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Industry Report on Industrial Automation and Terminal Automation

February, 2025

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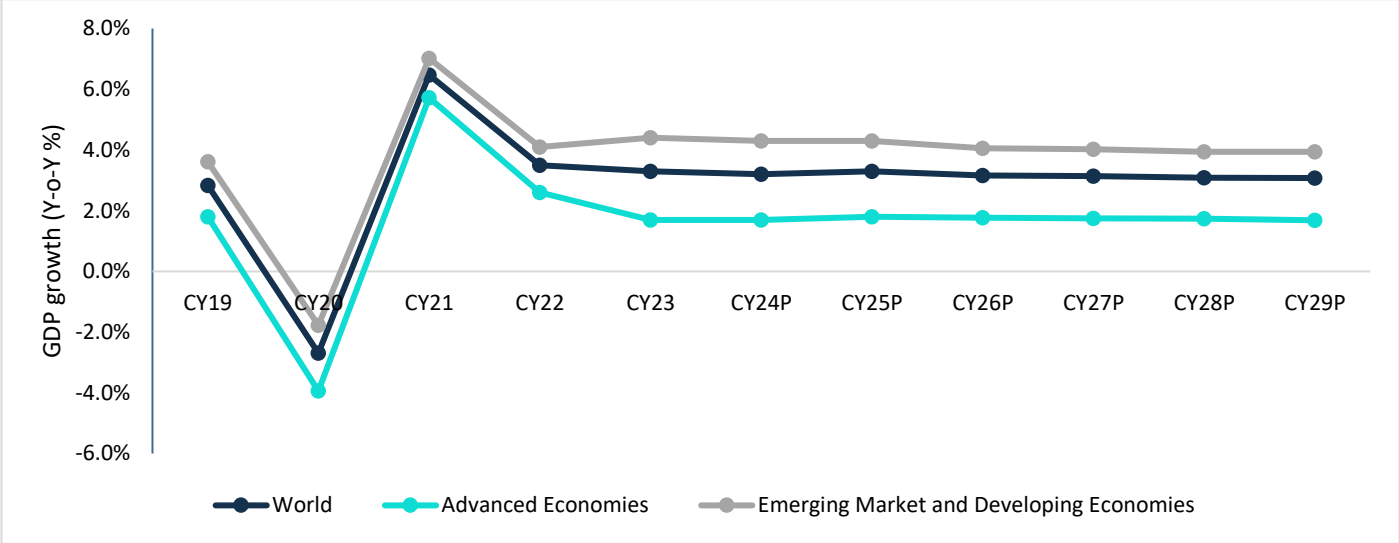
1 Economic Outlook

1.1 Global Economy

Global growth, which stood at 3.3% in CY23, is anticipated to fall to 3.2% in CY24 and then bounce back again to 3.3% in CY25. The CY24 forecast has remained same compared to the April 2024 World Economic Outlook (WEO) Update, and increased by 0.1 percentage point compared to the January 2024 WEO. Despite this, the expansion remains historically low, attributed to factors including sustained high borrowing costs, inflation woes, reduced fiscal support, lingering effects of Russia's Ukraine invasion, Iran–Israel War, sluggish productivity growth, and heightened geo-economic fragmentation.

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



Notes: P-Projection; Source: IMF – World Economic Outlook, July 2024

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	CY24P	CY25P	CY26P	CY27P	CY28P	CY29P
India	-5.8	9.7	7.0	8.2	7.0	6.5	6.5	6.5	6.5	6.5
China	2.2	8.5	3.0	5.2	5.0	4.5	3.8	3.6	3.4	3.3
Indonesia	-2.1	3.7	5.3	5.0	5.0	5.1	5.1	5.1	5.1	5.1
Saudi Arabia	-3.6	5.1	7.5	-0.8	1.7	4.7	4.0	3.5	3.0	3.5
Brazil	-3.3	4.8	3.0	2.9	2.1	2.4	2.1	2.0	2.0	2.0
Euro Area	-6.1	5.9	3.4	0.5	0.9	1.5	1.4	1.3	1.3	1.2
United States	-2.2	5.8	1.9	2.5	2.6	1.9	2.0	2.1	2.1	2.1

P- Projections; Source: IMF- World Economic Outlook Database (July 2024)

Advanced Economies Group

Advanced economies are expected to experience a gradual increase in growth, remaining same at 1.7% in CY24 and increasing to 1.8% in CY25. The projection for CY24 and CY25 remains unchanged compared to the April 2024 WEO Update.

The **United States** is expected to see growth rise to 2.6% in CY24, followed by a slight slowdown to 1.9% in CY25. This deceleration is attributed to gradual fiscal tightening and labor market softening, which dampen aggregate demand.

The **Euro Area's** growth is anticipated to rebound from its sluggish growth in CY23 to 0.9% in CY24 and further to 1.5% in CY25. This recovery is driven by stronger household consumption, as the impact of elevated energy prices diminishes and declining inflation bolsters real income growth. Additionally, strong momentum in services, higher than expected net exports, and higher investments have further driven this growth.

Emerging Market and Developing Economies Group

Emerging market and developing economies are forecasted to maintain stable growth at 4.3% in both CY24 and CY25. This forecast has been made on account of stronger activity in Asia, particularly China and India. Growth prospects in economies across the Middle East and Central Asia continue to be weighed down by oil production and regional conflicts. Growth forecast of sub-Saharan Africa has also been revised downward on account of weak economic activity. Low-income developing countries are anticipated to experience a gradual growth uptick, starting at 4.4% in CY24 and climbing to 5.3% in CY25, as certain constraints on near-term growth begin to ease.

The economic forecast for emerging and developing Asia reveals a modest deceleration in growth, with projections indicating a decline from 5.4% in CY24 to 5.1% in CY25. **China's** trajectory reflects a slowdown, transitioning from 5.0% in CY24 to 4.5% in CY25 due to fading post-pandemic stimuli and ongoing property sector challenges. In contrast, **India's** growth remains robust, with anticipated rates of 7.0% in CY24 and 6.5% in CY25, bolstered by resilient domestic demand and a burgeoning working-age populace.

The **Indonesian** economy is expected to register growth of 5.0% in CY24 and 5.1% in CY25 with a strong domestic demand, a healthy export performance, policy measures, and normalization in commodity prices. **Saudi Arabia's** growth in CY24 is predicted to see a revamp in growth rate to 1.7% on account of Vision 2030 reforms that helped advance the country's economic diversification agenda, including through reduced reliance on oil. Going forward, GDP is expected to grow at 4.7% in CY25. On the other hand, **Brazil's** growth is projected to ease to 2.1% in CY24, driven by fiscal consolidation, the lingering impact of tight monetary policies, and reduced contributions from the agricultural sector. Going forward, GDP is expected to grow at 2.4% in CY25 on account of reconstruction following the floods and supportive structural factors.

Despite the turmoil in the last 2-3 years, India bears good tidings to become a USD 5 trillion economy by CY27. According to the IMF dataset on Gross Domestic Product (GDP) at current prices, the nominal GDP has been at USD 3.6 trillion for CY23 and is projected to reach USD 5.3 trillion by CY27 and USD 6.4 trillion by CY29. India's expected GDP growth rate for coming years is almost double compared to the world economy. The Indian economy shows resilience amid global inflation, supported by a stable financial sector, strong service exports, and robust investment driven by government spending and high-income consumer consumption, positioning it for better growth than other economies.

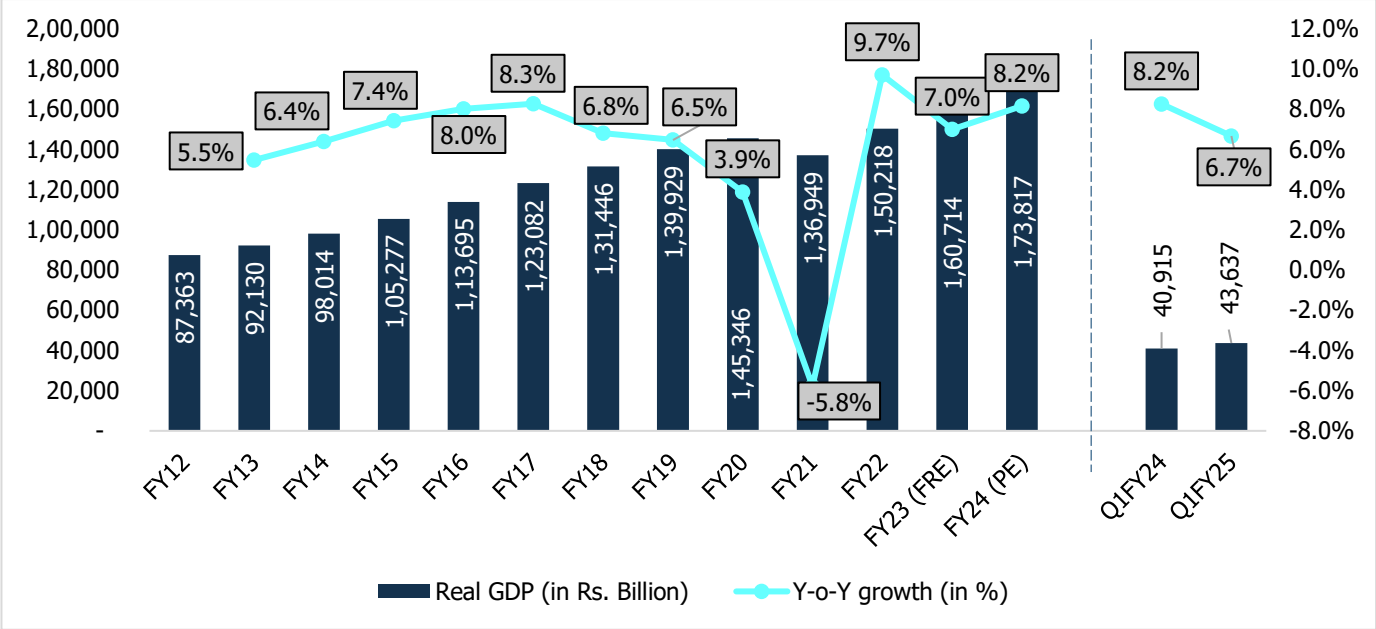
Besides, India stands out as the fastest-growing economy among the major economies. The country is expected to grow at more than 6.5% in the period of CY24-CY29, outshining China's growth rate. By CY27, the Indian economy is estimated to emerge as the third-largest economy globally, hopping over Japan and Germany. Currently, it is the third largest economy globally in terms of Purchasing Power Parity (PPP) with a ~7.6% share in the global economy, with China (~18.7%) on the top followed by the United States (~15.6%).

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



Note: FRE – First Revised Estimates, PE – Provisional Estimate; Source: MOSPI

India's real GDP grew by 7.0% in FY23 and stood at ~Rs. 161 trillion, as per the First Revised Estimate, despite the pandemic in previous years and geopolitical Russia-Ukraine spillovers. Real GDP in the year FY24 is estimated to grow at 8.2% at Rs. 173.82 trillion as per provisional estimate of the Ministry of Statistics and Programme Implementation. It is expected that domestic demand, especially investment, to be the main driver of growth in India, amid sustained levels of business and consumer confidence.

In Q1FY25, real GDP grew by 6.7% y-o-y, hitting a 15-month low, as compared to 8.2% y-o-y in the previous quarter. Private consumption, a key driver of the GDP, showed resilience increasing by 7.45% while government spending contracted by 0.24%. This growth was largely driven by elections and extreme summer conditions, which impacted economic activities across several sectors.

GDP Growth Outlook

- Driven by fixed investment and improving global environment, domestic economic activity continues to expand. The provisional estimates (PE) placed real GDP growth at 8.2% for FY24.

- Industrial activity led by manufacturing continues its momentum on the back of strengthening domestic demand, lower input costs, and a supportive policy environment. The purchasing managers' index for both manufacturing and services sector remained elevated in September 2024, indicating a robust expansion.

- Domestic economic activity continues to remain steady. On the supply side, advancing monsoon has boosted kharif sowing and improved agricultural production prospects, while higher reservoir levels and good soil moisture conditions are favorable for the upcoming rabi crop. Additionally, growth in GVA for major non-agricultural sectors like manufacturing, construction, and utilities has stayed above 5% for Q1FY25, indicating expansion. On the demand side, household consumption is bolstered by an upward trend in rural demand while urban demand continues to hold firm. Additionally, improvement in government consumption can also be observed. Moreover, on the global trade front, services exports are supporting overall growth.

- Fixed investment activity is robust, supported by the government's ongoing focus on capital expenditure, healthy balance sheets of banks and corporates, and other policy measures. Private investment is picking up, driven by an increase in non-food bank credit, higher capacity utilization, and rising investment intentions.

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 October 2024 monetary policy, has projected real GDP growth at 7.2% y-o-y for FY25.

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

FY25P (complete year)	Q2FY25P	Q3FY25P	Q4FY25P	Q1FY26P
7.2%	7.0%	7.4%	7.4%	7.3%

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

1.2.2 Gross Value Added (GVA)

Gross Value Added (GVA) is the measure of the value of goods and services produced in an economy. GVA gives a picture of the supply side whereas GDP represents consumption.

Industry and Services sector leading the recovery charge

• The gap between GDP and GVA growth turned positive in FY22 (after a gap of two years) due to robust tax collections. Of the three major sector heads, the service sector has been the fastest-growing sector in the last 5 years.

• In FY23, **the agriculture sector** performed well despite weather-related disruptions, such as uneven monsoon and unseasonal rainfall, impacting yields of some major crops and clocked a growth of 4% y-o-y, garnering Rs. 22.3 trillion. The agriculture sector's growth slowed in FY24 to an estimated 1.4% rise for the year, down from 4.7% in FY23. The sector reached to Rs. 23.1 trillion for FY24 as per provisional estimate. In Q1FY25, the agriculture sector grew by only 2% y-o-y as compared to 3.7% in Q1FY24. Better monsoon conditions are expected to brighten outlook for the agriculture sector. Going forward, rising bank credit and increased exports will be the drivers for the agriculture sector.

• The **industrial sector** output in FY23 grew by only 2.1% with estimated value Rs. 44.74 trillion owing to decline in manufacturing activities. India's industrial sector experienced robust growth in FY24 supported by positive business sentiment, falling commodity prices, and government policies like production-linked incentives. The sector grew by 9.5% on y-o-y basis, reaching Rs. 48.9 trillion for FY24. In Q1FY25, the industrial sector grew by 8.3% y-o-y as compared to 6% in Q1FY24. This growth was driven mainly by sales growth in manufacturing companies, construction, and utility services. Construction grew at the highest rate of 10.5% as compared to a growth rate of 8.3% in the same quarter in previous year.

• In FY23, benefitting from the pent-up demand, the **services sector** was valued at Rs. 80.6 trillion and registered growth of 10.0% y-o-y. In FY24, India's services sector growth was driven by steady growth in various service sector

indicators like air passenger traffic, port cargo traffic, GST collections, and retail credit. With this, the growth of service sector is estimated at Rs. 86.7 trillion registering 7.6% growth in FY24 overall. In Q1FY25, the services sector grew by only 7.2% y-o-y as compared to 10.7% in Q1FY24.

Table 3: Sectoral Growth (Y-o-Y % Growth) - at Constant Prices

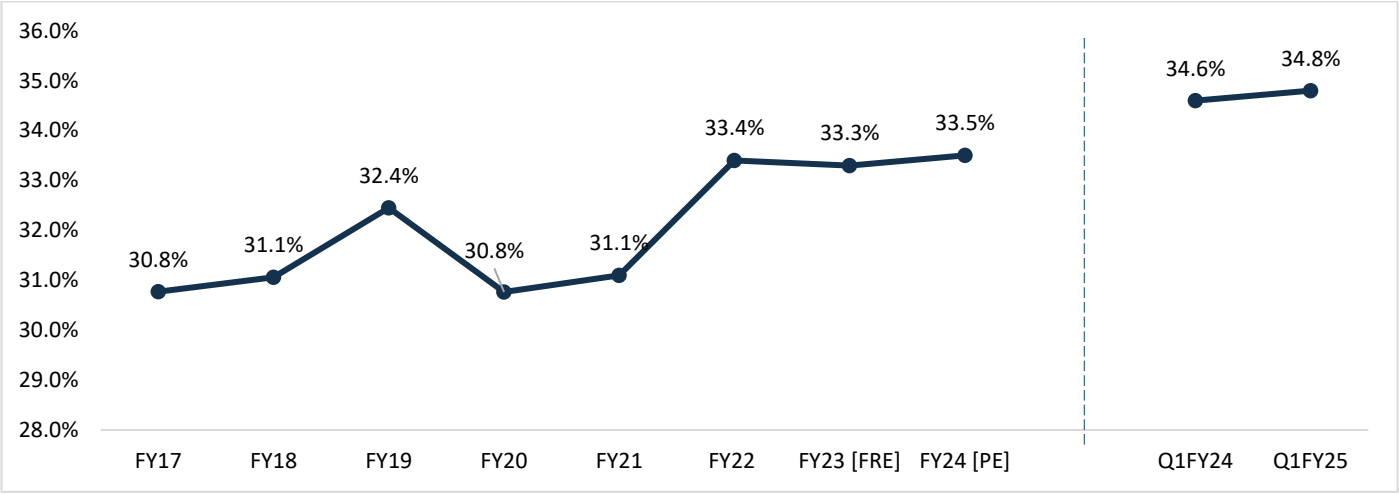
At constant Prices	FY19	FY20	FY21	FY22	FY23 (FRE)	FY24 (PE)	Q1FY24	Q1FY25
Agriculture, Forestry & Fishing	**2.1**	**6.2**	**4.1**	**3.5**	**4.7**	**1.4**	**3.7**	**2.0**
Industry	**5.3**	**-1.4**	**-0.9**	**11.6**	**2.1**	**9.5**	**6**	**8.3**
Mining & Quarrying	-0.9	-3.0	-8.6	7.1	1.9	7.1	7.0	7.2
Manufacturing	5.4	-3.0	2.9	11.1	-2.2	9.9	5.0	7.0
Electricity, Gas, Water Supply & Other Utility Services	7.9	2.3	-4.3	9.9	9.4	7.5	3.2	10.4
Construction	6.5	1.6	-5.7	14.8	9.4	9.9	8.6	10.5
Services	**7.2**	**6.4**	**-8.2**	**8.8**	**10.0**	**7.6**	**10.7**	**7.2**
Trade, Hotels, Transport, Communication & Broadcasting	7.2	6.0	-19.7	13.8	12.0	6.4	9.7	5.7
Financial, Real Estate & Professional Services	7.0	6.8	2.1	4.7	9.1	8.4	12.6	7.1
Public Administration, Defence and Other Services	7.5	6.6	-7.6	9.7	8.9	7.8	8.3	9.5
GVA at Basic Price	**5.8**	**3.9**	**-4.2**	**8.8**	**6.7**	**7.2**	**8.3**	**6.8**

Note: FRE – First Revised Estimates, PE – Provisional Estimate; Source: MOSPI

1.2.3 Investment Trend in Infrastructure

Gross Fixed Capital Formation (GFCF) is a measure of the net increase in physical assets. In FY23, the ratio of investment (GFCF) to GDP remained flat, as compared to FY22, at 33.3%. Continuing in its growth trend, this ratio has reached 33.5% in FY24. In Q1FY25, GFCF as a proportion in GDP, reached 34.8% as compared to 34.6% in Q1FY24 mainly reflecting growth in private investment.

Chart 3: Gross Fixed Capital Formation (GFCF) as % of GDP (At constant prices)



Note: 3RE – Third Revised Estimate, 2RE – Second Revised Estimates, 1RE – First Revised Estimates, PE – Provisional Estimate, FAE- First Advance Estimate; Source: MOSPI

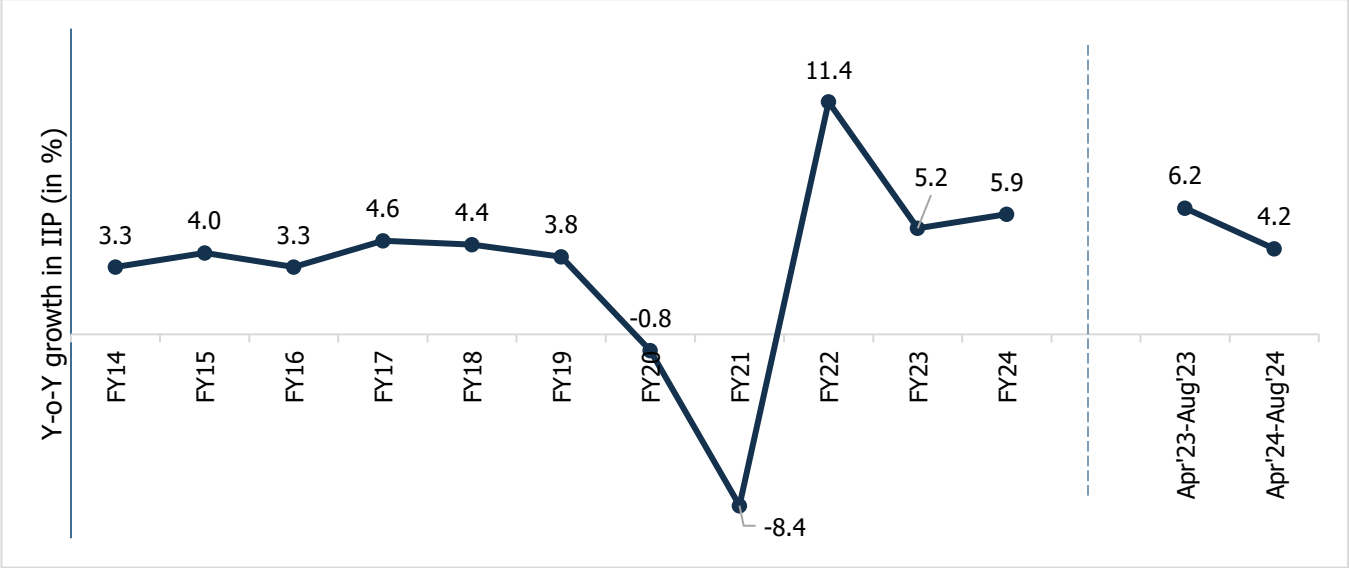
Overall, the support of public investment in infrastructure is likely to gain traction due to initiatives such as Atmanirbhar Bharat, Make in India, and Production-linked Incentive (PLI) scheme announced across various sectors.

1.2.4 Industrial Growth

Improved Core and Capital Goods Sectors helped IIP Growth Momentum

The Index of Industrial Production (IIP) is an index to track manufacturing activity in an economy. During FY23, the industrial output recorded a growth of 5.2% y-o-y supported by a favorable base and a rebound in economic activities. During FY24, the industrial output recorded a growth of 5.9% y-o-y supported by growth in manufacturing and power generation sectors. The period April 2024 – August 2024, industrial output grew by 4.2% compared to the 6.2% growth in the corresponding period last year. For the month of August 2024, the IIP growth contracted by 0.1% as compared to the last year's IIP growth of 10.9%. This decline was on account of decline in growth in mining and electricity sectors on account of heavy rainfall and reduced electricity demand. The manufacturing sector also grew modestly in August 2024 by 1% as compared to a growth of 10% in August 2023. Within the growth in manufacturing, the top three positive contributors were Manufacture of basic metals, Manufacture of electrical equipment, and Manufacture of chemicals and chemical products. So far in the current fiscal, the government's strong infrastructure spending and rising private investment are evident, though consumer non-durables production has declined. Urban demand drives consumption, while rural demand improves, highlighting the importance of sustained consumption and investment for industrial performance.

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

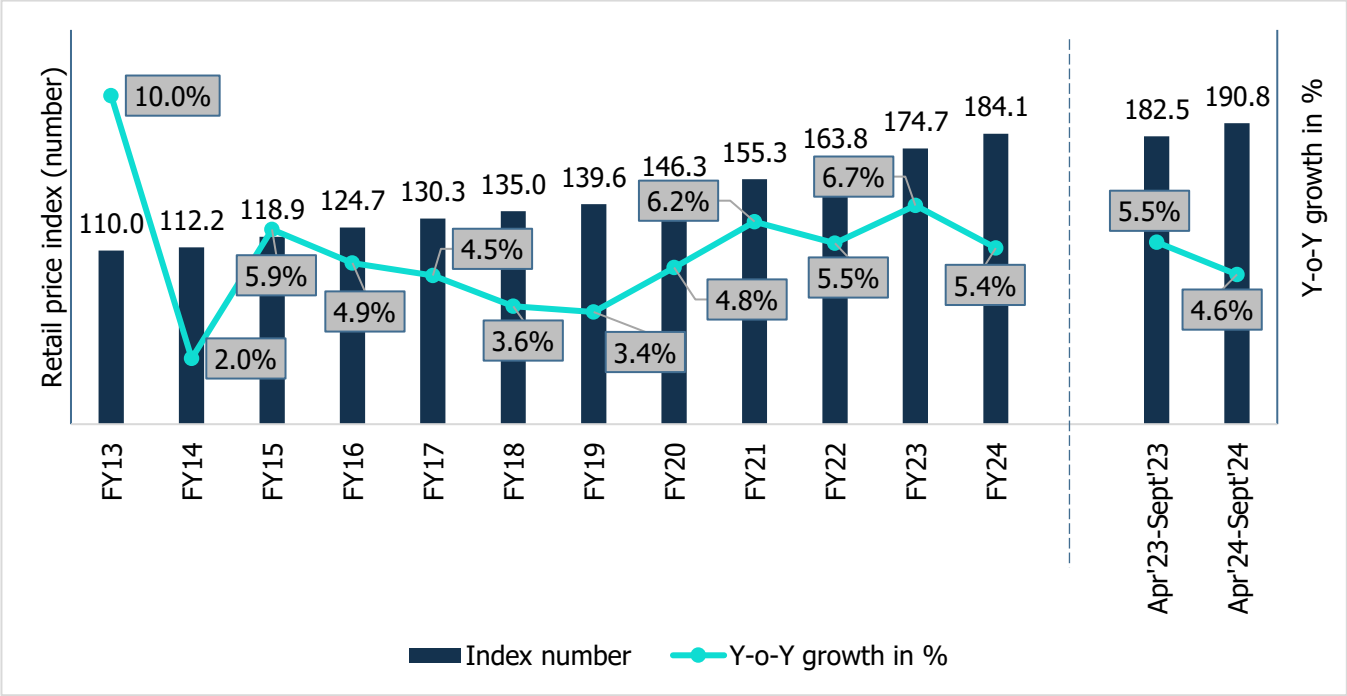


Source: MOSPI

1.2.5 Consumer Price Index

India's consumer price index (CPI) tracks retail price inflation in the economy. During FY23, CPI remained elevated at an average of 6.7%, above the RBI's tolerance level. In FY24, the Consumer Price Index (CPI) showed fluctuations, starting with a moderation to 4.3% in May 2023, followed by a spike to 7.4% in July 2023 due to rising food prices. Overall, inflation moderated to 5.4% for the year, remaining within the RBI's target range of 2% to 6%, despite volatility in food prices throughout the months. High inflation in specific food items poses inflation risk, even though an improvement in south-west monsoon and better kharif sowing are improving the food inflation outlook. The numbers for April 2024-September 2024 show a decline in inflation growth y-o-y to 4.6% as compared to inflation growth y-o-y of 5.5% in April 2023-September 2023 period. For September 2024, CPI inflation stood at 5.5% which has been the highest retail inflation since December 2023. There was a decline in inflation observed among the subgroups meat and fish, pulses and products, sugar and confectionery, and spices.

Chart 5: Retail Price Inflation in terms of index and Y-o-Y Growth in % (Base: 2011-12=100)

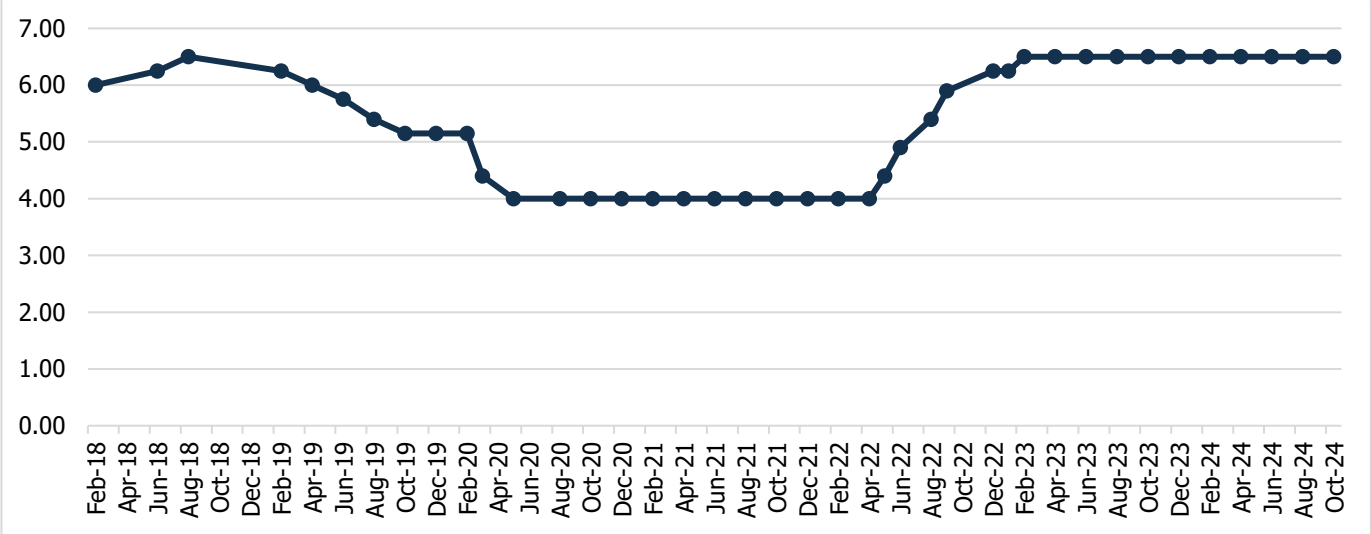


Source: MOSPI

The CPI is primarily factored in by RBI while preparing their bi-monthly monetory policy. At the bi-monthly meeting held in October 2024, RBI projected inflation at 4.5% for FY25 with inflation during Q2FY25 at 4.1%, Q3FY25 at 4.8%, Q4FY25 at 4.2%, and Q1FY26 at 4.3%.

Considering the current inflation situation, RBI has kept the repo rate unchanged at 6.5% again in the October 2024 meeting of the Monetary Policy Committee.

Chart 6: RBI historical Repo Rate



Source: RBI

Further, the central bank changed its stance to neutral. While headline inflation has started easing due to softening in core component and economic activity has been resilient supported by domestic and investment demand, volatility in food prices due to adverse weather conditions pose a risk to the path of disinflation. Core inflation has likely reached its lowest point, and fuel prices are contracting. Domestic growth remains strong, driven by private consumption and investment, allowing the MPC to focus on bringing inflation down to the 4% target. As a result, the MPC decided to adopt a 'neutral' stance, monitoring inflation while supporting growth.

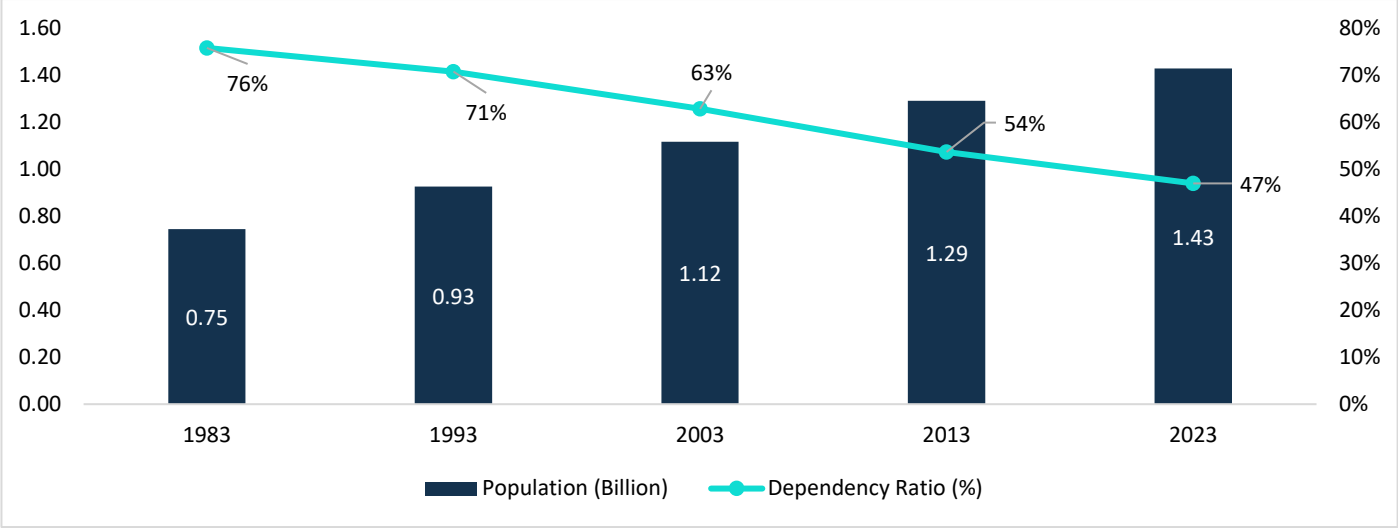
1.2.6 Overview on Key Demographic Parameters

- **Population growth and Urbanization**

The trajectory of economic growth of India and private consumption is driven by socio-economic factors such as demographics and urbanization. According to the world bank, India's population in 2022 surpassed 1.42 billion slightly higher than China's population 1.41 billion and became the most populous country in the world.

Age Dependency Ratio is the ratio of dependents to the working age population, i.e., 15 to 64 years, wherein dependents are population younger than 15 and older than 64. This ratio has been on a declining trend. It was as high as 76% in 1983, which has reduced to 47% in 2023. Declining dependency means the country has an improving share of working-age population generating income, which is a good sign for the economy.

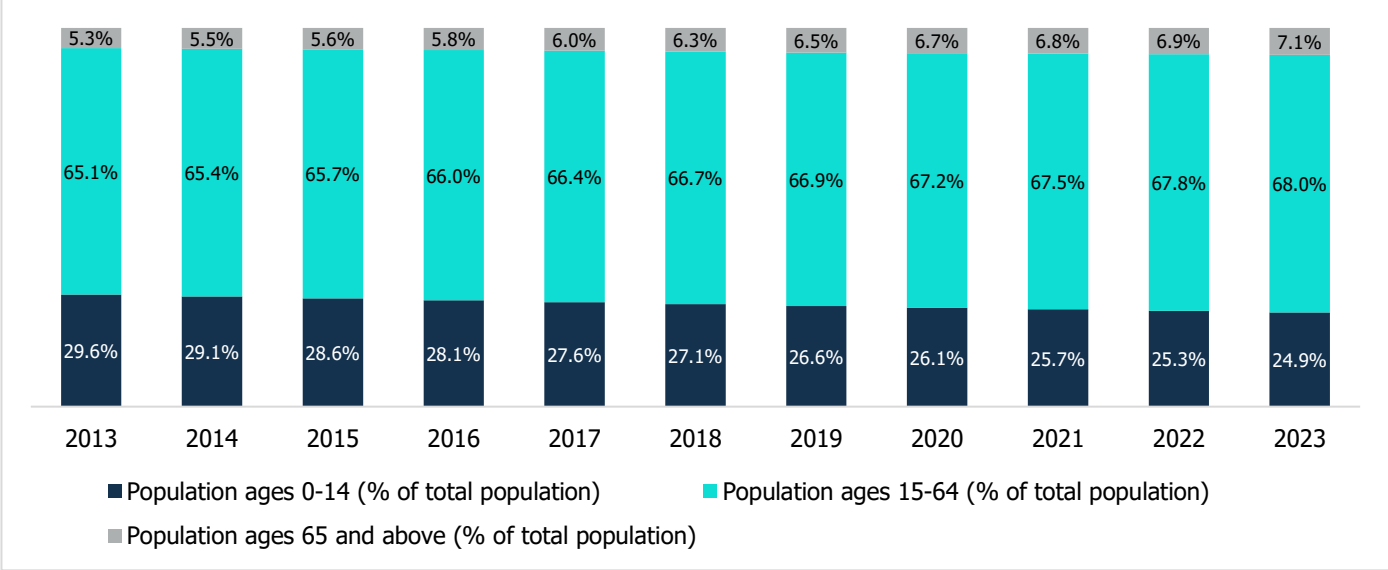
Chart 7: Trend of India Population vis-à-vis dependency ratio



Source: World Bank Database

With an average age of 29, India has one of the youngest populations globally. With vast resources of young citizens entering the workforce every year, it is expected to create a 'demographic dividend'. India is home to a fifth of the world's youth demographic and this population advantage will play a critical role in economic growth.

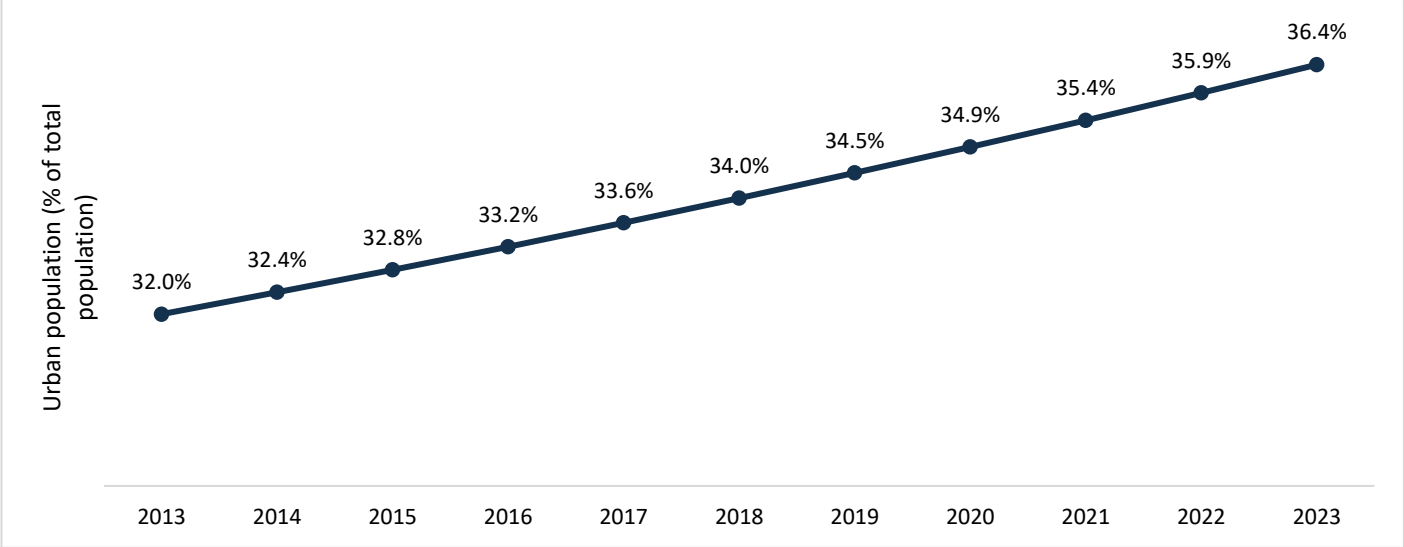
Chart 8: Age-Wise Break Up of Indian population



Source: World Bank Database

The urban population is significantly growing in India. The urban population in India is estimated to have increased from 413 million (32% of total population) in 2013 to 519.5 million (36.4% of total population) in the year 2023.

Chart 9: Urbanization Trend in India



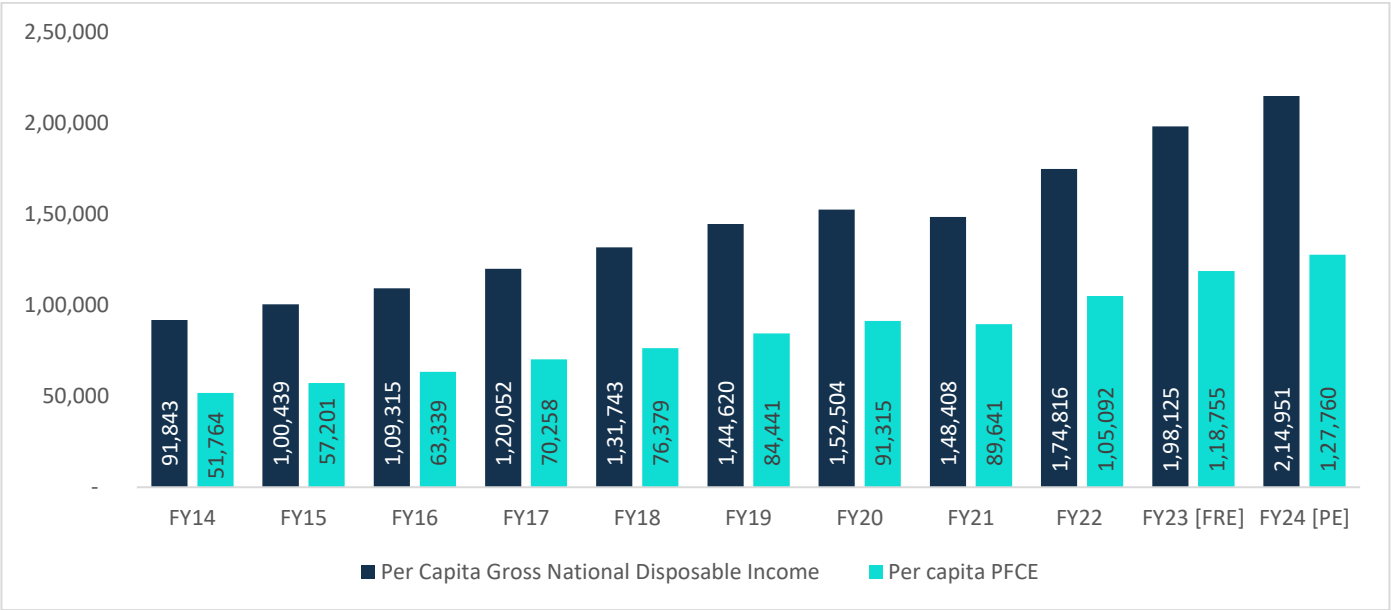
Source: World Bank Database

- **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 FY24, per capita GNDI at current prices registered a CAGR of 8.88%. More disposable income drives more consumption, thereby driving economic growth.

With increase in disposable income, there has been a gradual change in consumer spending behaviour as well. Private Final Consumption Expenditure (PFCE) which is measure of consumer spending has also showcased significant growth in the past decade at a CAGR of 9.46%.

Chart 10: Trend of Per Capita GNDI and Per Capita PFCE (Current Price)



Note: FRE – First Revised Estimates, PE – Provisional Estimate; Source: MOSPI

1.2.7 Concluding Remarks

The major headwinds to global economic growth are escalating geopolitical tensions, volatile global commodity prices, high interest rates, inflation woes, volatility in international financial markets, climate change, rising public debt, and new technologies. Despite the global economic growth uncertainties, the Indian economy is relatively better placed in terms of GDP growth compared to other emerging economies. According to IMF's forecast, it is expected to be 7% in CY24 compared to the world GDP growth projection of 3.2%. The bright spots for the economy are continued healthy domestic demand, support from the government towards capital expenditure, moderating inflation, investments in technology and improving business confidence.

Likewise, several high-frequency growth indicators including the purchasing managers index, E-way bills, bank credit, toll collections and GST collections have shown improvement in FY24. Moreover, normalizing the employment situation after the opening up of the economy is expected to improve and provide support to consumption expenditure.

At the same time, public investment is expected to exhibit healthy growth as the government has allocated a strong capital expenditure of about Rs. 11.11 lakh crores for FY25. 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.

2 Terminal Automation Industry

India has 13 major ports out of which 12 are Government owned and 1 is privately owned ports and 217 non- major ports as in FY24.The Ministry of Ports, Shipping and Waterways has developed a comprehensive plan to achieve 10,000 MTPA port capacity by 2047 and has identified around 150 initiatives across ports under Maritime India Vision 2030.To achieve this, terminal automations plays a crucial role in the development of ports functioning. Terminal automation systems are instrumental in efficiently, securely, and precisely managing critical industrial processes, particularly in sectors such as oil & gas, logistics, and manufacturing. By automating complex tasks like product loading and unloading, inventory management, and data analysis, terminal automation not only reduces human errors but also speeds up operations, improves safety, and ensures compliance with strict industry regulations. Furthermore, it provides decision-makers with real-time data insights, enabling data-driven strategies and swift responses to dynamic market conditions. In an era prioritizing optimization, sustainability, and safety, terminal automation is essential for industries aiming to enhance competitiveness, minimize environmental impact, and streamline operations.

The automation of the terminals automates processes which are usually done manually specifically load authorization, product movement, product measurement, documentation and reporting. The automated technology of storage and transfer equipment is similar and handles the automation of the inventory of the stock of containers located in the yard and the monitoring of equipment in real time. It is evolving towards the design of handling systems that are increasingly more self-sufficient in operational and economical terms such as those composed by the combination of Automated Lifting Vehicles and Automated Shuttle Carriers. The Oil And Gas Terminal Automation Market is a rapidly growing and competitive industry. There are so many global players like ABB India Limited, Honeywell Automation India Limited, Yokogawa India Limited, Endress+Hauser (India) Pvt. Ltd etc. are present in this segment whereas Advanced Sys-tek is the only established Indian player in this segment. Advanced Sys-tek has over 25 years of experience in providing automation solutions for large and complex terminals as well as small depots. It specializes in upgradation of existing manually operated terminals to completely automated terminals with minimum downtime and loss of productivity.

Capex of Oil Marketing Companies

Oil marketing companies (OMCs) in India are major players in the petroleum and energy sector. These companies are involved in various aspects of the oil and gas industry, including refining, distribution, and marketing of petroleum products. These oil marketing companies play a crucial role in meeting the energy needs of India's growing economy by ensuring the availability and distribution of essential petroleum products across the country. They operate through a network of refineries, terminals, depots, and retail outlets to serve both industrial and consumer markets. Some prominent oil marketing companies in India include:

Indian Oil Corporation Limited (IOCL): IOCL is the largest oil marketing company in India and operates extensively in refining, distribution, and marketing infrastructure. It owns and operates numerous refineries across India and is involved in the marketing of various petroleum products, including motor fuels, lubricants, and petrochemicals.

	Particulars	Percentage Share	Planned for (FY23-FY24) (INR Mn)
IOCL - Capex Expenditure	Refining	31%	81,613.7
	Pipelines	20%	52,654.0
	Marketing	22%	57,919.4
	Petro chemical	16%	42,123.2
	R&D	5%	13,163.5
	Equity Investments in JVs	3%	7,898.1
	Others	3%	7,898.1
	Total		**2,63,270.0**

Source: Company Annual Report

Bharat Petroleum Corporation Limited (BPCL): BPCL is another leading oil marketing company in India with a significant presence in refining and marketing operations. It operates refineries and markets a wide range of petroleum products, including gasoline, diesel, aviation fuel, and lubricants.

	Particulars	FY23 (INR Mn)	FY24 (Budgeted) (INR Mn)
BPCL - Capex Expenditure	Refineries	26,570.0	16,040.0
	Marketing	53,540.0	35,510.0
	Investments in Exploration	22,000.0	21,500.0
	Investments in Gas	13,840.0	21,060.0
	Others	5,250.0	5,890.0
	Total	**1,21,200.0**	**1,00,000.0**

Hindustan Petroleum Corporation Limited (HPCL): HPCL is a major player in India's oil and gas industry, with operations spanning refining, marketing, and distribution. The company operates refineries and markets petroleum products under various brands.

	Particulars	Percentage Share	(FY24 to FY28) (Budgeted) (INR Mn)
HPCL - Capex Expenditure	Petroleum	52%	4,00,400.0
	Non-Fuel	7%	53,900.0
	Petchem	5%	38,500.0
	Net Zero	6%	46,200.0
	Renewable	8%	61,600.0
	Gas	15%	1,15,500.0
	Biofuels	4%	30,800.0
	EV/Alternate	3%	23,100.0
	Total		**7,70,000.0**

Source: Company Annual Report

Reliance Industries Limited (RIL): RIL is a diversified conglomerate with interests in petrochemicals, refining, and oil marketing. It owns one of the largest refining complexes in the world at Jamnagar, Gujarat, and is involved in the marketing of refined petroleum products.

2.1 New Marketing Terminals Added by Companies

Oil marketing companies in India regularly expand and enhance their marketing terminal infrastructure to improve distribution and reach. These terminals serve as crucial nodes in the supply chain for petroleum products, facilitating storage, blending, and distribution. Here are some recent additions and expansions of marketing terminals by prominent oil companies:

Indian Oil Corporation Limited (IOCL): IOCL has been expanding its marketing terminal network across India. For instance, IOCL inaugurated a new bulk storage terminal at Puducherry to enhance its capacity for storing and distributing petroleum products in the region. IOCL has also invested in modernizing and expanding existing terminals to meet growing demand and improve operational efficiency.

Marketing Terminal Projects

IOCL Project Name	Amount (INR Mn)	
	To be completed in	
	FY24	FY25
Augmentation of Kandla LPG Import Terminal	3,067.2	
POL Terminal at Atchutapuram	2,728.5	
Vizag Terminal Revamping	500.0	1,014.8
Augmentation of Ratlam Terminal Project	2,527.9	
POL Terminal at Atchutapuram	2,331.4	
POL Terminal at Motihari	1,964.0	
TOP at Manmad Terminal	1,494.8	
Arrangements with Adani Ports and Special Economic Zone Limited related to land for a period of 8 years and 2 months for setting up tank farm at Mundra Port, Gujarat for storing crude oil.	Not Specified	
Mumbai Aviation Fuel Farm Facility Private Limited (MAFFFL)	529.2	

Source: Company Annual Report 2022-23

Bharat Petroleum Corporation Limited (BPCL): BPCL has added new marketing terminals in strategic locations to strengthen its distribution network. For example, BPCL has set up new terminals in locations like Bina (Madhya Pradesh) and Nalco Nagar (Odisha) to cater to local demand and improve logistics. BPCL focuses on increasing the capacity and capability of its terminals to handle various petroleum products efficiently.

Marketing Terminal Projects

BPCL Project Name	Amount (INR Mn)
	Ongoing as of March 2023
Common User Facility POL Terminal at Jammu	6,768.9
Common User Facility POL Terminal at Sadashibpur (Meramundali), Odisha	3,935.4
Augmentation of Cryogenic Facilities at Uran LPG Import Terminal	11,646.9
PetroNet LNG Limited (PLL)	987.5
Delhi Aviation Fuel Facility Private Limited (DAFFPL)	1,700.0
BPCL-KIAL Fuel Farm Private Limited (BKFFPL)	500.0
Mumbai Aviation Fuel Farm Facility Private Limited (MAFFFL)	529.2

Source: Company Annual Report 2022-23

Hindustan Petroleum Corporation Limited (HPCL): HPCL has invested in upgrading its marketing terminals and building new facilities. This includes the expansion of terminals in key regions to enhance storage capacity and streamline distribution operations. HPCL's terminal expansion projects aim to support the growing demand for petroleum products in target markets.

Marketing Terminal Projects

HPCL Project Name	Amount (INR Mn)
	To be completed in
	FY24
LNG Regasification Terminal [in respect of HPCL LNG Limited]	28,000.1
80 TMT LPG Cavern at Mangalore	90,000.0
3 LPG plants & Capacity Augmentations	

HSD evacuation facilities at various locations	
Dahej LPG Import Facility	
MSV & TT Loading Facilities	
5 new LPG Plants	
Two Crude tanks	1,120.2
Mumbai Aviation Fuel Farm Facility Private Limited (MAFFFL)	529.2

Source: Company Annual Report 2022-23

Reliance Industries Limited: Private sector players like Reliance Industries Limited (RIL) has also expanded their marketing terminal infrastructure. RIL, with its massive refining complex in Jamnagar, has enhanced its terminal capacities to efficiently handle and distribute refined products.

2.2 Existing Marketing Terminals

India is home to numerous sizable oil marketing terminals that have a vital function in storing and distributing petroleum products throughout the nation.

As on April 2024, there are total of 313 petroleum, oil and lubricants (POL) terminals/ depots in India.

Period	IOCL	BPCL	HPCL	RIL/ RBML/ RSIL	NEL	Shell	MRPL & Others	Total
April 2024	126	80	81	17	3	-	6	313

Source: PPAC

Note: (*) denotes RBML- Reliance BP Mobility Limited; RSIL-RBML Solutions India Ltd

The key marketing terminals are given below-

1. **Kandla Oil Terminal, Gujarat-**
   - Operated by IOCL
   - Comissioned in 1983
   - Its strategic location on the western coast makes it a key hub for supply chain operations.

2. **Vizag Terminal, Andhra Pradesh-**
   - Operated by HPCL
   - One of the largest on the eastern coast of India, handles both imports and exports.
   - Connected to the Vizag refinery (one of the major refinery in the country).

3. **Mumbai Port Terminal, Maharashtra-**
   - Operated by BPCL and IOCL
   - Has significant storage capacity and handles large volumes of refined products.

4. **Chennai Terminal, Tamil Nadu-**
   - Operated by IOCL
   - Linked to the nearby Chennai refinery.

5. **Paradip Terminal, Odisha-**
   - Operated by IOCL
   - Part of Paradip Refinery Complex.
   - Plays a significant role in the supply chain for eastern and northeastern India.

6. **Mangalore Terminal, Karnataka-**
   - Operated by MRPL
   - Major Distribution point for pretroleum products in south India.

7. **Haldia Terminal, West Bengal-**
   - Operated by IOCL

   Hub for petroleum distribution in eastern India.
8. **Kochi Terminal, Kerela-**
   - Operated by BPCL

9. **Jamnagar Terminal, Gujarat-**
   - Operated by RIL

10. **Noida- Bijwasan Terminal-**
    - Operated by IOCL

Few of the other terminal details are listed below:

Year	IOCL (Completed Projects)	Amount (Rs. Mn)
2018-2019	Grass Root POL ToP at Una, HP	3,560.0
	Ennore LNG Import Terminal	51,500.0

Source: Company Investor Presentation 2023

Year	BPCL (Completed Projects)	Amount (Rs. Mn)
2018-19	Ennore Coastal Terminal Project	3,930.0
2019-20	POL Terminal with Railway Siding at Pune	2,826.4
2020-21	Resitement of Raichur POL depot to Gulbarga	2,062.6
2022-23	Development of Coastal Terminal with Railway Siding at Krishnapatnam, Andhra Pradesh	5,802.0
	New Petroleum, Oil, and Lubricants (POL) Depot at Radhanagar (Bokaro), Jharkhand	2,471.7

Source: Company Annual Report 2022-23

Year	HPCL (Completed Projects)	Amount (Rs. In Mn)
2018-19	Construction of New Road Fed Depot at Leh	NA
	Construction of a Tank Wagon (TW) Loading gantry at Visakh Black Oil Terminal	740.0
2019-20	Infrastructure Augmentation at Irumpanam terminal, 2019	NA

	The Railway Siding located approx. 1.5 Km away from Kolkata Terminal-I, 2019	NA
	Revamp of Meerut depot, 2019	NA
2020-21	New Railway Siding along with allied facilities at Madurai, 2021	960.0

Source: Company Website, accessed on 7 May 2024

Other major marketing infrastructure projects completed and commissioned by Engineering & Projects department of HPCL incudes-

- **Depot at Kadapa**- POL depot at Kadapa in the state of Andhra Pradesh is constructed with a combined storage facility of a total of 33780 KL for White Oil and Black Oil and 16 bays of Tank Truck (TT) loading facilities. It started its fully automated loading operation in the month of December 2014.
- **Budge Budge Terminal Revamping-** Revamp of Budge Budge-I Terminal is completed and commissioned with state of art safety features and fully compliant to the latest OISD standard and fully automated loading operation in the month of March 2015.
- **Revamping of Jabalpur Depot-** Started operations in July 2017 and has revamped with a storage facility of a total of 16980 KL for White Oil and 8 bays of Tank Truck (TT) loading facilities. The depot receives product by rail movement through a single spur railway siding facility.
- **Construction of New Road Fed Depot at Leh-** HPCL constructed POL depot for winter stocking at Leh region in the UT of Ladakh. At a high altitude of over 11800 feet above MSL, the depot is constructed with a storage capacity of 4460 KL and 4 bays of Tank Truck Gantry for both loading and unloading operations.

The demand for oil is directly impacted by an increase in marketing terminal requirements. Marketing terminals serve as distribution centers for oil products to retailers or end consumers. In order to reduce delays and guarantee that items get at the market on schedule, increased demand calls for a more effective distribution network.

Furthermore, having more terminals dispersed throughout various locations acts as a buffer against events like strikes, natural disasters, or geopolitical unrest that could interrupt the supply chain. In order to avoid any major effects on the market, this becomes more and more crucial as demand increases.

3 Domestic Industrial Automation Industry

3.1 Industry Overview

Industrial automation is the use of robotics, machines and control systems to perform tasks that were traditionally carried out by human workers. Automation can improve productivity, quality and safety in manufacturing and other industrial applications.

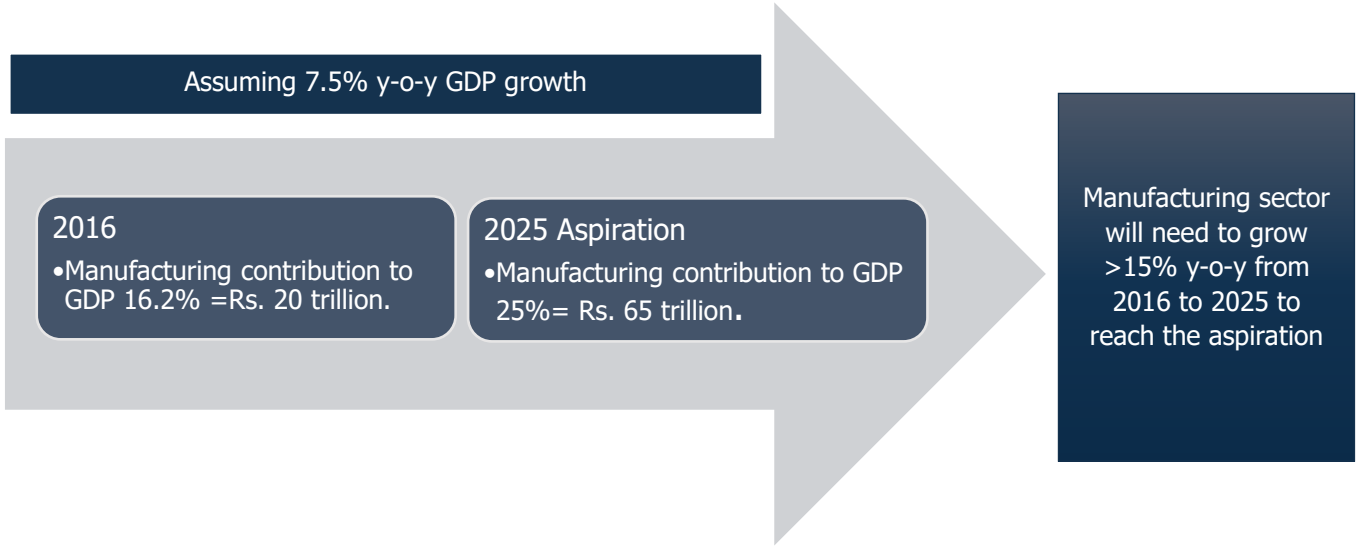
Automation technology includes a wide range of tools and technologies, such as robots, numerical control (NC) machine tools, programmable logic controllers (PLCs), computer numerical control (CNC) systems and industrial sensors. Automation systems can be integrated into existing production lines or stand-alone and can be used to collect data for preventative maintenance of the equipment. Industrial automation offers a number of benefits over traditional manual labour. Automated facilities can work faster and more accurately than human workers, and they can operate around the clock without tiring and can collect data for monitoring the health status of the equipment and reduce waste. Automation can also help to improve safety in hazardous environments.

In recent years, industrial automation has been adopted by a number of industries, including automotive manufacturing, food and beverage processing, pharmaceuticals and electronics assembly. The trend is expected to continue as companies look for ways to improve efficiency and competitiveness.

India's industrial automation industry is still developing but growing at a rapid pace. This is due to increasing foreign direct investment (FDI) and continued growth across industries. Factory automation is becoming very important in the competitiveness among business. The growing manufacturing sector is scaling up the demand for industrial automation technology.

Industrial automation has revolutionized manufacturing processes across various industries, optimizing efficiency, precision, and productivity.

Chart 11: Contribution of manufacturing sector in Indian GDP



Source: SMARTH UDYOG Bharat 4.0

The manufacturing sector in India is expected to contribute to 25% of the GDP which is a CAGR of 15% from 2016 to 2025. The manufacturing sector consists of 17% i.e. Rs. 27 Trillion of the total GDP in FY24. The growth in manufacturing sector is expected to be driven by automation in the sector.

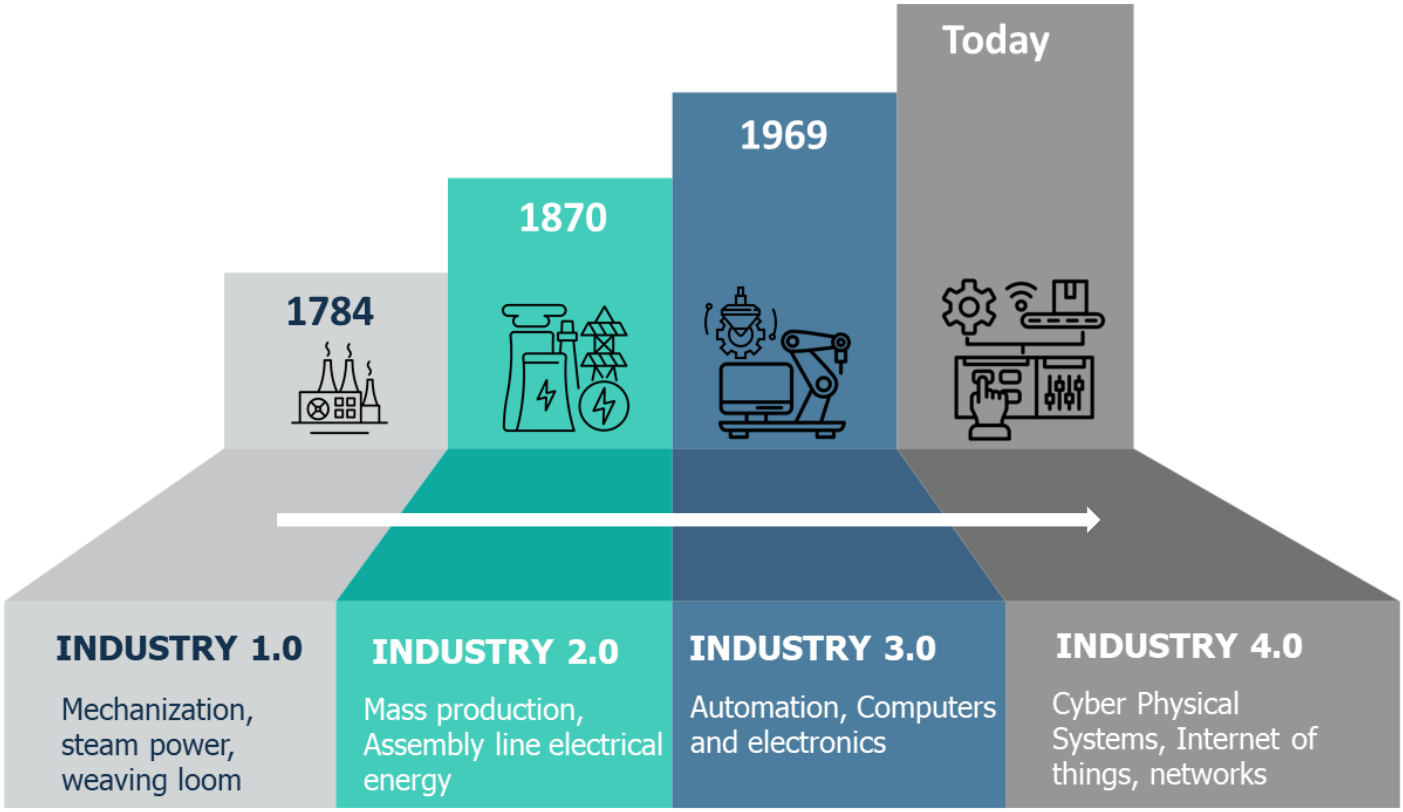
Automation is significantly influencing the Indian economy. Through the enhancement of efficiency and productivity, it is fostering economic expansion. Additionally, it is generating fresh employment prospects, as the need for proficient individuals to oversee and sustain automated systems escalates. Nonetheless, it is important to acknowledge that automation might result in job displacement in specific sectors, presenting a challenge that requires attention. The automation market is expected to grow around 7-9% in the next few years.

The automation market is segmented into **three automation types**: process automation, factory automation, and electric automation.

Process Automation	•Process Automation is the use of software and technologies to automate the business processes and functions in order to accomplish designed organization goals. It typically consists of three functions that are automating processes, centralizing information and reducing the requirement for input from people. It is used to eliminate bottlenecks, reduce errors and loss of data and improving transparency, communication across departments and speed of processing.
Factory Automation	•Factory automation involves applying technology and systems to automate manufacturing processes, aiming to boost productivity and cut costs. The degree of automation can range from individual operation automations to complete end-to-end automation, eliminating human involvement entirely. It can be integrated at any stage of the manufacturing process, spanning from material quantity control to production and assembly, and ultimately to packaging and dispatch.
Electric Automation	•Electrical automation simplifies the control of system functions, enabling electricity, electrical devices, and fixtures to activate and deactivate as instructed. A brief observation of nearly any public area reveals the ubiquitous use of smartphones, GPS devices, tablets, and other wireless components, which contribute to enhancing various aspects of our lives for added convenience.

3.2 Industry 4.0

Humanity has experienced three industrial revolutions between the 17th and 20th centuries. The first revolution began with the use of steam engines to power machinery in the textile industry. Subsequently, the invention of electricity transformed lifestyles, leading to the adoption of assembly lines and mass production concepts, fuelling industrialization worldwide. However, these assembly line operations remained heavily reliant on manual labour, which could introduce dependencies and errors due to variations in skill levels among workers.

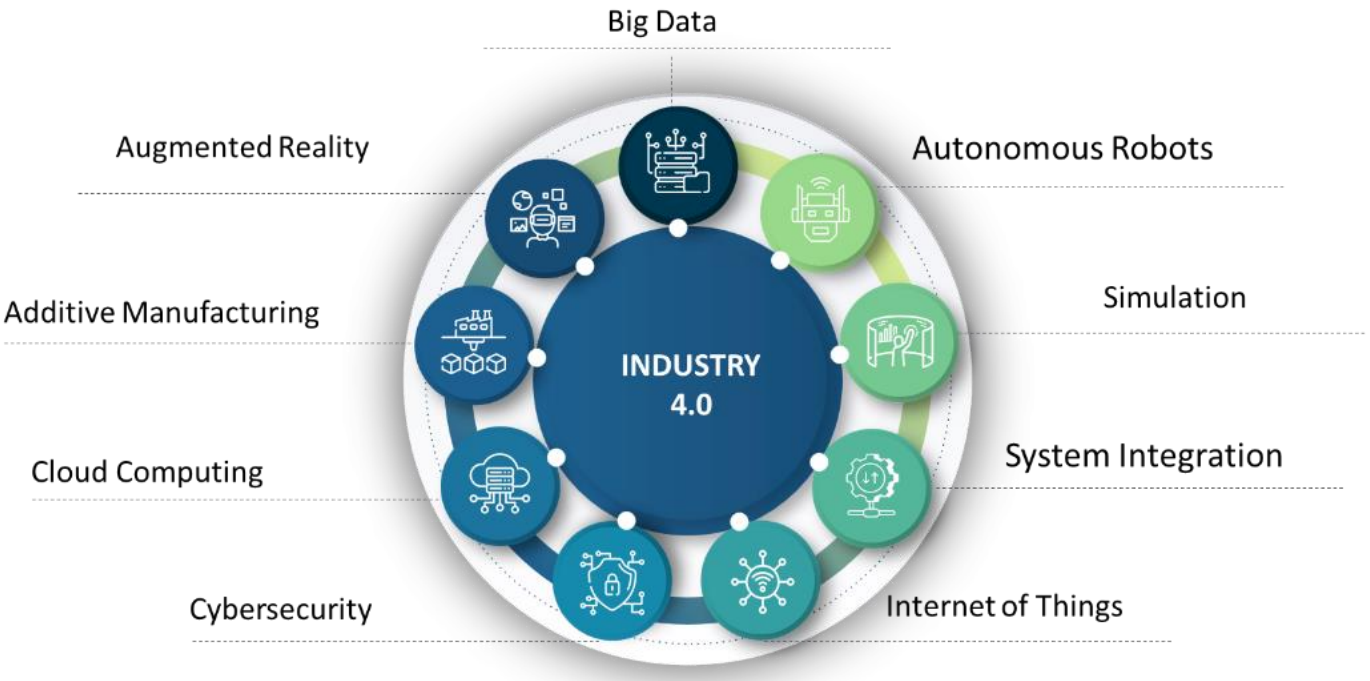


During this period, technology gained importance, and with the advent of computers and robotics, traditional manual labour was replaced with automated processes. This enabled the synchronization of operations with computers to perform repetitive tasks accurately and at higher speeds, marking the onset of the third industrial revolution in industrialization.

Steam propelled the original Industrial Revolution; electricity powered the second; preliminary automation and machinery engineered the third; and cyber physical systems—or intelligent computers—are shaping the Fourth Industrial Revolution.

Industry 4.0, also known as the Fourth Industrial Revolution or 4IR, represents the subsequent stage in the digital transformation of the manufacturing industry. It is propelled by disruptive trends such as the increasing importance of data and connectivity, advancements in analytics, human-machine interaction, and enhancements in robotics.

Chart 12: Nine pillars of technology



Industry 4.0 is based on 9 pillars of technology that are Big Data and AI analytics, Horizontal and vertical integration, cloud computing, augmented reality, industrial internet of things, additive manufacturing 3D printing, autonomous robots, simulation or digital twins and cybersecurity.

Industry 4.0 is one of the major factors driving the growth of industrial robots which involves the integration of advanced technologies of IOT, AI and machine learning in the industrial processes.

India is poised to embark on its journey towards becoming an economic, industrial, and defense superpower over the next three decades, given its current growth trajectory with continuous GDP growth of around 7.0% annually and ambitious initiatives like "Digital India," "Make in India," and "Smart Cities" projects. To realize this vision, the Indian industry needs to grasp the importance of "Industry 4.0" and equip itself for the fourth industrial revolution. The Supply Chain Industry will play a crucial role in this Indian dream.

3.3 Market Drivers

- **Upgradation and digitization of technology**

Technology advancement and digitalization have been key drivers behind the evolution of Industry 4.0, facilitated by the availability of low-cost hardware and intelligent machines, along with the influx of data. This surge in data volumes has given rise to the concept of "big data," underscoring the growing importance for companies to effectively store, gather, and utilize information.

- **Connectivity**

Connectivity plays a crucial role in Industry 4.0, with the widespread availability of fast internet and the adoption of technologies like remote database access (RDA) and radio frequency identification (RFID). These advancements support the concept of the Internet of Things (IoT) as a potential global digital infrastructure, enabling seamless collation and distribution of information.

- **Competitive Edge**

Achieving a competitive edge in the Industry 4.0 era involves leveraging both human expertise and dynamic data analysis. This synergy may pave the way for the development of a digital ecosystem where human decision-making is augmented by algorithms, leading to enhanced production accuracy, reduced time and costs, and optimized manpower utilization.

- **Digital Solutions**

Digital solutions enable the collection of real-time data from machines, equipment, and production systems through sensors and IoT devices. the digital solutions market drives industry automation by harnessing technologies such as data analytics, AI, IoT, automation, and smart manufacturing platforms. These solutions optimize operational efficiency, enhance quality and reliability, enable agile and responsive manufacturing, and pave the way for sustainable and innovative industrial ecosystems. Digital transformation is revolutionizing traditional manufacturing practices and accelerating the adoption of Industry 4.0 principles across diverse industries.

- **Automation and Digitization**

Manufacturers are increasingly embracing automation and digitization to meet the growing demand for faster production and improved efficiency. Technologies such as robotics, artificial intelligence (AI), and machine learning are playing pivotal roles in minimizing human intervention, enhancing product quality, and boosting productivity.

3.4 Market Restraints

Market restraints in industrial automation refer to factors that hinder or limit the growth, adoption, or implementation of automation technologies within various industries. These restraints can significantly impact the pace and extent of automation deployment. Here are some key market restraints in industrial automation:

Technology
- Lack of end-to-end encryption
- High Power Consumption
- Lack of seamless interoperability
- Unreliable network connectivity

Standards
- Lack of uniform security standards
- Disparate regional standards
- Lack of architecture and reference models
- Lack of standards in applications

Consumer
- Privacy of consumer data
- High price perception of IoT technology
- Technology Intimidation

Business
- Lack of compelling use-cases and viable business models
- Ambiguous RoI
- Scalability challenges
- Lack of smooth data sharing among organizations

- **High Initial Investment:** One of the primary restraints is the substantial upfront investment required for acquiring and implementing automation technologies such as robotics, control systems, sensors, and software. High initial investment presents a significant challenge for the adoption of industrial automation in India. Many organizations, especially smaller ones, may find the initial costs prohibitive.

  The capital-intensive nature of industrial automation can strain the budgets of businesses, particularly smaller enterprises and startups. The need for specialized equipment and skilled personnel further adds to the overall investment requirements. Moreover, the return on investment (ROI) timeline for automation projects may be longer, which can make decision-makers cautious about committing resources.

  To address the challenge of high initial investment, organizations often explore strategies such as phased implementation, leasing or financing options, and seeking government incentives or subsidies for technology adoption.

- **Complexity and Integration Challenges:** Industrial automation often involves integrating various systems, technologies, and processes, which can be complex and require specialized expertise. Compatibility issues between different systems and legacy equipment can further complicate integration efforts.

  India's industrial ecosystem comprises a wide range of sectors, each with distinct processes, equipment, and operational requirements. Integrating automation solutions across these diverse industries, such as manufacturing, automotive, healthcare, and agriculture, requires tailored approaches and specialized expertise. The compatibility and interoperability of automation systems with different software, hardware, and communication protocols present integration challenges. Ensuring seamless communication and data exchange between disparate systems is crucial for achieving comprehensive automation.

- **Lack of Skilled Workforce:** Automation technologies require specialized skills in robotics, control systems, machine learning, artificial intelligence, and data analytics. However, there is a shortage of professionals with hands-on experience and advanced knowledge in these areas. Automation technologies evolve rapidly, and keeping pace with the latest developments requires continuous learning and upskilling.

To address the lack of skilled workforce in the Indian automation sector, several measures are taken like Government initiatives, industry associations, and educational institutions collaborating to develop specialized skill development programs focused on automation technologies. These programs should include hands-on training and industry-relevant curriculum.

- **Cybersecurity Risks:** The increased connectivity of industrial systems through the Internet of Things (IoT) and cloud-based solutions raises concerns about cybersecurity. Vulnerabilities in automated systems can lead to potential cyber threats, including data breaches, sabotage, and operational disruptions.

  The cyber-risk terrain for the IoT/OT driven systems is also evolving with the evolving automation industry. Cyber-attacks such as ransomware and APTs are inevitable; hence, incident response plays a vital role in the current Indian IA market. However, incident response in the IoT/OT-driven IA space differs starkly from that in the IT sector. Subsequently, it cannot be adapted from an IT incident response playbook.

- **ROI Uncertainty:** Some organizations may be hesitant to invest in automation due to uncertainty about the return on investment (ROI) and the time it takes to realize cost savings and efficiency gains. Automation projects often require significant upfront capital expenditure to acquire technology, upgrade infrastructure, and train personnel. The long payback period associated with these investments can introduce uncertainty about when the benefits will offset the initial costs. Implementing automation systems involves integrating new technologies with existing processes, machinery, and IT systems. This complexity can lead to unexpected delays, cost overruns, and operational disruptions, impacting the projected ROI.

- **Limited Use Cases:** Certain industries or applications may have limited use cases for automation technologies, making it challenging to justify the investment compared to manual processes. IoT deployments often involve complex technology integration and scalability challenges. Developing IoT solutions that can seamlessly integrate with existing infrastructure and accommodate future growth can be difficult, leading to limited use cases.

3.5 Key Industry Developments

Disruptive Technological Trends	Shifting Growth Patterns	Organizational Transformation	Increased Pace of Digitization	Changing Customer Requirement
New Materials, Green Revolution, E-mobility, 3D-Printing	Sideways moving market, increasing competition for Asian competitors	More flexibility, agility and customer cooperation	Internet of Things and Industry 4.0 as the enablers for future and new digital businesses	Solutions instead of machinery customization and intuitive machine handling

The domestic industrial automation industry is undergoing significant developments driven by technological advancements, market trends, and evolving customer demands. Here are key industry developments shaping the domestic industrial automation sector:

- **Adoption of Industry 4.0 Technologies:** The industrial automation industry is embracing Industry 4.0 principles, integrating technologies such as IoT, AI, big data analytics, cloud computing, and digital twins into manufacturing processes. This transformation enables smart factories, predictive maintenance, and data-driven decision-making.
- **Generative Artificial Intelligence (GenAI):** Generative artificial intelligence (GenAI) has surged in importance over the past year, sparking strong interest in industrial applications integrated with this groundbreaking technology. Generative Artificial Intelligence (Generative AI) refers to a type of AI technology that is designed to create or generate new content, such as images, text, music, or even entire videos, based on patterns and examples from existing data. Generative AI systems typically use deep learning architectures, such as Generative Adversarial Networks (GANs) or Variational Autoencoders (VAEs), to learn patterns and relationships within data and then generate new content that resembles the original data. Almost 83% of the automation industry is expected to use GenAI for its operations in 2024.
- **Rise of Collaborative Robotics (Cobots):** Collaborative robots (cobots) are gaining popularity in domestic industrial automation due to their ability to work alongside human operators safely. Cobots enhance productivity, flexibility, and efficiency in manufacturing operations, particularly in small and medium-sized enterprises (SMEs).
- **Focus on Smart Manufacturing:** There is a growing emphasis on smart manufacturing solutions that optimize production processes, enhance quality control, and improve supply chain management. Smart manufacturing platforms integrate automation, data analytics, and connectivity to drive operational excellence.
- **Digital Transformation Initiatives:** Domestic industrial automation companies are undergoing digital transformation initiatives to digitize processes, automate workflows, and enhance connectivity across the production ecosystem. This digitalization improves agility, responsiveness, and competitiveness.
- **Expansion of Internet of Things (IoT) Applications:** The proliferation of IoT devices and sensors in industrial settings enables real-time monitoring, predictive maintenance, and remote asset management. IoT solutions enhance operational visibility, efficiency, and resource utilization.
- **Integration of Artificial Intelligence (AI):** AI technologies such as machine learning and deep learning are being integrated into industrial automation systems to optimize production scheduling, predict equipment failures, and automate decision-making processes. AI enhances efficiency and reduces operational costs.
- **Enhanced Cybersecurity Measures:** With increased connectivity and data exchange in industrial automation, cybersecurity has become a critical focus area. Domestic automation companies are implementing robust cybersecurity measures to protect manufacturing systems and data from cyber threats.
- **Shift towards Modular and Scalable Solutions:** Industrial automation solutions are evolving towards modular and scalable architectures that allow for flexible deployment and expansion. This approach enables companies to adapt quickly to changing production demands and business requirements.
- **Emphasis on Sustainability and Green Technologies:** There is a growing emphasis on sustainability in industrial automation, with a focus on energy efficiency, waste reduction, and eco-friendly manufacturing practices. Green technologies such as renewable energy integration and efficient resource utilization are gaining traction.

4 Automation in Petrochemicals Industry

4.1 Overview of Petrochemical Industry

Petrochemicals are downstream hydrocarbons derived from crude oil and natural gas, which consist of plastic and a host of other chemicals. It is a capital-intensive industry and plays a significant role in driving economic growth. Demand for petrochemicals is driven by end-use sectors such as fertilisers, packaging, tires, detergents, digital devices, medical tools, solar panels, electric vehicles, batteries, etc.

The prices of petrochemicals are determined from the prices of 'Naptha', which is a major feedstock used to make petrochemicals and is derived from crude oil. India is a net importer of petrochemicals. The overall petrochemical production grew at a CAGR of 1.7% during the period FY18- FY23.

Lower crude oil prices supported the petrochemicals export. Amongst the basic petrochemicals, acrylic fibre, nylon filament yarn, and nylon industrial yarn were imported substantially. Similarly, Thailand, Turkey, Germany, Nepal, and Japan accounted for the top five import destinations for petrochemicals during 2020-22.

Production of Major Petrochemicals

The COVID-19-led lockdown adversely impacted the demand for petrochemicals. The demand from non-essential sectors such as construction, automotive, textiles, electronics, and rigid packing experienced a decline in demand. Whereas, the demand for petrochemicals from healthcare and personal care stood up strongly.

Further, the quantum of production of major petrochemicals decreased to 40,657 thousand tonnes during 2022-23 as compared to 44,689 thousand tonnes during the previous year, indicating a decrease of 9%. This was possibly due to increased feedstock prices amid Russia-Ukraine tensions and the quantum of imports.

Between FY18 and FY22, CAGR value for installed capacity in the industry stood positive at 4.8%, indicating an increase in the size and output of the industry. Import and export were relatively favourable, but exports declined by 9% y-o-y in FY23, reflecting a drop in the industry's trade.

Domestic Petrochemical Prices

Petrochemical prices fell in FY24 (April- Jan) as compared to the same period in the previous year. However, FY23 witnessed a surge in prices due to the rapid demand and recovery of the economy. Other factors that contributed to the increase in prices were- recovery in polymer feedstock prices, slowdown in the supply of polymers in the domestic market due to lower production, and the unlocking of domestic and international markets.

The prices of petrochemical products remained low in FY21. The key factors attributed were the COVID-19 impact and weak demand due to the slowdown in global manufacturing. India being the net importer of intermediaries such as Purified Terephthalic Acid (PTA) and Mono-ethylene Glycol (MEG), the demand-supply situation in the international markets impacts the domestic prices.

The lockdown restrictions in China alongside Russia-Ukraine tensions increased crude oil prices, further raising the cost of Naphtha. This, in turn, resulted in higher prices for most of the petrochemicals which the industry passed on to the end-users.

4.2 Demand Drivers of Petrochemical Industry

- Rise in certain petrochemical products due to increasing consumption of healthcare products and flexible packaging for consumer goods, food, and e-commerce merchandise.

- Numerous petrochemicals, including ethylene, propylene, and benzene, are needed for the electrification and energy storage systems. Due to its increasing use in storing energy from renewable sources like solar and wind power, the demand for energy storage systems is rising. Batteries and capacitors, two essential parts of energy storage systems, are made of petrochemicals. Opportunities for products generated from petrochemicals are anticipated to arise as this industry advances and the demand for energy storage systems rises.

- The increasing packaging industry is a significant market driver due to its heavy reliance on petrochemical-derived products, particularly plastics. The growth of the packaging sector is closely linked to developments in urbanization and expanding worldwide consumption. The need for packaged goods rises along with the number of people living in cities. Plastics developed from petrochemicals offer a wide variety of affordable and adaptable packaging materials, which makes them the go-to option for industries ranging from consumer products and personal care to food and beverage. Growing worldwide consumption patterns are largely met by responses from the packaging industry, which supports the growth of the petrochemicals business.

- Movements in the price of crude oil on a worldwide scale have a direct impact on the petrochemical industry's pricing and production costs, which in turn affects market expansion. The rising demand for petrochemical goods across a wide range of sectors is also a key driver of market expansion.

- Allocation of resources and promoting innovation via programs such as the National Petrochemical Awards and Centers of Excellence (CoEs).

- As firms are using technology more to stay competitive in the worldwide market, the adoption of automation in the petrochemicals market is undergoing a substantial impact. More companies are projected to recognize the advantages of automation in petrochemicals, leading to a growth in the automation market within this industry.

4.3 Government Policies

The government is taking all the necessary steps to make India a global petrochemical manufacturing hub. Some of the initiatives taken include revised customs duties on petrochemicals, a reduction in the basic customs duty of naphtha, and a new addition to the Barmer Petrochemical Cluster.

Further, the Department of Chemicals and Petrochemicals has made the way for petrochemical infrastructure by implementing schemes under the National Policy on Petrochemicals. Schemes include- the setting up of plastic parks and the setting up of centres of excellence in polymer technology. Under this scheme, the Government of India provides grant funding up to 50% of the project cost, subject to a ceiling of Rs.400 million per project. The remaining project cost is funded by the state government or the State Industrial Development Corporation or similar agencies of the state government, beneficiary industries, and loans from financial institutions. Further, it aims to improve the existing petrochemical technology and research in the country and promote the development of new applications of polymers and plastics.

Moreover, with the implementation of four Petroleum, Chemical and Petrochemical Investment Regions (PCPIRs) in the States of Andhra Pradesh (Vishakhapatnam), Gujarat (Dahej), Odisha (Paradeep), and Tamil Nadu (Cuddalore and

Nagapanam), investments are likely to get infused worth Rs. 2.27 trillion. The purpose of establishing PCPIRs is to promote investment and industrial development.

4.4 Automation

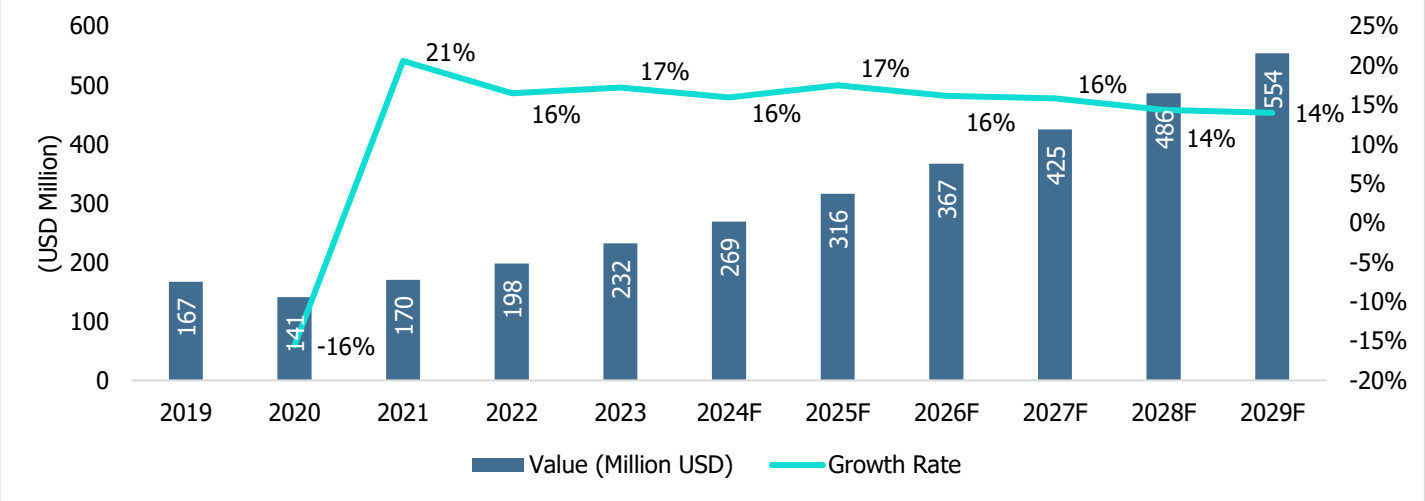
Automation in the Indian petrochemical industry is rapidly changing the way it operates- increasing efficiency, safety, and sustainability. Distributed Control Systems (DCS) and Supervisory Control and Data Acquisition (SCADA) are widely utilized for real-time monitoring and control of petrochemical processes. These solutions support in optimizing operations, decreasing human error, and assuring safety. AI-driven automation will become more prevalent in the future, with machines not just performing jobs but also making decisions, increasing efficiency.

Advanced Sys-tek's Control and Monitoring System integrates **High Availability Redundant Computer Platforms** with proprietary software to provide robust and efficient terminal automation. High Availability Redundant Computer Platform's operation is achieved by implementing redundancy, when individual components fail. Multiple identical components (like servers, storage devices, or network connections) seamlessly takes over in case of a primary component failure, minimizing downtime and ensuring high availability.

4.4.1 Market size for Automation in Petrochemical Sector

Cybersecurity becomes increasingly important as the industry gets more automated and linked. Automated systems are subject to cyber-attacks, which can disrupt operations and cause safety accidents. To mitigate these dangers, businesses are investing in strong cybersecurity systems such as firewalls, encryption, and constant network monitoring. In order for systems to bounce back fast from any possible breaches, resilience building is also a priority.

Chart 13: India Automation Market Size in Petrochemicals



Source: Maia Research

Note: Year mentioned above denotes calender year; (F) stands for forecasted period.

Between CY19 and CY23, the Indian automation market for the petrochemical sector increased at a CAGR of 8.6%. Automation in the Indian petrochemical industry is expected to evolve at CAGR of 15.5% between CY24 and CY29, with ongoing developments resulting in more intelligent, efficient, and sustainable operations. This shift is critical to the industry's worldwide competitiveness.

4.4.2 Major Players in India who have adopted Automation in Petrochemicals

Table 4: List of Players

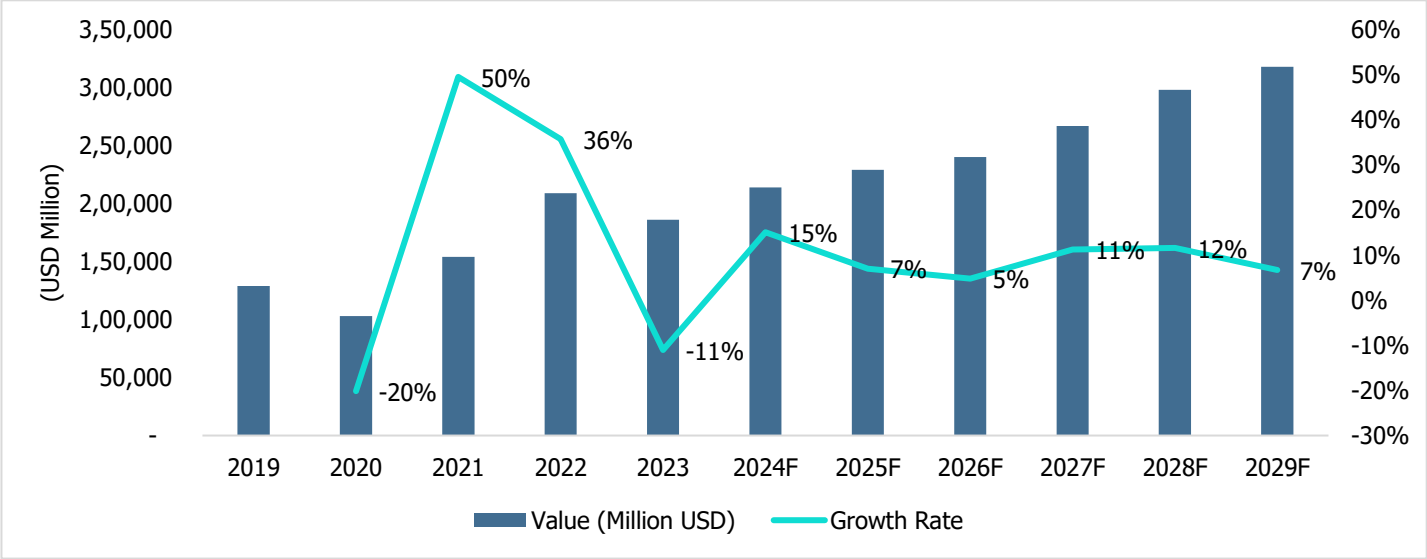
Company Name	Details
Indian Oil Corporation	IOCL uses automation for refining, petrochemical manufacture, and distribution. The company employs advanced process control (APC) systems and has begun integrating IoT devices to improve monitoring and control.
Reliance Industries	Reliance is considerably invested in automation for its petrochemical and refining businesses. To boost productivity, decrease waste, and increase safety, the company employs modern process control networks, robotics, and AI-driven insights.
Hindustan Petroleum	Hindustan Petroleum Corporation Limited (HPCL) has automated several elements of its petrochemical operations, including retail stores, terminals, supply and distribution. Systems of automation consist of: Centralized pricing adjustments: From one central location, HPCL is able to make almost real-time price adjustments at all of its automated fuel stations. This guarantees that clients are billed the accurate amount. Interlocking systems: HPCL has implemented a central interlocking system that, in response to certain situations, activates and regulates pump operations. Enhancing safety and transparency is the goal of this method. Integrated payment solutions: Automation ensures that clients receive bills for the items they fill out.
Bharat Petroleum	The organization has prioritized the digitization of its logistics and supply chain processes. BPCL has implemented the following automations: 1. The installation of automated systems for process control in refineries. 2. Use of robotics in inspection and maintenance duties. 3. Applying machine learning and AI to optimize operations.
Chennai Petroleum Corporation	CPCL implemented SAP business applications through IOCL. Finance & Controlling, Sales and Distribution, Plant Maintenance, Materials, Projects, Human Resources, and Payroll with ESS (Employee Self Service Portal) constitute some of the several SAP modules that CPCL has put into place. The introduction of SAP has allowed CPCL to smoothly combine the functions of major departments, resulting in a smooth workflow. Similarly, automated invoice creation in SAP for truck transportation was recently deployed.

4.5 Outlook for the Industry

The petrochemical industry in the last few years has done well despite some of the major challenges such as erratic prices of the feedstock in the international market and global container crisis. As the country is recovering from the contraction that took place due to the pandemic, real GDP of the country is expected to register a good growth in the coming period. This is expected to drive the growth of various end-user industries of petrochemicals and hence, benefit petrochemical industry. Further, the growth of this sector will be supported by the PLI scheme and other government initiatives such as Make in India. However, high feedstock price is a key risk that may restrict the growth.

Automation in the petrochemical sector is expected to streamline operations as a result of the rising demand for ethanol blending at oil terminals, which will introduce more steps and complexities in the supply chain and drive the need for increased automation. Automation is preferred in the bending process for precise blending control, monitoring and adjusting in real time, quality assurance and control, and integration of the system with supply chain and logistics.

Chart 14: India Petrochemicals Market Size in Value



Source: Maia Research

Note: Year mentioned above denotes calender year; (F) stands for forecasted period.

India's petrochemical industry is expected to grow at a CAGR of around 8% between CY24 and CY29. This will be driven by end user industries such as- plastics, detergents, medical equipment, and tyres. Other connected industries like textiles, automotive, and construction with highly expected growth will also support the demand for petrochemicals in the near future. Further, 100% foreign direct investment through the automatic route will also drive the demand for this sector.

At the same time, despite the stable demand from the domestic front, operating margins might be impacted by the lower prices and oversupply of petrochemical capacity in China, the US, and the Middle East. Besides, low demand in other international markets suggests that Indian producers might have to deal with the problem of foreign dumping.

The petrochemical segments of all the companies have reported profitability pressures over the last few quarters. This indicates that while Indian demand is likely to remain healthy, the global weakness in demand and oversupply situation will keep the petrochemicals spreads under check for the Indian players as well in the medium term.

The domestic demand for chemicals in India is predicted to remain healthy in 2024, but price expectations are not very high as the market tries to strike the right balance in the face of new production capacities entering the Asian market, shifting trade flows, weak global demand, and unstable upstream prices.

5 Indian Diesel Automotive Industry and Diesel Consumption

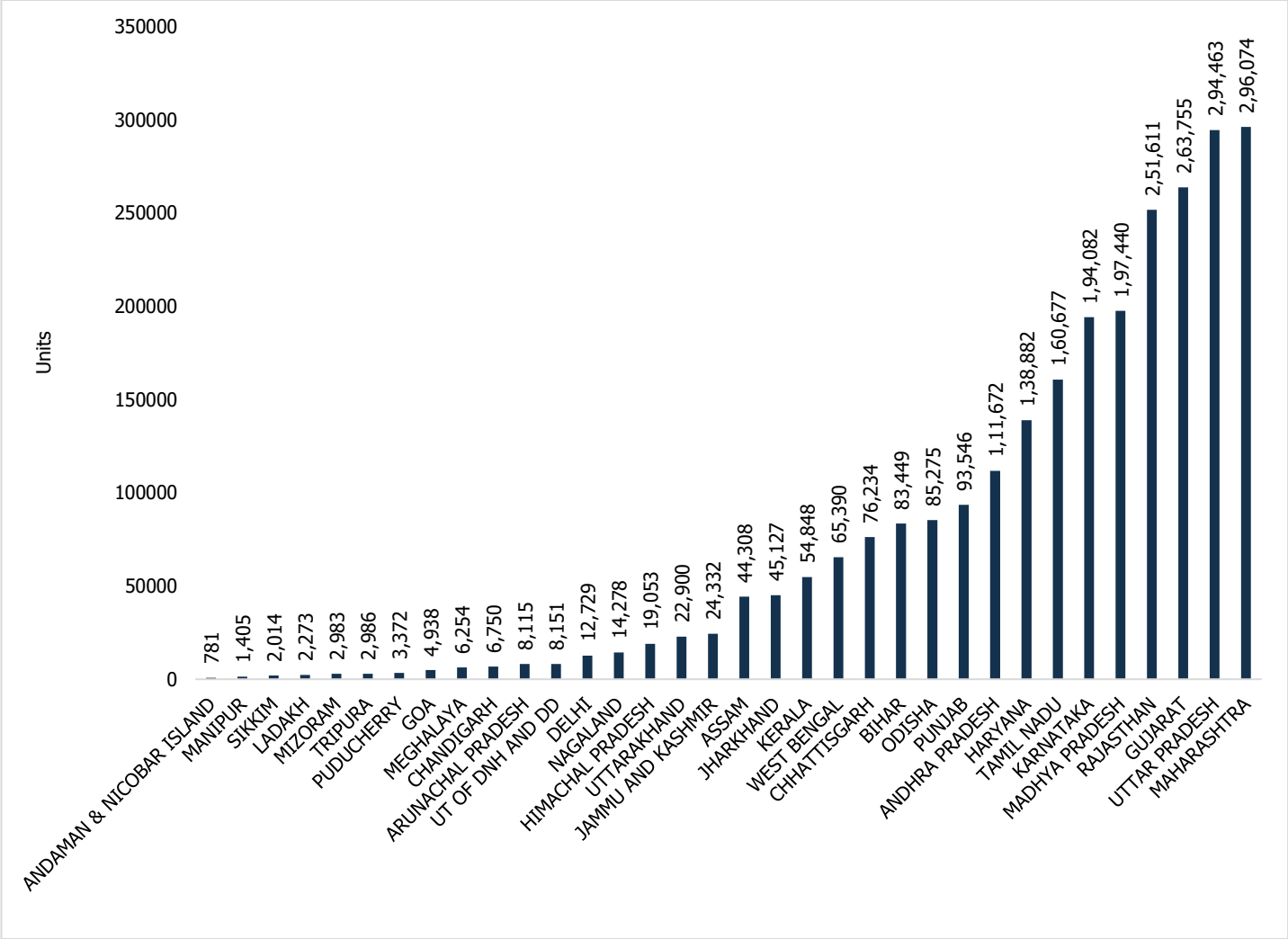
5.1 New Diesel Vehicle Registered- State-wise

There is increasing government's thrust for adoption of environment friendly alternate fuels such as Electric Vehicles (EVs), CNG in India in the recent years. This has led to most of the auto manufacturers planning to launch EVs in India with some of the players having already launched such vehicles. This creates some uncertainty for both the consumers and manufacturers of automobiles over the demand and supply of diesel-based vehicles which may lead to consumers deferring their purchase plans. However, considering the challenges revolving around EV ecosystem and LNG/CNG terminals, it will be difficult to imagine commercial vehicles without diesel engines at least in the near term.

India has implemented the Bharat Stage Emission Standards (BSES) in phases to reduce vehicle emissions, with different phases going into effect at different times and in different parts of the nation.

Over the last two years, Maharashtra has seen an increase in the registration of diesel vehicles, despite efforts to urge people to switch to cleaner fuels like CNG or electric.

Chart 15 : New Diesel Vehicle Registered- State-wise during FY24



Source: Vahan Dashboard

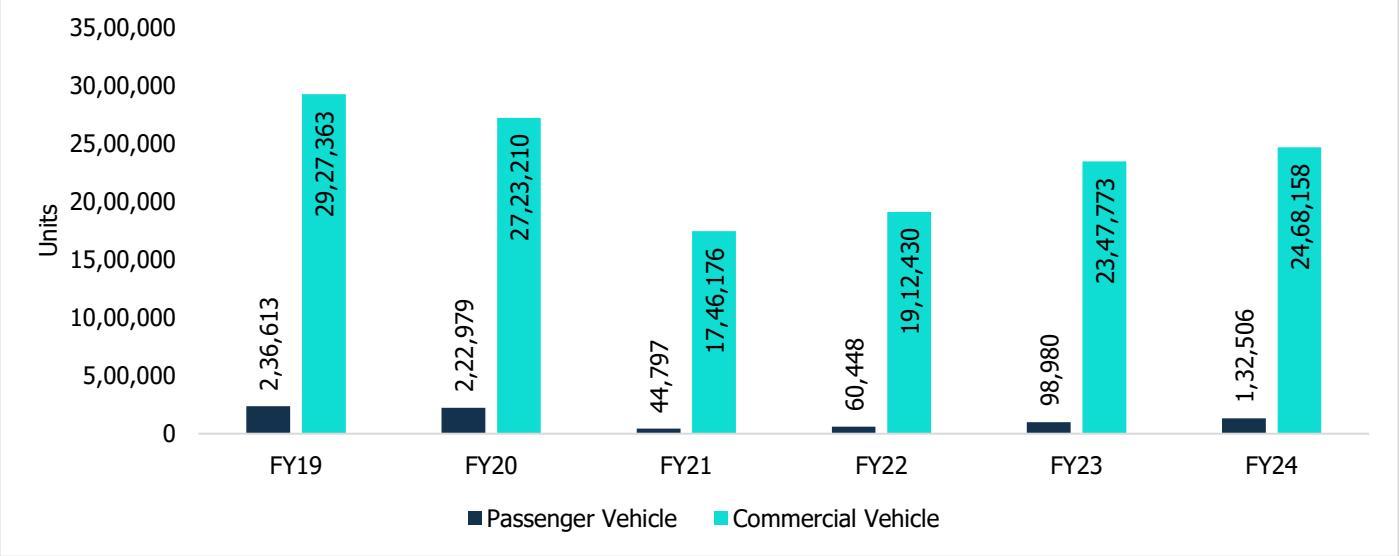
5.2 Passenger and Commercial Vehicles Registered (Diesel)

The diesel passenger vehicle (PV) industry domestic sales grew by 34% y-o-y in FY24. The segment's growth trajectory continued for two consecutive fiscal years with improved vehicle availability and an influx of new & refreshed models from various OEMs. This uplift was further supported by enhanced supplies and an increasing variety in the product portfolio, diversifying consumer demand.

The diesel commercial vehicle (CV) segment is considered a lifeline for the economy and the growth of this segment is closely related to the industrial activity in the economy. The commercial vehicle industry's domestic sales growth moderated to 5% in FY24 as compared to FY23. The growth can be attributed to the adequate deployment of funds from the central government towards infrastructure development and the high base of last year. Furthermore, there was a discernible improvement in market sentiment, supporting healthy traction in heavy commercial vehicles (HCVs), buses, and LCVs and signalling a revitalized tourism market. Similarly, customer sentiment has significantly improved in the tipper segment. Whereas fleet utilization continues to be at a healthy level as transporters' profitability remained stable which led to increasing demand in Medium & Heavy Commercial Vehicle segments. In addition, the industry saw a good demand for diesel CVs from the construction, steel, cement, e-commerce, and agri-transportation, among other industries.

Furthermore, the COVID-19 pandemic caused a downturn in the car sector in fiscal year 2021. Due to a strict statewide shutdown aimed at preventing the spread of coronavirus infections, automakers were unable to sell the targeted vehicles. Still, there were other factors contributing to the auto sector's downturn outside the pandemic. Deeper structural problems that needed to be addressed also beset the industry.

Chart 16 : Market Trend of Passenger and Commercial Vehicles Registered (Diesel)



Source: Vahan Dashboards

5.3 State-wise Diesel Consumptions

In India, diesel fuel is the most widely used fuel, making for over 40% of all petroleum product usage. Seventy percent of diesel sales in the nation are accounted for by the transportation industry. Additionally, it is the main fuel used in the agricultural industry, particularly in tractors and harvesters.

September, 2023 saw a decline in diesel sales in India for the second consecutive month as precipitation tempered demand and hindered industrial activity in certain regions of the nation. Rainfall reduces demand for diesel in the agriculture sector, which uses the fuel for transportation, irrigation, and harvesting, hence sales of the fuel usually decline during the monsoon season. Rain also slows down the movement of cars.

According to the IEA, the ongoing, tremendous industrial expansion shows that the single biggest driver of rising oil consumption is diesel/gasoil, which will account for about one-sixth of the total growing oil demand globally through 2030 and over half of the country's demand increase.

Diesel Demand (mb/d)

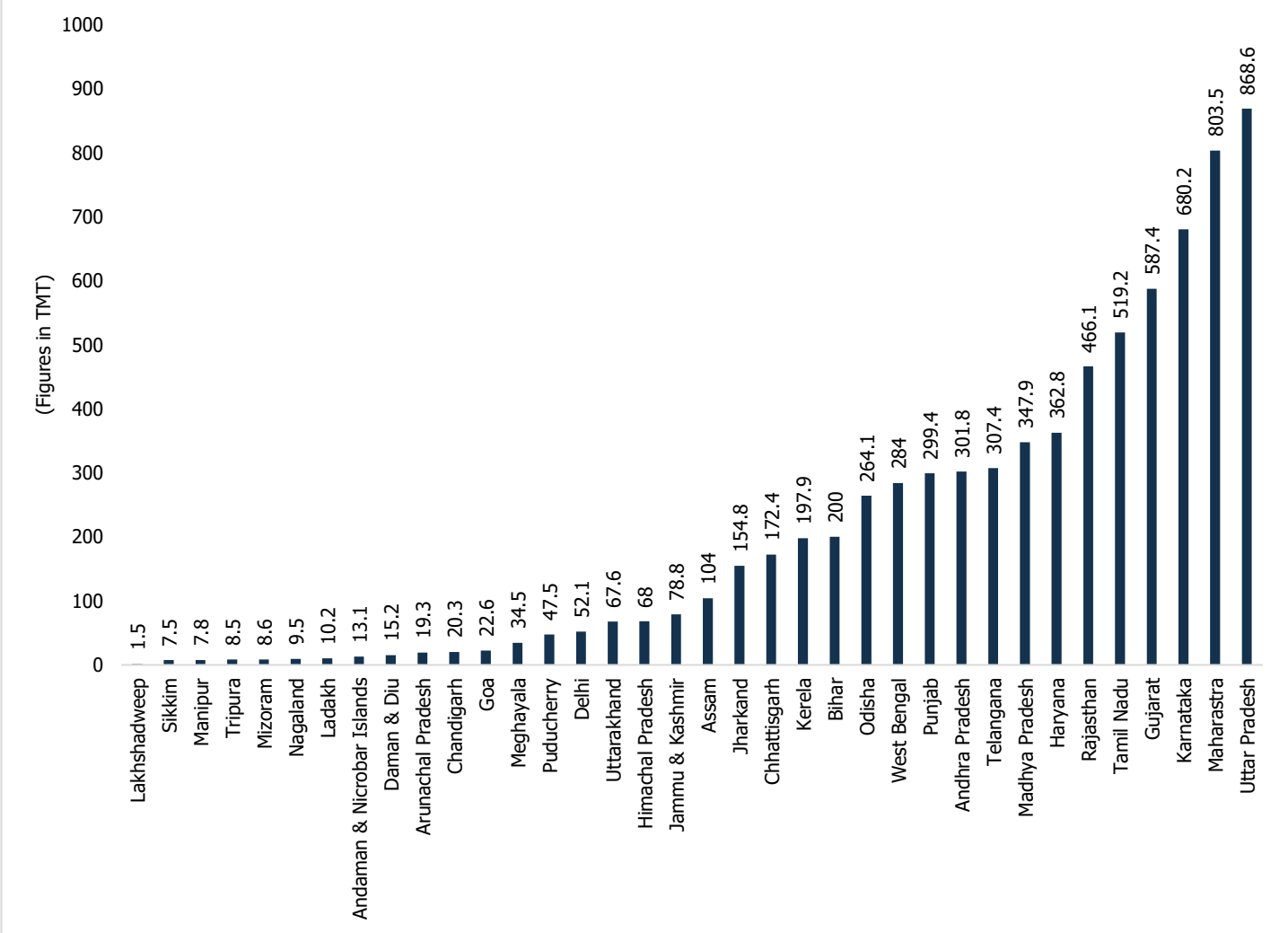
	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Global	28.3	26.1	27.5	28.3	28.4	28.5	28.7	28.7	28.8	28.9
India	1.6	1.5	1.5	1.7	1.8	1.8	1.9	2.0	2.1	2.2

Source: IEA

The state of Uttar Pradesh has the highest diesel consumption rate. The increased use of vehicles has resulted in higher diesel consumption in Uttar Pradesh.

Uttar Pradesh is one of India's most populous states in the north with a population of more than 200 million. A significant portion of the state's GDP comes from the service and agricultural sectors. Individuals commute from one location to another using both public and private means.

Chart 17 : State- Wise Diesel Consumption during FY24



Source: PPAC

5.4 Region-wise Diesel Consumption

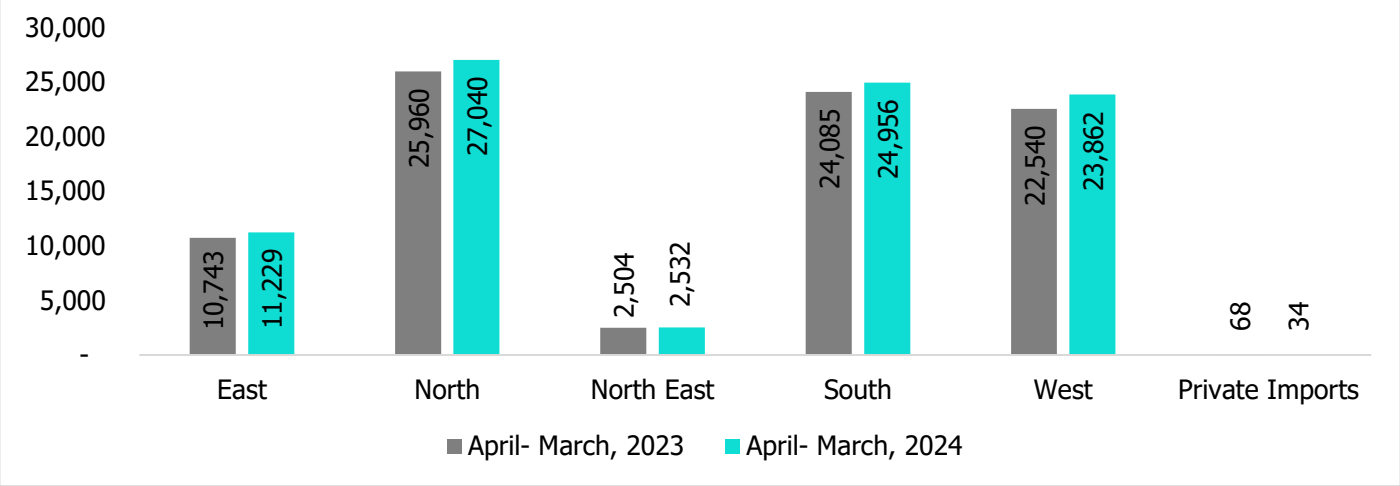
The consumption of High-Speed Diesel (HSD Diesel) in 2023–2024 increased by 4.4% to 89.65 MMT from 85.9 MMT the year before. Over the past ten years, the consumption driven by economic activity has increased at a CAGR of 2.7%.

The following are the main causes of HSD intake throughout the year:

- Increase in agricultural demand
- A considerable increase in weddings and related events is driving the hospitality industry's opulent comeback Celebrations following the pandemic are reverberating throughout the industry, indicating a significant shift in behaviors and attitudes and defining a colorful tapestry of changing customs

- Full-fledged mining and industrial operations raised diesel consumption across India

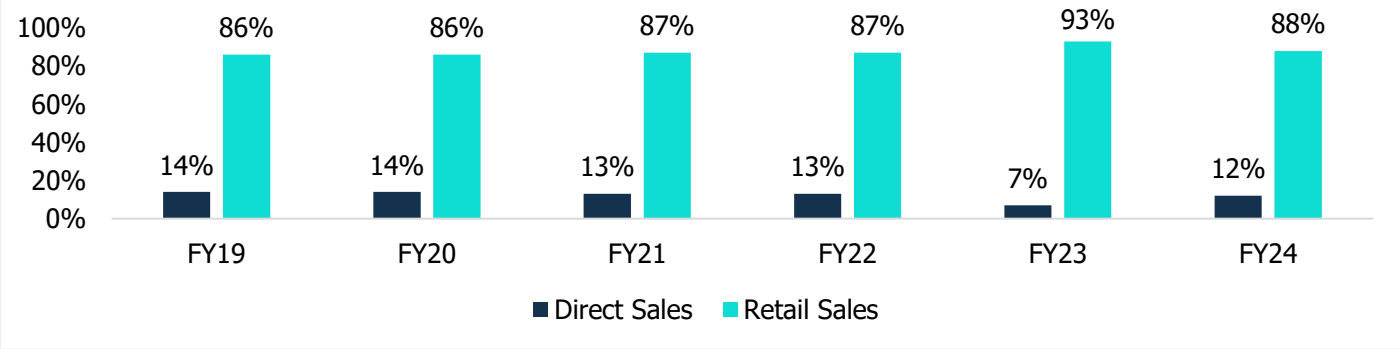
Chart 18 : Region wise HSD Consumption 2023-2024 (Figures in TMT)



Source: PPAC

Retail and Direct are the two ways that HSD is sold. Retail, which accounts for a sizable 88% of diesel sales, is the mainstay. The remainder is sold directly to major buyers such as factories, state road transport organizations, railroads, etc.

Chart 19 : Share of Retail & Direct business (%) in Diesel Consumption



Source: PPAC

5.5 Mining Market- Concentrated Areas, Growth Estimates, Earth Moving Equipment Requirements

India is endowed with vast reserves of rare earth elements, mineral salts, iron ore, bauxite, chromium, manganese ore, and baryte. With the introduction of the Mines and Minerals (Development and Regulation) Amendment Act 2021 and the National Mineral Policy 2019, India offers significant potential for investors seeking to participate in the country's metal industry. In the coming years, the Indian metals and mining industry is anticipated to undergo significant transformation due to initiatives like the Made in India Campaign, Smart Cities, Rural Electrification, and the National Electricity Policy's emphasis on developing renewable energy projects along with increased infrastructure development.

India has a wide range of mineral resources; in FY22 the value of mineral production was Rs. 21,18,570 million, an increase of 32% over the previous year. Non-metallic minerals comprised 42% of the overall value, whereas metallic minerals made up 58% of the total.

As India moves toward renewable energy and electric vehicles, the country's need for essential minerals (copper, manganese, zinc, indium, lithium, cobalt, and rare earth elements) is anticipated to rise. The increasing need for renewable energy is expected to cause the demand for essential minerals to surge fourfold by 2040, according to the International Energy Agency. Modern technologies such as solar panels, wind turbines, transmission networks, batteries, cell phones, flat-screen monitors, electric vehicles (EVs), drones, jet engines, and satellites depend on critical minerals.

DEF Plants for Non- Metallic Mines

Increase in the infrastructure projects and construction activity is expected to boost demand for nonmetallic minerals like limestone, gypsum, and clay. The future of non-metallic mines in India is predicted to be promising due to strong local demand, favorable government regulations, and increased investment in the sector. Following this, there will be significant demand for Diesel Exhaust Fluid (DEF) facilities in India. As India has been tightening its pollution rules, the demand for DEF would be pushed up. The advent of BS-VI rules, corresponding to Euro VI, has raised the necessity for DEF in diesel vehicles equipped with SCR systems. Growth in industries increases the demand for diesel-powered machinery and vehicles, which raises the demand for DEF.

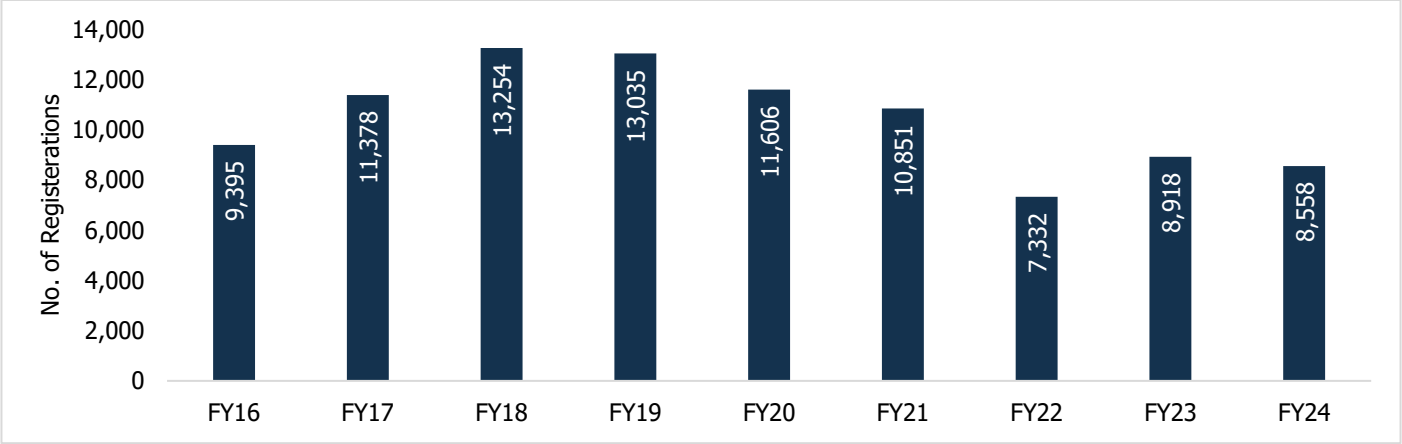
Earth Moving Equipment

In recent years, there has been an exponential increase in demand for contemporary infrastructure. The government has implemented a number of programs, including PMAY, Housing for All by 2022, and Smart Cities Mission, which call for either building new infrastructure or improving current infrastructure. It is reasonable to anticipate that these plans will benefit both the building and construction equipment sectors.

Because of its size and importance, earth-moving equipment is easily the most identifiable apparatus on any construction site. It is used in many different applications within the construction sector. They are utilized for many different types of earthworks, such as trench digging, demolition work, grading soil, removing dirt and boulders, and installing foundations. Professionals run these intricate machineries.

The mining industry uses a wide range of construction equipment, including cranes, forklifts, off-highway dumpers, scrapers, rope shovels, dump trucks, tippers, pavers, wheel loaders, bulldozers for coal mining work, and so forth. These pieces of machinery are capable of carrying out a wide range of tasks, including material handling, excavation, earthmoving, road construction, and ground preparation. Without a question, bulldozers and other earth moving equipment are the most often utilized pieces of equipment in the coal mining industry.

Chart 20 : Trend of Registrations of Earth Moving Equipment



Source: Vahan Dashboard

A variety of causes contributed to a drop in Indian Earth Moving Equipment industry sales between FY20 and FY22. The COVID-19 pandemic's second and third waves had a negative impact on the nation's construction activity and continued to cause supply chain disruptions, which limited the industry's capacity to meet the growing demand. As a result, the construction industry saw a 32% volume de-growth in FY22 (y-o-y).

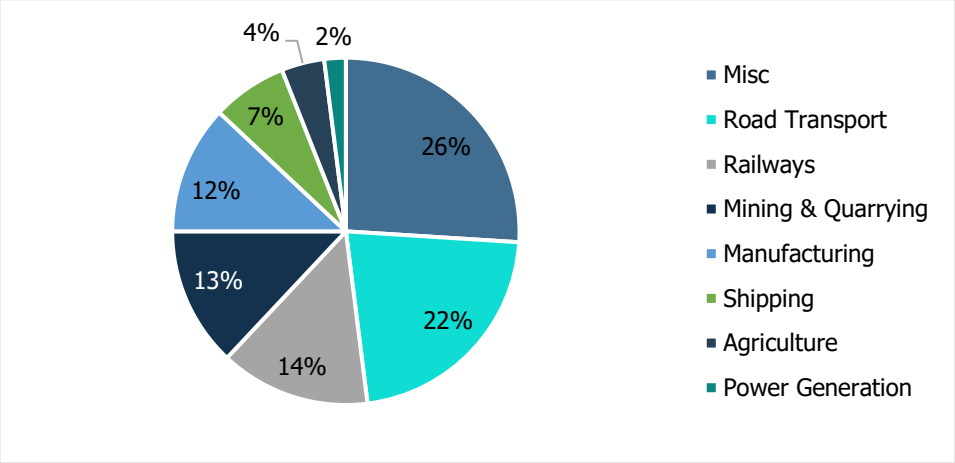
With the planned expansion in mines, the share of earth moving equipment in the mining application segment is likely to climb now as the machines are employed in a number of projects and growth. The successful and timely execution of projects is greatly dependent on earth moving equipment, which is used for everything from site preparation and foundation work to grading and landscaping. In rising nations, where there is a significant focus on rapid infrastructure construction and urbanization, there is a particularly strong demand for earth moving equipment.

Furthermore, diesel engines are the dominant source of power in the mining industry due to their power, performance reliability, mobility, durability, and fuel efficiency. In comparison to other fuel types, diesel generators are more dependable, resilient, have a lower volatility rate, and have the capacity to move up to 300 tons of material at once.

Three primary core functions are provided by diesel engines in the mining industry:

1. Heavy machinery in general: excavators, loaders, and bulldozers.
2. Vehicles used for transportation: For transporting employees and raw supplies.
3. Power generators: To supply isolated areas with electricity.

Chart 21 : Direct Sales HSD Apr-Mar'24 (10,483 TMT)



Source: PPAC

For the extraction, transportation, and processing of natural resources, the mining industry requires diesel-powered machinery such as shovels, drills, haul trucks, excavators, and material handling equipment. About 72% of the energy utilized in the mining sector, including for big drills, shovels, and digging equipment, comes from diesel generators.

5.6 Effect of Vehicle Scrapping Policy on BS VI compliant Diesel Vehicle Manufacture

India's policy on vehicle scrappage helps lower pollution, improve safety, and boost auto sales. The goal of the program, which went into force in April 2022, is to gradually phase out older cars, which should improve the quality of the air and reduce air pollution. By reducing greenhouse gas emissions, the program also contributes to the protection of natural resources and the slowing of climate change.

The auto sector in India has demonstrated its inventiveness. A few automakers released BS VI-certified cars three to four months ahead of April 1, while an established automotive manufacturer introduced its first gasoline vehicle that complied with BS VI regulations in April 2019, almost a full year ahead of schedule. Domestic brands executed the majority of their BS VI research and development work in-house.

Heavy Commercial Vehicles (HCVs) held by the government that are more over 15 years old had to be scrapped as of April 1, 2023. The goal of this stage is to lessen carbon footprints. Older car scrapping can help create a circular economy and lessen India's need on imported rubber and metals like copper and aluminum.

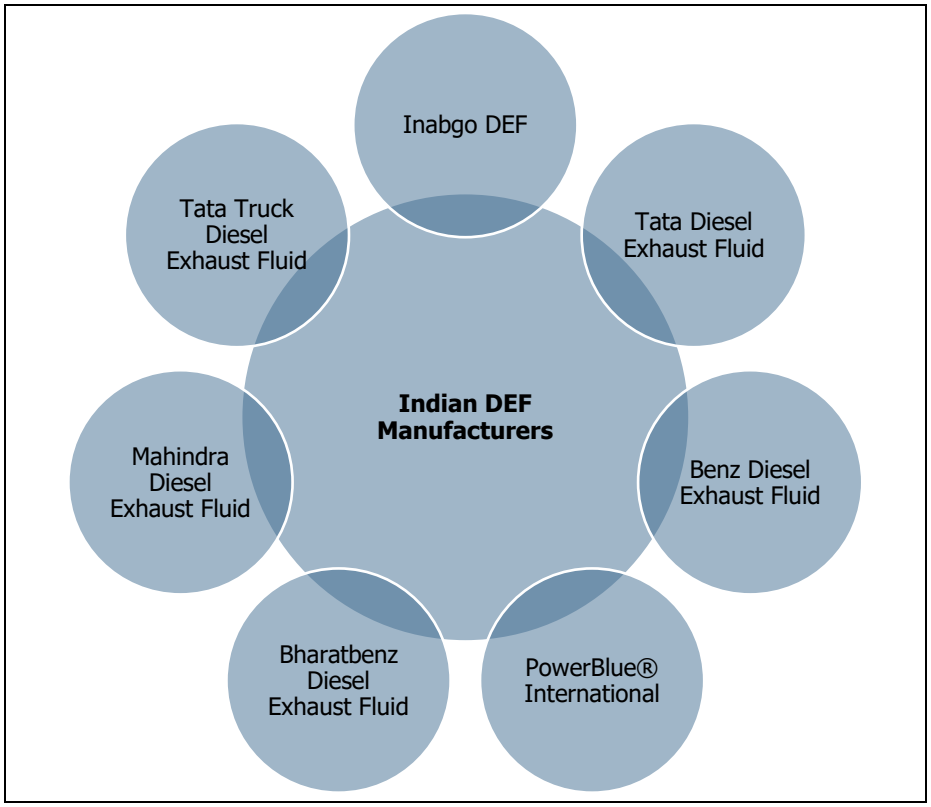
Due to the implementation of BS VI rules, Indian automakers are shifting their focus away from producing small diesel cars, which have lost their commercial appeal. This is because the government no longer provides a diesel fuel subsidy and because BS VI diesel vehicles are more expensive and require more maintenance. Because gasoline vehicles are an appealing and affordable option, the effects of these changes on the value proposition for diesels are most noticeable for those with smaller engines.

5.7 Diesel Exhaust Fluid (DEF) Manufacturer's in India with and without Verband der Automobilindustrie (VDA) Approvals

DEF, also known as Aqueous Urea Solution 32% (AUS 32), is a crucial additive for diesel-powered vehicles (also complied with BS VI norms) and heavy equipment. It's composed of 32.5% urea and 67.5% de-ionized water. These compounds aid in the conversion of nitrous oxide, a dangerous form of exhaust from diesel engines, into nitrogen and water, two common elements that make up our air. In essence, DEF plays a crucial role in initiating the chemical process that prevents harmful gasses released during the operation of diesel engines from entering the environment. DEF helps in reducing the emission of greenhouse gas, NOx into the environment.

This fluid is necessary to make sure that heavy-duty vehicles and equipment run in compliance with federal emissions regulations established by the Environmental Protection Agency (EPA). Because of these specifications, DEF is a common material that is utilized with almost all diesel engines. In the chemical reaction that takes place in selective catalytic reduction (SCR) systems, DEF is the reducing agent.

DEF has a two-year shelf life and is kept out of direct sunlight. Additionally, a few Indian businesses produce DEF-making machinery, such as: ActiveBlue, Ok Water System and MS Manufacturer of Diesel Exhaust Fluid.



In applications involving big combustion engines, Aqueous Urea Solution (AUS) 40, an aqueous high-purity urea solution at a concentration of 40%, is required to run converters with Selective Catalytic Reduction (SCR). Although Marine DEF is mostly employed in maritime applications, it is also being used more and more in rail and other land-based applications.

AdBlue, also known as AUS 32, is a clear, non-toxic urea solution used to lower the pollution emissions of diesel cars. AdBlue that has received VDA approval satisfies strict quality requirements by continuously meeting the necessary levels of concentration and purity. This quality level extends the life of a vehicle's pollution control system in addition to ensuring

greater emissions reduction. In every continent of AdBlue manufacture, VDA accreditation is the gold standard for quality and compliance.

In India, companies like - Bharat Petroleum Corporation Limited (BPCL) and Hindustan Petroleum Corporation Limited (HPCL) are VDA approved DEF manufacturers.

DEF Manufacturer's	Volume/ Production Overview
BPCL	In FY23, BPCL Lubes sales through the retail channel reached a sales volume of 35.8 thousand metric tons (TMT), of which 22.9 TMT were in Lubes and 11.9 TMT were in Diesel Exhaust Fluid (DEF). This represents a growth rate of 7.40% for Lubes and a combined growth of 16.58% for DEF and Lubes.
HPCL	HPCL increased commercial production and sales of Diesel Exhaust Fluid (DEF) for the second year in a row, reaching a record high of more than 25 TMT in FY23.

5.8 Overview of Market for AUS 40 DEF

AUS 40, occasionally referred to as Marine DEF, is a diesel exhaust fluid (DEF) mixture consisting of 40% urea in water. High-combustion diesel engines, including those seen in trains, large construction equipment, and maritime vessels, use it. Through a chemical reaction that turns the pollutants into nitrogen and water vapor, AUS 40 lowers the amount of nitrogen oxide (NOx) emissions from diesel engine exhaust systems.

Features of Diesel Exhaust Fluid 40:

- Non-toxic
- Non-polluting
- Non-hazardous
- Non-flammable
- Convert harmful emissions to harmless ones
- Increases fuel efficiency
- The freezing point of AUS40 Solution is around 0°C
- Meets ISO 18611-1:2014

When it comes to environmental awareness and vehicle economy, leading Diesel Exhaust Fluid (DEF) manufacturers are essential in lowering toxic emissions from diesel engines. These leading companies in the field are at the forefront of offering superior DEF solutions and guaranteeing adherence to strict environmental laws.

These businesses provide a selection of DEF products that improve engine efficiency and contribute to cleaner air thanks to their dedication to innovation and sustainability. They play a crucial role in advancing a more environmentally friendly future while preserving the reliability and effectiveness of diesel-powered automobiles as dependable partners for the business and industrial sectors.

Some of the leading companies in the global diesel exhaust fluid market are:

1. BASF SE (Germany)

A global player in the chemical industry with a strong emphasis on innovation, BASF SE is a German multinational corporation that produces DEF. The company's DEF products are regarded for their high quality and dependability, making them a popular choice among vehicle makers and fleet operators.

2. China Petrochemical Corporation (Sinopec) (China)
With a large presence in the Asia-Pacific area, Sinopec, a state-owned oil and gas firm in China, is a significant player in the worldwide DEF market. Due to its vast manufacturing capacity and distribution network, the company is a dependable DEF supplier to clients worldwide.

3. Brenntag AG (Germany)
Brenntag AG, a German-based worldwide distributor of chemicals and ingredients, offers Specialty Products in North America and Europe. These products include degreasers, cleansers, diesel exhaust fluid (DEF), salt neutralizer, car washes, fuel colors, and additives for engine and electric vehicle coolants.

4. **TotalEnergies (France)**
In Europe, TotalEnergies, a multinational energy corporation based in France, is a prominent manufacturer and supplier of DEF.

5. **Mitsui Chemicals Inc. (Japan)**
Mitsui Chemicals Inc., a Japanese chemical business, is a significant DEF producer in Asia, with an increasing position in the international market.

Other global companies in the production of DEF are- Faurecia SE (France), Cummins Inc. (USA), Honeywell International Inc. (USA), Agrium Inc. (Canada), Shell PLC (The Netherlands), etc.

The DEF market is a vibrant, quickly expanding sector of the economy. The businesses on the above list are setting the standard for technological advancement and innovation. The need for DEF is anticipated to increase even more as emission standards continue to tighten.

5.9 Impact of EV Vehicles on Diesel Consumption

Under its energy transition plans, India would reduce its oil demand growth by 480,000 b/d between 2023 and 2030 by introducing new electric vehicles and improving energy efficiency. Without these actions, India's oil demand would have grown to 1.68 million barrels per day by 2030 instead of the projected 1.2 million barrels per day growth (IEA projections).

India's industrial growth will make it the main driver of the global oil demand rise between now and 2030, predicts the IEA. However, the country's need for gasoline will only increase by 0.7 percent during this time, compared to a 40% growth in the number of cars in India due to rising EV and biofuel usage.

Notwithstanding an increase in the use of diesel, the analysis projected that by 2030, the electrification of India's car fleet would cut the country's need for oil products by 200,000 b/d. This indicates that up until 2030, electrification will have a significant impact on fuel demand.

5.10 Dependency on Imported Raw Material, i.e.- Technical Grade Urea used for Manufacture of DEF

Technical Grade Urea is an organic compound. An essential function of urea is in the metabolism of nitrogen-containing substances. Technical urea is a solid that is colorless and odorless. It dissolves easily in water and is mostly non-toxic. Further, it lowers the amount of nitrogen oxide (NOx) released into the exhaust gas in diesel engines. In order to improve

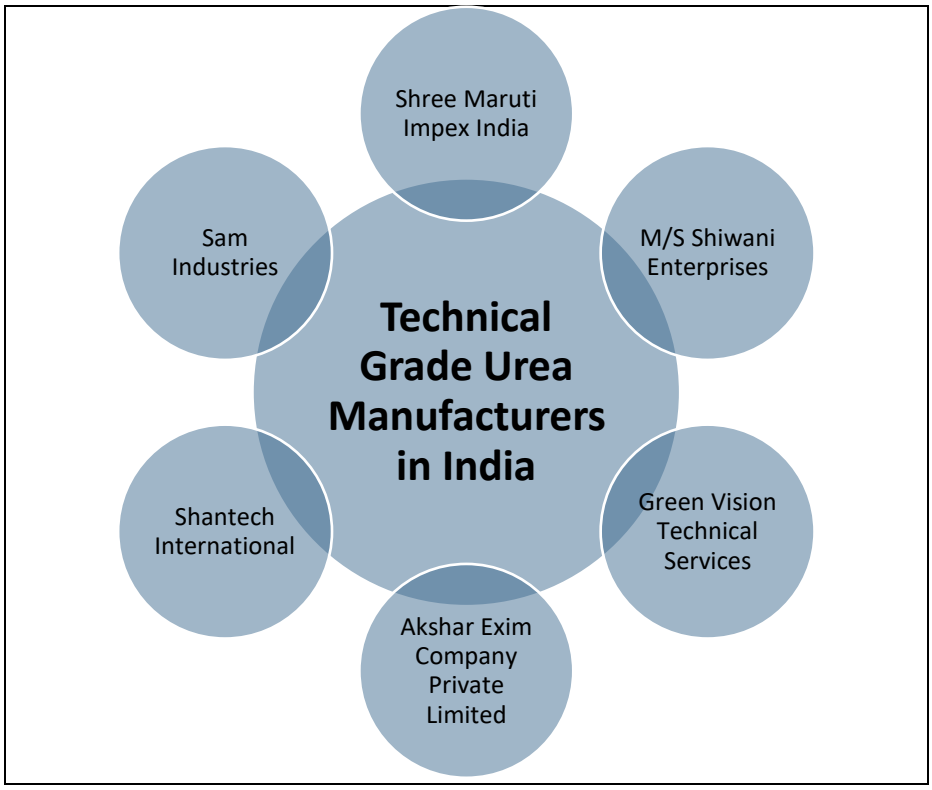
engine performance and fuel efficiency, Technical Grade Urea is injected into the exhaust stream prior to the catalytic converter. It is utilized as diesel exhaust fluid (DEF) and is also referred to as automotive grade urea. DEF is a solid, white, cylindrical pellet with 46% nitrogen by weight. At least 80% of the material in technical grade urea is in the size range of 1 mm to 2.8 mm.

Technical grade urea is a highly purified nitrogen source utilized in a variety of industries, whereas fertilizer grade urea is a nitrogen source used in fertilizers. Technical grade urea and fertilizer grade urea differ primarily in terms of purity and manufacturing norms. In general, technical grade urea is purer than fertilizer grade urea.

Technical grade urea works well in high pH soils since it is less acidifying than many other nitrogenous fertilizers. It can support bloom growth and enhance soil quality and productivity. The high concentration of nutrients in technical grade urea makes it less expensive to pack, store, and transport.

Applications for technical grade urea are numerous and include:

1. Creation of fertilizers that dissolve in water
2. The industries of dyes and pigments
3. Feed for cattle
4. Production of urea formaldehyde resin
5. Manufacturing diesel exhaust fluid to reduce pollution
6. The glue and plywood industries



Technical grade urea (TGU) is now freely imported into India for use in industry and the production of non-perishable fertilizers. A State Trading Corporation was previously in charge of approving these imports.

5.11 Expected Change in Energy Basket in India in Transport Sector, i.e.- Fossil Fuels, EV, Bio- Diesel, Hydrogen, etc.

- **Fossil Fuels & EVs**

Internal combustion engines (ICE) —which are often powered by fossil fuels—remain the backbone of motorized transportation on land, at sea, and in the air. Over one-third of CO2 emissions from end-use sectors are attributed to transportation.

According to the IEA, the Net Zero Scenario calls for a reduction in transportation sector emissions by 2030, despite an increase in transportation demand. Policies must promote the transition to more energy-efficient vehicles, such as electric trucks and cars, as well as less carbon-intensive modes of transportation, like walking, cycling, and public transportation.

Table 5: Passenger Transport Service Demand by Vehicle Type and Fuel (billion passenger-kilometres)

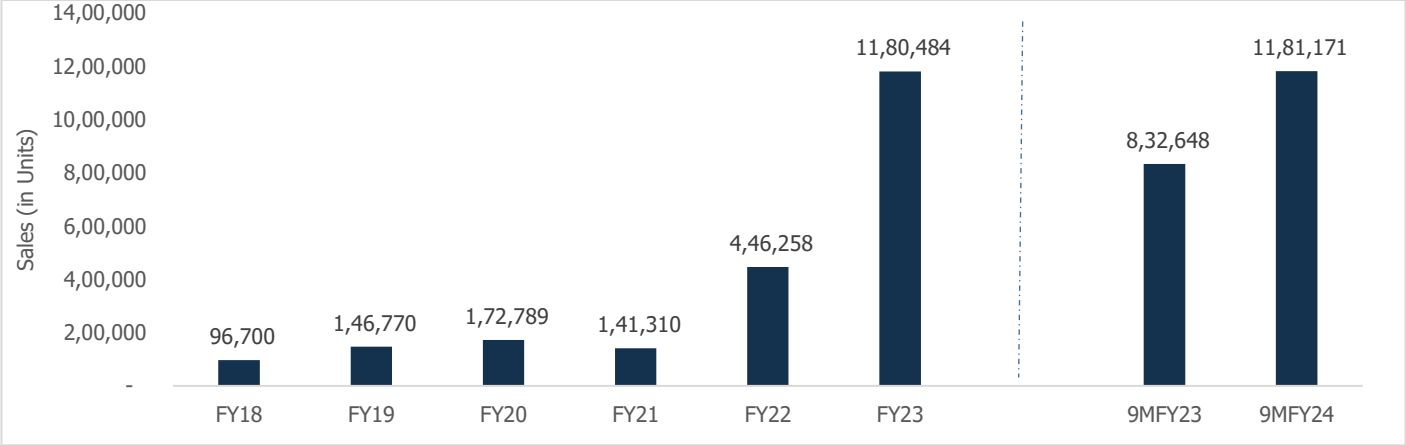
Vehicle Type	Fuel	2020	2025	2030	2035	2040	2045	2050
4W	BEV	2	31	179	533	1,062	1,753	2,564
	ICE*-Oil	329	456	564	632	673	689	679
	ICE-CNG	13	69	147	232	314	390	450
2W	BEV*	38	185	781	1,249	1,565	1,609	1,556
	ICE-Oil	1,073	1,285	1,095	853	522	326	194
3W	BEV	2	12	71	204	287	293	235
	ICE-Oil	404	388	322	208	106	42	16
	ICE-CNG	83	149	197	170	104	47	20
Bus	BEV	0	1	10	52	101	128	131
	ICE-Oil	561	524	407	279	177	113	75
	ICE-CNG	81	73	91	85	68	53	41

Source: CEEW

Note- (*) ICE stands for Internal Combustion Engine; BEV- Battery Electric Vehicle

The Electric Vehicle (EV) segment in India has been on an upward trend, parallel to the declining domestic sales of Internal Combustion Engine (ICE) vehicles in the last few years, attributed to the slowdown in the economy and consumption demand in FY20, COVID-19 impact, and economic degrowth in FY21. The other factors impacting ICE vehicle sales include increased fuel prices, semiconductor shortages, and rising vehicle prices. Whereas, in FY23, domestic automobile sales grew by 20% across segments, supported by healthy demand in the urban areas, increasing replacement demand, growing demand for utility vehicles in the passenger vehicle segment, vehicle scrappage policy, and higher infrastructure spending. The sales trend of Electric Vehicles in India is depicted below:

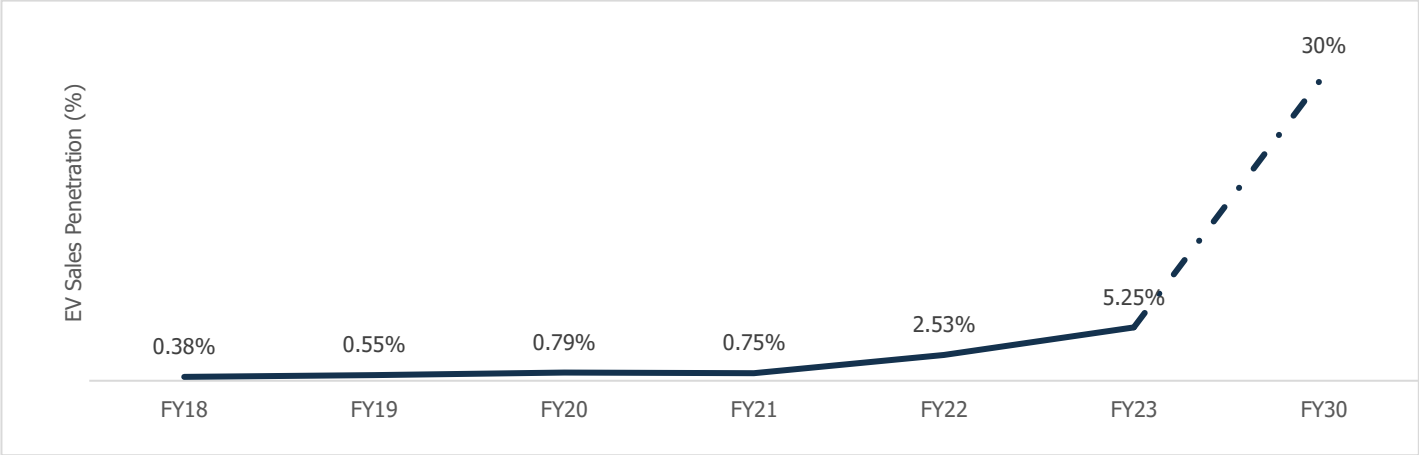
Chart 22: Total Electric Vehicle Sales in India (in Units)



Source: Center for Energy Finance, CareEdge Research

Overall, the penetration of EVs has increased to 6.23% of the total vehicle sales in 9MFY24. This can be aligned to the ambitious targets set by the Government of India at 30% EV penetration by 2030. Accordingly, the growing EV sales in FY23 are accredited to favorable government policies to reduce upfront costs in EVs, expansion of charging infrastructure, rising fuel prices, and shifting consumer preferences.

Chart 23: Overall EV Sales Penetration in India



Source: Center for Energy Finance, SIAM, CareEdge Research

The government's favorable policies are unleashing India's potential to revolutionize the global mobility landscape. The automobile sales are expected to gain traction with the recent announcements in Budget 2023-24 on the Vehicle Scrappage Policy, increased infrastructure spending, lowered direct taxes, and focus on green mobility. In addition, with the growth in sales of electric vehicles (EVs), the auto component industry is witnessing a fast transformation to be an integral part of the EV manufacturing supply chain.

The industry is making steady investments and also acquiring technology companies. Several global firms are looking forward to investing in the Indian auto components industry, given its increased focus on deep localization and the announcements of the PLI schemes by the government on Advanced Chemistry Cell (ACC) Batteries and auto & auto components. Such factors will enable the development of attractive alternative sources of high-end auto components in India.

EV's Impact on DEF-

Diesel exhaust fluid (DEF) demand is significantly impacted by electric cars (EVs), primarily because EV adoption reduces the need for DEF in the transportation sector. DEF usage declines in tandem with a drop in the demand for diesel vehicles as more consumers and industry transition to electric vehicles. In general, the increasing popularity of electric vehicles is anticipated to reduce the need for DEF over time; however, the degree of this effect will vary depending on how quickly and widely EVs are adopted in various industries and geographical areas.

The affect will be gradual rather than immediate as there are several factors that will impact the transition from diesel powered vehicle to electric vehicles- vehicle fleet turnover, infrastructure development, technological maturity, cost considerations and regulatory environment. In conclusion, the demand for DEF will unfold over a longer horizon, mostly after a decade.

- **Bio Diesel**

Biodiesel is a renewable, biodegradable, and environment friendly fuel derived from vegetable oils, animal fats, and waste oils. It possesses roughly 10% built-in oxygen and neither sulfur nor aromatics. Utilizing biodiesel as a fuel for vehicles can enhance environment and public health, increase safety, and build a more robust transportation network.

On April 30, 2019, the government released guidelines for the sale of biodiesel that can be blended with high-speed diesel for transportation. The Government has authorized the sale of biodiesel (B-100) exclusively through this notification, and not in any combination, regardless of percentage.

The amount of biodiesel that OMCs purchased grew from 11 million liters in 2015–16 to 105.6 million liters in 2019–20.

India has the potential to increase the production of biodiesel for diesel cars and biojet fuel to replace jet fuel. The IEA estimates that the government has set a target of 5% biodiesel by 2030, which would mean producing over 4.5 billion liters of biodiesel annually. A similar combination of policies as those for ethanol, such as production support, guaranteed pricing, and feedstock support, will be needed to mobilize production.

However, in comparison to the amount of Bio Diesel produced, the demand is enormous. Furthermore, it is difficult to find the raw ingredients needed to make biodiesel in India, and their cost changes with the seasons.

The following are additional issues influencing India's low production of biodiesel:

1. **Feedstock:** Jatropha and other oilseed crops are scarce sources of feedstock.

2. **Land:** Food crops are the main emphasis of the agricultural sector, and there is a limited supply of wasteland.

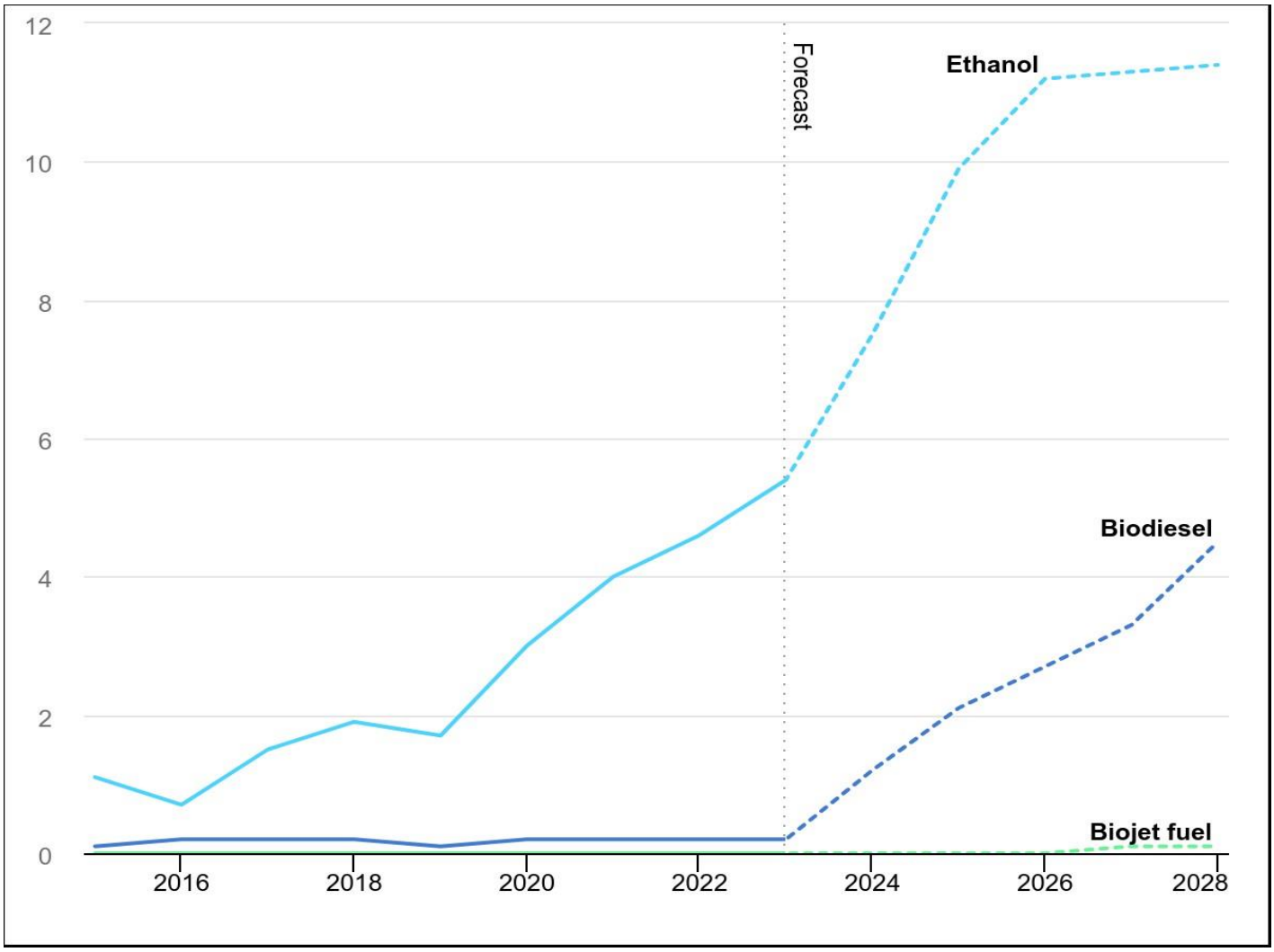
3**. Cost:** Exorbitant prices for biodiesel and costly plantation and maintenance expenses.

4. **Supply chain:** The informal sectors' production of biodiesel is not supported by Indian oil marketing companies (OMCs) and there is a lack of integrated supply-chain management.

5. **Demand:** Insufficient demand.

Eliminating barriers to greater ethanol blends and expanding the use of biofuel to replace diesel and jet fuel could roughly increase usage and production over the next five years. It must, however, monitor expenses, ensure the sustainability of feedstock, and implement regulations that favor biofuels other than ethanol.

Chart 24: Biofuel consumption in the accelerated case in India, 2015 to 2028



Source: IEA

Another emerging market is biojet fuel. Indicative blending targets of 1% by 2027 and 2% by 2028 were declared by the Ministry of Oil, Petroleum, and Natural Gas in 2023, for foreign flights departing from India. This would require about 100 million litres of biojet fuel annually, according to IEA estimates, most of which would originate from vegetable oils or residue that is farmed on marginal land. Future development, though, might come from alternative technologies, like ethanol-based alcohol-to-jet and gasification technologies, which turn municipal, forestry, and agricultural solid waste into jet fuel.

Biodiesel Impact on DEF-

Biodiesel use has an intricate link with diesel exhaust fluid (DEF) since it influences emissions and diesel engine performance in ways that are related to DEF requirements. In comparison to conventional diesel, biodiesel usually results in reduced particulate matter (PM) emissions, but it can also cause a bit more nitrogen oxide (NOx) emissions. Higher NOx emissions from biodiesel may increase the need for DEF to meet strict emission regulations because DEF is utilized in Selective Catalytic Reduction (SCR) systems to minimize NOx emissions.

- **Hydrogen**

With the commencement of pilot projects in January 2023, the National Green Hydrogen Mission promotes the use of green hydrogen in the transportation sector. In order to test the use of green hydrogen as fuel in buses, lorries, and four-wheelers, the government has released regulations that will require a total budgetary spending of Rs 4,960 million till the fiscal year 2025–2026. The generation of 5 million metric tonnes of green hydrogen annually by 2030, together with a corresponding 125 GW of renewable energy capacity, is the ambitious objective set by the Indian government. The government plans to achieve 15 GW of electrolysis capacity by 2030 in order to meet this production target. The Hydrogen Mission's policy actions are intended to bring the cost of green hydrogen production down to $1.5 per kilogram by 2030.

The objective is to establish India as a frontrunner in the production and utilization of green hydrogen, strengthening the nation's clean energy autonomy, diminishing reliance on imported fossil fuels, and driving the worldwide shift towards cleaner energy.

In conclusion, even though EVs, biodiesel and hydrogen are form of a cleaner fuel as compared to diesel, the latter, in the medium term, is expected to fulfill the India's rising energy demand from population growth and industrial activities, as well as from increased oil and gas exploration and production spending.

Hydrogen Impact on DEF-

Diesel Exhaust Fluid (DEF) demand is greatly impacted by the use of hydrogen as a fuel source. This is mainly because hydrogen-powered vehicles function differently from conventional diesel engines in several fundamental ways. Fuel cell vehicles (FCVs) that run on hydrogen and oxygen undergo a chemical reaction that produces electricity, with water as the only byproduct. The technique essentially eliminates NOx emissions, therefore in hydrogen-powered vehicles, DEF—a substance used in diesel engines to lower NOx—is not necessary at all. All things considered, the move to hydrogen as a fuel source poses a long-term danger to the need for DEF because vehicles running on hydrogen may cause some industries to drastically cut back on or stop using DEF altogether.

However, the adoption of hydrogen powered vehicles and their impact on DEF usage will take time, much like transition to EVs.

6 Distribution of Petroleum Products and Natural Gas Industry

6.1 Overview

Natural Gas is a mixture of hydrocarbon gases and contains substances like - Methane, Ethane, Propane, Butane and some other heavier fractions of gases. When these gases are removed from the gas stream, it is referred to as Natural Gas Liquid (NGL) and when Natural Gas is compacted at a pressure of 250 bars, it is known as Compressed Natural Gas (CNG). This highly flammable gaseous hydrocarbon is used for multiple purposes as it is one of the cleanest and safest energy forms as compared to other energy sources such as - coal. When burned, natural gas produces 30% - 40% less Carbon Dioxide (CO_2) than coal.

Table 6: Fractions of Natural Gas

Fraction	Common Name	Applications
C1	Methane	Fuel and feedstock for urea plants and fuel for power plants.
C2	Ethane	Production of petrochemicals.
C3	Propane	Production of petrochemicals, liquefied petroleum gas (LPG), auto fuels, and industrial fuels.
C4	Butane	Production of LPG.
C5 and heavier	Other Fractions	Production of solvents and pentane.

Source: MCX

6.2 Trend of Natural Gas Consumption in India

Table 7: Natural Gas Consumption in India

Financial Year	(Figure in)	FY19	FY20	FY21	FY22	FY23	FY24
Net Production	MMSCM	32,056	30,257	27,784	33,131	33,664	35,717
(as % of Total Consumption)	%	53%	47%	46%	52%	56%	54%
LNG import	MMSCM	28,740	33,887	33,198	31,028	26,304	30,917
(as % of Total Consumption)	%	47%	53%	54%	48%	44%	46%
Total Consumption (Net Production + LNG import)	MMSCM	60,796	64,144	60,981	64,159	59,969	66,634

Source: PPAC

The consumption of gas during the year FY24 stood at 66,634 MMSCM, which is 11% higher than consumption of 59,969 MMSCM in FY23. During the year FY23, gas consumption declined by 6.5% from the year FY22. This resulted from high prices making gas less affordable than other fuels. Natural gas prices spiked in February 2022 as a result of the conflict between Russia and Ukraine.

IEA estimates India's import dependence for natural gas to grow in the coming years. The import dependence increased from 20% in 2010 to around 44% in 2022-23. Natural Gas used in buildings have tripled over the last decade and this has been partly offset by the fall in demand in power sector.

6.3 Trend of Import of Liquified Natural Gas

India is highly dependent on the imported LNG to meet its gas demand with imports contributing to around 46% of total consumption in FY24. The trend of import of liquefied natural gas in India is depicted below:

Table 8: Import of LNG

Year	FY19	FY20	FY21	FY22	FY23	FY24	FY25 (P)	FY26 (P)	FY27 (P)	FY28 (P)	FY29 (P)
Units in MMT	21.54	24.42	25.05	23.42	19.85	23.30	24.29	25.50	26.49	27.61	28.68
Units in MMSCM	28,547	32,352	33,198	31,028	26,304	30,917	32,229	33,843	35,153	36,634	38,052
Year	FY19	FY20	FY21	FY22	FY23	FY24	FY25 (P)	FY26 (P)	FY27 (P)	FY28 (P)	FY29 (P)
Units in MMT	21.54	24.42	25.05	23.42	19.85	23.30	24.29	25.50	26.49	27.61	28.68
Units in MMSCM	28,547	32,352	33,198	31,028	26,304	30,917	32,229	33,843	35,153	36,634	38,052

Source: PPAC; CMIE; CareEdge Projections
Note: MMSCMD stands for Million Metric Standard Cubic Meters Per Day

India has been one of the largest importers of natural gas since last many years. With the GoI's vision of making India a gas-based economy, share of natural gas is anticipated to be increased from 6% to 15% by 2030. Following the same, imports of Natural Gas is further expected to rise as there are import terminals under construction. LNG imports are completely dependent on the completion of import terminals. Since the year 2016, India has expanded the list of countries from which it imports LNG. Major countries that supply gas to India are Russia, Qatar and USA. The first LNG shipment from Qatar to India took place in 2004 at the Dahej Terminal.

India is highly dependent on the imported LNG to meet its gas demand with imports contributing to around 46% of total consumption in FY24.

6.4 Natural Gas Infrastructure in India (Import Terminal)

LNG Import Terminal or LNG Terminals are facilities which are used for the purpose of degasifying the LNG shipped in by large LNG tankers from various production zones. These terminals are made to provide services such as -

- Berthing of LNG tankers and unloading or reloading of cargoes,
- Storage of LNG in cryogenic tanks (-160°C),
- Regasification of LNG and Injection of this gas into the transmission grid.

As on May, 2024, there are total seven RLNG terminals operating in the country with varying capacity utilization. India is expected to have new LNG terminals at Chhara and Jafrabad, which are expected to commence operations in the second half of 2024. The existing and potential capacity of LNG regasification terminals in India is presented in the table below:

Table 9: LNG Terminal in India (Operational)

Location	Promoters	Capacity as on 01.05.2024 (MMTPA)	% Capacity utilization (April-March, 2024)
Dahej	Petronet LNG Ltd (PLL)	17.5	95.1
Hazira	Shell Energy India Pvt. Ltd.	5.2	30.3
Dabhol	Konkan LNG Limited	*5	42.7
Kochi	Petronet LNG Ltd (PLL)	5	20.6
Ennore	Indian Oil LNG Pvt Ltd	5	18.3
Mundra	GSPC LNG Limited	5	14.6
Dhamra	Adani Total Private Limited	5	27.4
Total Capacity		**47.7**	
Jafrabad	Swan LNG Terminal	**5 MMTPA	NA (Yet to be commissioned)
Chhara	Chhara LNG Terminal	**5 MMTPA	NA (Yet to be commissioned)
Grand Total Capacity		**57.7 MMTPA**	

Source: PPAC

Note: (*) stands for - To increase to 5 MMTPA with breakwater. Only HP stream of capacity of 2.9 MMTPA is commissioned; (**) stands for- under construction site.

The capacity of RLNG terminals in India is expected to increase assuming all the existing and planned terminals in India would set up as planned. This is to be driven by the expansion of existing facilities on the west coast including Mundra and Dahej and construction of new floating terminals.

6.5 Awards & Projects in Pipeline

Gas Pipeline infrastructure is an economical and safe mode of transporting the natural gas by connecting gas sources to gas consuming markets. Gas pipeline grid determines the structure of the gas market and its development. Therefore, an interconnected National Gas Grid has been envisaged to ensure the adequate availability and equitable distribution of natural gas in all parts of the country. The vast potential that gas offers in India has prompted energy companies to push plans to expand the LNG terminals capacity in India, a move that will expand the clean fuel's reach to relatively smaller pockets of demand where there is limited pipeline access. A brief of major gas pipeline projects which are under construction are-

Under Construction Common Carrier Natural Gas Pipelines (as of June 30, 2023)

Table 10: Under construction Natural Gas Pipelines in India

S. No.	Name of Natural Gas Pipelines	Name of Authorized Entity	Date of Authorization	Authorized Length (KM)	Authorized Capacity (MMSCMD)	Target date of Completion	States from which Pipeline passes
1	Kakinada – Vizag – Srikakulam	APGDC	16.07.2014	275	90	June, 2024	Andhra Pradesh

S. No.	Name of Natural Gas Pipelines	Name of Authorized Entity	Date of Authorization	Authorized Length (KM)	Authorized Capacity (MMSCMD)	Target date of Completion	States from which Pipeline passes
2	Ennore-Nellore	GTIL	02.12.2014	220	36	April, 2020	Andhra Pradesh, Tamil Nadu
3	Kakinada-Vijayawada-Nellore	IMC	19.02.2018	667	18	March, 2024	Andhra Pradesh
4	North-East Natural Gas Pipeline Grid	IGGL	17.11.2020	1,656	4.75	Nov, 2023	Assam, Mizoram, Manipur, Arunachal Pradesh, Tripura, Nagaland, Meghalaya & Sikkim, West Bengal
5	Kanai Chhata - Panitar	HPPL	08.07.2019	317	19.2	May, 2023	West Bengal
6	Srikakulam-Angul	GAIL	23.07.2019	690	6.65	July, 2023	Andhra Pradesh, Odisha
7	Mumbai-Nagpur-Jharsuguda	GAIL	15.05.2020	1755	16.5	October, 2024	Maharashtra, Madhya Pradesh, Chhattisgarh and Odisha
8	Jamnagar to Dwarka (Gujarat)	GSPL	19.08.2021	100	3	August, 2024	Gujarat
9	Hazaribagh-Ranchi	IOCL	09.02.2023	65	1.03	February, 2026	Jharkhand
10	Gurdaspur-Jammu	GAIL	12.07.2023	160	3.1	July, 2026	UT of Jammu &

S. No.	Name of Natural Gas Pipelines	Name of Authorized Entity	Date of Authorization	Authorized Length (KM)	Authorized Capacity (MMSCMD)	Target date of Completion	States from which Pipeline passes
							Kashmir, Punjab

Source: PNGRB

A) Under Construction Tie-in connectivity (as on June 30, 2023)

Sr. No.	Name of Natural Gas Pipelines	Entity	Date of Authorization	Auth. Length (KM)	Authorized Capacity (MMSCMD)	Target date of Completion	States from which Pipeline passes
1	Kakinada Deep Water Sea Port to KG Basin Network at NFCL terminal, East Godavari district	ECCPL	21.02.2018	4	6.31	December, 2022	Andhra Pradesh
2	ONGC's Odelarevu terminal, Mallavaram connecting Kakinada-Vijayawada-Nellore NGPL	IMC	06.09.2019	49.10	18.00	March, 2024	Andhra Pradesh
3	GSPL's proposed Terminal at Petronet LNG Limited re-gasification expansion facilities, Dahej to GSPL's existing Terminal at Bhadbhut	GSPL	17.09.2019	39	14.77	September, 2022	Gujarat
4	HSEPL LNG Terminal at Chhara to GSPL's dispatch terminal at Londhpur	GSPL	17.09.2019	85	18.00	December, 2022	Gujarat
5	Proposed LNG Terminal at Karaikal Port to Chemplast/ PPCL on existing Narimanam - Kuthalam Natural Gas Pipeline Sub-Network of GAIL's Cauvery Basin Network	AGPKLPL	24.07.2020	8	2.00	July, 2023	Tamil Nadu and UT of Puducherry

Sr. No.	Name of Natural Gas Pipelines	Entity	Date of Authorization	Auth. Length (KM)	Authorized Capacity (MMSCMD)	Target date of Completion	States from which Pipeline passes
6	ONGC's Jharia CBM Block to SV-28 on DobhiDurgapur Section of GAIL's JHBDPL	GAIL	19.08.2021	6	0.87	August, 2024	Jharkhand
7	ONGC's Bokaro CBM Block to SV-01A on BokaroDharma Section of GAIL's JHBDPL	GAIL	19.08.2021	23	0.99	August, 2024	Jharkhand
8	Swan LNG Private Limited's FSRU-based LNG Terminal at Jafrabad to GPPC Terminal, Jafrabad falling on the Darod-Jafrabad section of GSPL's HPGGG	GSPL	19.08.2021	3	18	August, 2024	Gujrat
9	Swan LNG Private Limited's RLNG Terminal at Jafrabad to Hadala falling on the Gana-Hadala section of GSPL's HPGGG	GSPL	31.12.2021	198	18	December, 2024	Gujrat
10	Swan LNG Private Limited's RLNG Terminal at Jafrabad to GAIL's terminal at Dahej connecting to its integrated HVJ Natural Gas Pipeline	GAIL	31.12.2021	170	7	December, 2024	Gujrat
11	Vedanta Limited's Jaya Fields at Jambusar, Gujarat to South Gujarat Main subnetwork of GAIL's Gujarat Natural Gas Pipeline Network	GAIL	07.03.2022	18	0.1	March, 2025	Gujrat

Sr. No.	Name of Natural Gas Pipelines	Entity	Date of Authorization	Auth. Length (KM)	Authorized Capacity (MMSCMD)	Target date of Completion	States from which Pipeline passes
12	EPS 1 of Jharia Block I to SV-28 on Dobhi-Durgapur Section of JHBDPL of GAIL (India) Ltd.	GAIL	28.10.2022	9	0.79	October, 2025	Jharkhand
	Total			**612.1**			

Source: PNGRB

B) Under Construction Dedicated Natural Gas Pipelines (as on June 30, 2023)

Sr. No.	Name of Natural Gas Pipelines	Name of Authorized Entity	Date of Authorization	Auth. Length (KM)	Authorized Capacity (MMSCMD)	States from which pipeline passes
1	INOLE to Pashamylaram	APCPL	14.12.2012	14.60	1.5	Telangana
2	PLL Re-gasification Terminal, Dahej to SUGEN Power Plant	TPL	20.03.2020	90.00	6.5	Gujarat
3	PLL to OPaL, Dahej	OPaL	20.03.2020	17.00	3.32	Gujarat
Total				**121.60**		

Source: PNGRB

C) Under Construction Sub-Transmission Pipelines (as of June 30, 2023)

Sr. No.	Geographical Area/ CGD Networks	Authorized CGD Entity	STPL Length (KM)	Transmission PL from Tap-off taken	Transmission PL Entity
1	Jalandhar	JMEPL	4.00	DBNPL	GAIL
2	East Godavari District (EAAA)	GGPL	51.30	KG basin Network	GAIL
3	West Godavari District	GGPL	53.40	KG basin Network	GAIL
4	Barwala & Ranpur Talukas	ATGL	0.65	HPGGG	GSPL
5	Udupi District	ATGL	3.10	KKMBPL	GAIL

Sr. No.	Geographical Area/ CGD Networks	Authorized CGD Entity	STPL Length (KM)	Transmission PL from Tap-off taken	Transmission PL Entity
6	Balasore, Bhadrak & Mayurbhanj Districts	ATGL	0.10	JHBDPL	GAIL
7	Puducherry District	ECNGDPL	8.00	ETBPNMTPL	IOCL
8	Cuddalore, Nagapattinam & Tiruvarur Districts	ATGL	0.20	ETBPNMTPL	IOCL
9	Jhansi (EAAA) District, Bhind, Jalaun, Lalitpur and Datia Districts	ATGL	0.60	HVJ	GAIL
10	Medak, Siddipet & Sangareddy Districts	TGPL	2.00	EWPL	PIL
11	Bilaspur, Hamirpur & Una Districts	BPCL	4.70	GAIL	GAIL
12	Ballari & Gadag Districts	BPCL	0.10	GAIL	GAIL
13	Jagatsinghpur & Kendrapara Districts	BPCL	1.80	GAIL	GAIL
14	Chatra & Palamu Districts	BPCL	0.85	GAIL	GAIL
	Total		**130.80**		

Source: PNGRB

6.6 Metering Skids Equipment Market in Gas Pipeline Infrastructure Industry

Metering skids equipment in the gas pipeline infrastructure industry in India is a subset of the larger oil and gas equipment market. In order to maintain correct billing, regulatory compliance, precise measurement of gas flow in pipelines, and the effectiveness of the gas distribution network, metering skids are essential.

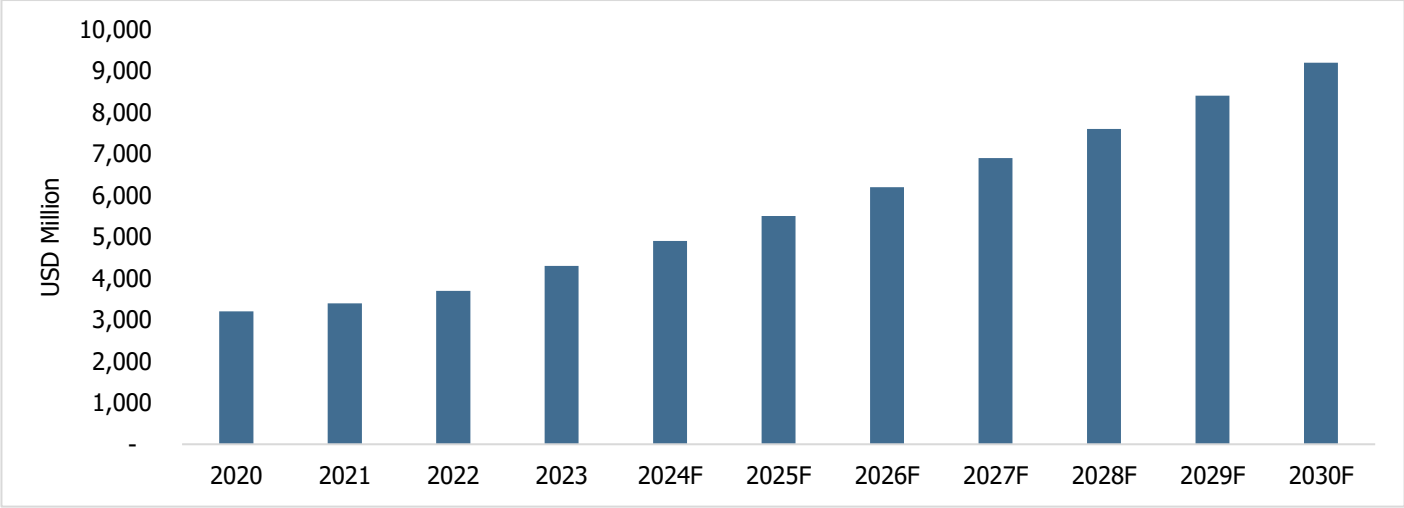
The growing emphasis on natural gas as a cleaner energy source, the expanding gas pipeline infrastructure, and the increasing requirement for precise measurement technology are the main factors driving the market for metering skids in India.

Technological advancements such as ultrasonic and Coriolis meters are increasingly being included into metering skids. These technologies are preferred in today's gas pipeline system because of their high accuracy, dependability, and low maintenance requirements.

6.6.1 Metering Skids Equipment Market in Gas Pipeline Infrastructure Industry in India

India's metering skids equipment market size in gas pipeline infrastructure industry was valued at around 4,300 USD million in 2023. It is expected to increase at a CAGR of 11% from CY24 to CY30. India is seeing increasing opportunities in the market for green hydrogen. The Indian government estimates that by 2030, the country's output of green hydrogen might exceed 5 million metric tons (MMT) annually. To attain this goal, the government intends to invest more than INR 8,000,000 million in green hydrogen production in order to cut greenhouse gas emissions by 50 MMT annually. Accordingly, the businesses can combine blended hydrogen with the assets of the gas network.

Chart 25 : India's Metering Skids Equipment Market Size in Gas Pipeline Infrastructure Industry



Source: Maia Research
Note: Year mentioned above denotes calender year; (F) stands for forecasted period.

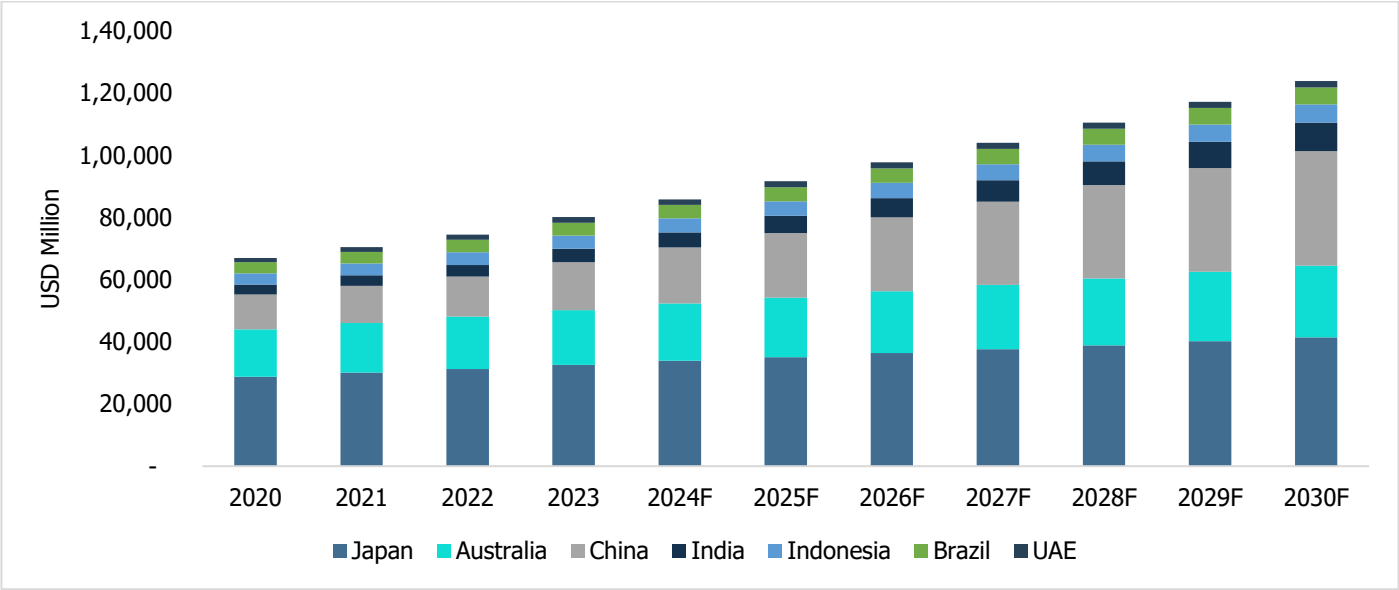
In addition, India is spending an enormous amount of financial resources on its infrastructure of gas pipelines to fulfill its rising energy needs. Metering skids are in high demand due to projects such as the National Gas Grid. The need for

efficient metering equipment is rising as a result of government measures to raise the proportion of natural gas in the energy mix and to expand pipeline infrastructure investments.

6.6.2 Metering Skids Equipment Market in Gas Pipeline Infrastructure Industry for Overseas

In the gas pipeline infrastructure sector, Japan topped the metering skids equipment market size, accounting for a total revenue of around USD 32,600 million in 2023. Australia and China market size stood at USD 17,600 million and USD 15,400 million, respectively. On the other hand, India was valued USD 4,300 million.

Chart 26 : Overseas Metering Skids Equipment Market Size in Gas Pipeline Infrastructure Industry



Source: Maia Research

Note: Year mentioned above denotes calender year; (F) stands for forecasted period.

6.6.3 Requirement & Benefit of Metering Skids Equipment

In the oil and gas sector and other industries where accurate monitoring of fluid and gas flow is critical, metering skids are essential equipment. An overview of their prerequisites is provided below:

1. Precision & Accuracy:

Measurements of the flow rate, volume, and quality of the fluids or gases being transported must be made precisely and accurately using metering skids. Billing, custody transfer, and process control all depend on this.

2. Adherence to Standards:

They must adhere to industry standards such as API, ISO, and AGA to ensure accurate and consistent measurements.

3. Personalization:

Metering skids must be adjusted to the specific requirements of the application, taking into account factors such the fluid type (oil, gas, or water), flow rate, and ambient conditions.

4. Robust Construction

Skids must to be built to resist challenging environmental factors like high pressure, temperature swings, and corrosive substances.

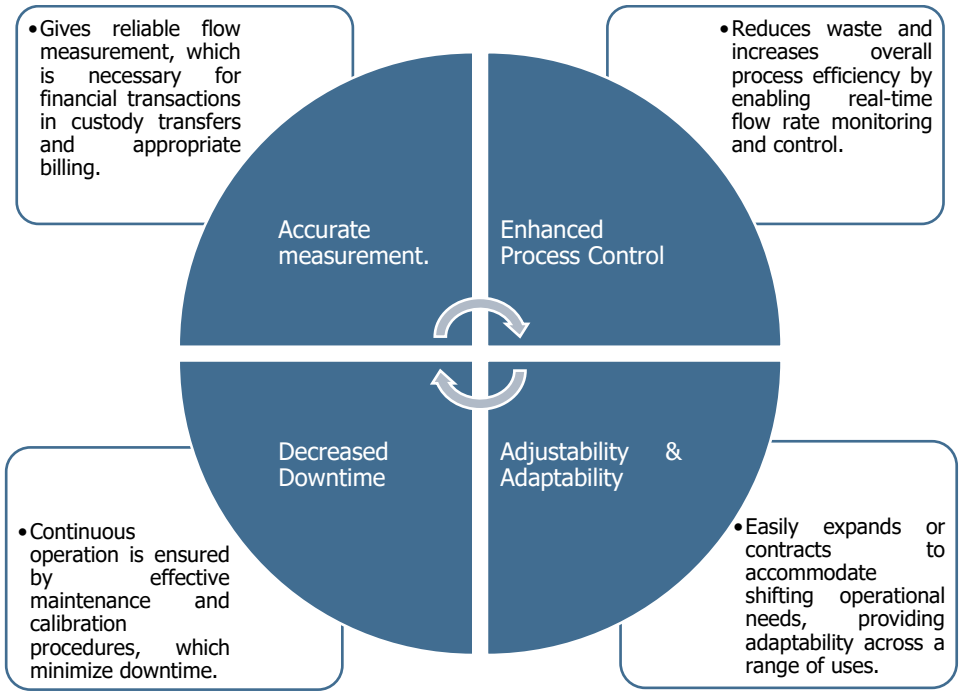
5. Automation System Integration:

For data collecting, control, and real-time monitoring, they ought to be connected with automation systems (like SCADA).

6. Security:

In order to ensure safe operation in dangerous areas, safety elements should be included to handle high-pressure conditions and avoid leaks.

Benefits of Metering Skids Equipment:



6.6.4 Competitive Profile in Metering Skids Equipment Market.

1. Pipeline Infrastructure Limited-

Modern features on the pipeline, which runs from Kakinada in the east to Bharuch in the west, provide safety, compliance, tracking, reporting, and—most importantly—smooth transportation via remote operation facilities. The

system is made up of a 1375 km long trunk pipeline, 102 km long spur lines with related Mainline Valves (MLVs), Tap-Off Points, Compressor Stations (CS), Metering and Regulating Stations (M&R), Pipeline Operation Control Center (POC), Cathodic Protection System (CP), Supervisory Control and Data Acquisition System (SCADA), Pipeline Integrity Management System (PIMS), Pipeline Application Software (PAS), and a specialized telecommunications system based on optical fiber cable.

2. Enbridge Inc-

Energy infrastructure provider Enbridge Inc. operates in North America, providing services relating to energy distribution, transportation, and handling. In addition to managing a crude oil and liquids pipeline system, the company is active in midstream and natural gas transportation, as well as worldwide energy projects. It provides natural gas utilities to clients in Ontario and Quebec that are residential, commercial, and industrial users. Liquids Pipelines, Gas Transmission and Midstream, Gas Distribution and Storage, Renewable Power Generation, and Energy Services are the five reportable segments that make up Enbridge Inc.'s corporate operations. The US and Canadian terminals and pipelines that export and move crude oil and other liquid hydrocarbons are included in the Liquids Pipelines section.

3. TC Energy Corp-

TC Energy Corp is a company that develops and manages energy infrastructure, including gas storage facilities in both regulated and unregulated markets, power generation, liquids pipelines, and natural gas pipelines. It also offers services related to gas storage. Three reportable segments comprise the company's operations: Natural Gas Pipelines, Liquids Pipelines, and Power and Storage. The Natural Gas Pipeline Network delivers natural gas from supply basins to local distribution companies, industrial facilities, power plants, LNG export terminals, interconnecting pipelines, and other businesses.

6.7 Demand Drivers for Natural Gas Consumption in India

The various factors driving the demand for natural gas consumption in India are discussed below:

1) Increasing demand from various sectors

The Natural Gas has found applications across various industries with majority of demand coming from power, fertilizer, industrial and CGD sectors. The key factors driving the usage of natural gas in various industries are -

Power Sector - Constrained domestic coal supply and rising cost of imported coal makes natural gas a good alternative fuel for power sector. The consumption of natural gas towards power sector has significantly declined from more than 1/3rd in 2012-13 to around 15% in 2022-23 (April- Nov, 2023). The share of power sector in the total natural gas consumption is expected to stay range bound over the medium term. However, with the increasing share of renewables in India's energy mix, natural gas can potentially play a key role in enabling grid stability.

Fertilizer Sector - Natural gas, having the highest hydrogen to carbon ratio, is the most preferred feedstock for the production of fertilizers. The demand for fertilizers is envisioned to increase, considering the agriculture productivity growth in India.

With this, fertilizer production using natural gas as a feedstock in India is expected to grow the highest globally. This, in turn, is likely to increase the consumption of natural gas going.The consumption of natural gas towards fertilizer industry

has been steady and has grown from around 25% to around 31% from the year 2012-13 to 2023-2024 (April - Nov, 2023).

Industrial User Segment - Industrial user segment uses natural Gas as a fuel for process heating, combined with heat and power systems, as a raw material (feedstock) to produce chemicals and hydrogen, and as plant fuel. The convenience of being able to adjust process heat temperatures and opportunities to make efficiency gains are advantages of natural gas over other liquid & solid fuels used by industrial users. As a result, industrial users are shifting from pet-coke, furnace oil and coal to natural gas. The key industries that use natural gas include - petrochemical, refineries, sponge iron, steel, etc.

The consumption of natural gas towards industrial sector stood at 35% for the period April - November, 2023).

City Gas Distribution (CGD) - There is Government's thrust to enhance the supply and consumption of natural gas through granting authorization to entities for development of CGD network in new Geographical Areas. This has received significant impetus from the Government's commitment towards clean energy under COP 26 as well.

After completion of 12th CGD bidding round, almost entire part of the country will be covered under the City Gas Distribution network providing access to cleaner cooking fuel to households, other industrial and commercial facilities as well as fuel for transportation. Further, through the Round 11A of CGD Bidding, the CGD network is now expected to cover 295 geographical areas (98% population and 88% area of India). CGD now constitutes around 20% of total natural gas consumption in India.

Out of total natural gas consumption, CGD share of consumption of natural gas stands at 19% for the period April-Nov,2023. With the significant Government impetus and expansion of the CGD network to 295 geographical areas, the natural gas consumption by the CGD segment is likely to grow.

- **Increase in Natural Gas Infrastructure as well as Investments -**

India is in the line to become the second largest user of natural gas in Asia as it has plans to boost the share of the natural gas in the energy mix to 15% by 2030. Over the last decade, the mix of natural gas in India's energy mix has been constrained at around 7% owing to inadequate infrastructure. With the governments' focus on increasing the natural gas consumption, massive investments are expected in developing the natural gas infrastructure. Lot of infrastructural developments are in progress including expansion of LNG import capacity, addition of new gas pipelines, development of City Gas Distribution networks. Around 23,478 km of gas pipelines was operational in India as on June 30, 2023 while 12,037 km of pipelines was under construction.

Some of the other factors that will be driving up the demand are-

- **Investment by Global Firms-**

India has been inviting global firms to invest in the opportunities occurring in the oil and gas sector. Government has been pushing for many attractive investments and opportunities to increase the area under oil and gas exploration.

- **Ongoing Deep-water Development-**

The ongoing deep-water development will soon lead to the increase in the production of India's natural gas. India will also witness an increase in the LNG trade. This will be further driven by the recent addition of the Ennore and Mundra terminals and the expansion of Dahej facility.

- **Government Initiatives**

The government's focus on enhancing the share of natural gas in India's energy mix is a key driver for the growth of gas sector. The government has taken several initiatives to boost the sector such as facilitating development of gas infrastructure including LNG terminals, long-distance transmission pipelines and city gas distribution networks. A total of 1544 Kms of pipelines have been laid as part of the National Gas Grid in 2020. The government launched the Indian Gas Exchange (IGX), first nationwide online delivery-based gas trading platform in 2020. The government's favorable policies will help in driving the gas demand growth over the next decade.

- **Cost Competitiveness**

The natural gas is usually cost competitive as compared to various other fuels which is a key demand driver. For instance, it is usually cheaper as compared to petrol and diesel which has led to its increased usage in automobile sector. Similarly, it competes with LPG for domestic cooking and therefore, there is increased switching of residential customers from LPG to natural gas in the past few years.

- **Metering Business**

The demand for natural gas metering is growing across various domains, driven by the increasing use of natural gas as an energy source, advancements in metering technology, and the expansion of infrastructure. As the country is expanding its distribution network, the demand for natural gas aligns well with the demand for metering services, pipelines, storage facilities.

6.8 Challenges in the Natural Gas Sector

1) Unified Tariff Regulation for natural gas pipeline

The government announced a new unified natural gas pipeline tariff Regulation in 2020 which changed the tariff regime for gas transmission pipelines. As per the earlier policy, the consumers were charged on the basis of their distance from the source of gas and the number of pipelines used. However, the new policy brought out a uniform tariff regime with one tariff for gas transported to consumers within 300km from the source of natural gas and another tariff for consumers beyond 300 km. The objective of this reform is to reduce the cost of gas transportation for consumers farther from sources of gas and make it affordable in all parts of the country. However, this will lead to higher cost for consumers located near the source of gas as they will end up subsidizing the consumers farther from the source of gas.

2) Limited Marketing Exclusivity

The development of CGD network including pipeline network, CNG stations, city gas station is capital intensive and takes some years. The high fixed costs coupled by the low margins owing to competition from alternate fuels result in long payback period for CGD players. The Regulations provide marketing exclusivity to the CGD players for a period of eight years (earlier 5 years) from the date of authorization which restricts entry of new players in the respective Geographical area during this period. However, the effective operating period is lower as it usually takes 2 to 3 years to develop the network. Therefore, post expiry of marketing exclusivity period, players may be exposed to competition risk from new entrants.

3) Other challenges

In the present scenario, India has only limited reserves of natural gas, though further discoveries and infrastructures are being made from recent explorations. As India is import dependent, with volatile geopolitical scenario it may have adverse impact besides exposing to the price risk.

- Extraction of Natural Gas leads to large cavities in the ground. It requires massive complex treatment plants and pipelines for its delivery.
- Constructions of Natural Gas pipelines and import terminals are very expensive. Huge amount of investments is required for the same.

6.9 Outlook - Natural Gas

Natural Gas industry in India is expected to witness substantial growth over the next decade. Driven by increasing usage across various end-user customer segments, the Government of India has come up with multiple reforms as they target to raise the share of Natural Gas in the primary energy mix to 15% by 2030 from around 6.5% currently (in 2022-23). This is a CAGR of around 6.4% projected for the period 2021-2030.

Covid-19 global pandemic has impacted both the production and the consumption of Natural Gas. Now, with the return of normalcy, industries have opened up and the production and the consumption have almost reached to the pre- Covid levels.

Major demand for natural gas is expected to come from - fertilizer sector, increase in CNG consumption, expansion of CGD network to around 295 geographical areas post Round 11A of CGD bidding and industries using blast furnaces such as steel, oil refineries, long-haul transport, and heating and cooling requirement. Natural gas has seen an increasing usage in transportation and households as adoption of CNG and PNG gains traction. Further, improved pace of economic development and government's impetus for non-fossil fuel will drive the natural gas demand in coming years.

There is Government's thrust to enhance the supply and consumption of natural gas as there is a growing concern towards environment and climate change. This has received significant impetus from the Government's commitment towards clean energy under COP 28 as well. The pipeline network is expected to expand to around 34,135 Kms over the medium to long term, that would connect all major demand and supply centers in the country. As per Ministry of Petroleum & Natural Gas (MoPNG, Government of India), as of June 30, 2023 - 23,478 kms of natural gas pipelines are operational and 12,037 km of Natural Gas pipeline (including sub-transmission pipeline & tie in connectivity pipeline) are under various stages of construction.

There is Government's thrust to enhance the supply and consumption of natural gas as there is a growing concern towards environment and climate change. This has received significant impetus from the Government's commitment towards clean energy under COP 27 as well. The demand revival will also be supported by the ease in natural gas prices.

7 Indian Defense Sector

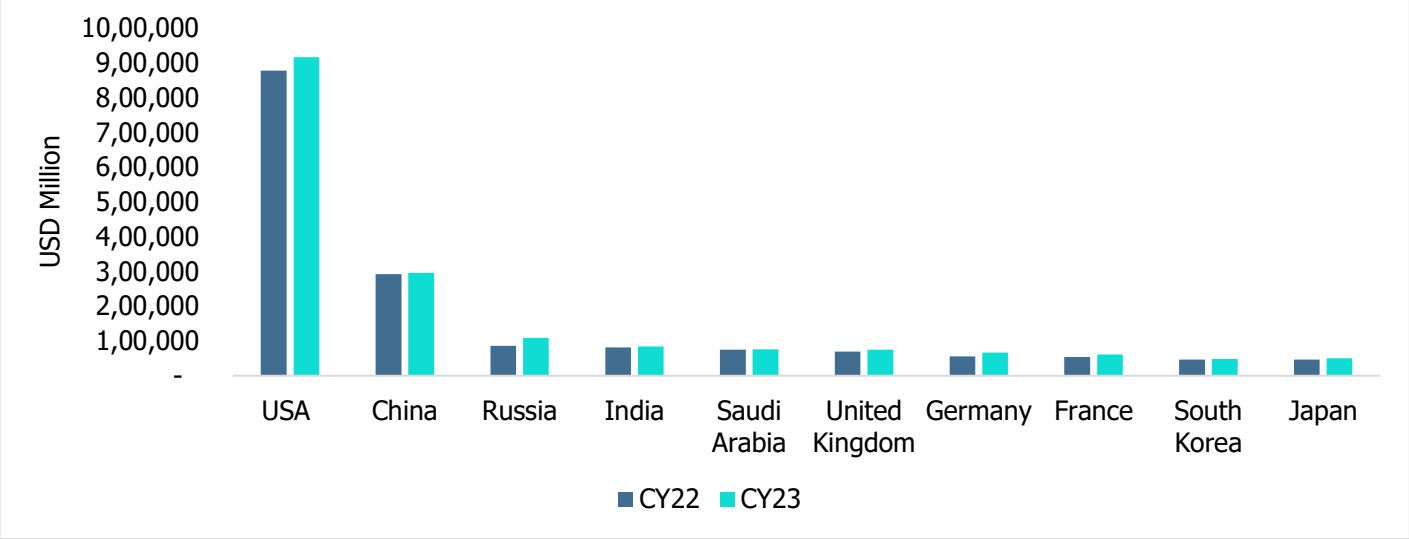
7.1 Overview

The aerospace and defence sector involve the manufacturing and supply of various items such as aircraft, helicopters, missiles, radars, satellites, and associated defence equipment or components. In this sector, manufacturers are generally classified into Tier 1 and Tier 2. Tier I manufacturers primarily concentrate on producing final products like aircraft, helicopters, and missiles, while Tier II manufacturers specialize in providing components for these systems.

According to Stockholm International Peace Research Institute (SIPRI), India accounted for 3.4% of the global military expenditure in CY23, securing its position as the world's fourth-largest military spender in constant USD terms. With the government's push on "Make in India" initiative and Atmanirbhar Bharat, the government made it mandatory to procure 75% of annual defence requirement from India in FY24, which was earlier 68% in FY22.

The proportion of defence expenditure relative to GDP has been steadily increasing. It rose from 1.64% in fiscal 2016 to 2.48% in FY23. Notably, defence spending continued to rise even during the pandemic period.

Chart 27: Global Military Spending

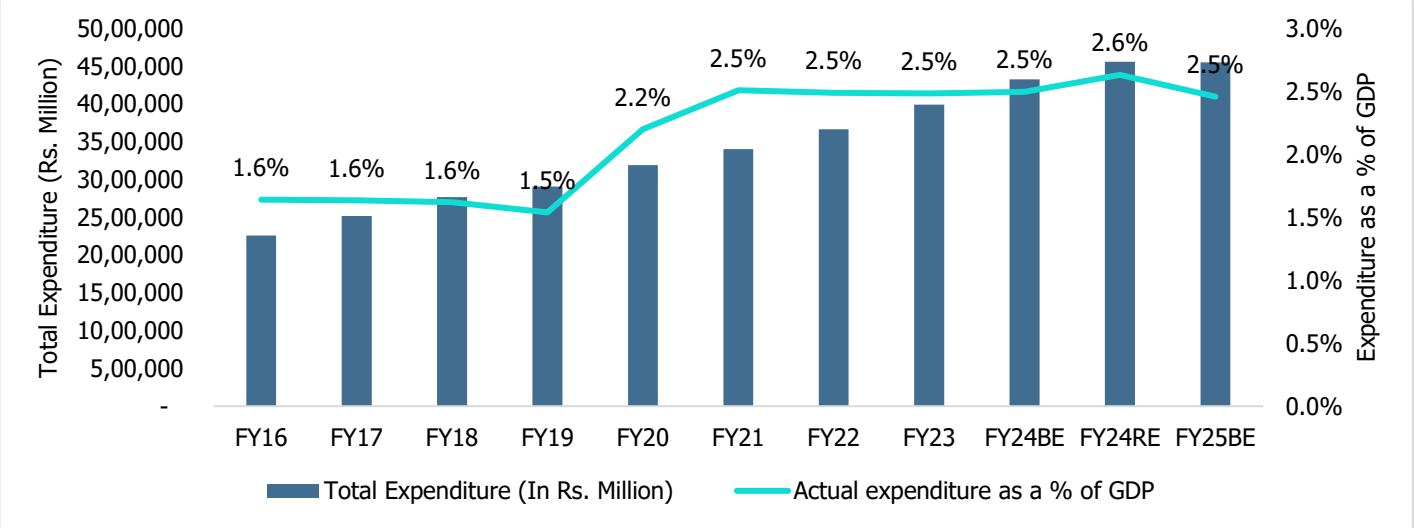


Source: SIPRI, CareEdge Research

7.2 Annual Defence Budget expenditure in value, as % of GDP and growth rate in defence expenditure

The key growth driver is the government's capex in defence procurement. Over the fiscal years 2016 to 2024, defence spending (both revenue and capex) exhibited a robust 10.8% Compound Annual Growth Rate (CAGR), rising from around Rs 20,10,000 million to Rs. 45,60,000 million. The budgeted outlay for fiscal 2025 stands at around Rs. 45,50,000 million.

Chart 28: Annual defence budget expenditure as a percentage of GDP



Note: 1. Budget expenditure excluding civil and pension
2. GDP for FY25 are projected and FY24 are Revised Estimates
RE – Revised Estimates, BE – Budget Estimates
Source: MOSPI, Union budget documents, CareEdge Research

7.3 Review of defense production for fiscals 2017-2024

In May 2001, the previously state-controlled Defense Industry sector was opened up to 100% participation from the Indian private sector, with Foreign Direct Investment (FDI) capped at 26%, subject to licensing. Subsequently, the Department for Promotion of Industry and Internal Trade, Ministry of Commerce & Industry permitted FDI up to 49% under the automatic route and beyond 49% through the government route, particularly if it promised access to modern technology or for other specified reasons. In May 2020, the Government of India announced a significant reform in the defense sector aimed at enhancing self-reliance. This reform included raising the FDI limit in Defense Production from the existing 49% to 74% under the Automatic Route. It was proposed to allow FDI up to 74% through the Automatic Route for companies applying for new defense industrial licenses, and up to 100% via the Government Route, under specific circumstances such as ensuring access to modern technology or for reasons to be duly recorded. In February 2024, the Ministry of Defense recorded Rs 50,770 million worth of FDI investment in the companies operating in the defense sector.

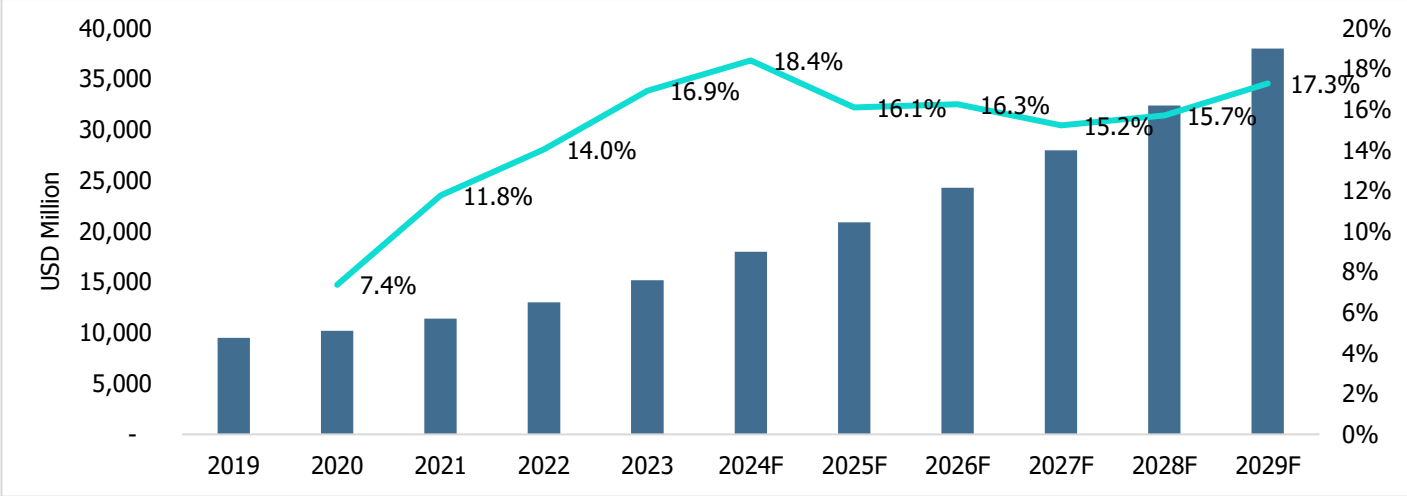
7.4 Automation in Defence Sector

India's defense automation market is growing quickly as the nation strives to modernize its armed forces and lessen its need on foreign technology. This industry's automation market includes a range of technologies, including as robotics, AI, unmanned systems, and sophisticated production techniques.

7.4.1 Market Size of Defence Manufacturing Sector

With a massive medium and long term investment, the Indian defense business is among the biggest and most lucrative in the world. Due to significant reforms intended to promote growth in the enormously promising defence sector, the value of defence output in the nation surpassed Rs. 15,200 USD million in CY2023.

Chart 29: India Defence Manufacturing Market Size



Source: Maia Research

Note: Year mentioned is calender year

Market Dynamics-

1. The Department of Military Affairs and Ministry of Defence have created four positive indigenization lists of 411 products under the Aatmanirbhar Bharat Initiative, which require the products to be manufactured domestically for the defence sector rather than being supplied through imports.

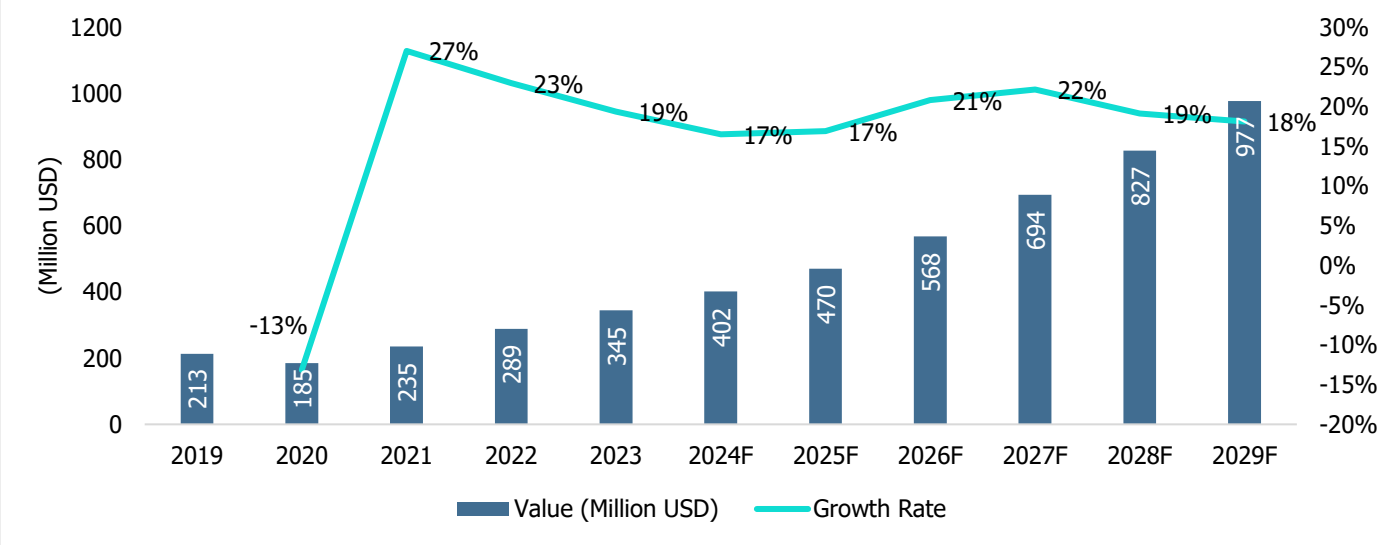
2. To encourage indigenization, the SRIJAN portal was launched. The portal displays 19,509 defense goods for indigenization.

7.4.2 Market Size of Automation in Defence Sector

India has made significant investments in unmanned aerial vehicles (UAVs), unmanned ground vehicles (UGVs), and other robotic systems for surveillance, reconnaissance, and battle. The military forces are integrating these technology more and more in order to improve operational effectiveness and lower personnel dangers.

Furthermore, the indigenization of defense technology is being propelled by the Indian government's "Make in India" initiative. This endeavor greatly benefits from automation, which makes it possible to produce cutting-edge defense equipment domestically, lessens reliance on imports, and promotes national innovation.

Chart 30: India's Automation Market Size in Defence Sector



Source: Maia Research

Note: Year mentioned above denotes calender year; (F) stands for forecasted period.

With an emphasis on indigenization, growing defense budgets, and government initiatives, the automation industry in India's defense sector is predicted to increase at a CAGR of 19% from CY24 yo CY29. Sustaining this growth trajectory and guaranteeing India's ability to satisfy its defense requirements independently will depend on ongoing investments in R&D and innovation.

7.4.3 Technological advancement in Defence manufacturing process

Automation in the military sector refers to the application of cutting-edge technology to the assembly of weaponry, ammunition, and aircraft parts at generally faster and higher quality rates than manual labor alone. Automation solutions for the military and armaments sector include gantry systems, robots, vision, and conveyors. Automation technology guarantees that parts fulfill stringent requirements for repeatability and quality.

The production of defense equipment makes extensive use of automation technology, which significantly raises the productivity, standard, and safety of weaponry production.

1. **Production Line Automation**-

   One of the main uses of automation technology in the manufacturing of military weapons is automated production lines. Automation is applied throughout the process, from processing raw materials to assembling finished goods, through the use of robots, sensors, and computer control systems.

2. **Technologies for Virtual Simulation-**

   Virtual simulation technology is a technical tool used to validate weapon designs, process analysis, and performance evaluation prior to actual production. It is based on computer models. This technology eliminates the danger of manufacturing line closure and equipment decommissioning because of design flaws or process

issues, and it can simulate a variety of harsh environments and wartime circumstances. It can also give equipment performance testing and optimization solution analysis.

3. Autonomous Robotics-

An emerging technology in the manufacturing of defensive weapons is autonomous robots. Autonomous robots has the ability to perceive, make decisions, and carry out a variety of tasks on their own without the need for human assistance. Autonomous robots can perform dangerous, precise, and repetitive jobs including equipment installation, maintenance, and part replacement in the weapons manufacturing industry. The flexibility and responsiveness of the weapons manufacturing industry are increased by autonomous robots since they are highly adaptive and autonomous and can be swiftly deployed and modified in accordance with mission requirements.

8 Brewery Industry

8.1 Overview of Indian Alcoholic Beverages Industry

India's alcohol industry is the third largest in the world with a value of more than $35 billion. Indian alcoholic beverage industry is one of the biggest alcohol industries across the globe only behind from two major countries that is China and Russia. It is also the largest spirits market in the world. The positive demographic factors along with globalization and a growing economy is all set to redefine the alcohol beverage market in India.

Growing demand for alcoholic beverages in India is majorly attributed to the huge young age population base, changing lifestyles as well as rising disposable income is strengthening the industry growth. With population of 1.39 billion, India is one of the largest consumer markets across the globe. It has become a customary tradition for a majority of people residing in India's urban cities to consume alcoholic beverages. It is also demographically one of the youngest with around 25% of its population below the age of 15 and around 40% between the age of 15 to 35 and around 28% between the age of 36 to 64. Most of the alcohol volume is consumed by people between the ages of 18 and 40. Additionally, rapid urbanization of tier-II cities is further fueling the market growth. The sheer size of India's population provides a massive opportunity for growth.

India is the largest consumer of Whisky in the world. The Indian Market is still largely untapped, making it attractive for liquor players. Largely consumed Beer/IMFL drinking states and Union Territories are Daman & Diu, Andaman & Nicobar Islands, Dadra & Nagar Haveli, Arunachal Pradesh, Sikkim and Puducherry, followed by Goa, Andhra Pradesh, Kerala and Karnataka. Alcoholic Beverages are among the top sources of revenue earning across most of the states. Most of the sale of alcohol in India is coming from Tier 1 and Tier 2 cities. Growing income leading to rising spending power mixed with access to alcohol at restaurants and liquor stores is the reason for such a remarkable increase in demand. It has been estimated that the share of the upper middle-income group has increased steadily from 7% to 21% and is also expected to increase to 44% by 2030 in alcohol consumption as per ICRIER.

Emerging Trends in Alcohol Beverages Industry

- **The Growth of Low and No Alcohol**
  Tapping into the health & wellness trend, the low and no alcohol category is likely to see some of the most innovation and evolution across the whole industry, offering consumers more variety, better tasting and higher quality products. The biggest challenge will come to wine producers, who will need to invest in R&D to create an alcohol-alternative that appeals in terms of both quality and taste.

  Other innovation within the health & wellness movement will come from an increasing consumer demand for gluten-free, low- and no- sugar, low calorie and low carbohydrate products; beverages that are light and fresh to drink will also likely see increased uptake, as will products that offer functional wellness.

- **Ecommerce and Technology**
  An increase in the number of multinational companies in India and technology boom has led to a rise in the disposable income and prevalence of western culture of social drinking which will boost alcohol consumption. Rising prominence of cocktail culture in urban cities and emergence of ecommerce platform promoting online sales will escalate demand further.

- **Brand Ethics and Packaging Innovation**
  As consumers become more environmentally aware, there will be increased demand for brands to share consumers' approach to ethical and sustainable living. Sustainability is having an impact on everything from packaging to production methods and ingredient sourcing, with drinks producers looking at activities such as waste reduction, eco-

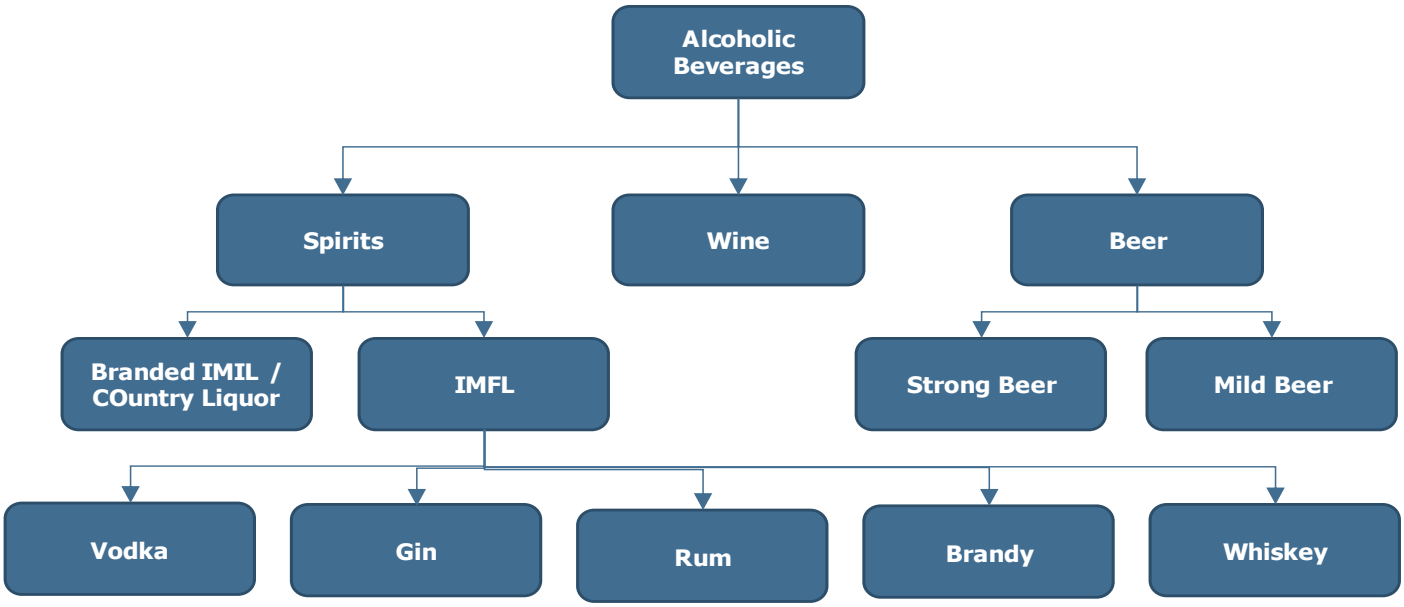
friendly packaging programmes and carbon footprint levels. Products that are organic, vegan, free from additives, and/or that offer label and ingredient transparency, will strive to match consumer ethics as well.
Within eco-packaging, innovation will come from drinks producers exploring ways of reduced packaging, paper formats, recyclable materials, or even forgoing packaging altogether. Premium packaging poses a key need for innovation, as much of this packaging contains gold and metals that are non-recyclable.

- **Premiumization and the Evolution of Rum**
  The long-running premiumization trend in most global markets will continue. However, the industry should watch out for the premiumization of local national spirits, both in large markets such as China and India, as well as in smaller markets, like the Balkans. These products will pose competition for Western premium spirits already in those countries.

  There is room in the rum category for premiumization and product innovation as well. Premium rum will re-position the spirit as a sipping drink, moving away from a consumer perception of a low-quality party drink.

8.1.1 Structure of Indian Alcohol Beverages Industry

The Indian alcoholic beverage industry is broadly classified into five categories namely Indian Made Foreign Liquor (IMFL), India Made Indian Liquor (IMIL), Foreign Liquor Bottled in Origin (BIO), Beer and Wine. IMFL comprises primarily of brown spirits such as whisky, brandy and rum whereas white spirits comprise of vodka, gin and white rum. BIO forms a small portion of alcohol consumption in India.



Source: CareEdge Research

8.1.1.1 Regulations in the Alcohol Industry

Alcohol Sale is important to State Governments

Alcoholic Beverages are among the top sources of revenue earning across most of the states. Most states derive around one-fifth of their revenue from alcohol taxation, which is their second largest source of income after sales tax. Each state and union territory have full control of its alcohol legislation and state excise rates, as well as the organization of the production, distribution, and sale of alcohol. There are different policies that govern different aspects of alcohol in each state.

Liquor contributes a considerable amount to the exchequers of all states and Union Territories except Gujarat and Bihar, both of which have enforced prohibition. Generally, states levy excise duty on manufacture and sale of liquor. Some states, for example Tamil Nadu, also impose VAT (value added tax). States also charge special fees on imported foreign liquor; transport fee; and label & brand registration charges. A few states, such as Uttar Pradesh, have imposed a "special duty on liquor" to collect funds for special purposes, such as maintenance of stray cattle.

The sale and production of alcohol is regulated in majority of countries in the world to guard against the harmful uses of alcohol. Some policies include pricing, storage and movement, final consumption, age bar, and control from production. In India, different state ministries and departments regulate various aspects of alcohol. In addition, there are significant changes including change in distribution model, change in excise duties and limiting number of stores selling alcoholic beverages followed by the states leads to loss of revenue to the alcohol beverage industry. In order to cover for revenue loss due to Covid-19, there has been an increase in excise duties in multiple states.
Sale of alcohol is one of the easiest ways for individual states to generate revenues, given the other transactions in goods and services as well as public and private transport will stay limited. Delhi, Uttar Pradesh, Maharashtra, Assam, Karnataka, Chhattisgarh and Rajasthan were among the states that allowed the sale of liquor either across or the state or in select zones, much to the delight of those who were in forced abstinence.

India has a unique system of prohibition, under which an alcohol is not being sold on specific days which are quoted as "Dry Days". These dry days are usually observed on major religious festivals, national holidays and certain occasions. Also, its prerogative of each state governments to decide on its dry days.

State Budgets and Excise Duty on Sale of Alcohol Collections

The alcohol industry is subject to extensive government regulations as well as regulations by a variety of local bodies. Indian states along with seven union territories have adopted different approaches when it comes to regulating and taxing liquor. The state of Gujarat for instance has entirely banned trade and consumption of liquor since 1961. By contrast, Puducherry which is the territory on the Coromandel Coast, earns most of its revenue from alcohol trade. Each state has its own formula of deciding the prices of alcoholic products. The price is determined by two key factors namely- Ex distillery price (EDP) which covers the cost of production and state excise policies which specify duties, license fees, cess and surcharges, retail margin and wholesale margin. The taxes and margin are a percentage of EDP.

All countries have alcohol excise taxes to regulate price of alcoholic beverages. Revenue from alcohol constitutes a major share in total revenue receipts of states in India. More than 60% of revenue of leading alcoholic beverage companies in India constitutes of excise paid directly to the state governments. Moreover, the share of excise in total revenues of leading alcoholic beverage companies in India has shown an increasing trend.

In spite of GST not being levied on liquor, the prices of liquor continue to rise after the rollout of Goods and Services Tax. This is because the inputs used to manufacture liquor were taxed at 12-15% under the VAT regime before GST. However, after the introduction of GST, most of the input raw material now attract 18% GST resulting in increased input

cost. This rise in taxes on the inputs is passed on to the end customers. The other reason for the sharp increase in the cost of liquor is the applicability of GST on transportation and freight charges. Previously, transportation and freight attracted a service tax of around 15%. However, post-GST, they are taxed at 18%. The Goods and Service Tax (GST) usually has two components – the central GST and state GST. The central GST, although collected by the state, is transferred to the central government. States also get a share in personal income and corporate taxes that are collected by the Centre.

Many states in India are changing their excise policy to transform the nature of liquor trade in line with the changing nature of the society. This is to improve the standard of customer experience and increasing the revenue of the excise department.

8.2 Overview of Automation in Brewery Industry

Automation is a technology driven approach that aims to streamline processes, improve quality, productivity and efficiency. The primary areas where automation is used in breweries are in the processes of processing raw materials, saccharification, filtration, boiling and brewing, fermentation and storage, and filling and packing.

- **Raw Material Processing** - Automated equipment can automatically mix and grind raw materials such as water, malt, hops, etc.

- **Saccharification** - In the fully automatic craft beer equipment, the saccharification process is controlled by automated temperature control equipment to ensure that the starch in the malt can be effectively saccharified into monosaccharides or disaccharides to form sugar juice.

- **Filtration** - After saccharification, the fully automatic craft beer equipment will automatically start the filter to remove insoluble impurities and solid waste in the sugar juice to ensure the clarity of the beer.

- **Boiling and brewing** - The boiling link is the key stage to complete beer brewing. The fully automatic craft beer equipment heats the beer sugar solution through automated control to promote yeast fermentation.

- **Fermentation and storage** - During the fermentation process, the yeast is fermented through automated temperature control to ensure the quality and taste of the beer. After fermentation, the beer will be automatically transferred to the beer storage tank for storage.

- **Filling and packaging** - The cooperation of robotic arms or conveyor belts enables cans to be automatically sent to the filling position and complete a series of operations such as filling, sealing, and labeling. In addition, it can also be equipped with a special cleaning and disinfection system to ensure that the glass bottle can be thoroughly cleaned and disinfected before filling.

Technological advances such as automated brewing systems have had a significant and widespread impact on the brewing industry. Automation helps brewers control every stage of the production of liquor, thereby producing high-quality liquor. Automated systems also help streamline operations, reduce labor costs and the time required for processes.

Various Players including public and private players, would have automated different processes in their value chain starting from manufacturing to distribution. However, State owned breweries generally lag behind private breweries in terms of automation. The level of automation also depends on factors like investments, modernization efforts and

regional priorities. Few large Private Companies may be having Automated brewing system which control temperature, pressure levels, flavour development etc. but may not have reconciled system which helps in tracking and analysing of what quantity of input was utilized and what should have been the ideal output and whether actually that quanity of alcohol was producted or not.

Automation solutions help in hastle free production, execution and inventory management which helps to complete the orders on time. Various cleaning automated solutions help in reducing time in cleaning cycle without shutting down production. Reducing production losses is essential for lowering production costs and environmental effects. The most significant production losses in the brewery are the extract losses. Owing to the many quantitative measurement methods used in the brewery (volume, concentration, and raw material yield), it is essential to combine these data into a single basis of comparison in order to calculate extract loss. The raw material input, the total volume filled (net production) delivered to the warehouse, the beginning and final stocks of each stage, and the extraction loss are all computed over a certain period of time. Automation solutions help in detailed tracking of extract losses in the brewing and bottling process and also provides information for generation of automated reports in the respective system for breweries.

8.3 key areas where automation is making impact

Automation in the brewery industry has transformed the way beer is produced, improving efficiency, consistency, and scalability. Few key areas where automation is making impact are as below:

1. **Brewing Process Control**

- **Automatic Brewing Systems:** Modern breweries use automated systems to control brewing parameters such as temperature, pressure, and timing. This ensures consistent quality and reduces the need for manual intervention.
- **Sensors and Data Analytics:** Sensors monitor various aspects of the brewing process, providing real-time data that can be analyzed to optimize production and predict maintenance needs.

2. **Ingredient Handling**

- **Automated Mashing and Lautering:** Automated systems handle the mixing of malt with water (mashing) and the separation of wort from the grain (lautering), improving efficiency and consistency.
- **Ingredient Dosage:** Automated dosing systems accurately measure and add ingredients like hops, malt, and yeast, ensuring precise recipes.

3. **Fermentation Management**

- **Controlled Fermentation:** Automated fermentation tanks control temperature, pressure, and other conditions, which are crucial for yeast activity and beer quality.
- **Data Collection:** Continuous monitoring of fermentation parameters allows brewers to track progress and make adjustments as needed.

4. **Packaging**

- **Automated Bottling and Canning Lines:** Automation in packaging lines improves speed and accuracy, reduces waste, and maintains product integrity.
- **Labeling and Quality Control:** Automated systems ensure that labels are correctly applied and that the final product meets quality standards through inline inspection.

5. **Quality Control and Testing**

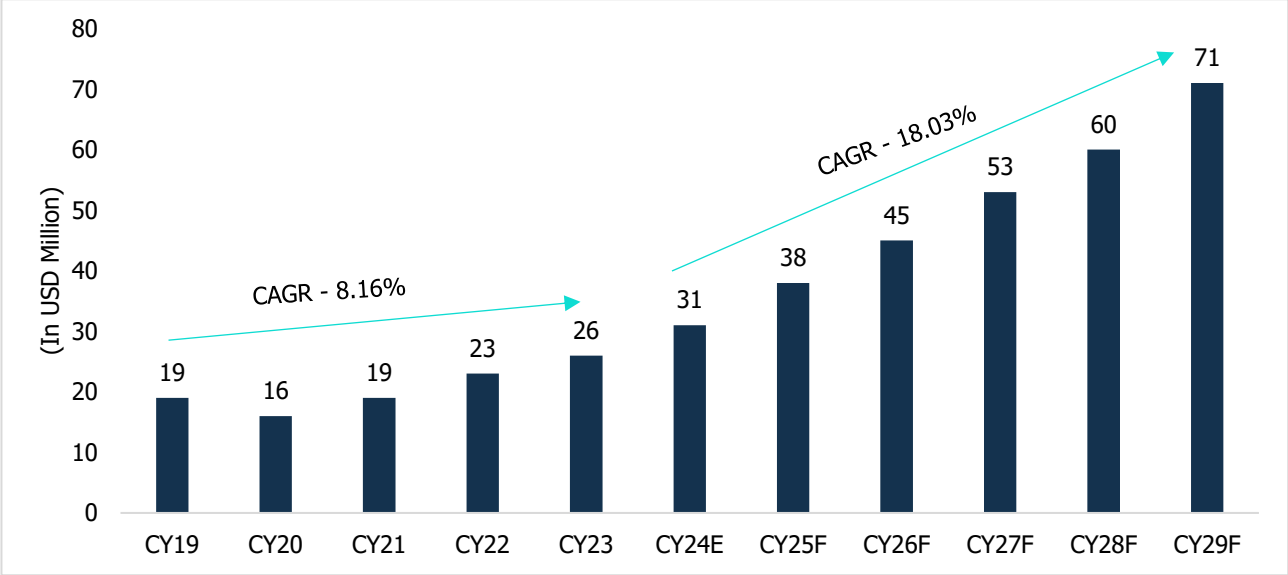
- **Automated Testing Equipment:** Automated systems test beer for various quality parameters, such as pH, alcohol content, and carbonation levels, providing consistent results.
- **Data Integration:** Test results are integrated into production systems for real-time quality monitoring and control.

6. **Other Process –** Other process include Cleaning and Sanitation, Inventory and Supply Chain Management, Energy Management, Integration and Monitoring. Automated systems optimize energy use in brewing operations, such as controlling heating and cooling processes, which helps reduce costs and environmental impact.

8.4 Market Size of Automation in Indian Brewery Industry (CY19-CY29)

The Indian Brewery Automation Industry grew at a CAGR of 8.16% from CY19 to CY23 and reached at USD 26 million, the same is expected to grow at a CAGR of 18.03% from CY24 to CY29 and reach USD 71 million. The increased growth rate is attributable to the increasing adoption of Industry 4.0 technologies, deployment of AI driven services, various government initiatives like "Make in India" and "Digital India". All these factors aim to promote the adoption of advanced technologies, including automation, to strengthen the manufacturing sector and digital infrastructure. The increasing demand for automation in brewery industry is supported by government also, the Rajasthan State Ganganagar Sugar Mills (A Government of Rajasthan Undertaking) had issued tenders for procurement of Fully Automatic and Semi-Automatic Liquor Bottling Line, Labelling Machine.

Chart 31: Trend in Automation in Indian Brewery Industry



Source: CareEdge Research, Maia Research

9 Threats and Challenges to Advanced Sys-tek Limited and its Product & Services.

1. **Technological Changes**
   Technology evolves rapidly, leading to frequent changes in customer preferences and industry standards. Rapid advancements in automation technologies, such as robotics, AI, and IoT, blockchain, and quantum computing can quickly make existing solutions obsolete. Company should invest in research and development to keep up with technological advancements and maintain relevance in the market.

2. **Protecting Intellectual Property (IP) Rights**
   As automation solutions provider, the risk of counterfeit products and piracy of software and hardware components also grows. These threats can diminish market competitiveness and revenue streams, necessitating robust safeguards against intellectual property theft. Moreover, operating in a global market entails navigating diverse intellectual property laws and regulations across different jurisdictions. Understanding and complying with international IP frameworks can be intricate and resource-intensive for automation companies.

3. **Cost and Return on Investment**
   High initial costs associated with implementing automation solutions can be a barrier for adoption, especially for small and medium-sized enterprises (SMEs). Companies need to demonstrate tangible ROI to justify investments in automation technology by comparing upfront costs of automation equipment with long-term benefits such as reduced labor costs, increased throughput, and improved quality.

4. **Global Supply chain Disruptions**
   Dependence on global supply chains for components and parts used in developing automation systems can lead to disruptions. Shortages of semiconductor chips affect the production of automation equipment or delays in delivery of critical components can lead to many problems both for company as well as client. This challenge can be handled by developing contingency plans, maintaining buffer stocks for critical components, and establishing alternative sourcing options in different geographical regions.

5. **Adoption of Diesel exhaust fluid (DEF)**
   The requirement for effective and readily accessible diesel exhaust fluid to satisfy strict emission regulations is one of the main issues. It is logistically difficult to guarantee diesel exhaust fluid supply and quality throughout the nation. It is technically challenging to modify diesel engines so that they can use this fluid efficiently without sacrificing performance. A persistent challenge is weighing the environmental benefits of diesel exhaust fluid against its expense.

6. **Highly controlled Beverage Market**
   The alcohol beverage industry in India is highly regulated by both central and state governments. The existing regulatory complexities can be bifurcated into initial licensing requirements and post-production compliances. Pricing and distribution are also highly controlled, with state governments specifying quotas for each player, limiting the potential to increase market share. Given that state laws differ, the complexity increases with the number of states the business want to establish operations in. The alcohol beverages market is highly competitive, with established players having strong brand portfolios and marketing strategies making it challenging for the new entrant to survive in the industry.

7. **India's dependency on LNG imports due to limited domestic gas production**

   Dependence on Imports: India's heavy reliance on imported LNG makes it vulnerable to supply disruptions caused by geopolitical tensions, natural disasters, or trade conflicts. The security and reliability of the nation's energy supply may be impacted by this dependence.

   Competing for LNG Supplies: As other countries strive to obtain LNG supplies to suit their energy demands, India must compete in the global LNG market. Prices may rise as a result of this competition, and obtaining long-term contracts may become more difficult.

10 Peer Comparison

There is no direct competitor for Advanced Sys-tek in terms of products and size. Peer companies offer comparable products in certain areas which again differs from company to company.

10.1 Honeywell Automation India Limited (HAIL)

Honeywell Automation India Limited was incorporated in India and provides integrated automation and software solutions which includes process solutions and building solutions. It has a wide product portfolio in environmental and combustion controls, and sensing and control, and also provides engineering services in the field of automation and control to global clients. It has presence across India in cities namely Pune, Bangalore, Hyderabad, Mumbai, Chennai, Gurgaon, Kolkata, Jamshedpur and Vadodara.

Table 11: Consolidated Financials of Honeywell Automation India Limited **(Rs. In Million)**

Particulars	FY22	FY23	FY24	H1 FY25
Revenue from operations	29,483.20	34,476.00	40,582.00	19,843.00
Revenue growth	-3.10%	16.93%	17.71%	-
Revenue CAGR	17.32%			-
EBITDA	4,364.50	5,214.00	5,948.00	2,832.00
EBITDA Margin	14.80%	15.12%	14.66%	14.27%
EBITDA CAGR	16.74%			-
PAT	3,391.30	4,380.00	5,014.00	2,516.00
PAT YoY growth	-26.28%	29.15%	14.47%	-
PAT Margin	11.50%	12.70%	12.36%	12.68%
PAT CAGR	21.59%			-
ROCE (%)	17.17%	19.97%	20.27%	9.28%
Current Ratio	3.23	3.34	3.72	3.9
Interest Coverage Ratio	44.09	72.23	60.12	98.65
Debt to Equity Ratio	0.02	0.01	0.02	0.02
Net debt to Equity	-0.69	-0.73	-0.77	-0.74
ROE (%)	12.52%	14.54%	14.76%	6.82%
Working Capital days	60	54	46	58
PE Ratio	102.96	72.72	67.49	171.87
MPS as on date	31-03-2022	31-03-2023	28-03-2024	30-09-2024

Source: Annual Report, CareEdge Research

Note: Total Debt includes borrowings plus lease liabilities

10.2 ABB India Limited

ABB India Limited is a subsidiary of ABB Group, a multinational corporation headquartered in Switzerland. ABB India provides a wide range of products and services in the power and automation sectors. These include transformers, switchgear, circuit breakers, motors, drives, robotics, industrial automation solutions, and grid integration technologies for renewable energy. It serves various sectors such as utilities, industries, infrastructure, and transportation. It has presence across India in cities namely Kochi, Ahmedabad, Coimbatore, Raipur, Kolkata, Jaipur, Mumbai, Nagpur, Pune.

Table 12: Consolidated Financials of ABB India Limited **(Rs. In Million)**

Particulars	CY21	CY22	CY23	H1 CY24
Revenue from operations	69,340.00	85,675.30	1,04,465.20	59,112.20
Revenue growth	19.12%	23.56%	21.93%	-
Revenue CAGR	22.74%			-
EBITDA	5,647.00	9,641.60	14,940.90	11,076.70
EBITDA Margin	8.14%	11.25%	14.30%	18.74%
EBITDA CAGR	62.66%			-
PAT	5,197.10	10,162.30	12,420.50	9,027.80
PAT YoY growth	137.07%	95.54%	22.22%	-
PAT Margin	7.50%	11.86%	11.89%	15.27%
PAT CAGR	54.59%			-
ROCE (%)	19.72%	31.07%	31.11%	20.03%
Current Ratio	1.66	1.82	1.9	1.91
Interest Coverage Ratio	24.72	55.81	80.98	125.63
Debt to Equity Ratio	0.01	0.01	0.01	0.01
Net debt to Equity	-0.66	-0.63	-0.8	-0.78
ROE (%)	13.58%	22.62%	22.82%	14.70%
Working Capital days	-4	-3	-9	-3
PE Ratio	91.87	56.37	79.36	200.68
MPS as on date	31-12-2021	30-12-2022	29-12-2023	28-06-2024

Source: Annual Report, CareEdge Research

Note: Total Debt includes borrowings plus lease liabilities

10.3 Yokogawa India Limited

Yokogawa India Limited is a subsidiary of Yokogawa Electric Corporation, operates as a provider of industrial automation solutions and services in India. They offer a wide range of products and services such as Distributed Control Systems, Safety Instrumented Systems, SCADA Systems, Analytical Instruments, Field Instruments catering to various industries including oil and gas, power, chemical, pharmaceutical, food and beverage, and more. It has presence across India in cities namely Mumbai, Delhi, Chennai, Kolkata, Hyderabad, Vadodara.

Table 13: Standalone Financials of Yokogawa India Limited **(Rs. In Million)**

Particulars	FY22	FY23
Revenue from operations	12,728.32	14,200.92
Revenue growth	-3.32%	11.57%
Revenue CAGR	-	
EBITDA	1,313.08	1,254.99
EBITDA Margin	10.32%	8.84%
EBITDA CAGR	-	
PAT	822.32	745.8
PAT YoY growth	67.18%	-9.31%
PAT Margin	6.46%	5.25%
PAT CAGR	-	
ROCE (%)	40.68%	33.95%
Current Ratio	1.24	1.26
Interest Coverage Ratio	7.65	21.98
Debt to Equity Ratio	0.04	0.04
Net debt to Equity	-0.46	-0.52
ROE (%)	23.61%	17.95%
Working Capital days	-3	2

Source: Annual Report, CareEdge Research

Note: Total Debt includes borrowings plus lease liabilities

FY24 financials not available

10.4 Advanced Sys-tek Limited

Advanced Sys-tek is an established Indian player that specializes in terminal automation market. Advanced Sys-tek Limited was incorporated as Advanced Spectra-Tek Private Limited, is a Software Developer and Industrial Solutions provider, offering a wide range of services, products and solutions in the field of Software, Engineering and Automation, which includes Terminal Automation System, Liquid & Gas Fiscal Metering Systems, Diesel Exhaust Fluid System, Magnetic Locking Needle, Pulse Transmitters, Over-spill Detectors etc. The company is based out of Gujarat.

Their business is primarily focussed on Industrial Automation Solutions (IA Solutions) and they specialize in setting up completely automated metering systems in oil and gas terminals and upgrading existing manually operated oil and gas terminals.

Table 14: Consolidated Financials of Advanced Sys-tek Limited **(Rs. In Million)**

Particulars	FY22	FY23	FY24	H1 FY25
Revenue from operations	1,356.01	1,404.23	1,882.32	1,058.43
Revenue growth	-6.33%	3.56%	34.05%	-
Revenue CAGR	17.82%			-
EBITDA	182.35	174.18	235.53	146.88
EBITDA Margin	13.45%	12.40%	12.51%	13.88%
EBITDA CAGR	13.65%			-
PAT	69.89	131.71	192.17	121.54
PAT YoY growth	-52.56%	88.44%	45.91%	-
PAT Margin	5.15%	9.38%	10.21%	11.48%
PAT CAGR	65.82%			-
ROCE (%)	21.61%	15.99%	17.43%	9.13%
Current Ratio	2.94	3.27	3.13	3.96
Interest Coverage Ratio	NA	NA	NA	NA
Debt to Equity Ratio	NA	NA	NA	NA
Net debt to Equity	NA	NA	NA	NA
ROE (%)	6.32%	10.93%	12.23%	6.31%
Working Capital days	188	231	184	199

Source: Annual Report, CareEdge Research

Note: Total Debt includes borrowings plus lease liabilities

10.5 ICON Controls Private Limited

ICON Controls originally started with providing Installation and commissioning services in various process industries. For nearly 3 decades, ICON has provided solutions to almost all process industries like Oil & Gas, Refineries, Petrochemicals, Fertilizers, Steel, Power, Paper, Cement, Pharma, Water & Waste Water and Sugar Industries. ICON offers expertise across the whole spectrum of process industries and E&I solutions. Along with their presence in India, they have provided services in Dubai, Abu Dhabi, Nigeria, Bangladesh, Thailand & Indonesia.

Table 15: Standalone Financials of ICON Controls Private Limited **(Rs. In Million)**

Particulars	FY22	FY23	FY24
Revenue from operations	269.74	225.2	263.5
Revenue growth	9.26%	-16.51%	17.01%
Revenue CAGR	-1.16%		
EBITDA	104.52	46.69	56.81
EBITDA Margin	38.75%	20.73%	21.56%
EBITDA CAGR	-26.28%		
PAT	112.82	51.96	56.5
PAT YoY growth	289.69%	-53.95%	8.74%
PAT Margin	41.82%	23.07%	21.44%
PAT CAGR	-29.23%		
ROCE (%)	62.09%	22.65%	20.82%
Current Ratio	1.36	1.4	1.44
Interest Coverage Ratio	69.69	60.43	199.18
Debt to Equity Ratio	0.02	0.01	0
Net debt to Equity	-0.02	0	-0.03
ROE (%)	47.70%	16.35%	15.19%
Working Capital days	65	73	31

Source: Annual Report, CareEdge Research

Note: Total Debt includes borrowings plus lease liabilities

FY24 financials not available

10.6 Comparison of Financial Parameters

Table 16: Revenue from Operations

Company Name	Revenue from Operations (Rs. In Millions)				Revenue from Operations CAGR, FY22–FY24
	FY22	FY23	FY24	H1 FY25	
Honeywell Automation India Limited	29,483.20	34,475.90	40,582.00	19,843.00	17.32%
ABB India Limited	69,340.00	85,676.30	1,04,465.20	59,112.20	22.74%
Yokogawa India Limited	12,728.30	14,200.90	-	-	-
Advanced Sys-tek Limited	1,356.01	1,404.23	1,882.32	1,058.43	17.82%
ICON Controls Private Limited	269.74	225.20	263.50	-	-1.16%

Source: Company Annual Report

Note: For ABB India Limited June 2024 is considered as H1 FY2025

Table 17: Earnings Before Interest, Tax, Depreciation and Amortization (EBITDA)

Company Name	EBITDA (Rs. In Millions)				EBITDA Margin				EBITDA CAGR, FY22–FY24
	FY22	FY23	FY24	H1 FY25	FY22	FY23	FY24	H1 FY25	
Honeywell Automation India Limited	4,332.00	5,189.00	5,894.00	2,832.00	14.80%	15.12%	14.66%	14.27%	16.64%
ABB India Limited	5,567.10	9,618.70	14,897.80	11,076.70	8.14%	11.25%	14.30%	18.74%	63.59%
Yokogawa India Limited	1,277.00	1,229.10	-	-	10.32%	8.84%	-	-	-
Advanced Sys-tek Limited	182.35	174.18	235.53	146.88	13.45%	12.40%	12.51%	13.88%	13.65%
ICON Controls Private Limited	104.52	46.69	56.81	-	38.75%	20.73%	21.56%	-	-26.27%

Source: Company Annual Report

Note: For ABB India Limited June 2024 is considered as H1 FY2025

Table 18: Profit After Tax (PAT)

Company Name	PAT (Rs. In Million)				PAT % of Revenue from Operations				PAT CAGR, FY22 – FY24
	FY22	FY23	FY24	H1 FY25	FY22	FY23	FY24	H1 FY25	
Honeywell Automation India Limited	3,391.00	4,380.00	5,014.00	2,516.00	11.50%	12.70%	12.36%	12.68%	21.60%
ABB India Limited	5,197.00	10,162.00	12,421.00	9,027.80	7.50%	11.86%	11.89%	15.27%	54.60%
Yokogawa India Limited	822.00	746.00	-	-	6.46%	5.25%	-	-	-
Advanced Sys-tek Limited	69.89	131.71	192.17	121.54	5.15%	9.39%	10.21%	11.48%	65.82%
ICON Controls Private Limited	112.80	52.00	56.50	-	41.82%	23.07%	21.44%	-	-29.23%

Source: Company Annual Report

Note: For ABB India Limited June 2024 is considered as H1 FY2025

Table 19: Net worth and NAV per share

Company Name	Net Worth				NAV per Share (Basic)			
	FY22	FY23	FY24	H1 FY25	FY22	FY23	FY24	H1 FY25
Honeywell Automation India Limited	28,367.70	31,885.10	36,062.00	37,695.00	3,208.29	3,606.10	4,078.49	4,263.18
ABB India Limited	40,451.90	49,394.10	59,446.00	63,415.80	190.90	233.10	280.54	299.27
Yokogawa India Limited	3,781.40	4,527.90	-	-	444.61	532.38	-	-
Advanced Sys-tek Limited	1,141.07	1,271.21	1,871.01	1,982.01	60.61	67.52	99.30	103.08
ICON Controls Private Limited	291.75	343.71	400.21	-	61.42	72.26	84.25	-

Source: Company Annual Report

Note: For ABB India Limited June 2024 is considered as H1 FY2025

Table 20: Earning Per Share (EPS)

Company Name	EPS Basic				EPS Diluted			
	FY22	FY23	FY24	H1 FY25	FY22	FY23	FY24	H1 FY25
Honeywell Automation India Limited	383.54	495.40	567.10	284.52	383.54	495.40	567.10	284.52
ABB India Limited	24.53	47.96	58.61	42.61	24.53	47.96	58.61	42.61
Yokogawa India Limited	96.68	87.68	-	-	96.68	87.68	-	
Advanced Sys-tek Limited	3.71	7.00	10.20	6.32	3.71	7.00	10.20	6.32
ICON Controls Private Limited	238	109	119	-	238	109	119	-

Source: Company Annual Report

Note: For ABB India Limited June 2024 is considered as H1 FY2025

Table 21: Debt to Equity Ratio

Company Name	Debt Equity Ratio			
	FY22	FY23	FY24	H1 FY25
Honeywell Automation India Limited	0.02	0.01	0.02	0.02
ABB India Limited	0.01	0.01	0.01	0.01
Yokogawa India Limited	0.04	0.04	-	-
Advanced Sys-tek Limited	-	-	-	-
ICON Controls Private Limited	0.02	0.01	0	-

Source: Company Annual Report,

Note: Total Debt includes borrowings plus lease liabilities

For ABB India Limited June 2024 is considered as H1 FY2025

Table 22: Return on Net Worth, Return on Capital Employed and Working Capital Days

Company Name	Return on Net Worth				Return on Capital Employed				Working Capital Days in Number of Days			
	FY22	FY23	FY24	H1 FY25	FY22	FY23	FY24	H1 FY25	FY22	FY23	FY24	H1 FY25
Honeywell Automation India Limited	11.95 %	13.73 %	13.90 %	6.98 %	17.17	19.97	20.27	9.28	60	54	46	58
ABB India Limited	12.80 %	20.60 %	23.10 %	14.24 %	19.72 %	31.07 %	31.11 %	20.03 %	-4	-3	-9	-3
Yokogawa India Limited	21.73 %	16.47 %	-	-	40.68 %	33.95 %	-	-	2	-3	-	-
Advanced Sys-	6.13 %	10.36 %	10.27 %	6.13 %	21.61 %	15.99 %	17.43 %	9.13 %	188	231	184	199

tek Limited												
ICON Controls Private Limited	38.67 %	15.12 %	14.12 %	-	62.09 %	22.65 %	20.82 %	-	31	73	65	-

Source: Company Annual Report
Note: For ABB India Limited June 2024 is considered as H1 FY2025
CAGR for Yokogawa is calculated from FY21 to FY23.

Definition of KPIs:

- Revenue from Operations means the revenue from operations as appearing in the Restated Financial Information.
- Year on year growth rate is calculated by subtracting the value of the previous year from the current year's value, then dividing by the previous year's value.
- Compound Annual Growth Rate (CAGR) is computed by dividing the value as at the year-end by its value at the beginning of that period, raise the result to the power of one divided by the period length, and subtract one from the subsequent result [(End Value / Start Value) ^ (1 / Periods) – 1)]
- EBITDA is calculated as profit/ (loss) for the year less exceptional items and other income plus finance costs, depreciation and amortisation, and total income tax expenses
- EBITDA Margin (%) is calculated as EBITDA divided by Revenue from Operations.
- PAT is restated Profit/ (Loss) or the period/ year as appearing in the Restated Financial Information.
- PAT Margin refers to the percentage margin derived by dividing Profit after Tax by Revenue from Operations.
- Return on Capital Employed (ROCE) is calculated as earnings before interest and taxes divided by Average Capital Employed for the period/year.
    - Earnings before interest and tax is calculated as restated profit / (loss) for the period /year plus total tax expense / (credit) plus finance costs.
    - Average Capital Employed is calculated as the average of Total equity, Total Debt and Deferred Tax Liability for the current and previous financial period/year
- Current Ratio is Calculated as Current asset divided by Current Liabilities.
- Return on Equity (ROE) refers to restated profit for the year/period attributable to equity shareholders of the Company divided by average Equity for the period/year.
- Working Capital Days or days working capital (DWC), represent the number of days a business takes to turn its working capital into revenue.
- Working Capital Days are calculated by dividing the number of days in the year/period by the Operating Working Capital Turnover Ratio based on Consolidated Financial Data
    - The Operating Working Capital Turnover Ratio is determined by dividing the revenue from operations by the operating working capital.
- Order book reflects the total backlog of the Company calculated as Opening Backlog add Orders Intake during the year / period Less Sales during the year / period.
- Order Intake reflects the new orders received and booked during the year / period.
- Net worth means the aggregate value of the paid-up share capital and all reserves created out of the profits and securities premium account and debit or credit balance of profit and loss account, after deducting the aggregate value of the accumulated losses, deferred expenditure and miscellaneous expenditure not written off, as per the

audited balance sheet, but does not include reserves created out of revaluation of assets, write-back of depreciation and amalgamation.

- Return on Net Worth (RoNW) is calculated as Profit after tax divided by Net Worth
- Net Asset Value per Share represents Net Asset Value per Equity Share as per Restated Financial Information. It is calculated as Net Worth as of the end of relevant period/year divided by number of equity used in calculating earnings per share.
- Net debt to equity is calculated by dividing a company's net liabilities by its shareholders' equity.
- Interest coverage ratio is calculated based on interest expenses including bank charges divided by Earning before interest and tax.

Explanation for KPI metrics

Sr. No.	KPI	Explanation
1.	Revenue from operations	Revenue from operations represents the total turnover of the business
2.	Year on Year growth rate (%)	Year on Year growth rate provides information regarding the year over year growth of our Company.
3.	2-year CAGR (%) of revenue from operations between Fiscal 2022 and Fiscal 2024	2-year CAGR of revenue from operations provides information regarding 2-year compounded growth rate of revenue of the business.
4.	EBITDA	EBITDA provides information regarding the operational efficiency of the business of our Company.
5.	2-year CAGR (%) of EBITDA	2-year CAGR of EBITDA provides information regarding 2-year compounded growth rate of EBITDA of the business.
6.	EBITDA margin (%)	EBITDA margin is an indicator of the operational profitability of our business before interest, depreciation, amortization, and taxes in percentage.
7.	Profit after tax (PAT)	PAT represents the profit / loss that our Company makes for the financial year or during a given period. It provides information regarding the overall profitability of our business.
8.	2-year CAGR of PAT between Fiscal 2022 and Fiscal 2024	2-year CAGR of PAT between Fiscal 20222 and Fiscal 2024 provides information regarding 2-year compounded growth rate of PAT of the business between Fiscal 2022 and Fiscal 2024.
9.	Year on Year Growth Rate of PAT (%)	Year on Year growth rate provides information regarding the year over year PAT growth of our Company.
10.	PAT Margin (%)	PAT margin is an indicator of the overall profitability of our business in percentage.
11.	Return on Capital Employed (%)	Return on Capital Employed represents how efficiently our Company generates earnings before interest & tax from the capital employed.
12.	Current ratio	Current Ratio indicates the short-term liquidity and measures the ability of the company to pay off its short term obligations.
13.	Return on equity (%)	Return on Equity represents how efficiently our Company generates profits from our shareholders funds.
14.	Total debt to equity (in times)	Debt to equity is a measure of the extent to which our Company can cover our debt and represents our debt position in comparison to our equity position. It helps evaluate our financial leverage.
15.	Net debt to equity	Net Debt to equity is a measure of the extent to which our Company can cover our net debt and represents our net debt position in

Sr. No.	KPI	Explanation
		comparison to our equity position. It helps evaluate our financial leverage.
16.	Working capital days	Working Capital Days measures how efficiently our company manages its working capital by indicating the average number of days it takes to convert working capital into revenue.
17.	Order Book	The order book represents the total outstanding orders at a given time, calculated by adding new orders and subtracting sales during the period from the opening backlog
18.	Order Intake	Order intake represents the value of new orders received and confirmed during the period

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About:

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