benchmarking of Key players

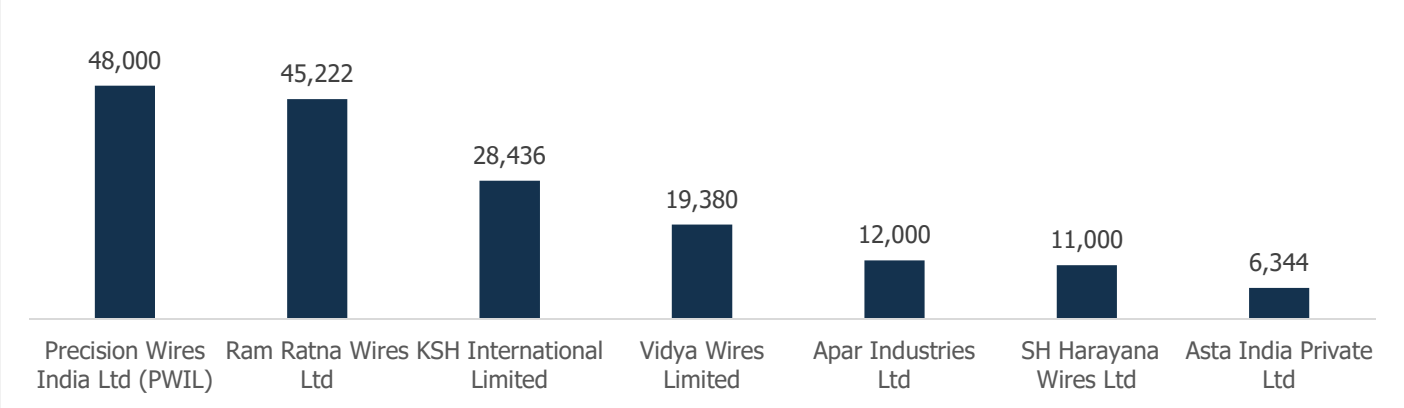
Chart 57: Magnet Winding Wires Industry Market Size in FY24 (Production in volume) – 3,30,000 MTPA



Source: Industry sources
Note – Asta India Private Limited figure is as of FY23

The Indian magnet winding wire market is around 3.30 lakh MT, with the above mentioned eight companies collectively holding a 51.63% market share. Precision Wires India Ltd (PWIL) leads the market with a 14.55% share, followed by Ram Ratna Wires Ltd at 13.70%. KSH International Limited holds an 8.62% share, while Vidya Wires Limited accounts for 5.87%. Apar Industries and SH Haryana Wires Ltd holds 3.64% and 3.33% share respectively, while Asta India Private Ltd accounts for 1.92% share. The remaining 48.28% of the market, or 1.59 lakh MT, is held by various other companies.

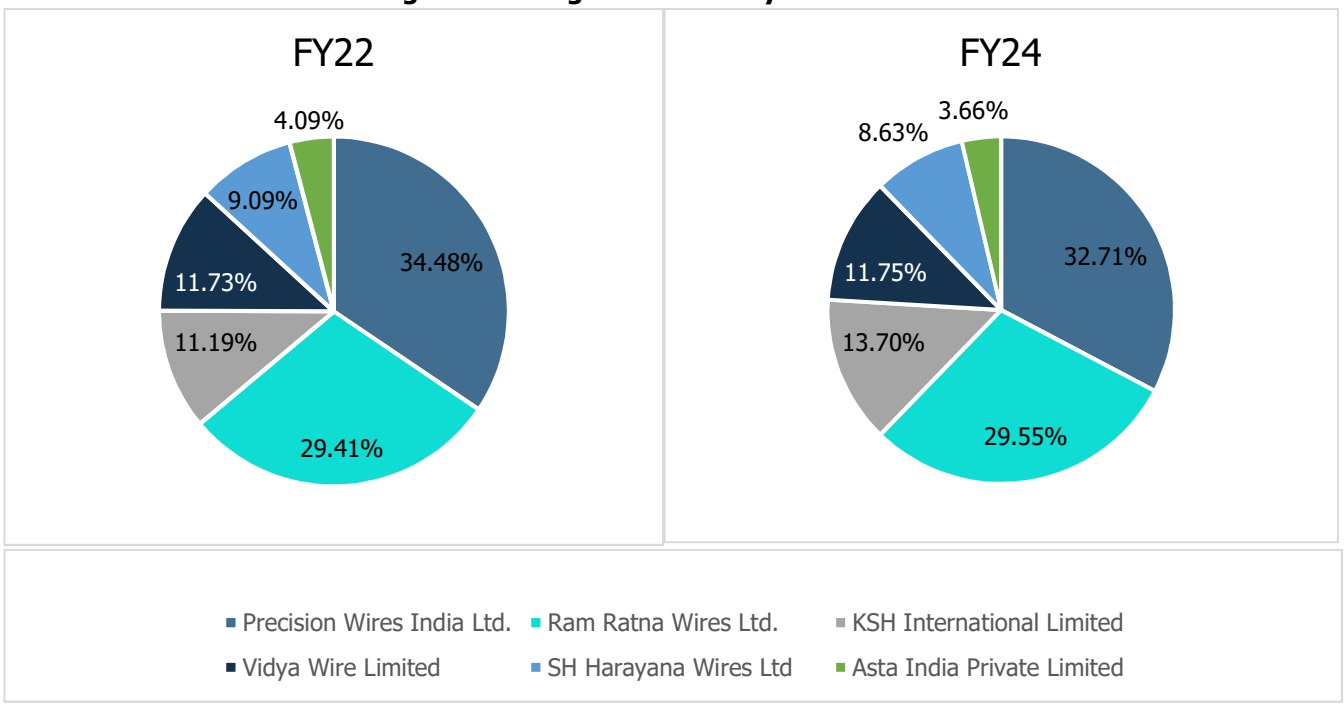
Chart 58: Production Capacity in FY24 (In Metric Tonne)



Source: Company's disclosures
Note – Asta India Private Limited figure is as of FY23

KSH International Limited has established itself as one of the prominent players in the magnet winding wire industry, with a production capacity of 28,436 MT for FY24. Within the industry, Precision Wires India Ltd (PWIL) holds the top position with the highest capacity of 48,000 MT, followed by Ram Ratna Wires Ltd at 45,222 MT. KSH International ranks third among the industry, ahead of Vidya Wires Limited with 19,380 MT, Apar industries with 12,000 MT, SH Haryana Wires Ltd at 11,000 MT, and Asta India Private Ltd at 6,344 MT.

Chart 59: Market Share of Magnet Winding Wire Peers by Revenue



Source: Company's disclosures

Based on the revenue of above-mentioned magnet winding wires players, Precision Wires India Ltd and Ram Ratna Wires Ltd continues to lead the market despite dip in share in FY24. On other hand, KSH International Limited has gained share in the market from 11.19% to 13.70%.

Table 19: Peer Comparison – Operational and Financial Parameters for FY24 (In Rs. Million)

Sr No	Name of the Company	Location	Backward Integration?	Production Capacity (MT)	Capacity Utilization (%)	Revenue	EBITDA	PAT
1	KSH International Limited	Pune	No	28,436	77%	13,828.15	714.63	373.50
Key Magnet Winding Wire Market Peers								
2	Precision Wires India Ltd (PWIL)	Mumbai	No	48,000	86%	33,016.91	1,340.23	728.54
3	Ram Ratna Wires Ltd	Mumbai	No	45,222	85%	29,832.48	1,193.00	546.17
Unlisted Magnet Winding Wire Market Peers								
4	Vidya Wires Limited	Gujarat	Yes	19,380	80%	11,860.73	455.15	256.93
5	SH Harayana Wires Ltd	New Delhi	No	11,000	N.A.	8,714.19	154.41	69.26
6	Asta India Pvt Ltd	Gujarat	No	6,344	N.A.	3,690.70	137.43	(52.01)
Diversified Wires and Cables Market Players								
7	Apar Industries Ltd	Mumbai	Yes	12,000	59%	1,61,529.80	15,270.80	8,251.20
8	KEI Industries	New Delhi	No	1818400 kms	Over 90%	81,040.80	8,373.32	5,807.33

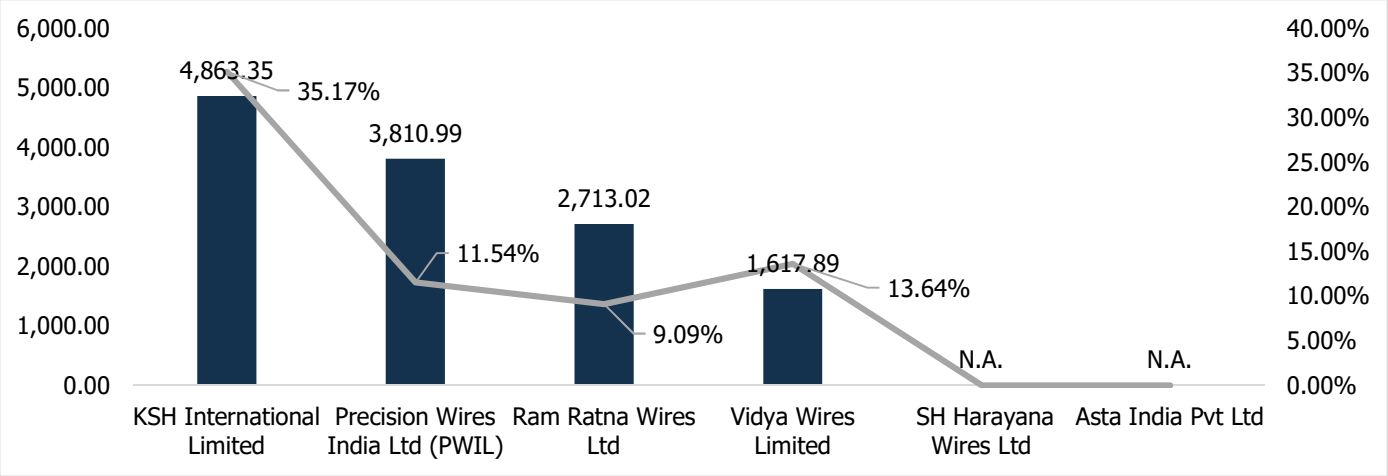
Source: Company's disclosures

Note – Asta India Private Limited Production capacity figure is as of FY23 and KEI Industries provides capacity data in kms

* implies Apar Industries production capacity for magnet winding wire segments

Based on the available data related to Magnet Winding Wire Market players, KSH International Limited ranks third in terms of Sales, EBITDA and PAT. Precision Wires India Ltd (PWIL) leads with sales of Rs. 33,016.91 million, EBITDA of Rs. 1,340.23 million, and PAT of Rs. 728.54 million. It is followed by Ram Ratna Wires Ltd in second place, with Vidya Wires Limited, SH Haryana Wires Ltd, and Asta India Private Ltd (which is seventh in the industry).

Chart 60: Export Revenue of Magnet Winding Wires Peers for FY24 (In Rs. Million)



Source: Company Annual Reports

Based on the export revenue of above-mentioned magnet winding wires players, KSH International Limited emerges as the largest exporter with Rs. 4,863.35 million, while Precision Wires India Ltd ranks second with Rs. 3,810.99 million. It is followed by Ram Ratna Wires Ltd with Rs. 2,713.02 million and Vidya Wires Limited with Rs. 1,617.89 million. On the other hand, SH Haryana Wires Ltd, and Asta India Pvt Ltd have no reported export revenue, indicating their focus on the domestic market.

Table 20: Capacity Expansion Plans

Company	Capacity Expansion Plans
KSH International Limited	The company plans to expand its capacity by 30,000 MT in next two years in Supa, Maharashtra, which is within a 250 kms radius to several other companies such as CG Power, Siemens, Toyota Kirloskar, Ather Energy etc. are expanding their own capacities.
Precision Wires India Ltd (PWIL)	The company announced a new 6000 MTPA expansion/modernization project for various Winding Wires for FY 2024-25, estimated at Rs. 63 crores with equipment orders in progress. The company is expected to increase its capacity to ~60,000 MT by Q2 FY27.
Ram Ratna Wires Ltd	The company is establishing a 24,000 MTPA copper tube manufacturing plant in Bhiwadi, Rajasthan, expected to be fully operational by FY25.
Vidya Wires Limited	The company is planning to increase their capacity in various winding wire product and copper components with another 18,000 MT at Narsanda, Gujarat.
SH Harayana Wires Ltd	-
Asta India Pvt Ltd	-
Apar Industries	The company plans to expand its annual production capacity for CTC by Q3 FY26. Post the expansion, capacity will be 20,490 MT.
KEI Industries	The company is planning spend around Rs. 1,100-1,200 crores on greenfield project in Sanand, Gujarat.

Source: Industry Sources, "- "implies data not available

Table 21: Comparison of Production Capacity

Company Name	Production Capacity (MT)			
	FY22	FY23	FY24	9MFY25
KSH International Limited	23,729	25,265	28,436	29,045
Key Magnet Winding Wire Market Peers				
Precision Wires India Ltd	39,400	39,400	48,000	N.A.
Ram Ratna Wires Ltd	N.A.	N.A.	45,222	N.A.
Unlisted Magnet Winding Wire Market Peers				
Vidya Wire Limited	18,460	19,080	19,380	N.A.
SH Harayana Wires Ltd	N.A.	N.A.	11,000	N.A.
Asta India Private Limited	N.A.	6,344	N.A.	N.A.
Diversified Wires and Cables Market Players				
Apar Industries Ltd*	1,80,000	1,80,000	2,10,000	N.A.
KEI Industries Limited	N.A.	13,32,000 kms	18,18,400 kms	N.A.

Source: Company's disclosures

Note –KEI Industries provides capacity data in kms

* implies Apar Industries production capacity for conductor segment

Table 22: Comparison of Sales Volume and Volume Growth

Company Name	Sales Volume (MT)				Volume Growth (%)		
	FY22	FY23	FY24	9MFY25	FY23	FY24	9MFY25
KSH International Limited	15,766	17,645	21,495	17,424	11.92%	21.82%	8.08%
Key Magnet Winding Wire Market Peers							
Precision Wires India Ltd	N.A.	N.A.	~39,188	N.A.	N.A.	N.A.	N.A.
Ram Ratna Wires Ltd	N.A.	30,237	34,003	26,746	N.A.	12.45%	4.88%
Unlisted Magnet Winding Wire Market Peers							
Vidya Wire Limited	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
SH Harayana Wires Ltd	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Asta India Private Limited	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Diversified Wires and Cables Market Players							
Apar Industries Ltd.	1,07,357	1,60,131	2,06,633	N.A.	49.16%	29.04%	N.A.
KEI Industries Limited	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

Source: Company's disclosures, CareEdge Research

Table 23: Comparison of Export Revenue

Company Name	Export Revenue (Rs. Million)			
	FY22	FY23	FY24	9MFY25
KSH International Limited	3,094.16	4,110.36	4,863.35	4,586.95
Key Magnet Winding Wire Market Peers				
Precision Wires India Ltd	1,824.78	3,085.51	3,810.99	N.A.
Ram Ratna Wires Ltd	1,986.04	2,148.13	2,713.02	N.A.
Unlisted Magnet Winding Wire Market Peers				
Vidya Wire Limited	1,343.14	1,867.17	1,617.89	N.A.
SH Harayana Wires Ltd	N.A.	N.A.	N.A.	N.A.
Asta India Private Limited	N.A.	N.A.	N.A.	N.A.
Diversified Wires and Cables Market Players				
Apar Industries Ltd.	36,079.50	69,340.70	72,762.90	N.A.
KEI Industries Limited	5,850.00	6,930.00	10,970.00	N.A.

Source: Company's disclosures

Table 24: Product Company Mapping

Products Offered	KSH International Limited	Precision Wires India Ltd	Ram Ratna Wires Ltd	Vidya Wires Limited	SH Haryana Wires Ltd	Asta India Pvt Ltd	Apar Industries Limited	KEI Industries
Standard Winding Wires								
Enamel Round Copper Winding Wires	✔	✔	✔	✔	✔		✔	
Enamel Round Aluminium Winding Wires	✔		✔		✔		✔	
Speciality Winding Wires								
Enamel Rectangular Copper Winding Wires	✔	✔	✔	✔	✔		✔	
Enamel Rectangular Aluminium Winding Wires	✔		✔		✔		✔	
Round/Flat Paper Insulated Copper Conductors (PICC)	✔	✔	✔	✔		✔	✔	
Round/Flat Paper Insulated Aluminium Conductors (PIAC)				✔			✔	
Continuous Transposed Conductor (CTC)	✔	✔				✔	✔	
Netted CTCs	✔						✔	
Tape Insulated Copper Winding wire	✔		✔			✔	✔	
Cotton Covered Copper Conductors			✔	✔				
Glass Fibre Covered Aluminium Conductors			✔	✔				
Glass Fibre Covered Copper Conductors				✔				
Enamel + Paper insulated Copper Conductors	✔					✔	✔	
Multi Paper Insulated Copper Wires	✔		✔			✔	✔	
Wires Raw Materials, Cables and Others								
Submersible Wires		✔	✔					✔
Bare Copper Wire	✔		✔	✔			✔	
Bunched Copper Wire			✔	✔				
Cables			✔				✔	✔
Copper Rod			✔	✔			✔	
Copper Busbar			✔	✔			✔	
Copper Foil			✔					
PV Ribbon				✔				
Copper Tubes			✔					

Source: Company's disclosures

4.4 Financial Benchmarking of Key players

Table 25: Revenue from Operations

Company Name	Revenue from Operation (Rs. Million)				Revenue Growth (%)			CAGR, FY22-FY24
	FY22	FY23	FY24	9MFY25	FY23	FY24	9MFY25	
KSH International Limited	8,705.89	10,494.60	13,828.15	14,204.56	20.55%	31.76%	36.96%	26.03%
Key Magnet Winding Wire Peers								
Precision Wires India Ltd.	26,831.43	30,335.79	33,016.91	29,690.04	13.06%	8.84%	19.90%	10.93%
Ram Ratna Wires Ltd.	22,885.74	26,495.99	29,832.48	27,200.04	15.78%	12.59%	21.57%	14.17%
Unlisted Magnet Winding Wire Peers								
Vidya Wire Limited	9,125.81	10,114.35	11,860.73	N.A.	10.83%	17.27%	N.A.	14.00%
SH Harayana Wires Ltd	7,075.36	8,241.40	8,714.19	N.A.	16.48%	5.74%	N.A.	10.98%
Asta India Private Limited	3,185.87	3,333.15	3,690.70	N.A.	4.62%	10.73%	N.A.	7.63%
Peer Average (excluding KSH International)					**12.15%**	**11.03%**	**-**	**11.54%**
Diversified Wires and Cables Players								
Apar Industries Ltd.	93,165.70	1,43,363.00	1,61,529.80	1,33,714.50	53.88%	12.67%	10.37%	31.67%
KEI Industries Limited	57,269.91	69,081.74	81,040.80	68,074.12	20.60%	17.30%	12.00%	18.96%

Source: Company Annual Reports

KSH International Limited has demonstrated consistent revenue growth over the past three fiscal years. KSH's CAGR of 26.03% exceeded the peer average of 11.54%, securing highest position among the peer. In FY24, the company achieved its highest y-o-y revenue growth of 31.76%.

Table 26: Total Income

Company Name	Total Income (Rs. Million)			
	FY22	FY23	FY24	9MFY25
KSH International Limited	8,764.69	10,565.95	13,904.95	14,283.70
Key Magnet Winding Wire Peers				
Precision Wires India Ltd.	26,900.46	30,554.70	33,210.01	29,812.44
Ram Ratna Wires Ltd.	22,952.38	26,565.14	29,982.53	27,313.49
Unlisted Magnet Winding Wire Peers				
Vidya Wire Limited	9,169.83	10,157.18	11,884.89	N.A.
SH Harayana Wires Ltd	7,087.56	8,254.60	8,730.90	N.A.
Asta India Private Limited	3,188.05	3,333.92	3,691.50	N.A.
Diversified Wires and Cables Players				
Apar Industries Ltd.	93,490.60	1,43,737.70	1,62,340.50	1,34,537.20
KEI Industries Limited	57,415.87	69,399.53	81,530.96	68,557.84

Source: Company Annual Reports

KSH International Limited has demonstrated consistent total income growth over the past three fiscal years. In FY24, the company achieved its highest y-o-y total income growth of 31.60%.

Table 27: EBITDA and EBITDA Margin

Company Name	EBITDA (Rs. Million)				EBITDA Margin				CAGR, FY22-FY24
	FY22	FY23	FY24	9MFY25	FY22	FY23	FY24	9MFY25	
KSH International Limited	494.12	499.00	714.63	873.51	5.68%	4.75%	5.17%	6.15%	20.26%
Key Magnet Winding Wire Peers									
Precision Wires India Ltd.	1,174.04	1,064.67	1,340.23	1,152.76	4.38%	3.51%	4.06%	3.88%	6.84%
Ram Ratna Wires Ltd.	1,106.88	1,090.03	1,193.00	1,103.81	4.84%	4.11%	4.00%	4.06%	3.82%
Unlisted Magnet Winding Wire Peers									
Vidya Wire Limited	310.11	358.32	455.15	N.A.	3.40%	3.54%	3.84%	N.A.	21.15%
SH Harayana Wires Ltd	198.27	96.80	154.41	N.A.	2.80%	1.17%	1.77%	N.A.	-11.75%
Asta India Private Limited	167.20	35.10	137.43	N.A.	5.25%	1.05%	3.72%	N.A.	-9.34%
Peer Average (excluding KSH International)					**4.13%**	**2.68%**	**3.48%**	**-**	**2.14%**
Diversified Wires and Cables Players									
Apar Industries Ltd.	5,479.70	12,269.30	15,270.80	10,891.30	5.88%	8.56%	9.45%	8.15%	66.94%
KEI Industries Limited	5,887.80	7,020.14	8,373.32	6,760.11	10.28%	10.16%	10.33%	9.93%	19.25%

Source: Company Annual Reports

KSH achieved a strong EBITDA y-o-y growth of 43.21% in FY24, with a CAGR of 20.26% over FY22-24. KSH's CAGR exceeded the peer average of 2.14%, securing the second highest rank among its peers. In terms of EBITDA margin, KSH consistently maintained highest margin in all three fiscal years (FY22-FY24).

Table 28: PAT and PAT Margin

Company Name	PAT (Rs. Million)				PAT Margin				CAGR, FY22-FY24
	FY22	FY23	FY24	9MFY25	FY22	FY23	FY24	9MFY25	
KSH International Limited	275.70	266.13	373.50	495.29	3.15%	2.52%	2.69%	3.47%	16.39%
Key Magnet Winding Wire Peers									
Precision Wires India Ltd.	630.11	594.93	728.54	604.56	2.34%	1.95%	2.19%	2.03%	7.53%
Ram Ratna Wires Ltd.	541.77	470.00	546.17	515.42	2.36%	1.77%	1.82%	1.89%	0.41%
Unlisted Magnet Winding Wire Peers									
Vidya Wires Limited	197.31	214.99	256.93	N.A.	2.15%	2.12%	2.16%	N.A.	14.11%
SH Harayana Wires Ltd	101.66	44.09	69.26	N.A.	1.43%	0.53%	0.79%	N.A.	-17.46%
Asta India Private Limited	21.74	-131.47	-52.01	N.A.	0.68%	-3.94%	-1.41%	N.A.	-
Peer Average (excluding KSH International)					**1.79%**	**0.48%**	**1.11%**	**-**	**1.15%**
Diversified Wires and Cables Players									
Apar Industries Ltd.	2,567.30	6,377.20	8,251.20	5,713.40	2.75%	4.44%	5.08%	4.25%	79.28%
KEI Industries Limited	3,760.15	4,773.42	5,807.33	4,698.66	6.55%	6.88%	7.12%	6.85%	24.28%

Source: Company Annual Reports

KSH International demonstrated a robust performance in terms of PAT, achieving a y-o-y growth of 40.34% in FY24. Over FY22 to FY24, KSH maintained a strong CAGR of 16.39%, ranking first among peers and significantly exceeding the peer average of 1.13%. In terms of PAT margin, KSH consistently maintained highest margin in all three fiscal years (FY22-FY24).

Table 29: Return on Equity (ROE)

Company Name	Return on Equity (ROE)			
	FY22	FY23	FY24	9MFY25
KSH International Limited	16.51%	13.74%	16.17%	17.68%
Key Magnet Winding Wire Peers				
Precision Wires India Ltd.	17.27%	13.21%	14.39%	N.A.
Ram Ratna Wires Ltd.	19.21%	14.43%	12.64%	N.A.
Unlisted Magnet Winding Wire Peers				
Vidya Wire Limited	25.19%	21.48%	20.47%	N.A.
SH Harayana Wires Ltd	21.19%	8.42%	11.68%	N.A.
Asta India Private Limited	8.29%	-101.08%	-66.14%	N.A.
Peer Average (excluding KSH International)	**18.23%**	**14.38%**	**14.79%**	**-**
Diversified Wires and Cables Players				
Apar Industries Ltd.	14.97%	28.52%	21.29%	N.A.
KEI Industries Limited	17.61%	18.44%	18.45%	N.A.

Source: Company Annual Reports

KSH International Limited achieved a ROE of 16.17% in FY24, reflecting strong performance and exceeding the peer average of 14.79%.

Table 30: Return on Capital Employed (ROCE)

Company Name	Return on Capital Employed (ROCE)			
	FY22	FY23	FY24	9MFY25
KSH International Limited	13.84%	13.25%	14.15%	13.59%
Key Magnet Winding Wire Peers				
Precision Wires India Ltd.	29.82%	23.65%	21.94%	N.A.
Ram Ratna Wires Ltd.	16.79%	15.03%	15.69%	N.A.
Unlisted Magnet Winding Wire Peers				
Vidya Wire Limited	14.63%	16.64%	18.04%	N.A.
SH Harayana Wires Ltd	19.62%	6.95%	12.21%	N.A.
Asta India Private Limited	8.29%	-1.37%	10.79%	N.A.
Peer Average (excluding KSH International)	**17.83%**	**12.18%**	**15.73%**	**-**
Diversified Wires and Cables Players				
Apar Industries Ltd.	25.10%	55.24%	38.81%	N.A.
KEI Industries Limited	24.96%	29.13%	29.74%	N.A.

Source: Company Annual Reports

KSH International Limited reported a ROCE of 14.15% in FY24, reflecting slight improvement over the previous years.

Table 31: Working Capital Days

Company Name	Working Capital Days			
	FY22	FY23	FY24	9MFY25
KSH International Limited	89	73	76	68
Key Magnet Winding Wire Market Peers				
Precision Wires India Ltd.	28	28	30	N.A.
Ram Ratna Wires Ltd.	49	46	33	N.A.
Unlisted Magnet Winding Wire Market Peers				
Vidya Wire Limited	59	51	49	N.A.
SH Harayana Wires Ltd	26	25	24	N.A.
Asta India Private Limited	91	2	-2	N.A.
Peer Average (excluding KSH International)	**51**	**30**	**27**	**-**
Diversified Wires and Cables Market Players				
Apar Industries Ltd.	1	-5	32	N.A.
KEI Industries Limited	116	98	88	N.A.

Source: Company Annual Reports

KSH International Limited reported working capital days of 76 in FY24, higher than peer average of 27 days.

Table 32: Fixed Asset Turnover Ratio

Company Name	Fixed Asset Turnover Ratio			
	FY22	FY23	FY24	9MFY25
KSH International Limited	9.92	10.66	10.42	11.15
Key Magnet Winding Wire Players				
Precision Wires India Ltd.	27.00	26.17	23.70	N.A.
Ram Ratna Wires Ltd.	15.35	18.52	17.36	N.A.
Unlisted Magnet Winding Wire Peers				
Vidya Wire Limited	28.28	26.70	29.92	N.A.
SH Harayana Wires Ltd	19.69	18.93	19.65	N.A.
Asta India Private Limited	5.53	5.82	6.37	N.A.
Peer Average (excluding KSH International)	**19.17**	**19.23**	**19.40**	**-**
Diversified Wires and Cables Players				
Apar Industries Ltd.	11.40	16.21	14.30	N.A.
KEI Industries Limited	12.08	14.28	14.97	N.A.

Source: Company Annual Reports

KSH International Limited reported a Fixed asset turnover ratio of 10.42 in FY24, lower than peer average of 19.40 times.

Table 33: Net Debt/EBITDA

Company Name	Net Debt/EBITDA			
	FY22	FY23	FY24	9MFY25
KSH International Limited	2.82	2.28	2.65	3.19
Key Magnet Winding Wire Market Peers				
Precision Wires India Ltd.	-0.20	-0.59	0.17	N.A.
Ram Ratna Wires Ltd.	2.29	2.35	1.66	N.A.

Company Name	Net Debt/EBITDA			
	FY22	FY23	FY24	9MFY25
Unlisted Magnet Winding Wire Market Peers				
Vidya Wire Limited	3.78	2.68	2.40	N.A.
SH Harayana Wires Ltd	1.92	5.15	2.78	N.A.
Asta India Private Limited	7.35	18.91	5.35	N.A.
Peer Average (excluding KSH International)	**3.03**	**5.70**	**2.47**	**-**
Diversified Wires and Cables Market Players				
Apar Industries Ltd.	0.05	-0.18	-0.16	N.A.
KEI Industries Limited	-0.05	-0.57	-0.68	N.A.

Source: Company Annual Reports

In FY24, KSH International Limited ranked fourth in terms of Net Debt/EBITDA with a ratio of 2.65.

Table 34: Net Debt/Equity

Company Name	Net Debt/Equity			
	FY22	FY23	FY24	9MFY25
KSH International Limited	0.83	0.59	0.82	1.00
Key Magnet Winding Wire Market Peers				
Precision Wires India Ltd.	-0.06	-0.14	0.04	N.A.
Ram Ratna Wires Ltd.	0.9	0.78	0.46	N.A.
Unlisted Magnet Winding Wire Market Peers				
Vidya Wire Limited	1.50	0.96	0.87	N.A.
SH Harayana Wires Ltd	0.8	0.95	0.72	N.A.
Asta India Private Limited	4.69	5.1	9.35	N.A.
Peer Average (excluding KSH International)	**1.57**	**1.53**	**2.29**	**-**
Diversified Wires and Cables Market Players				
Apar Industries Ltd.	0.01	-0.1	-0.06	N.A.
KEI Industries Limited	-0.01	-0.16	-0.18	N.A.

Source: Company Annual Reports

In FY24, KSH International Limited ranked fourth in terms of Net Debt/Equity with a ratio of 0.82 which is lower than the peer average of 2.29.

Formula Sheet

Parameter	Formula
Revenue	Revenue from Operations
Total Income	Revenue from Operations + Other income
EBITDA	Depreciation + Finance Cost+ Profit (Loss) before exceptional item and tax- Other Income
EBIT	Profit before tax + Interest expenses
EBITDA Margin	EBITDA/ Revenue from operations
PAT Margin	Profit after Tax/ Total income
Cash and Cash equivalent	Cash and cash equivalent + Other Bank balances (if any)
Net Debt	Long term Borrowings + Short term Borrowings – Cash and Cash Equivalent
Total Equity	Equity Share Capital+ Other Equity+ Reserves & surplus
Capital Employed	Net Debt + Total Equity + Deferred Tax Liability (Net)
Return on Equity (ROE)	PAT/ Total Equity
Return on Capital Employed (ROCE)	EBIT/ Capital Employed
Fixed Asset Turnover	Revenue from Operations/ Property, Plant and Equipment
Debtor Days	(Debtors/ Revenue from operations) * 365 or 274
Creditor Days	(Creditors/ Cost of Goods Sold) *365 or 274
Inventory Days	(Closing Inventory/Cost of Goods Sold) * 365 or 274
Net Debt to EBITDA	Net Debt / EBITDA
Net Debt to Equity	Net Debt / Total Equity

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