



**Industry Report On
Community Industrial Gases Generation &
Distribution in India**

SUBMITTED TO

STEAMHOUSE INDIA LTD

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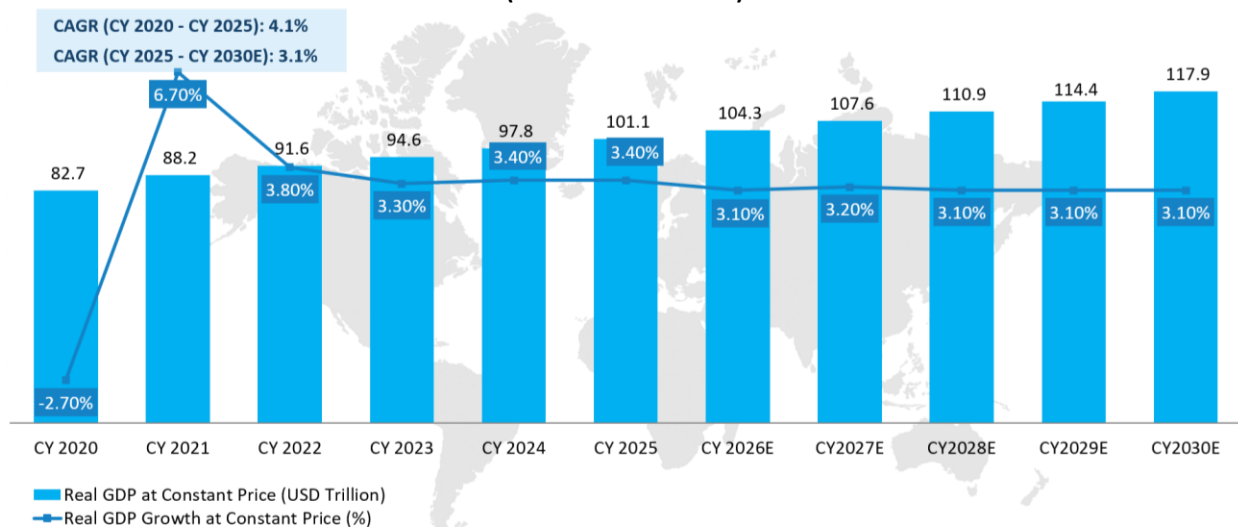
1 MACROECONOMIC OVERVIEW

1.1 Global Macroeconomic Overview

In recent years, the global economy has demonstrated resilience despite repeated disruptions. Following the contraction in CY2020 caused by the COVID-19 pandemic, global real GDP rebounded strongly in CY2021, growing by 6.7%, before moderating to 3.8% in CY2022 amid the Russia–Ukraine conflict, elevated inflation, and ongoing supply-chain pressures. Growth remained relatively stable at 3.3% in CY2023 and strengthened slightly to 3.4% in CY2024, according to the International Monetary Fund (IMF). Global real GDP growth was 3.4% in CY2025 and is projected at 3.1%¹ in CY2026 and 3.2% in CY2027. Over the medium term, global growth is expected to remain around 3.1%, reflecting a relatively stable but slower growth trajectory compared with the pre-pandemic historical average.

1.1.1 Global² Real GDP and Growth Outlook

Exhibit 1.1: Real GDP and real GDP growth (annual percentage change), Global, growth in %, CY2020-CY2030E, (Value in USD trillion)



Note: E refers to Estimate

Source: IMF; World Bank; Frost & Sullivan Analysis

The global economy continued to face a complex operating environment in CY2025, with trade-policy uncertainty, geopolitical tensions, and uneven regional growth shaping economic activity. In CY2025, the global economy was influenced by several significant factors:

Geopolitical and Trade Tensions: Trade restrictions intensified during CY2025, particularly following changes in US tariff policy, prompting businesses to accelerate imports, adjust sourcing strategies, and reroute supply chains. The resulting uncertainty continued to weigh on investment and global trade flows.

Shift in Monetary Policy: Major central banks moved from the restrictive monetary stance of CY2022–CY2023 toward policy easing as inflation moderated. However, the easing cycle has become more cautious as renewed energy-price pressures have complicated the inflation outlook. In July 2026, the ECB kept its key interest rates unchanged, citing elevated uncertainty and the potential inflationary impact of higher energy prices.

¹ https://www.imf.org/external/datamapper/NGDP_RPCH@WEO/WEO_WORLD

Energy Market Volatility and Geopolitical Conflict: The escalation of the conflict in West Asia during CY2026 has created a significant shock to global energy markets. The effective closure of the Strait of Hormuz disrupted oil and LNG flows, with the route previously accounting for almost 20% of global LNG supply, resulting in heightened price volatility and tighter gas market balances. The IEA expects global gas demand to decline by approximately 0.5% in CY2026, with higher LNG prices reducing gas consumption in Asia and Europe and lowering operating rates across gas- and energy-intensive industries. European natural gas prices also rose sharply following the onset of the conflict, highlighting the continued sensitivity of energy-importing economies to disruptions in LNG supply.³

The escalation of the West Asia conflict has also heightened concerns around energy security and dependence on conventional fuel sources, particularly among energy-importing economies. The disruption to LNG flows through the Strait of Hormuz has prompted countries to diversify energy supply routes and sources, while increasing the focus on domestically available resources, renewable energy, electrification and energy efficiency. Global energy investment is expected to reach USD 3.4 trillion in 2026, of which approximately USD 2.2 trillion is directed toward clean energy, including renewables, grids, storage, low-emissions fuels, nuclear, efficiency and electrification. For energy-intensive industries, elevated energy-price volatility is increasing the focus on fuel switching, alternative fuels, energy efficiency and greater diversification of energy sources to reduce exposure to supply disruptions and operating-cost volatility.^{4 5}

China's Structural Challenges: China's economy continued to face subdued domestic demand, weakness in the property sector, slowing productivity growth, and demographic pressures. The IMF's July 2026 outlook projects China's growth to slow from 5.0% in CY2025 to 4.6% in CY2026, while highlighting the need for a stronger shift from export-led toward consumption-led growth.

These developments have also been accompanied by a stronger technology investment cycle. Rapid investment related to artificial intelligence has provided an important offset to the drag from trade and geopolitical shocks, particularly in economies integrated into global technology supply chains. The IMF expects this technology-driven investment boom to support activity in CY2026, although its sustainability remains a potential downside risk.

1.1.2 Global Inflation

Global inflation, after peaking at 8.7% in CY2022, declined to 6.7% in CY2023, 5.8% in CY2024, and 4.1% in CY2025. The moderation reflects the cumulative effects of monetary tightening, easing supply constraints, and lower commodity-price pressures from their earlier peaks. However, renewed geopolitical tensions, energy-price volatility, and trade disruptions could create fresh inflationary pressures and slow the pace of disinflation. Global headline inflation is projected to increase from 4.1% in CY2025 to 4.7% in CY2026E, before moderating to 3.9% in CY2027E, reflecting higher energy and food prices and the impact of the ongoing geopolitical conflict. The continued moderation is expected to support a gradual easing in inflationary pressures, although the pace of monetary-policy normalization is

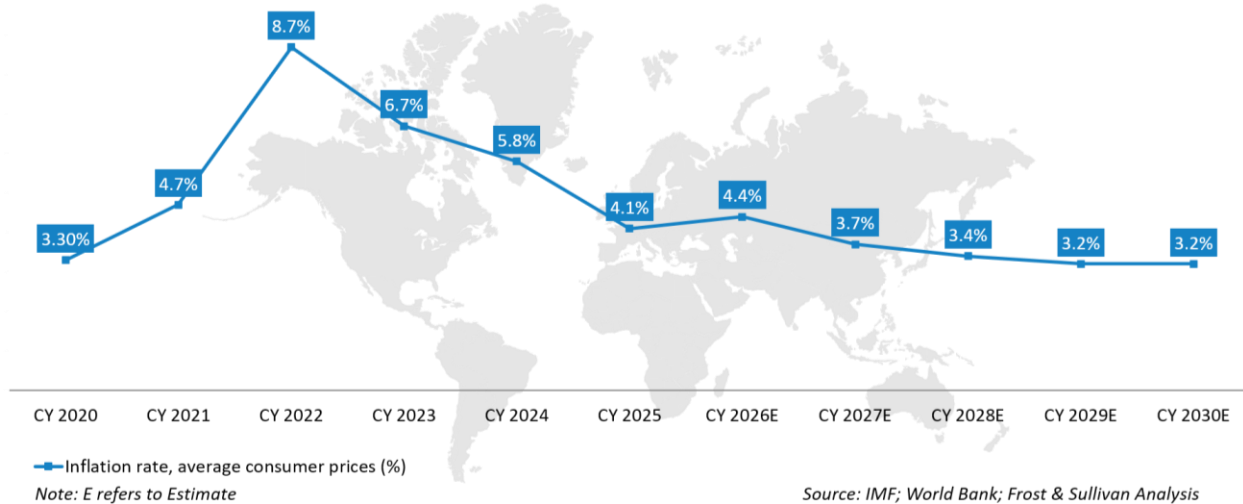
³ <https://www.iea.org/reports/gas-market-report-q3-2026/executive-summary?utm>

⁴ <https://www.iea.org/reports/world-energy-investment-2026?utm>

⁵ <https://www.iea.org/reports/gas-market-report-q3-2026?utm>

likely to remain dependent on developments in energy prices, global trade, and underlying price pressures across major economies.⁶

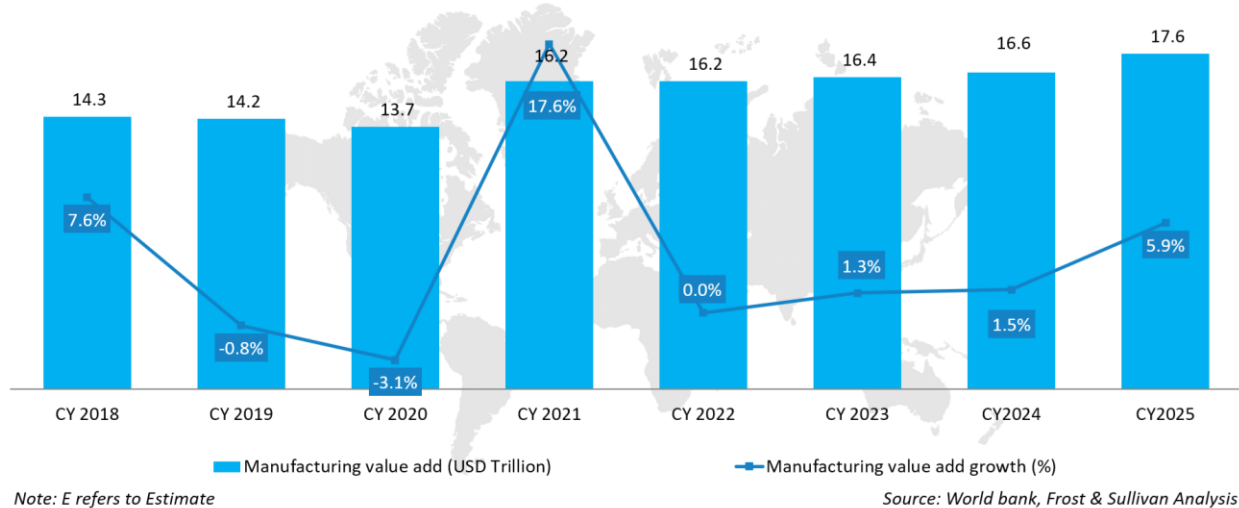
Exhibit 1.2: Global Inflation rate, average consumer prices (annual percentage change), growth in %, CY2020-CY2030E



1.1.3 Manufacturing Value Added (At current USD)

India's manufacturing sector has experienced significant fluctuations in growth in recent years. Growth moderated from 7.6% in the initial period to -0.8% and -3.1%, reflecting the impact of the pandemic and associated disruptions. This was followed by a sharp rebound of 17.6%, supported by the reopening of the economy and a recovery in industrial activity. Growth subsequently moderated in CY2022, before improving to 1.3% and 1.5% in the following years.

Exhibit 1.3: Manufacturing value added at current prices, CY2018 – CY2025, (Value in USD trillion)



The latest period shows a stronger recovery, with growth reaching 5.9%, indicating an improvement in manufacturing activity and demand conditions. The gradual strengthening in the latest period, supported

⁶ <https://www.imf.org/external/datamapper/PCPIPCH@WEO/WEO WORLD>

by domestic demand, investment and government-led manufacturing initiatives, provides a positive backdrop for further capacity expansion across industrial and process-oriented sectors.⁷

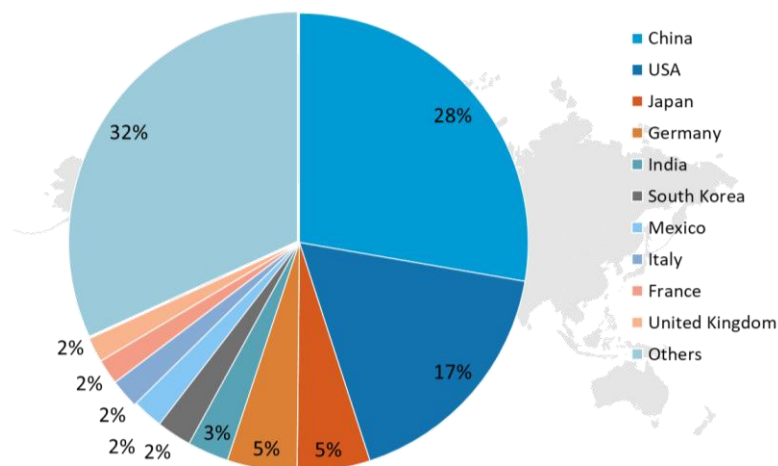
1.1.4 Share of Major Economies To Global Manufacturing Output

Emerging economies, particularly in Asia, have witnessed a significant rise in the share of manufacturing in their GDP. Countries like China, India, and several Southeast Asian nations have become manufacturing powerhouses, attracting foreign investments, and capitalizing on lower labour costs. These countries have established themselves as global manufacturing hubs, driving their economic growth and development.

China: China, home to the approximately 1.4 billion people, leads the globe in manufacturing, accounting for 27.7% of total global output. In 2024, this represented nearly USD 5 trillion of China's economic activity. With low production costs, a vast workforce, and high-quality manufacturing standards, China remains a dominant force in the industry. Its unmatched manufacturing value plays a pivotal role in global supply chains.

China's advanced manufacturing sectors include electronics, machinery, and textiles, solidifying its position as the world's top manufacturer and maintaining its leadership in global manufacturing rankings.

Exhibit 1.4: Top 10 manufacturing countries in the world, share in %, CY2024



Source: Frost & Sullivan Analysis

United States: Manufacturing is a vital component of the United States' GDP, contributing over USD 2.9 trillion in 2024 and accounting for 17% of the nation's economic activity. This sector also represents a significant portion of U.S. exports. The country is renowned for its advanced manufacturing techniques and the production of high-quality goods.

Despite challenges such as the need to diversify manufacturing bases due to global supply chain disruptions, the U.S. remains a major player in global manufacturing. The World Bank recognizes the United States as a leader in innovation and technology, which continues to drive its manufacturing industry forward.

India: India is emerging as a reliable hub for various business sectors, supported by its population of over 1.4 billion and a manufacturing output of USD 490 billion in 2024. Renowned for its IT workforce and

⁷<https://data.worldbank.org/indicator/NV.IND.MANF.CD?contextualregionlocationsin=null&end=2025&start=1961&utm>

customer service centers, India is also strengthening its manufacturing capabilities, making it a competitive force in the global market.

The country's manufacturing value added has been steadily increasing, driven by government initiatives and a large, skilled workforce. Key industries in India's manufacturing sector include textiles, automotive, chemicals and pharmaceuticals, making it a diverse and dynamic destination for business expansion.

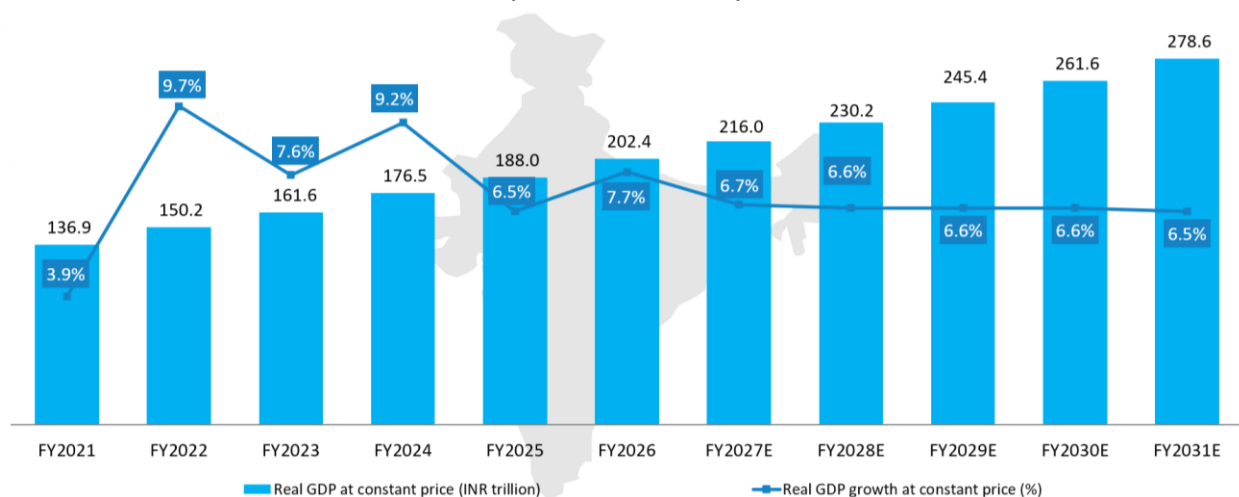
The Government of India (GoI) has launched several manufacturing schemes to boost industrial growth, enhance exports, and strengthen the **"Make in India"** initiative.

1.2 Indian Macroeconomic Overview

1.2.1 Real Gross Domestic Product (GDP) and outlook

India's real GDP growth has remained robust, with growth moderating from 9.7% in CY2021 to 6.5% in CY2025 and projected to remain broadly stable at around 6.5%-6.7% through CY2031E. Sustained economic expansion is expected to support industrial activity and capacity additions across manufacturing and other energy-intensive sectors. For industries with significant process and heating requirements, continued growth in production and operating capacity can support steady demand for industrial steam and other utility services.

Exhibit 1.5: Annual Real GDP and Real GDP growth (Annual % Change), Growth in %, India, FY2021-FY2031E, (Value in INR Trillion)



Note: E refers to Estimate

Source: MoSPI (Annual Estimates of GDP at constant price, 2011-12 series), IMF; Frost & Sullivan Analysis

India has continued to record strong economic growth despite global uncertainties. Real GDP grew by 7.7% in FY2025-26, compared with 6.5% in FY2024-25, according to MoSPI. The Government continues to support growth through measures focused on manufacturing, infrastructure, investment and domestic value addition, including the Production Linked Incentive (PLI) schemes, National Manufacturing Mission, National Logistics Policy and PM Gati Shakti National Master Plan.⁸

In the Union Budget FY2026-27, the Government maintained its focus on infrastructure-led growth and fiscal consolidation. Capital expenditure has been increased to approximately INR 12.2 lakh crore, while the fiscal deficit is budgeted at 4.3% of GDP. The Government has also continued to strengthen support

⁸ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2269286&lang=1®=1&utm>

for MSMEs, manufacturing and strategic sectors, including electronics, semiconductors, clean technology and pharmaceuticals.⁹

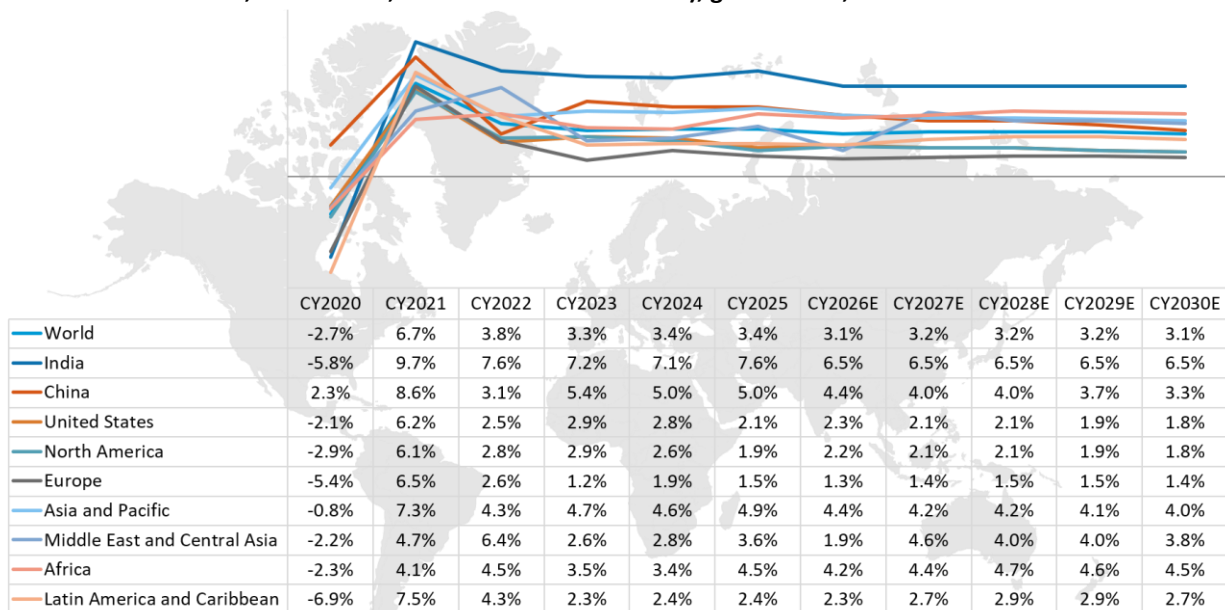
India's growth outlook remains supported by domestic consumption, investment and continued manufacturing capacity expansion. With real GDP growth of 7.7% in FY2025-26 and continued policy support for infrastructure and manufacturing, India is expected to remain among the faster-growing major economies.

1.2.2 Growth in Real GDP - India vs leading global economies

India's economic performance has remained stronger than that of most major economies despite the disruptions arising from the Russia-Ukraine conflict, elevated commodity prices and tighter global financial conditions. Global real GDP growth moderated to 3.8% in CY2022, before increasing to 3.3% in CY2023 and 3.4% in CY2024. Growth was estimated at 3.4% in CY2025 and is projected at 3.1% in CY2026 and 3.2% in CY2027. The global outlook continues to be influenced by geopolitical tensions, trade-policy uncertainty, energy-price volatility and financial conditions.¹⁰

India has continued to outperform the global economy, with real GDP growth of 7.2% in CY2023, followed by 7.1% in CY2024 and 7.6% in CY2025. The IMF projects growth of 6.5% in both CY2026 and CY2027, supported by domestic demand and continued investment. In comparison, growth in major economies such as China and the United States is expected to remain lower, while the euro area continues to face weaker underlying growth.

Exhibit 1.6: India vs. Global - Real GDP growth (annual percentage change) in key economies (India, USA, Europe, China, Middle East, South East Asia and Africa), growth in %, CY2020-CY2030E



Note: E refers to Estimate

Source: IMF, World Economic Outlook, April 2026; Frost & Sullivan Analysis

India's relatively strong growth outlook is supported by domestic consumption, investment, infrastructure development, manufacturing expansion and ongoing structural reforms. Continued urbanisation, rising formal employment, digitalisation and increasing integration with global supply chains are also expected

⁹ <https://www.indiabudget.gov.in/>

¹⁰ <https://www.imf.org/-/media/files/publications/weo/2026/april/english/text.pdf?utm>

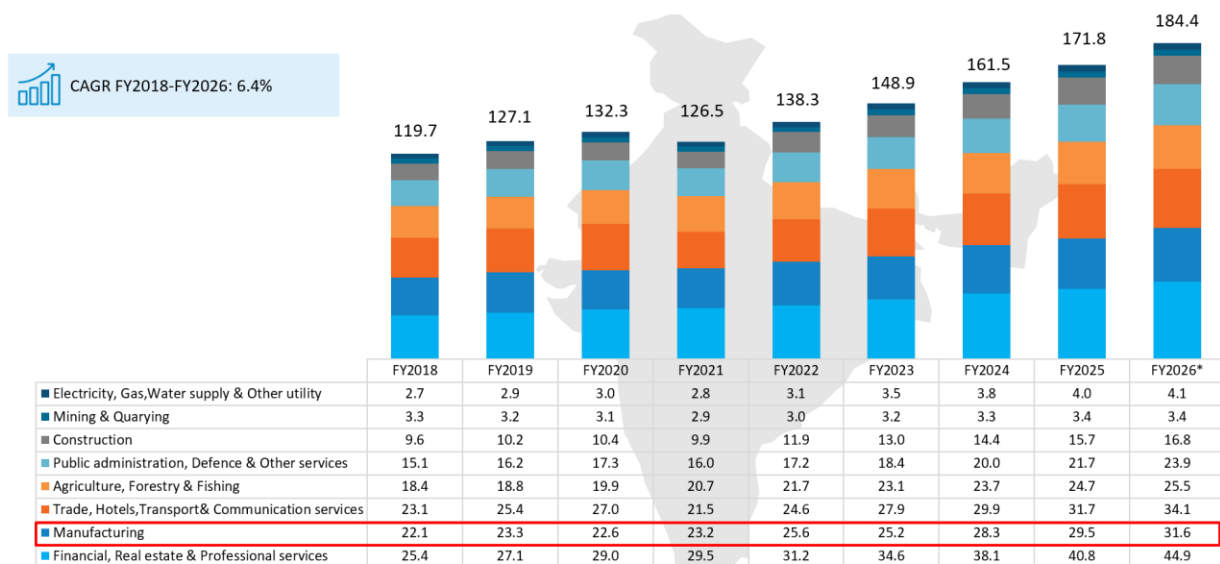
to support economic activity. However, the outlook remains subject to external risks, particularly changes in global trade policies, geopolitical developments, energy prices and weaker global demand.

India is among the world's largest economies by nominal GDP and remains the third-largest economy on a purchasing-power-parity (PPP) basis. India continues to pursue its medium-term ambition of becoming a USD 5 trillion economy, with its progress toward becoming the world's third-largest economy dependent on sustained economic growth, exchange-rate movements and global economic conditions.¹¹

1.2.3 Sectoral Share of Gross Value Added (GVA)

India's Gross Value Added (GVA) has expanded steadily, with the total GVA shown in the exhibit increasing at a CAGR of 6.4% between FY2018 and FY2026. The composition of GVA remains diversified across agriculture, manufacturing, construction, utilities and services, with the services sector accounting for the largest share of economic activity. Within services, financial, real estate and professional services, along with trade, hotels, transport and communication constitute significant components of GVA.

Exhibit 1.7: India - Gross value added (GVA) at basic price by economic activity, FY2018-FY2026, (Value in INR trillion)



* Second Advance Estimates

Source: National Statistical Office; Frost & Sullivan Analysis

Manufacturing remains an important contributor to India's economic output and has expanded alongside investments in industrial capacity, infrastructure and domestic production. The manufacturing base is supported by growth in automobiles, electronics, pharmaceuticals, engineering and other industrial segments, while construction and utilities have also benefited from continued infrastructure and capacity development.

The overall composition indicates that India's growth is increasingly supported by a combination of services expansion and a broadening industrial base, with manufacturing, construction and related activities providing an important link between domestic demand, investment and industrial capacity creation. For process industries, the expansion of manufacturing and construction activity is particularly relevant as it supports demand for industrial utilities and process-related services.

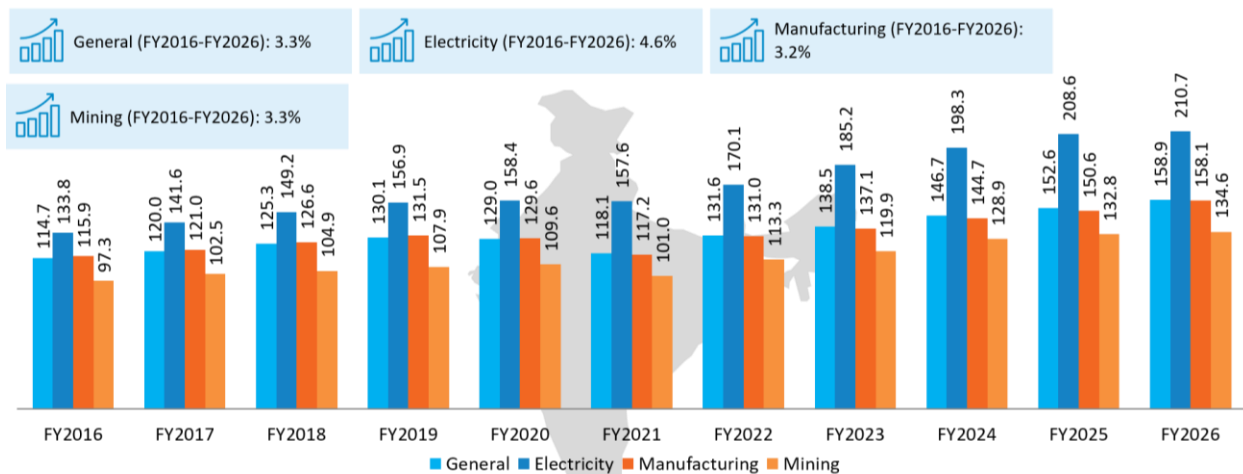
¹¹ <https://www.imf.org/external/datamapper/profile/IND/WEO?utm>

1.2.4 Index of Industrial Production (IIP)

India's industrial activity continued to expand in FY2026, with the General Index of Industrial Production (IIP) increasing from 152.6 in FY2025 to 158.9 in FY2026, representing 4.1% year-on-year growth. Manufacturing remained the main contributor to industrial growth, with the manufacturing index increasing from 150.6 to 158.1, corresponding to 5.0% growth during FY2026. Mining recorded more moderate growth, with its index increasing from 132.8 to 134.6, while the electricity index increased from 208.6 to 210.7, reflecting comparatively slower growth of 1.4% and 1.0%, respectively.¹²

Over the longer period covered in the exhibit, manufacturing has also recorded a steady upward trend, with the sector's index increasing consistently through FY2026. The continued expansion in manufacturing activity, together with growth in mining and electricity output, indicates sustained industrial capacity and production activity in India. For process-oriented industries, the continued increase in manufacturing output is particularly relevant as it supports demand for industrial input, utilities and production-related services.¹³

Exhibit 1.8: India - Index of Industrial Production (IIP) by Sectors, FY2016-FY2026



Source: MoSPI (Annual Estimates of GDP at constant price, 2011-12 series); RBI (Reserve Bank of India); Frost & Sullivan Analysis

1.2.5 India Manufacturing PMI (Purchase Managers Index)

India's manufacturing PMI remained above the neutral level of 50 throughout the period shown in the exhibit, indicating continued expansion in manufacturing activity. The index reached 59.1 in July 2025 and 59.3 in August 2025, supported by stronger output and new order growth. The PMI subsequently moderated as the pace of demand and production growth normalized and external uncertainties increased.¹⁴

During early 2026, manufacturing activity continued to expand, although at a slower pace. The PMI declined to 53.9 in March 2026, as softer demand, heightened market uncertainty, competitive pressures and rising input costs affected new orders and output. In April 2026, the PMI increased to 54.7, before returning to 54.3 in May 2026, indicating a renewed improvement in manufacturing conditions. The May

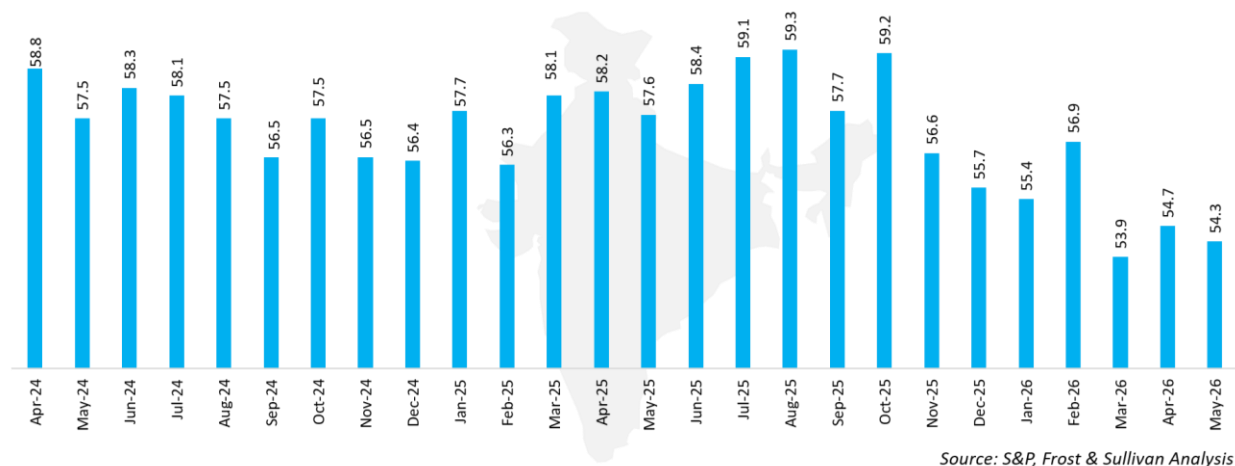
¹² <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2256241&lang=1®=3&utm>

¹³ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2256241&lang=1®=3&utm>

¹⁴ <https://www.pmi.spiglobal.com/Public/Home/PressRelease/9806df5729e64068a9d3c6e17c8ee67b>

expansion was supported primarily by stronger domestic demand, new orders and output, while export-order growth moderated.¹⁵

Exhibit 1.9: Indian Manufacturing PMI, Apr 2024 - May 2026



Overall, the sustained PMI readings above 50 indicate that India's manufacturing sector has remained in expansion territory despite fluctuations in the pace of growth. The recent trend also indicates a shift from the stronger expansion observed during mid-2025 toward a more moderate but continuing expansion in 2026, with domestic demand remaining an important support while higher input costs and global trade and geopolitical uncertainties continue to influence manufacturers.

1.2.6 Foreign Direct Investment (FDI)

India has continued to remain one of the leading destinations for FDIs among emerging economies, supported by its large domestic market and expanding manufacturing ecosystem.

Total FDI inflows increased from USD 74.4 billion in FY2020 to USD 84.8 billion in FY2022, driven by strong investor interest across sectors such as digital services, manufacturing, infrastructure, renewable energy, financial services, logistics, and technology. During this period, India benefited from increasing global focus on supply chain diversification, localization of manufacturing capacities, and rising investments in digital infrastructure and industrial development.

Although total FDI inflows moderated to approximately USD 71 billion during FY2023 and FY2024 amid global economic slowdown and elevated interest rates, India continued to attract significant long-term investments supported by strong domestic growth prospects and structural reforms. In FY2025, total FDI inflows recovered to USD 80.6 billion.

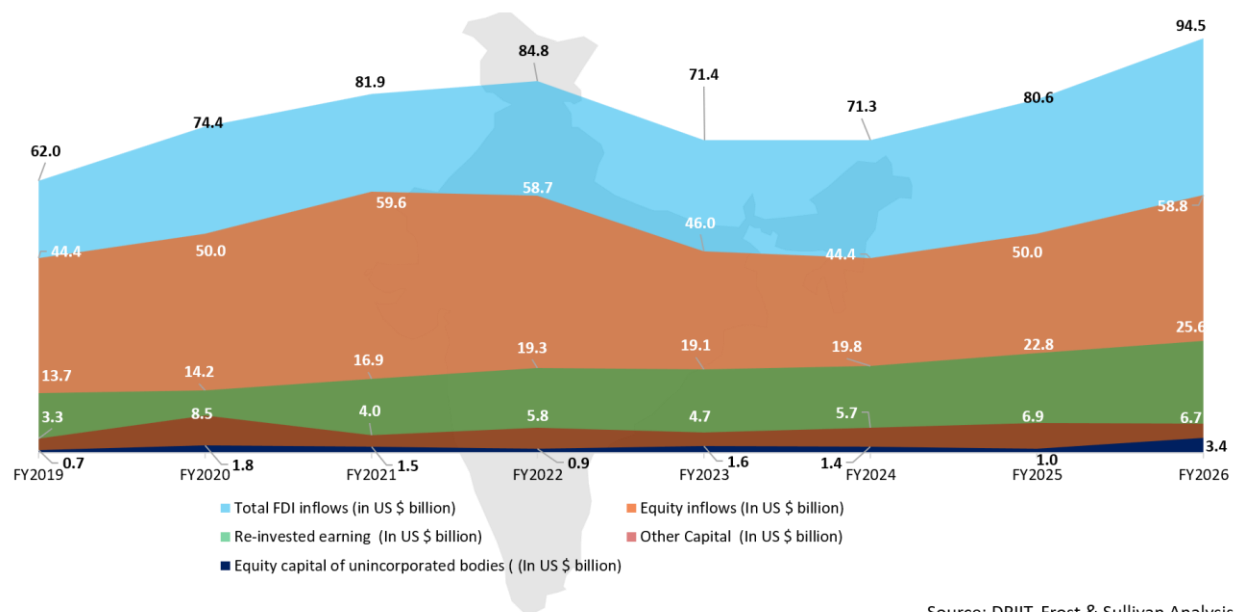
Equity inflows remained the largest component of total FDI during the review period. Re-invested earnings also demonstrated consistent growth, rising from USD 14.2 billion in FY2020 to USD 22.8 billion in FY2025, indicating sustained confidence among existing foreign investors regarding India's long-term economic and business outlook.

During FY2026, India recorded total FDI inflows of USD 94.5 billion, with equity inflows accounting for USD 58.8 billion. The strong contribution from equity investments reflects continued investor interest in sectors linked to manufacturing, infrastructure, renewable energy, electronics, transportation, industrial

¹⁵ <https://www.pmi.spglobal.com/Public/Home/PressRelease/6030251beded4e3ab5fa9f5b8f9678c1>

engineering, logistics, and digital services. In addition, increasing investments across semiconductor manufacturing, electric mobility, data centers, and clean energy infrastructure continue to strengthen India's position as a strategic long-term investment destination.¹⁶

Exhibit 1.10: FDI inflow in India, in US\$ billion, FY2020 to FY2026



India's growing integration into global supply chains, relatively stable macroeconomic environment, expanding consumer market, and increasing focus on industrial self-reliance continue to position the country favorably for long-term foreign investments across manufacturing and infrastructure-linked sectors. However, global risks related to geopolitical tensions, trade fragmentation, currency volatility, and slower global economic growth may continue to influence short-term investment flows and capital allocation trends.

1.3 Notable Trends in the Indian Manufacturing Sector

1.3.1 India Strengthening its Position in Global Manufacturing

India's manufacturing sector remains an important component of the country's industrial base, contributing approximately 16-17% of GDP and employing more than 27 million workers, according to the Government's April 2026 assessment. The Government's long-term objective is to increase manufacturing's contribution to at least 25% of GDP, supported by greater domestic value addition, technology adoption and deeper integration with global value chains.¹⁷

Manufacturing activity also remained supportive in FY2025-26. According to the Economic Survey 2025-26, the manufacturing sector grew by 8.4% during H1 FY2025-26, compared with 6.1% during H1 FY2024-25, supported by resilient domestic demand and improved utilisation of existing capacity.¹⁸

India's external manufacturing base is also expanding. Merchandise exports reached USD 441.78 billion in FY2025-26, compared with USD 437.70 billion in FY2024-25, while total merchandise and services exports

¹⁶ <https://www.dpiit.gov.in/static/uploads/2026/06/58b5bb60fa2d0b268d9017d393e7eb0e.pdf>

¹⁷ <https://www.pib.gov.in/PressNoteDetails.aspx?ModuleId=3&NotelId=158382&id=158382&lang=1®=3>

¹⁸ <https://www.indiabudget.gov.in/economicsurvey/doc/echapter.pdf>

reached an estimated USD 860.09 billion during FY2025-26. Engineering goods were among the key contributors to merchandise export growth during the year.¹⁹

The manufacturing landscape is increasingly characterised by capacity expansion in priority sectors, higher domestic value addition and the development of integrated manufacturing ecosystems. Electronics, pharmaceuticals, automobiles and auto components, solar PV, specialty steel, food products, textiles, telecom equipment, white goods and advanced batteries are among the sectors where significant policy-led manufacturing investments are being developed. The shift is increasingly towards targeted sectoral development combined with industrial infrastructure, technology and supply-chain integration.²⁰

For process industries, this expansion is relevant because several of the sectors receiving substantial manufacturing investment-including food processing, pharmaceuticals, textiles, specialty steel, chemicals, automobiles and consumer products-have recurring requirements for process heat, steam and other industrial utilities.

1.4 India's focus on boosting domestic manufacturing

1.4.1 Government Policies and Schemes Driving Manufacturing in India

The Government's manufacturing strategy has evolved from broad-based policy support towards a combination of targeted production incentives, integrated industrial infrastructure, domestic value addition, technology development and global value-chain integration. The key initiatives relevant to India's manufacturing expansion are outlined below:

A. National Manufacturing Mission

The National Manufacturing Mission (NMM), announced in Union Budget 2025-26, provides an overarching framework for expanding India's manufacturing base. The Mission targets increasing the manufacturing sector's share of GDP to 25% by 2035, generating 143 million jobs, and increasing merchandise exports to USD 1.2 trillion through deeper integration with global value chains.

Implementation of the Mission is focused on reducing the cost and complexity of doing business, workforce readiness, MSME growth, deregulation, technology access and quality manufacturing. An inter-ministerial committee has been constituted, with NITI Aayog coordinating consultations and implementation proposals.²¹ The Mission also places greater emphasis on sector-specific industrial clusters and integrated manufacturing ecosystems, representing a shift from standalone incentives towards coordinated development of production capacity, infrastructure and supply chains.²²

B. Production Linked Incentive (PLI) scheme

Production Linked Incentive (PLI) framework remains one of the Government's principal instruments for accelerating domestic manufacturing and increasing India's participation in global value chains. PLI schemes currently cover 14 strategic sectors.

As of 31 March 2026, the PLI schemes had attracted more than INR 2.40 lakh crore of cumulative investment. Cumulative exports reported under the schemes increased to INR 15.2 lakh crore in FY2025-

¹⁹ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2252272&lang=1®=3>

²⁰ <https://www.pib.gov.in/PressNoteDetails.aspx?ModuleId=3&NotelId=158382&id=158382&lang=1®=3>

²¹ <https://static.pib.gov.in/WriteReadData/specificdocs/documents/2026/feb/doc2026212786601.pdf>

²² <https://www.indiabudget.gov.in/economicsurvey/doc/eschapter/echap08.pdf>

26. The schemes cover sectors including electronics, pharmaceuticals, automobiles, advanced chemistry cell batteries, solar PV modules, telecom and networking products, food processing, textiles, specialty steel, white goods and drones.²³ The concentration of PLI-linked investment in solar PV, pharmaceuticals, automobiles, specialty steel and electronics indicates that manufacturing expansion is increasingly concentrated in sectors requiring large-scale physical production facilities and associated industrial infrastructure.

Exhibit 1.11: Approved financial outlay under Production Linked Incentive (PLI) scheme

Sector	Implementing Ministry/Department	Cumulative investment till March 2026 (INR crore)
High Efficiency Solar PV Modules	Ministry of New and Renewable Energy	64,873
Pharmaceuticals	Department of Pharmaceuticals	45,158
Automobiles & Auto Components	Department of Heavy Industries	44,326
Specialty Steel	Ministry of Steel	23,896
Large Scale Electronics Manufacturing	Ministry of Electronics and Information Technology	20,580
Food Products	Ministry of Food Processing Industries	9,207
Textile Products	Ministry of Textiles	8,117
White Goods (Air Conditioners and LED Lights)	Department for Promotion of Industry and Internal Trade	6,409
Telecom & Networking Products	Department of Telecommunications	5,278
Bulk Drugs	Department of Pharmaceuticals	5,070
Advanced Chemistry Cell Batteries	NITI Aayog / Department of Heavy Industries	4,570
Medical Devices	Department of Pharmaceuticals	1,151
IT Hardware 2.0	Ministry of Electronics and Information Technology	908
Drones & Drone Components	Ministry of Civil Aviation	595
Total		2,40,138

Source: DPIIT, Invest India, Frost & Sullivan Analysis

C. Electronics and Semiconductor Manufacturing

Electronics and semiconductors have become major focus areas of India's manufacturing strategy. Under Union Budget 2026-27, the Government increased the proposed outlay for the Electronics Components Manufacturing Scheme (ECMS) to INR 40,000 crore and announced India Semiconductor Mission 2.0 to strengthen semiconductor manufacturing, equipment and materials, design capabilities and supply chains.²⁴

The Government subsequently approved Semicon 2.0 with a total budget outlay of INR 1,27,500 crore in July 2026, aimed at developing a broader semiconductor design and manufacturing ecosystem in India.²⁵

The ECMS is also generating new project investments. In January 2026, the Government approved 22 proposals under the third tranche of ECMS, representing projected investment of INR 41,863 crore and projected production of INR 2,58,152 crore across components used in mobile manufacturing, telecom, consumer electronics, strategic electronics, automotive and IT hardware.²⁶

D. Integrated Manufacturing Hubs and Industrial Corridors

Industrial policy is increasingly being supported by integrated manufacturing hubs combining industrial land, utilities, logistics connectivity and common infrastructure. The Government is developing 11 industrial corridors under the National Industrial Corridor Development Programme, with projects and

²³ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2287008&lang=1®=3>

²⁴ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2221522&lang=2®=3>

²⁵ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2284796&lang=1®=3>

²⁶ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2210864&lang=2®=48>

industrial nodes being implemented across multiple states. Union Budget 2026-27 allocated INR 3,000 crore to the National Industrial Corridor Development and Implementation Trust (NICDIT). (PIB, February 2026)

As of 2026, the Government reported that several industrial nodes were operational or under development. Phase-I cities under the Delhi-Mumbai Industrial Corridor, including Dholera Special Investment Region and other nodes, had collectively allotted 350 industrial plots and attracted approximately INR 2.02 lakh crore of investments across electronics, renewable energy, pharmaceuticals and electric vehicles. (PIB, February 2026)

Union Budget 2026-27 has further strengthened the hub-based approach through proposals for three new chemical parks, seven PM MITRA textile parks, MSME manufacturing clusters and common facility centres. A INR 10,000 crore Biopharma SHAKTI initiative has also been proposed to develop India's biopharmaceutical manufacturing ecosystem.²⁷

E. MSME Support and Integration into Manufacturing Supply Chains

MSMEs remain an important part of India's manufacturing ecosystem. According to the Economic Survey 2025-26, MSMEs account for approximately 35.4% of manufacturing output, 48.58% of exports and 31.1% of India's GDP. The Government has also revised MSME classification thresholds from 1 April 2025 to allow enterprises to scale while retaining access to policy support.²⁸

The revised classification increased the investment and turnover limits for micro, small and medium enterprises to INR 2.5 crore / INR 10 crore, INR 25 crore / INR 100 crore, and INR 125 crore / INR 500 crore, respectively. The objective is to enable greater scale, technological upgrading and competitiveness while maintaining access to credit and other Government programmes.²⁹

F. Export Promotion and Manufacturing Competitiveness

Export-oriented manufacturing continues to receive policy support through schemes such as the Remission of Duties and Taxes on Exported Products (RoDTEP). In April 2026, the Government revised the RoDTEP schedules following changes in the customs tariff structure, covering 194 tariff lines and aligning the scheme with the revised customs framework.³⁰

The Government also restored RoDTEP rates and value caps in March 2026 following disruptions to maritime logistics associated with developments in West Asia, highlighting the continued use of export-support mechanisms to mitigate external trade and logistics disruptions.

G. Tax and Business-Environment Support for Manufacturing

The Government continues to provide a concessional corporate tax framework for qualifying domestic companies. Under Section 115BAB of the Income-tax Act, eligible new domestic manufacturing companies can opt for a 15% income-tax rate, subject to prescribed conditions. The concessional framework remains applicable under the current tax regime³¹.

²⁷ <https://www.pib.gov.in/PressNoteDetails.aspx?ModuleId=3&NotelId=158382&id=158382&lang=1®=3>

²⁸ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2219984&lang=1®=6>

²⁹ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2220403&lang=1®=1>

³⁰ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2257092&lang=1®=3>

³¹ <https://www.pib.gov.in/PressNoteDetails.aspx?ModuleId=3&NotelId=158382&id=158382&lang=1®=3>

Overall, India's manufacturing policy is increasingly moving toward an integrated manufacturing ecosystem, combining production-linked incentives with industrial hubs, semiconductor and electronics development, MSME scaling, export support and technology adoption. The emphasis is shifting from simply attracting individual manufacturing investments toward building larger production clusters with supporting infrastructure, domestic supply chains and common industrial utilities, which is expected to support continued capacity creation across process- and manufacturing-intensive industries.

2 OVERVIEW OF INDUSTRIAL GASES IN INDIA

Industrial gases consist of individual gases or gas mixtures utilized across diverse industries for various manufacturing processes and operations. They play an essential role throughout the industrial value chain, from the procuring of raw materials to intermediate processing in industries such as metals, chemicals, pharmaceuticals, and ceramics, ultimately contributing to the production of industrial, consumer, and food products. Industrial gases are indispensable to large-scale industries such as pharmaceuticals, chemicals and textiles, where they play a critical role in optimizing production efficiency and ensuring operational stability.

With the continuous expansion of industries reliant on these gases and the broad spectrum of applications within the sector, the industrial gases market is expected to maintain its strong growth momentum well into the future. This growth has been driven by rapid industrialization, infrastructure development, and advancements in gas production, storage, and distribution that improve efficiency and reduce costs.

Traditionally, oxygen, nitrogen, and argon are extracted from air through the air separation process and supplied via on-site production or merchant distribution using tanks, cylinders, and containers. In contrast, steam has historically been generated on-site for captive use in industries such as textiles, food & beverages, chemicals, pharmaceuticals, and tires.

However, certain companies like Steamhouse India Limited (Steamhouse) are working towards transitioning steam production from an on-site generation to a service-based model by introducing community boilers. This innovation eliminates the need for industries to invest in and maintain steam boilers, making "steam as a service" an emerging opportunity. Companies in this up-coming sector with community boiler-based steam-as-a-service model, and ability to deliver industrial gases through a pipeline network, are enabling industries to focus on their core-production as well as achieve higher energy efficiency, reduce capital expenditure on in-house equipment, and enhance operational efficiencies. A shift towards community industrial gas generation and distribution systems also contributes to sustainability by centralizing boiler operations, leading to lower emissions and improved fuel utilization. Additionally, industries benefit from a more flexible and scalable steam supply without concerns about maintenance, regulatory compliance, and fuel procurement. Steamhouse and its promoters have been pioneers of the community boiler system in India, which was first introduced in 2014.

As of FY26, cylinder-based supply accounts for 41.5% of India's industrial gas (excluding steam) demand by value. This presents significant potential for players like Steamhouse to offer cost-effective pipeline supply, enabling savings on logistics, ensuring uninterrupted flow, and improving operational efficiency for end users. As the Indian industrial sector continues to expand, the supply of industrial gases through

pipelines is emerging as a preferred alternative. This shift also contributes to sustainability by centralizing industrial gas generation, which leads to lower emissions and improved fuel utilization.

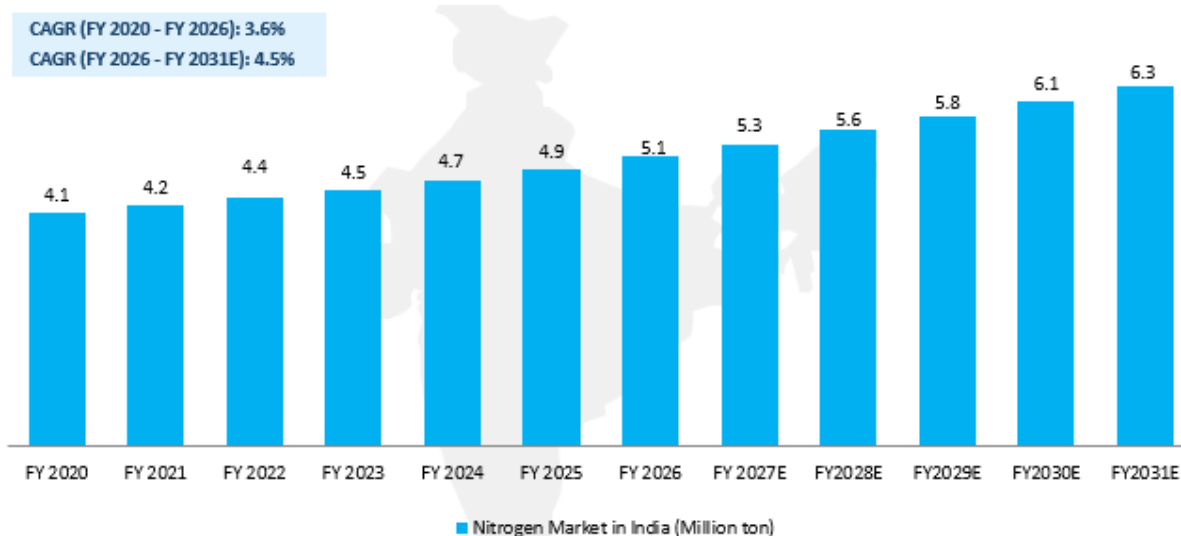
Being a pioneer in this sector, Steamhouse targets higher energy efficiency and enables their customers to reduce capital expenditure on in-house infrastructure, lowers compliance burdens and enhances safety and operational reliability. In the landscape of industrial gases in India, Steamhouse has emerged as a key player as a community industrial gas provider, poised to address the evolving needs of modern industrial processes.

2.1 Nitrogen

Overview: Nitrogen gas (N_2) is a colorless, odorless, tasteless, and inert diatomic gas that constitutes approximately 78% of Earth's atmosphere. Nitrogen gas is a vital industrial gas in India, produced through air separation processes. It is available in gaseous and liquid forms, until now, it was supplied via on site production, cylinders, or bulk storage tanks. However, Steamhouse India Limited has commissioned a common nitrogen facility in Ankleshwar that supplies multiple customers through a dedicated distributed pipeline network. As of the date of this report, Steamhouse India Limited is the only company in India known to offer nitrogen through such a shared off-site production and pipeline distribution model, providing an alternative to customer-specific on-site nitrogen generation or conventional cryogenic tank supply. A dedicated pipeline network for nitrogen can enhance supply reliability, reduce logistical complexities, and improves cost efficiency for customers. In addition to ensuring uninterrupted availability for industrial consumers, the dedicated pipeline for an industrial gas like Nitrogen can also demonstrate the scalability of pipeline-based distribution for other industrial gases.

Market size: The demand of nitrogen in India has increased from 4.1 million tons in FY2020 to become 5.1 million tons in FY2026 with CAGR of 3.6% owing to growth in fertilizer production, rapid growth of food packaging industry, consistent consumption in steel production, etc. It is projected to become 6.3 million tons in FY2031.

Exhibit 2.1 Nitrogen Market in India, by Volume (Million tons), FY2020-2031E

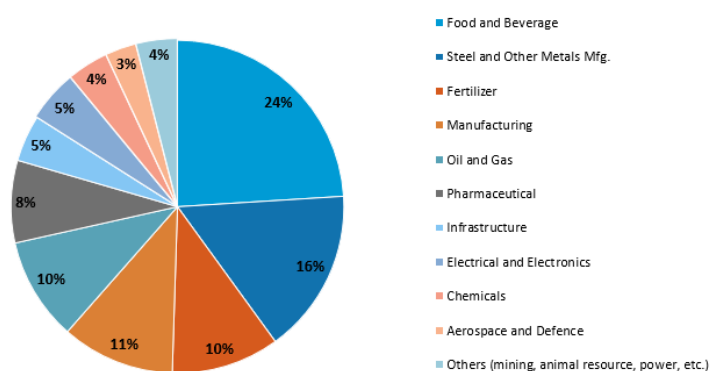


The market size by value has increased from USD 0.25 billion in FY2020 to USD 0.34 billion in FY2026 and is projected to expand to USD 0.45 billion in FY2031. The major driving factors for such advances are India's push for self-sufficiency in fertilizer sector, rapid improvement in population and urbanization that

has increased the crop yield demand, innovations and advancements in emerging applications, investments in manufacturing sector owing to immense support from government in terms of incentives, etc.

Market segmentation by application: In FY2026, the food and beverage industry led nitrogen demand in India, accounting for 24%, primarily for food preservation and gas flushing. Steel and other metal manufacturing also consumed 16%, utilizing nitrogen for strengthening and alloying. The fertilizer sector, with 10% share, relied on nitrogen for ammonia production. The manufacturing, oil & gas, and pharmaceutical industries together accounted for a significant portion, using nitrogen in processes like heat treatment, refining, and reactor cooling. Other industries, including electronics, infrastructure, chemicals and aerospace, contributed to smaller shares, utilizing nitrogen for inert atmospheres, purging, and safety applications.

Exhibit 2.2 Nitrogen Market Segmentation by Application, by Volume (%), FY2026



Source: Frost & Sullivan Analysis

Driving factors for growth: India's nitrogen market is growing due to evolving lifestyle trends, industrial expansion, and government support. The increasing demand for packaged food, driven by fast-paced lifestyles, has boosted nitrogen usage in food packaging. The steel sector, accounting for 7.9% of global production, is witnessing capacity expansion, supported by government incentives and the China+1 strategy, further driving nitrogen demand. Rising food demand has also led to increased use of nitrogenous fertilizers, backed by government policies promoting self-sufficiency in fertilizer production. Additionally, the shift of global pharma and chemical supply chains from China to India, driven by cost advantages and quality standards, has further fueled nitrogen consumption across industries.

2.2 Hydrogen

Overview: Hydrogen (H₂) is a lightweight, highly flammable gas used across a range of industrial applications, particularly in oil & gas refining, fertilizers, steel production, and emerging energy applications. Its role is expanding beyond conventional industrial uses as India develops a broader hydrogen economy.

Market size: The demand increased from 0.13 million tons in FY2020 to 0.19 million tons in FY2026 and is projected to reach 0.30 million tons by FY2031, representing a CAGR of 8.8%. The market size by value increased from USD 0.17 billion in FY2020 to USD 0.26 billion in FY2026 and is projected to reach USD 0.41 billion by FY2031.

Market segmentation by application: In FY2026, steel and metal manufacturing accounted for ~30% of India's hydrogen demand, primarily for metal reduction and refining. Chemicals accounted for 25%, driven mainly by ammonia production for fertilizers, while manufacturing contributed 20% through applications such as heat treatment, metal fabrication, and turbine cooling. Oil & gas accounted for 15%, with hydrogen used for desulfurization, hydrogenation, and fuel upgrading.

Driving factors for growth: India's goal of achieving energy independence by FY2047 is driving investments in renewable energy and green hydrogen to reduce dependence on crude oil and coal imports. Decarbonization efforts are further supporting the development of green and blue hydrogen, while emerging applications in transportation, power generation, and fuel cells are expected to drive demand. The National Green Hydrogen Mission supports technology development and commercialization, alongside global collaborations aimed at strengthening hydrogen production, infrastructure, and market development.

2.3 Carbon dioxide

Carbon dioxide (CO₂) is a versatile industrial gas used across food & beverages, chemicals, healthcare, manufacturing, refining, and other industrial applications. In India, CO₂ is primarily sourced as a byproduct of industrial processes such as ammonia and ethanol production.

Market size: India's CO₂ demand increased from 3.7 million tons in FY2020 to 4.5 million tons in FY2026, representing a CAGR of 3.5%, and is projected to reach 5.6 million tons by FY2031, growing at a CAGR of 4.5%. In value terms, the market increased from USD 0.12 billion in FY2020 to USD 0.16 billion in FY2026 and is projected to reach USD 0.22 billion by FY2031.

Market segmentation by application: In FY2026, food & beverages remained the largest consumer of CO₂ in India, accounting for ~30% of demand, primarily for carbonation and food preservation. Chemicals accounted for ~15%, driven by urea and methanol production, while manufacturing contributed ~12% through welding and laser cutting. Oil & gas accounted for 10%, mainly for enhanced oil recovery, with infrastructure, pharmaceuticals, healthcare, and aerospace & defense accounting for the remaining demand across applications such as concrete curing, medical uses, fire suppression, and cryogenic cooling.

Driving factors for growth: Market growth is supported by increasing demand from food & beverages, refining, chemicals, pharmaceuticals, and manufacturing, alongside emerging applications in fuel production, plastics, fire protection, healthcare, and construction. Rising refinery activity is particularly important, with India's 267.1 million tons per annum refining capacity across 23 refineries supporting CO₂ consumption. In parallel, Atmanirbhar Bharat initiatives and higher domestic urea production are strengthening demand, while carbon capture and CO₂ utilization initiatives are expected to further support long-term growth.

2.4 Argon

Argon (Ar) is an inert, colorless and odorless gas primarily used as a shielding gas in tungsten inert gas (TIG) and metal inert gas (MIG) welding. It is widely used across aerospace, automotive, construction, general metal fabrication, steel manufacturing, and other industrial applications where protection from atmospheric contamination is required.

Market size: India's argon consumption increased from 0.18 million tons in FY2020 to 0.25 million tons in FY2026 with the CAGR of 5.6%. Demand is projected to reach 0.33 million tons by FY2031, representing

a forecast CAGR of 5.8%. In value terms, the market increased from USD 0.10 billion in FY2020 to USD 0.16 billion in FY2026 and is projected to reach USD 0.25 billion by FY2031.

Market segmentation by application: In FY2026, manufacturing accounted for 22% of India's argon demand, primarily for MIG welding and metal fabrication. Electrical & electronics and steel & metals each contributed 20%, driven by semiconductor manufacturing, solar cells, lighting, and the AOD process. Healthcare (10%) and pharmaceuticals (8%) used argon for lasers, cryosurgery, gas chromatography, and inert atmospheres, while infrastructure (7%) and aerospace & defense (4%) primarily consumed it for welding applications.

Driving factors for growth: India's rapid urbanization and industrialization are driving demand for finished steel and automotive applications, supporting argon consumption in stainless steel production and welding. Expansion of EVs and semiconductor and electronics manufacturing are further increasing demand for argon in precision welding and specialized manufacturing processes. Government initiatives such as the PLI scheme, along with growing investments in metal fabrication, healthcare, automotive, and defense manufacturing, are expected to further support argon demand.

2.5 Steam

Overview: Traditionally, industries have relied on on-site steam generation for captive use, with steam being a critical requirement across industrial sectors such as pharmaceuticals, textiles, food processing, paper and pulp, rice mills, distilleries, dairy, urea production, wood processing, chemicals, and tyre manufacturing. However, the emergence of community boilers and steam-as-a-service models, provided by companies like Steamhouse India Limited, is transforming the landscape of industrial steam supply by bringing Steam-as-Service. These centralized boiler systems enable industries to procure steam through pipelines, reducing their capital investment in boiler infrastructure, improving energy efficiency, and lowering operational costs. This transition has created new revenue streams, enabling steam producers to sell steam as a service rather than limiting it to captive use. This model presents a significant market potential, encouraging industries to opt for outsourced steam supply and drive the growth of the industrial steam distribution network.

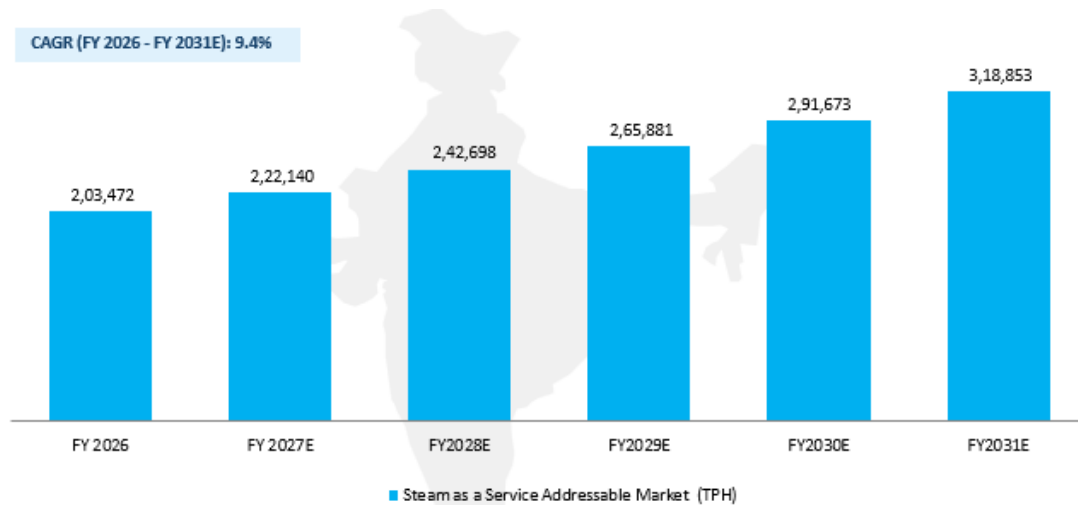
Market size: In FY2026, India's total process steam demand was approximately 203,472 TPH. With a projected CAGR of 9.4% from FY2026 to FY2031, the market is poised for significant expansion. Assuming an annual operation of 8,000 hours, the total process steam demand is estimated at 1,628 million tons in FY2026. The average cost of steam varies by multiple factors such as the end-use industry (power plants, pharmaceuticals, food processing, etc.), boiler type, fuel type, water quality, feedwater treatment requirements, condensate recovery efficiency, and operational maintenance costs. Considering an average steam cost of INR 2-2.5 per kg, the addressable market potential for the "Steam-as-a-Service" model in India is estimated at approximately ₹3,66,250 crore for FY2026.

Market segmentation by application: Steam consumption across various industries, highlighting the percentage share of each sector by volume in the total industrial steam usage. Here's a detailed breakdown:

Pharmaceuticals (25%) – The largest consumer of steam, the pharmaceutical industry relies heavily on steam for sterilization, cleanroom environments, and process heating in drug formulation and production.

Textiles (18%) – The textile sector utilizes steam in dyeing, bleaching, and finishing processes. It is essential for controlling fabric moisture content and improving quality.

Exhibit 2.3: Steam as a Service Addressable Market in India, by Volume (TPH), FY2026-2031E



Note: E refers to Estimate

Source: Frost & Sullivan Analysis

Food Processing (17%) – Steam is used for cooking, drying, pasteurization, and sterilization in food production. It plays a key role in ensuring hygiene and maintaining product quality.

Paper and Pulp (5%) – Steam is used in pulping, drying, and pressing of paper to ensure proper consistency and smoothness in paper production.

Distillery (5%) – A significant share of steam consumption is in distilleries, where it is used for fermentation, distillation, and evaporation processes in alcohol and beverage production.

Dairy (4%) – Steam is utilized in dairy processing for pasteurization, sterilization, and cleaning-in-place (CIP) systems to ensure hygiene in milk and milk-based product manufacturing.

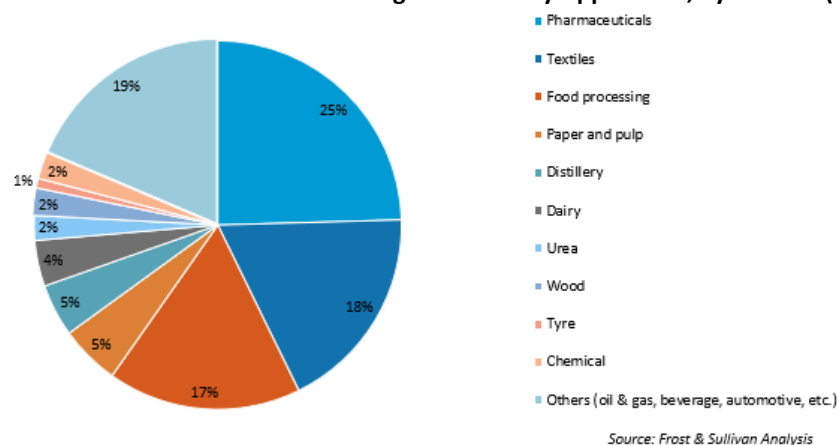
Urea (2%) – The fertilizer industry requires steam for chemical reactions in urea production, as well as for process heating.

Wood (2%) – Steam is used in seasoning and drying of wood to reduce moisture content, improving durability and strength.

Tyre (1%) – The tyre industry uses steam for vulcanization, which enhances the elasticity and durability of rubber.

Chemical (2%) – Steam is widely used in the chemical industry for reaction heating, distillation, and solvent recovery in various chemical manufacturing processes.

Others (19%) – This category includes industries like power plants, refineries, and other small-scale industries where steam plays a vital role in heating, cleaning, and manufacturing.

Exhibit 2.4: Steam as a Service Addressable Market Segmentation by Application, by Volume (%), FY2026

Driving factors for growth: The growth of steam use in India from FY2026 to FY2031 will be driven by rising industrial demand, energy efficiency advancements, and sustainability initiatives. The pharmaceutical sector, the largest consumer, will see increased steam utilization due to expanding drug production, stringent sterilization standards, and the growth of cleanroom facilities.

In textiles, steam demand will rise with modernization efforts, process automation, and the push for sustainable fabric treatment. The food processing industry will continue to rely on steam for cooking, pasteurization, and sterilization, driven by growing food safety regulations and increasing consumer demand for processed foods. Distilleries will witness higher steam consumption as alcohol production scales up and energy-efficient distillation techniques gain traction.

2.6 Key Growth Drivers for Industrial Gases Market

The industrial gases market in India is witnessing strong growth, driven by several key factors:

Rising demand from healthcare and pharmaceuticals: The healthcare and pharmaceutical sectors have become significant consumers of industrial and medical-grade gases, with the COVID-19 pandemic highlighting the vital role of medical oxygen infrastructure. Demand remains strong for gases like oxygen, nitrous oxide, and carbon dioxide across hospitals, diagnostics, biotechnology, and pharmaceutical manufacturing.

Clean energy and green hydrogen initiatives: India's clean energy transition, led by the National Green Hydrogen Mission, is emerging as a major growth catalyst. With rising emphasis on green hydrogen production and building a hydrogen-based economy, industrial gas producers are set to play a central role—supporting hydrogen generation, storage, and infrastructure for renewable energy and fuel cell technologies.

Infrastructure development and refinery expansion: India's continued investments in infrastructure and the expansion of its refining and petrochemical sectors are driving robust demand for industrial gases across multiple applications—ranging from nitrogen for purging and blanketing, to oxygen for combustion, and hydrogen for hydrocracking. Leading oil and gas companies are ramping up investments in new refinery projects and capacity expansions, reinforcing the need for dependable gas supply. The country aims to increase its refining capacity from 267.1 million tons in FY2026 to 310 million tons by FY2030.

Electronics and semiconductor manufacturing push: India's push to become a global hub for electronics and semiconductor manufacturing is unlocking a significant growth opportunity for industrial gases. Semiconductor fabs and electronics assembly units require ultra-high-purity gases like nitrogen, argon, silane, hydrogen, etc. which drives long-term demand for specialty gas suppliers in this sector. The India Semiconductor Mission (ISM), under the SEMICON India program, is backed by a substantial budget outlay of ₹76,000 crore.

2.7 Key Threats and Challenges for Industrial Gases Market

The industrial gases market in India faces several challenges that could impact its growth and sustainability:

Supply chain challenges: The supply chain for industrial gases is fraught with several challenges that affect their availability and distribution. The sector suffers from inadequate storage and handling infrastructure, leading to bottlenecks and increased costs. Poor road infrastructure, specialized transportation needs for cryogenic and high-pressure gases, and fragmented distribution networks result in delivery delays and higher costs. A shortage of skilled professionals and the need for continuous training affect operational efficiency.

Logistical challenges may arise from stringent laws concerning the shipping of hazardous chemicals. Strict safety regulations, which can be difficult to implement logistically, must be followed when transporting gases like hydrogen. Use of specialized vehicles is also required along with expertise in the operation and maintenance of specialized vehicles used to transport cryogenic gases. Complying with transportation rules, maintaining temperature and pressure control throughout transit, and comprehending the workings of cryogenic tankers and cylinders are all crucial.

Safety and environment: When it comes to handling, storing, and transporting industrial gases, strict safety and environmental standards are crucial. Proper training is essential for anyone handling industrial gases. This includes understanding the properties of different gases, safe handling procedures, and emergency protocols. Users must follow safety guidelines, store gases properly, and use appropriate equipment. Meeting emissions standards and minimizing environmental impact requires investment in cleaner technologies and sustainable practices. By transitioning from cylinder-based delivery to a pipeline distribution system, end-users can minimize the environmental impact as well as enhance safety by reducing the need for handling of high-pressure storage vessels.

Energy intensive process: Producing industrial gases involves energy-intensive processes, such as air separation, compression, and purification. These steps require significant electricity or fuel. Fluctuations in energy prices, whether due to geopolitical events, supply-demand dynamics, or seasonal variations, directly impact production costs. Sudden spikes can strain profitability. Some industrial gases companies enter long-term energy contracts to stabilize costs. However, these contracts may not always align with market fluctuations. Investing in energy-efficient technologies and practices can reduce consumption. Upgrading equipment, optimizing processes, and using renewable energy sources are effective strategies.

2.7.1 Regulatory environment for Industrial Gases Market

Stringent Licensing and Safety Compliance: The Gas Cylinders Rules, 2016, under the Explosives Act, 1884, mandate strict licensing for manufacturing, storage, and transportation of gas cylinders. Companies

must obtain approvals from the Chief Controller of Explosives, and exceeding prescribed storage limits requires additional licenses. Compliance with PESO (Petroleum and Explosives Safety Organization) regulations for cryogenic storage and transportation adds to operational complexities.

Environmental Regulations and Pollution Control: The Environment (Protection) Act, 1986 (extended in 2022), imposes strict environmental standards on industrial gas plants, requiring pollution control measures to minimize environmental impact. Compliance with these regulations demands significant investments in emissions reduction technologies, waste management, and regular monitoring, increasing operational costs.

Hazardous Waste Management and Disposal: Under the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016, companies must ensure the proper disposal and recycling of gas cylinders, storage tanks, and associated waste. Failure to meet these guidelines can lead to penalties and environmental liabilities, making waste management a critical regulatory challenge for industrial gas manufacturers.

Workplace Safety and Hazard Management: The Factories Act, 1948, and the Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989 (MSIHC Rules), mandate strict safety measures for handling hazardous gases like hydrogen. Industrial gas manufacturers must conduct risk assessments, implement accident prevention protocols, and provide extensive training and protective equipment to workers. Ensuring compliance with these safety regulations increases operational complexity and costs.

3 DEEP DIVE INTO ‘STEAM’ AND ‘COMMUNITY BOILER’ INDUSTRY

3.1 Usage of Steam in the Process Industries

Steam is vital across industries like textiles, pharma, food, chemicals, paper, and more due to its versatility. While traditionally generated in-house, steam is now gaining recognition as part of the industrial gas supply market, with companies like Steamhouse promoting "Steam as a Service," driving market expansion.

3.1.1 Textile Industry

Low pressure steam of 2-5 bar is commonly used in Textiles production. Approximately 4 kg of steam is required for production of 1 kg of Fabric. Following are the applications of steam in a textile unit:

Exhibit 3.1: Usage of steam in Textile Industry

Application	Usage of Steam
Fabric Pre-treatment	• Steam is used for fabric cleaning, de-sizing (removing sizing agents), scouring (removing impurities), and bleaching processes. • It helps in heating and activating chemicals for effective fabric preparation.
Fabric Dyeing	• Steam is used for heating dye liquor, activating dyes, and fixing colors onto fabrics. • Steam is also employed in printing machines for color fixation and steaming of printed fabrics.

Fabric Finishing	• Steam is utilized in fabric finishing processes such as calendaring, setting, and heat treatment. • It helps in improving fabric texture, setting wrinkles, and enhancing the overall appearance of the fabric.
Yarn Drying	• Steam enables precise temperature control for optimal dye absorption and fixation, ensuring uniform color distribution in yarn. It also supports efficient processing by allowing rapid heating and drying, which reduces both processing time and energy consumption.
Yarn Printing	• After the yarn has been printed and the color or pattern has been applied, steam may be used in subsequent processes to fix or set the printed design on the yarn. • The steam fixation process enhances color-fastness and durability of the printed design.
Common Effluent Treatment Plants (ETPs)	• Common Effluent Treatment Plants (CETPs) in textile clusters are established to collectively treat wastewater from multiple units, removing the need for individual ETPs at each facility. Steam plays a crucial role in these CETPs, especially in multi-effect evaporators, to achieve Zero Liquid Discharge (ZLD), enhancing treatment efficiency, reducing environmental impact, and ensuring regulatory compliance.

3.1.2 Pharmaceutical Industry

In general, 1-2 bar pressure steam is used in most of the process, however, there are units which also use 5 - 8 bar pressure steam. Approximately 3 - 3.5 TPH of steam is used in a standard Bulk Drugs, API unit. Following are the common uses of steam in the pharmaceutical industry:

Exhibit 3.2: Usage of steam in Pharmaceutical Industry

Application	Usage of Steam
Raw material heating	• Steam provides controlled, uniform heating essential for dissolving ingredients and preparing consistent pharmaceutical solutions, suspensions, and emulsions.
Equipment disinfection and Drying	• Any visible dirt, debris, or contaminants on the equipment should be removed through a pre-cleaning step before steam disinfection. • Steam is used in drying process. Equipment may be dried using hot air, compressed air, or other suitable methods.
Concentration	• Steam is used to remove solvents or water from solutions or suspensions, effectively concentrating the active pharmaceutical ingredient (API) due to its superior heat transfer and controlled, efficient heating capabilities.
Heat exchanger	• Steam is often utilized as the heating medium in steam-to-fluid heat exchangers. • Steam transfers its thermal energy to the process fluid, effectively heating it to the desired temperature

Humidification	Steam is used for humidifying pharmaceutical manufacturing facilities, which helps to maintain the proper moisture levels and prevent the products from drying out.
Freeze drying	Steam is used in the freeze-drying process, which involves removing moisture from pharmaceutical products while preserving their potency and stability.
Sterilization	Steam is used for sterilizing pharmaceutical products, equipment, and packaging materials, to ensure that they are free from harmful bacteria and other microorganisms ensuring the safety and sterility of pharmaceutical products.
Heating	Steam is used for heating pharmaceutical products and ingredients, as it is a precise and efficient method of avoiding damage to the products.

3.1.3 Chemical Industry

Steam pressure varies between 1- 10 bar based on types of chemicals produced in the plant. The steam consumption in the chemical industry is approximately 1.5 kg of steam per kilogram of chemical produced. However, this can vary depending on the specific process to be followed, equipment design, energy efficiency measures implemented, and the heat requirements. Following are the common uses of steam in the chemical industry:

Exhibit 3.3: Usage of steam in Chemical Industry

Application	Usage of Steam
Distillation and Fractionation	Steam is used in distillation and fractionation processes to facilitate the separation and purification of chemical compounds by creating a vapor-liquid equilibrium within columns or towers.
Sterilization and Disinfection	Steam is used for sterilization and disinfection of equipment, containers, and surfaces in the chemical industry to ensure aseptic conditions and prevent contamination.
Heat transfer	- Steam is employed as a heat transfer medium in various heat exchangers, condensers, and other heat transfer equipment. - It allows for efficient and controlled heat exchange between different process streams.
Evaporators	- Steam is employed in evaporation processes to remove solvents or water from chemical solutions or mixtures. - Steam is passed through heat exchangers or evaporators to heat the solution, causing the volatile components to vaporize, and leaving behind a concentrated product.
Reactor heating	Steam is commonly used for heating chemical reactors to facilitate chemical reactions.

- It provides efficient and controlled heat transfer, maintaining the desired temperature conditions for the reaction to occur.

3.1.4 Tyre Industry

In the Tyre industry, steam pressure varies between 18-24 bar in the vulcanization process. On average, 2 TPH of steam is used in the production of 1 kg of rubber. Following are the common uses of steam in the tyre industry:

Exhibit 3.4: Usage of steam in Tyre Industry

Application	Usage of Steam
Rubber compounding	• Steam is primarily used to heat and soften rubber compounds, making them more pliable for effective mixing and blending of natural rubber, synthetic rubber, fillers, chemicals, and additives.
Tyre building	• Steam is used during the tyre building process to aid in the shaping and bonding of tyre components. • It helps to heat and soften the rubber components, allowing them to be easily molded and adhered together to form the tyre structure.
Vulcanization	• The built tyre is transferred to a tire curing press, and steam is injected into the press to provide the required heat. • The heat from the steam causes the rubber to crosslink, resulting in a solid and durable tyre.
Post curing and finishing	• Steam autoclaves are used to apply controlled heat, pressure, and steam during tyre curing, enhancing the tyre's shape, strength, and appearance through additional curing.

3.1.5 Paper and Pulp Industry

Steam of 10 bar and above is commonly used in paper and pulp production. Approximately 1.6 – 2.2 kg of steam is required to produce 1 kg of dry paper. Following are the applications of steam in a paper and pulp unit:

Exhibit 3.5: Usage of steam in Paper and Pulp Industry

Application	Usage of Steam
Wood and Fiber Preparation	• Steam is used to soften and condition wood chips and other fibrous materials during the pulping process. • This facilitates the separation of fibers and helps to create a pulp suitable for papermaking.

Steam Digester	• Steam is used in the digester to cook wood chips or other raw materials with chemicals like sodium hydroxide or sulfite, breaking down lignin and separating cellulose fibers during the pulping process.
Pulp Washing	• After cooking, the pulp undergoes washing to remove spent chemicals and impurities. • Steam is utilized in various stages of pulp washing to aid in the efficient removal of chemicals and contaminants.
Evaporation	• Steam is used in evaporators to concentrate the black liquor, a byproduct of the pulping process, and recover chemicals for reuse in the pulping process.
Steam Heated Dryers	• After pulp washing, the wet pulp is dried using steam-heated dryers to reduce moisture content and prepare it for the papermaking process.
Paper Machine Drying	• Steam is used in the paper machine's drying section to remove water from the wet paper web. • Steam-heated dryer cylinders and rolls help achieve the desired moisture content for the paper.
Coating and Sizing	• In certain paper grades, steam is used in the coating and sizing processes to apply special coatings or treatments to enhance the paper's surface properties.
Cleaning and Sterilization	• Steam is used for cleaning and sterilizing various equipment and components in the paper and pulp mills to maintain hygienic and safe operating conditions.

3.1.6 Distilleries

Low-pressure steam of 1.5 to 3.5 bar is commonly used in distilleries. Approximately 3.4 – 6.6 kg of steam is required to produce 1 liter of Ethanol. Following are the applications of steam in a distillery unit:

Exhibit 3.6: Usage of steam in Distilleries

Application	Usage of Steam
Mash cooking	• Steam is used to heat the mash during the cooking process. • The mash typically consists of grains (e.g., barley, corn, rye) mixed with water, and steam is applied to heat the mixture and facilitate starch conversion into fermentable sugars.
Fermentation	• Steam is sometimes used indirectly for temperature control during fermentation by jacketed vessels, helping maintain consistent temperatures essential for yeast activity and proper flavor development.

Distillation	• Steam is extensively used in distillation by heating the mash in a still to vaporize alcohol based on its boiling point; the vapor is then condensed back into liquid form to produce distilled spirits.
Heat Exchangers	• Steam is used in heat exchangers to transfer heat efficiently during various stages of the distillation process, improving energy efficiency and reducing operational costs.
Cleaning and Sanitization	• Steam is utilized for cleaning and sanitizing various equipment, tanks, and pipelines to maintain hygiene and ensure the quality and safety of the distilled spirits.
Bottle sterilization	• Before bottling, steam can be used to sterilize bottles, caps, and closures, ensuring the final product is free from contaminants.
Barrel treatment	• Steam can be used to prepare wooden barrels before ageing spirits, helping to sanitize and prepare the barrels for the ageing process.

3.1.7 Wood Industry

Low-pressure steam of 6- 8 bar is commonly used for most of the processes in the Wood industry. Approximately 0.45 kg of steam is required to produce 1 kg of processed wood. Following are the applications of steam in a wood processing unit:

Exhibit 3.7: Usage of Steam in Wood Industry

Application	Usage of Steam
Wood drying	• Steam is used to dry green or wet wood to reduce its moisture content. • Kilns and steam-heated dryers are employed to control the drying process and prepare the wood for further processing or use.
Plywood manufacturing	• In plywood manufacturing, steam is used to soften wood veneers before pressing, while steam-heated platens help form strong bonds between layers during the pressing stage.
Fiberboard production	• Steam is used in the production of fiberboards (MDF, HDF) to soften and steam the wood fibers before they are formed into boards. • This process improves the bonding and strength of the boards.
Wood treatment	• In some wood treatment processes, steam is used to pre-treat wood before applying preservatives or finishes. • Steam treatment helps open the wood pores, allowing for better absorption of chemicals.
Laminating and Veneering	• Steam is used to soften wood veneers, making them more pliable for laminating or veneering onto substrates.

Wood conditioning	• Steam is used to condition wood before certain machining processes, making the wood more flexible and easier to shape.
Composite wood production	• Steam is used in the production of composite wood products, such as particleboard and OSB (oriented strand board). • Steam is applied to soften wood particles or strands before forming the panels.

3.2 Usage of Fuels for Steam Generation

Various types of fuels are used for steam generation, and they can be bucketed under two categories – fossil fuels and non-fossil fuels. The most common fossil fuel used for steam generation is coal however, other fossil fuels such as Diesel, HFO, LDO, LSHS, etc. are also used in the industries. As the City Gas Distribution (CGD) network is expanding, piped natural gas (PNG), is now available in many industrial areas across the country. Besides, other fossil fuels such as LPG, Propane, etc. are also used among the industries for heating purpose and steam generation.

Exhibit 3.8: Gross Calorific Value (GCV) of various fossil fuels

Fossil Fuel Name	Gross Calorific Value (GCV)
Coal	2,200 (G17) - >7,000 (G1) Kcal / Kg
Diesel	10,550 – 10,900 Kcal / Kg
Heavy Fuel Oil (HFO)	10,335 Kcal / Kg
Light Diesel Oil (LDO)	10,300 – 10,400 Kcal / Kg
Low Sulphur Heavy Stock (LSHS)	10,500 Kcal / Kg
Natural Gas	10,000 Kcal / SCM (8000-8500 of Gujarat Gas)
Liquid Petroleum Gas (LPG)	12,500 Kcal / Kg

Fossil fuel-based steam generation offers several advantages, including high energy density, easy availability, and reliable performance. These fuels have a high calorific value, meaning they can produce significant amounts of heat when burned. The combustion process is efficient, allowing for rapid and consistent steam production. Fossil fuels are widely accessible and have well-established supply chains, making them readily available for industrial steam generation.

3.2.1 Fossil Fuels

A. Coal

Coal is the most important and abundant fossil fuel in India. It accounts for 55% of the country's energy need. Commercial primary energy consumption in India has grown by about 700% in the last four decades (source: Ministry of Coal, Govt. of India). The current per capita commercial primary energy consumption in India is about 350 kilogram of oil equivalent (kgoe) / year which is well below that of developed

countries. Driven by the rising population, expanding economy and a quest for improved quality of life, energy usage in India is expected to rise.

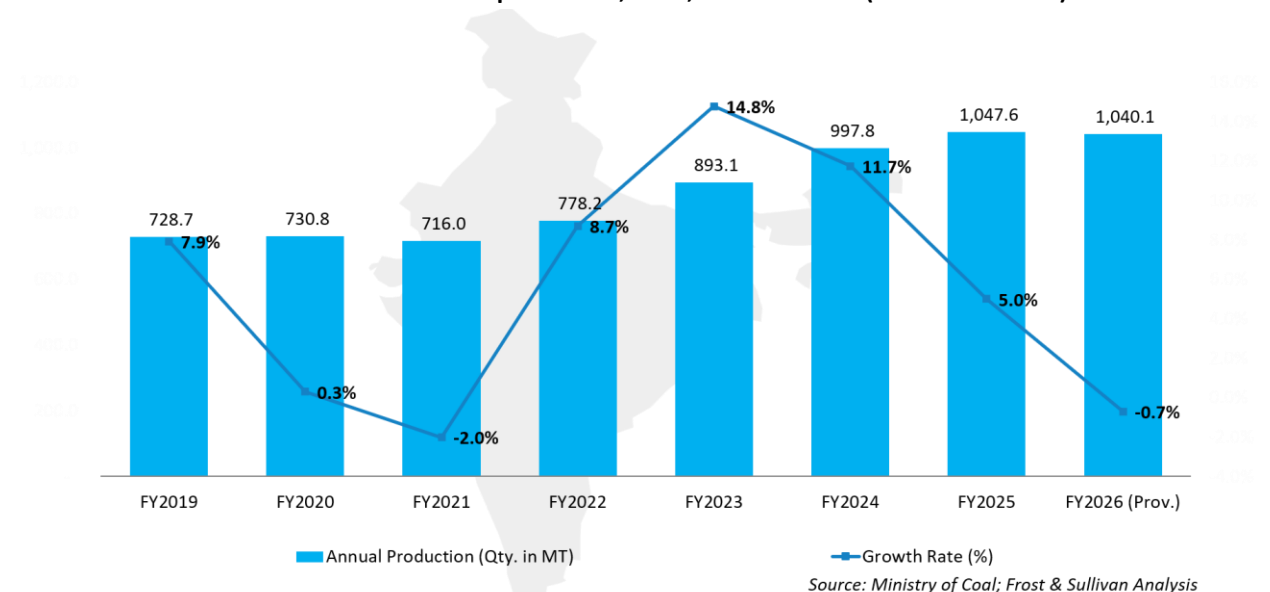
Domestic coal production: India is the second largest producer and consumer of coal in the world after China. India's coal production has grown at 5.2% CAGR between FY2019 and FY2026 to reach ~1,040.1 million tonnes in FY2026.

Coal India's total coal production declined 1.7 per cent year-on-year to 768.1 million tonnes (mt) in FY2026, falling significantly short of its annual production target of 875 mt. In comparison, the state-run mining major produced 781.1 mt in FY2025.

Of Coal India's seven coal-producing subsidiaries, four reported a year-on-year decline in production during FY2026. Bharat Coking Coal (BCCL), Central Coalfields (CCL), Western Coalfields (WCL) and Mahanadi Coalfields (MCL) recorded production declines of 12.3 percent, 6.1 percent, 8.8 percent and 3 percent, respectively.

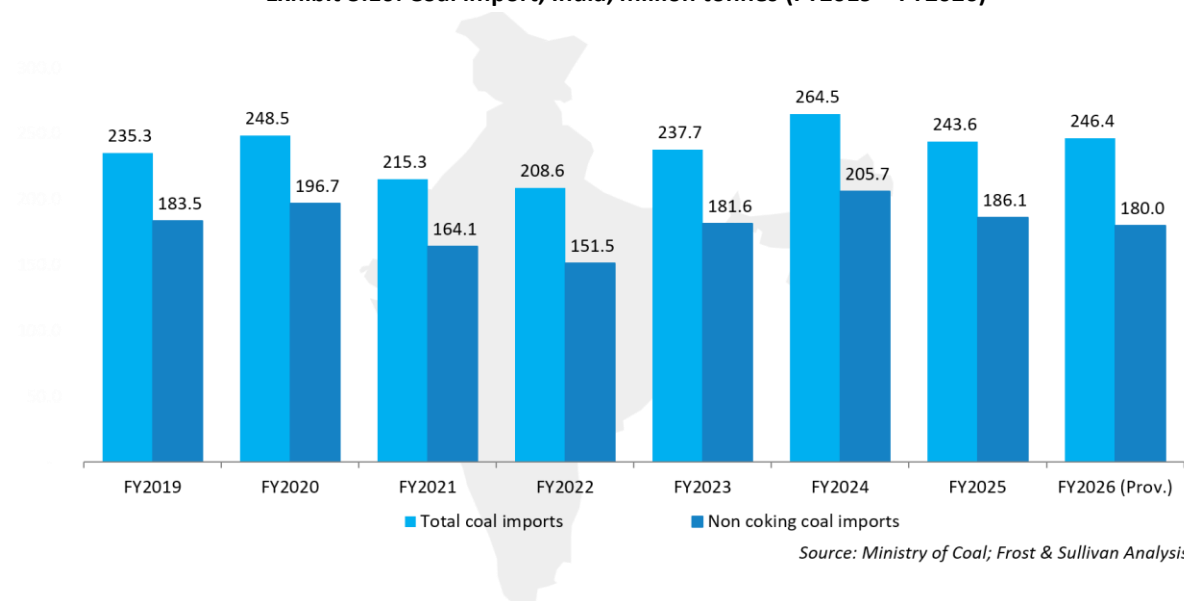
Medium term projection from the Ministry estimates India's domestic coal production to reach 1.5 billion tonnes by FY2030.

Exhibit 3.9: Domestic Coal production, India, million tonnes (FY2019 – FY2026)



Coal imports into India: In FY2025-26, India imported 246.37 million tonnes (MT) of coal, marginally higher than 243.63 MT in FY2024-25, an increase of around 1.1% year-on-year. The FY26 import basket comprised 66.33 MT of coking coal and 180.04 MT of non-coking coal.

In value terms, India's coal imports in FY2026 were worth approximately ₹2.36 lakh crore, compared with ₹2.50 lakh crore in FY2025, indicating a decline in the average import cost despite the rise in volumes. Coking coal imports increased sharply to 66.33 MT, while non-coking coal imports declined to 180.04 MT in FY2026, reflecting stronger requirements from the steel sector and relatively softer thermal-coal imports.

Exhibit 3.10: Coal import, India, million tonnes (FY2019 – FY2026)

Indonesia remained the largest supplier, accounting for roughly 42% of India's total coal imports, followed by Australia, South Africa, Russia and the United States. Other important sources included Singapore, Mozambique, the UAE, Canada and Colombia. The import basket reflects India's continued dependence on overseas supplies, particularly for thermal coal and high-quality coking coal.

Australia remains particularly important for coking coal used by the steel industry, while Indonesia and South Africa are major sources of thermal coal for power generation. India has also been diversifying its sourcing base, with Russia and the US becoming significant suppliers. This diversification helps Indian buyers manage price, quality and geopolitical risks while ensuring adequate coal availability for the power and steel sectors.

Price of Coal: On the price front, average import price of non-coking coal almost increased more than 90 percent in FY22 to INR 8,316 per tonne and further increased to INR 12,650 in FY23 due to Russia – Ukraine war. Price started to stabilize after that.

The average import price of non-coking coal surged from ₹4,308/tonne in FY2021 to a peak of ₹12,650/tonne in FY2023, driven by the global coal-price spike. It then declined to ₹8,614/tonne in FY2024, ₹7,865/tonne in FY2025 and ₹7,308/tonne in FY2026. Thus, FY2026 prices were 7.1% lower YoY and about 42% below the FY23 peak, although they remained around 70% above FY21 levels.

Exhibit 3.11: Average import price of non-coking coal between FY21 and FY26

Price per tonne in INR	FY21	FY22	FY23	FY24	FY25	FY26(Prov.)
Average import price of non-coking coal in India	4,308	8,316	12,650	8,614	7,865	7,308

As per International Energy Agency (IEA), international coal prices have touched three all-time peaks between October 2021 and May 2022. Sanctions and bans on Russian coal following Russia's invasion of Ukraine have disrupted markets, and issues in other major exporters have contributed to supply shortages.

B. Industrial Gas

Industrial gases consist of individual gases or gas mixtures utilized across diverse industries for various manufacturing processes and operations. They play an essential role throughout the industrial value chain, from the procuring of raw materials to intermediate processing in industries such as metals, chemicals, pharmaceuticals, and ceramics, ultimately contributing to the production of industrial, consumer, and food products. Industrial gases are indispensable to large-scale industries such as pharmaceuticals, chemicals and textiles, where they play a critical role in optimizing production efficiency and ensuring operational stability.

With the continuous expansion of industries reliant on these gases and the broad spectrum of applications within the sector, the industrial gases market is expected to maintain its strong growth momentum well into the future. This growth has been driven by rapid industrialization, infrastructure development, and advancements in gas production, storage, and distribution that improve efficiency and reduce costs.

Traditionally, oxygen, nitrogen, and argon are extracted from air through the air separation process and supplied via on-site production or merchant distribution using tanks, cylinders, and containers. In contrast, steam has historically been generated on-site for captive use in industries such as textiles, food & beverages, chemicals, pharmaceuticals, and tires.

In India, industrial-gas prices vary significantly by gas, purity, volume, and supply mode (bulk/tonnage versus packaged cylinders). As a useful FY25 benchmark, average realisations were approximately ₹17–18/Sm³ for oxygen, ₹14/Sm³ for nitrogen, and ₹120/Sm³ for argon.

Prices can also fluctuate based on supply-demand conditions. In particular, argon prices have recently moderated to around ₹70–80/Sm³, from about ₹120/Sm³ in FY25, while oxygen and nitrogen have remained around ₹18/Sm³ and ₹14/Sm³, respectively.

3.2.2 Non-Fossil Fuels

Non-Fossil Fuels or Green fuels refer to those fuels which are carbon-neutral or even carbon-free. These fuels are crucial to decarbonize the manufacturing and economic activities in future. Following are some of the green fuels used in the industry for heating and power generation applications:

A. Raw Biomass

Commonly used Biomass materials in the country are bagasse, rice husk, straw, cotton stalk, coconut shells, soya husk, de-oiled cakes, coffee waste, jute wastes, groundnut shells, saw dust etc.

B. Biomass Briquette



Biomass briquette is made from agricultural waste and a replacement for fossil fuels such as oil or coal and can be used to heat boilers in manufacturing units. Many companies in India have switched from furnace oil to biomass briquettes to save costs on boiler fuels. The use of biomass briquettes is predominant in the southern parts of India, where coal and furnace oil are being replaced by biomass briquettes. Use of biomass briquettes can earn Carbon Credits for reducing emissions in the atmosphere. Biomass briquettes also provide more calorific value compared to raw biomass and save around 30-40 percent of boiler fuel costs when compared with liquid fossil fuels.

C. Municipal Solid Waste (MSW)



Municipal Solid Waste (MSW) consists of everyday items such as product packaging, grass clippings, furniture, clothing, bottles, food scraps, newspapers, appliances, paint, and batteries. These wastes are generated in homes, schools, hospitals, and businesses. With the fast pace of urbanization, especially in metro cities, the issue of sustainable management and disposal of Municipal Solid Waste (MSW) is gaining attention from various stakeholders in the society. Central and State Governments and Urban Local Bodies (ULBs) are contemplating various usages of MSW such as steam and electricity generation, RDF and Compost generation, Fly ash for bricks manufacturing, etc. Urbanization in India has led to increased migration from rural to urban areas, exerting pressure on cities to manage MSW. The waste-to-steam model is poised to be highly effective in India, given the abundant MSW and the country's rapid economic growth, which will likely increase per capita waste generation.

D. Industrial Waste

This waste material has a high potential energy content, making it suitable as a fuel source for boilers. Industrial waste, also known as NRSW, is non-biodegradable. It is typically either landfilled or delivered to cement factories. Company like Steamhouse are adopting strategies focusing on addressing local waste issues locally by burning NRSW in a controlled environment. This approach manages waste efficiently and minimizes transportation-related emissions.

E. Waste gas from Industrial Waste Heat

Certain industries generate waste gases such as methane, carbon monoxide and other inflammable gases during their generation processes. This includes the production of black carbon, commonly known as soot, which is a component of fine particulate air pollution resulting from various industrial applications. If released into the atmosphere, these gases pose significant environmental and health risks. By burning these waste gases in a waste heat recovery boiler, we can generate steam. This method mitigates environmental harm and eliminates the need for fossil fuels. Industrial waste heat corresponds to heat rejected from industrial processes, in which energy (mostly in the form of heat or electricity) is used to produce high-added value products. Multiple technologies such as waste heat recovery boiler (WHRB), vapour absorption chillers, organic rankine cycle (ORC), etc. have been deployed by the industries to recover the industrial waste heat to generate steam, electricity, and produce cooling.

F. Refuse Derived Fuel (RDF)

Refuse-derived fuel (RDF) is a fuel produced from various types of waste such as municipal solid waste (MSW), industrial waste or commercial waste. RDF consists combustible components of various types of wastes. These fractions are separated by different processing steps, such as screening, air classification, ballistic separation, separation of ferrous and non-ferrous materials, glass, stones, and other foreign materials and shredded into a uniform grain size or also pelletized to produce a homogeneous material which can be used as substitute for fossil fuels for heating applications or generating electricity. It is a renewable energy source that ensures waste simply isn't thrown into a landfill and instead put to good use.

G. Textile Waste

Textile waste is fabric or clothing that is being generated by textile manufacturing units. Textile waste can contain chemical wastes and heavy metals that are potentially toxic. This waste material has a high potential energy content, making it suitable as a fuel source for boilers. Textile waste generated by the textile industry, process house, Dyeing Mills, including fabric scraps, yarn waste, or garment remnants, can also be effectively utilized for green steam generation. By processing and preparing this waste through techniques like shredding or baling, it can be used as a renewable fuel source in dedicated textile waste boilers. This not only helps in waste management but also reduces the reliance on fossil fuels for steam generation.

H. Plastic and Paper Waste

Plastic waste, which poses a significant environmental challenge, can be transformed into a valuable resource for steam generation. Plastic waste-to-energy technologies, including pyrolysis or gasification, can convert plastic waste into a fuel gas or liquid fuel, which can be utilized in boilers for steam generation. This not only helps in plastic waste management but also reduces the dependency on fossil fuels.

I. Agro-waste

A significant amount of agro-waste is generated across the country, which can include crop waste, animal waste, processing waste and some hazardous waste (such as pesticides and insecticides). This approach benefits farmers financially, reduces open-air burning of agro-waste and supports environmental sustainability

3.3 Introduction to Community Boiler service

Steam is an inevitable requirement for most of the process industries like textiles, pharmaceuticals, chemicals, food processing, fertilizer, plywood, paper, etc. to meet their heat requirements. Traditionally, industries set up boilers at their own premises to meet the steam requirements. These boilers are small to medium in size, have low efficiency, and at times safety is compromised, which results in casualties. The chimneys in industrial areas add PM-2.5 and PM-10 particles to the environment, causing diseases because of improper air pollution control equipment and non-professional management.

Steam As A Service (SAAS) through community boilers refers to a model where a company operates a centralized boiler and distributes the produced steam to various industries for their production processes. The steam is distributed through a network of pipes to the industries that rely on it for various applications, such as heating, power generation, sterilization, or industrial processes. These service providers ensure the reliable generation of steam in required quantity and quality to meet the specific

needs of the end user of steam. Replacing captive boilers with the use of community boilers, there can be potential savings of up to 25-30% of the fossil fuels that would have been used locally by individual boilers

By outsourcing steam production to a specialized service provider, industries can not only eliminate the need to invest in their own steam boilers but also focus on their core operations without the burden of operating and maintaining their own boiler systems. The approach to centralizing steam generation and distribution promotes efficiency, reduces environmental impact by installing pollution control mechanisms, and simplifies operations for businesses within the community. The use of community boilers often results in more efficient and optimized combustion processes as compared to individual boilers. However, there is a geographical space limitation regarding the installation and placement of new pipelines to distribute industrial gases in the established industrial clusters in India. Any new entrant would need to determine where and how to facilitate distribution to customers that are located far from the generation area without transmission losses. Moreover, those customers who have already provided a landing for the pipeline installed by an incumbent supplier may not be keen on creating another landing point for the distribution pipeline offered by such new entrant.

Steamhouse India Limited is the pioneer in community boiler service in India. It also purchases excess steam/ waste steam generated by industries during their process and acts as a distributor of such steam by laying distributed pipeline network and supplying the collected steam to its customers. Steamhouse has established their geographic dominance within industrial clusters through the creation of an exclusive pipeline network. The limited space available prevents the setup of additional distribution networks by other companies. Any new market entrants may need to overcome several entry barriers. They will likely need to source a significant amount of capital expenditures to be able to provide a centralised generation and distribution of industrial gasses, including the procurement of community boilers, gas separation and compression systems, pipelines and materials. Steam generation and distribution – the primary business model

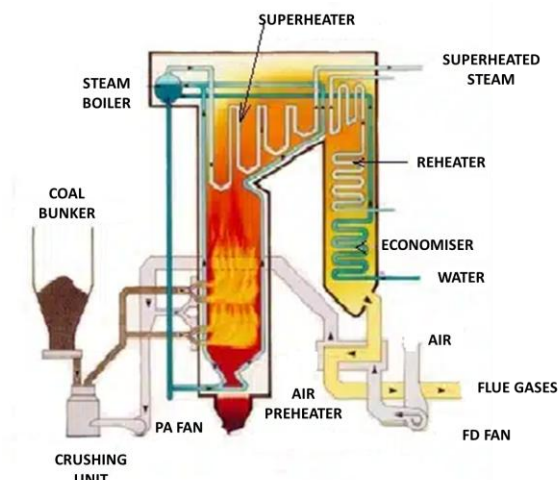
The steam is generated in a community boiler or steam generator by converting heat energy from various fossil or renewable fuel sources. The produced steam is then distributed to various industrial end users through an array of pipelines. The steam generation process using various fuel sources have been explained in the following sections.

A. Steam generation using fossil fuel (Coal)

The process of steam generation using coal involves the combustion of Crushed coal within a boiler's combustion chamber to the required sized in fluidized conditions to achieve maximum combustion. Depending on the geographical area and availability of non-fossil fuel in a particular sector, we reduce our emission by the use of scientific and automatic handling of coal and the coal ash-controlled movement and storage of coal. Where coal is the fuel source, hydrated lime is sprinkled on coal to reduce Sox emission. The heat energy released during combustion transfers to water-filled tubes within the boiler, causing the water to reach its boiling point and generate steam.

Once the steam is generated, it is distributed to various clients located nearby the common facility. The distribution system includes a network of pipes, valves, and control systems to transport and regulate the flow of steam. Steam is transferred through a network of insulated pipes which are designed to transport high-pressure steam over long distances. The insulation help minimizing heat loss during transportation.

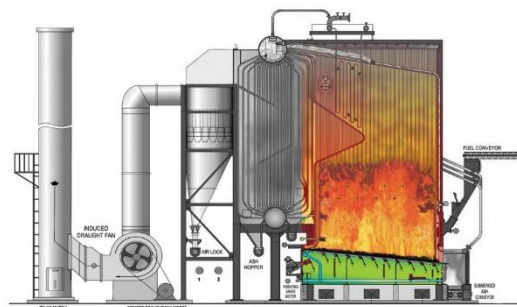
Exhibit 3.12: Process diagram of a coal based steam generation plant



B. Green steam generation using non-fossil fuels

Biomass: Green Steam is generated by using various types of green fuels such as biomass, briquette, industrial waste, RDF, waste heat, etc. In case of solid fuels, a biomass boiler is used for generating the steam. In case of MSW, incinerators are also used to burn the waste and generate heat which is then used in the boiler for generating the steam.

Exhibit 3.13: Process diagram of a biomass boiler based steam generation



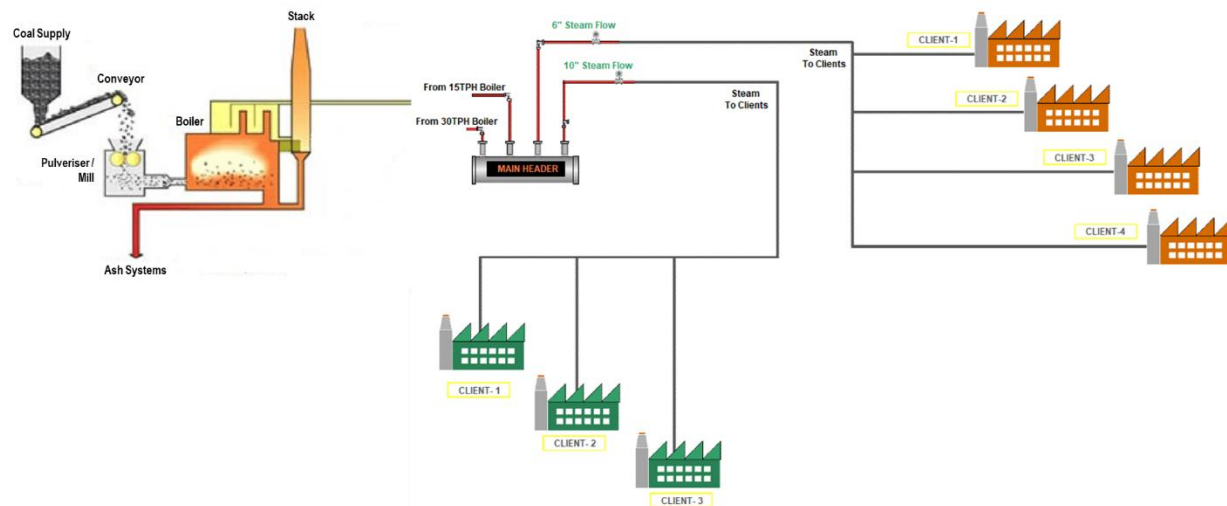
Industrial Wastes: In case of industrial wastes, most of them cannot be used directly. These industrial wastes are processed to generate liquid fuel or gas which are then used in the boiler to generate the steam. In general, Anaerobic Digestion (AD) or Bio-methanation process is used to extract gas from industrial wastewater, spent wash and aqueous waste. In the AD process, organic fraction of the waste is processed through Biogas Digester which produces methane rich biogas. This biogas can be used for cooking, heating, steam generation or for power generation.

Industrial Waste Heat: In case of waste heat recovery, the modern waste heat recovery plants are designed to extract maximum possible energy from waste. The combustion process releases the energy within the fuel or waste in the form of hot flue gas. The thermal energy within the hot flue gas is recovered with the help of a Waste Heat Recovery Boiler (WHRB) or Heat Recovery Steam Generator (HRSG) positioned after the combustion stage. As the hot flue gases flow through the boiler, the thermal energy is absorbed and eventually converted to steam.

3.3.1 Steam distribution process and structure

The steam distribution system is the essential link between the steam generator and the steam user. Irrespective of the source, an efficient steam distribution system is essential if steam of the right quality and pressure is to be supplied, in the right quantity, to the steam using industries. A typical steam distribution system is shown in the figure below.

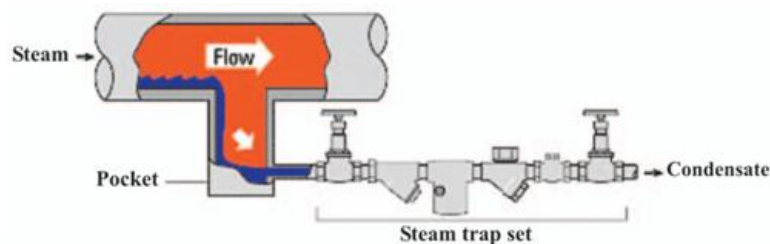
Exhibit 3.14: Layout of a steam distribution system



The steam generated in the boiler is conveyed through piping network to the point where its heat energy is required. One or more main pipes, or 'steam mains' carry steam from the boiler in the direction of the steam using plants. Smaller branch pipes then carry the steam to the individual equipment. General layout and location of steam consuming equipment is of great importance in efficient distribution of steam. Steam pipes are laid in a manner to maintain the shortest possible distance rather than to follow a building layout or road etc.

Apart from proper sizing of pipelines, provisions are made for proper draining of condensate which is bound to form as steam travels along the pipe. Large pockets are used in the piping network to enable water collection so that water is not carried along with steam. These drain pockets are provided at every 30 to 50 meters and at any low point in the pipe network. The pocket is fitted with a trap to discharge the condensate.

Exhibit 3.15: Drainage of condensate through steam traps in a steam distribution network



Expansion loops are also necessary in the network to take care of the expansion of pipes when they get heated up. Automatic air vents are fixed at the dead end of steam mains, which allows removal of accumulated air.

3.3.2 Additional Revenue sources / business model of a Community Boiler

A. Co-Generation of electricity³²

Community boilers can function as cogeneration or Combined Heat and Power (CHP) plants, producing both electricity and useful heat from a single fuel source. This dual-generation process significantly improves overall energy efficiency compared to separate production methods.

In a cogeneration-enabled community boiler, fuels such as coal or biomass are combusted to generate steam or hot water for heating, while simultaneously driving turbines to produce electricity. The waste heat from electricity generation is recovered and utilized for various thermal applications, improving overall efficiency. Turbine types like Extraction Cum Condensing or Back Pressure are employed based on system needs.

B. Carbon credits

International Scenario:

Community boilers that adopt sustainable practices and reduce greenhouse gas emissions can earn carbon credits under international carbon trading and climate initiatives. These credits can be monetized through:

1. **Carbon Credit Sales** to companies, governments, or investors aiming to meet regulatory or voluntary emission targets.
2. **Offset Partnerships** with organizations seeking long-term emission offsets.
3. **Voluntary Carbon Markets**, targeting buyers committed to environmental responsibility.
4. **Sustainability Labels**, such as green or renewable energy certifications, which enhance credit value.

Indian Scenario:

India is developing the **Indian Carbon Market (ICM)** to price GHG emissions through tradable Carbon Credit Certificates. Spearheaded by the Bureau of Energy Efficiency and Ministry of Environment, the scheme will set sector-specific emissions intensity targets aligned with national climate goals. The ICM will include both compliance and voluntary mechanisms to encourage wider participation.

India's efforts support its **Nationally Determined Contribution (NDC)** to reduce GDP emissions intensity by 45% by 2030 (from 2005 levels). The **Emission Trading Scheme (ETS)** pilot in Surat, launched in 2019 to cap particulate matter emissions, demonstrated success with a 24% reduction. This market-based model incentivizes industries to either cut emissions or purchase additional permits, promoting cleaner technologies and low-carbon growth.

³² IEA report on cogeneration and renewable energy

C. Revenue from fly ash

Community boilers using coal as a fuel source can generate additional revenue by utilizing coal fly ash—a byproduct rich in silica and alumina—in various industries. Fly ash can be sold for brick manufacturing, where it replaces cement to produce stronger, cost-effective, and eco-friendly bricks.

D. Revenue from flue gas sales

Community boilers can generate additional revenue by utilizing flue gases, particularly through the capture and sale of carbon dioxide (CO₂), which holds commercial value. CO₂ extracted from flue gases can be used in carbonation for beverages, food preservation and freezing, and as a feedstock in chemical and polymer manufacturing. Additionally, flue gases retain significant thermal energy, which can be harnessed using waste heat recovery systems—such as boilers or heat exchangers—to produce extra steam or hot water for industrial processes or community heating, further enhancing efficiency and profitability.

E. Revenue from sale of chill water services

Community boiler service providers can tap into an additional revenue stream by offering chilled water services, leveraging their infrastructure and expertise to meet diverse cooling needs. This can include the installation of chilled water generation systems for applications such as air conditioning, industrial processes, and data center cooling.

F. Revenue from advertising on steam pipeline network

Bridges spanning over pipeline infrastructure offer a unique opportunity for advertising, providing high visibility and a steady revenue stream. Large banners or wraps can be installed on the sides of these bridges, showcasing company logos, product promotions, or brand messages to pedestrians and motorists alike. Additionally, illuminated signs enhance visibility during nighttime or low-light conditions, maximizing the impact of the advertisements. These prominent locations serve as effective platforms for advertisers while enabling community boiler operators to monetize otherwise unused infrastructure.

G. Revenue from selling of third-party generated steam

Many industries deploy waste heat recovery boiler (WHRB) or similar technologies to generate steam from industrial waste heat or industrial waste. This steam is either used in generating electricity and for process heating or sold to other nearby end-users. Also, in certain industries, steam is generated as a byproduct in the manufacturing process. A community boiler service provider can purchase this steam and re-sell it to the nearby end-users through its own steam distribution network. Alternately, the service provider can also allow the third-party steam generator to use its network and charge rental fees for the used capacities.

3.3.3 Technology innovation in Community boilers

Steamhouse India, a leader in community boiler industry, has elevated its community boiler monitoring and assessment system through the application of state-of-the-art technologies. Innovations such as the Internet of Things (IoT), Supervisory Control and Data Acquisition (SCADA), drones, satellite images, and steam traps/auto valves have played a crucial role in revolutionizing boiler operations, monitoring, and maintenance. These technology advancements have led to improvements in efficiency, safety, and overall

performance, making boilers smarter, more reliable, and aligned with the demands of modern industrial processes.

A. IoT (Internet of Things)

IoT technology is increasingly being used in boilers to enable remote monitoring, data collection, and control. IoT sensors and devices can provide real-time information about boiler performance, temperature, pressure, fuel consumption, and emissions. This data can be utilized for condition monitoring, predictive maintenance, energy optimization, and overall process efficiency improvement.

B. SCADA (Supervisory Control and Data Acquisition)

SCADA systems have found widespread applications in the Indian boiler industry, transforming how boiler operations are monitored and controlled. These centralized systems provide Indian boiler operators with a comprehensive view of critical data, consolidating information from various sensors and devices. SCADA systems offer remote access capabilities, allowing operators to manage multiple boilers and industrial processes from a central location, reducing the need for on-site personnel and enhancing operational efficiency. The real-time data acquisition and visualization provided by SCADA systems enable operators to make informed decisions promptly, responding to alarms and events efficiently. This remote accessibility and data-driven decision-making contribute to improved productivity and streamlined operations of boiler facilities.

C. Drones

In India, drones are emerging as a valuable tool for inspecting and maintaining industrial facilities, including boilers. Drone-based visual inspections of boilers and related equipment offer several advantages, particularly in India's diverse and vast industrial landscape. Equipped with high-resolution cameras, drones can access difficult-to-reach areas and provide detailed imagery of boiler components. For the boiler industry, this eliminates the need for physical access to confined spaces, reducing safety risks for inspectors. Drone inspections also support preventive maintenance efforts in boilers, as regular inspections help identify potential issues early, allowing for timely repairs and minimizing unplanned downtime.

D. Steam Trap/Auto Valves

Steam traps and automatic valves are essential components in steam distribution systems. Steam traps are used to remove condensate from the steam lines, ensuring efficient heat transfer and preventing water hammer. Automatic valves, such as control valves and safety valves, help regulate steam flow, pressure, and temperature within the boiler system. Advanced steam trap and valve technologies, including smart and self-regulating devices, improve energy efficiency, reduce steam losses, and enhance overall system performance.

3.3.4 Future Technology for Community Boiler

Emerging Technologies for Community Boilers in India

India is exploring several advanced technologies to enhance the sustainability and efficiency of community boilers. Green hydrogen, produced via electrolysis using renewable energy, holds significant potential as a clean fuel alternative. With India's vast solar and wind resources and supportive government policies, green hydrogen could soon play a key role in decarbonizing industrial steam generation.

Microwave plasma technology is a promising innovation. It uses microwave energy to generate high-temperature plasma for clean and efficient combustion. This method reduces emissions and allows flexible fuel use, including biomass and waste materials, making it a strong candidate for future boiler upgrades.

Concentrated Solar Power (CSP), which harnesses focused solar energy to generate heat, can be integrated into boiler systems to supplement or replace fossil fuel usage, lowering costs and emissions.

Exothermic reactions can be strategically utilized to generate heat in community boilers. These chemical processes reduce fuel dependency, cut emissions, and offer customized thermal output based on industrial requirements.

Small Modular Reactors (SMRs) offer a nuclear-based solution with compact design, factory fabrication, and modular deployment. Their scalability and smaller footprint make SMRs viable for industrial zones with high, consistent energy needs, while minimizing traditional nuclear plant limitations.

4 OVERVIEW OF INDUSTRIES WITH SIGNIFICANT STEAM DEMAND

4.1 Highlights of the Major Steam Consuming Industries in India

The below table represents a summary of industries who are major steam consumers

Exhibit 4.1: Highlights of the major steam consuming industries in India

INDUSTRY NAME	FY2026 INDUSTRY SIZE (INR BILLION)	MAJOR PRODUCTION HUBS	KEY GROWTH DRIVERS	FY2026 - FY2031E CAGR
Textile Industry	16,660	Maharashtra, AP, Haryana, Punjab, Gujarat, Tamil Nadu	Policy support, global demand, zero-duty access under the India-UK CETA	5.8%
Pharmaceutical Industry	5,096	Telangana, AP, Maharashtra, Gujarat	Accessibility, acceptability, Epidemiological factors	10.0%
Food Processing Industry	2,565	Maharashtra, Delhi, AP, UP, Tamil Nadu	Changing demographics, consumer preference, changing lifestyle	5.3%
Chemical Industry	25,577	Gujarat, Maharashtra, Tamil Nadu, Odisha	Government initiatives including the BHAVYA Rasayan chemical parks scheme, growth in specialty chemical sector	9.1%
Tyre Industry	1,080	Tamil Nadu, Gujarat, Maharashtra	Replacement market, improving road infrastructure, growing automobile industry	9.2%

Paper and Pulp Industry

1,597

Maharashtra, AP, MP, Karnataka, Gujarat, UP

Packaging industry, availability of raw material, increasing literacy rate

7.7%

4.2 Textile Industry

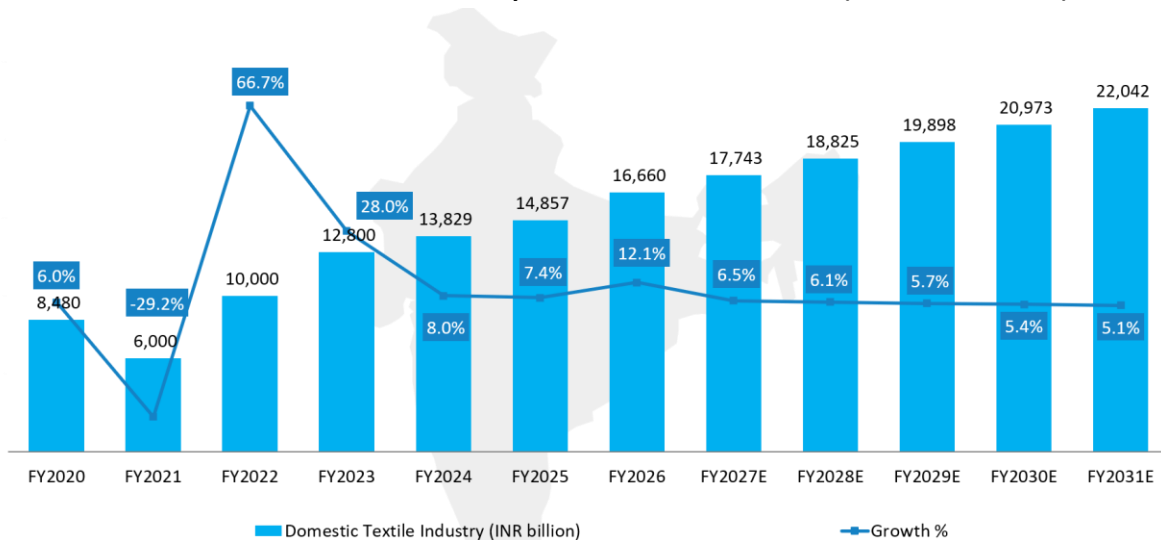
4.2.1 Introduction

India's textiles sector is one of the oldest industries in the Indian economy, and is extremely varied, with hand-spun and hand-woven textiles sectors at one end of the spectrum, and capital-intensive sophisticated mills at the other end.

The decentralized power looms/ hosiery and knitting sectors form the largest component of the textiles segment.

The textile sector is expected to play a significant role in India's export and manufacturing growth. The Government has set a target of US\$100 billion in textile and apparel exports by 2030. India's exports of textiles and apparel, including handicrafts, stood at INR 3,253 billion in FY2026, registering 1.8% growth over FY2025, with export growth recorded across more than 100 countries.³³ India is the world's second-largest producer of textiles and apparel and accounted for approximately 3.9% of global textile and apparel trade. The overall Indian textile and apparel industry was approximately INR 16,660 billion (approximately US\$190 billion) in FY2026 and is estimated to reach INR 22,042 billion by FY2031E. Separately, the Government has articulated an aspiration for the overall textile industry to reach US\$350 billion by 2030; this represents a policy target and should not be interpreted as a market forecast.

Exhibit 4.2: Domestic textile industry in India, FY2020 – FY2031E, (Value in INR billion)



Note: E refers to Estimate

Source: Min. of Textiles; Frost & Sullivan Analysis

4.2.2 Major Textile hubs in India

Following are the top 5 textile and clothing manufacturing hubs in India:

³³ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2288808&lang=1®=1&utm>

1. **Maharashtra**
2. **Andhra Pradesh**
3. **Haryana and Punjab**
4. **Gujarat**
5. **Tamil Nadu**

4.2.3 Textile industry in Gujarat

Leading national and international companies have invested in Gujarat textile industry owing to the availability of vast raw materials combined with investor friendly policies. Gujarat has a well-established textile manufacturing ecosystem supported by its cotton base, man-made fibre production and downstream textile processing capabilities. The state accounts for approximately 65% to 70% of India's denim production and around 50% of the country's man-made fibre production. Gujarat also accounts for around 30% of India's woven fabric production and has a significant presence in technical textiles.³⁴

The major textiles hubs in Gujarat are listed below:

Exhibit 4.3: Prominent Textile clusters in Gujarat

Textile hub	Key textile activities
Ahmedabad	Cotton and textile manufacturing; apparel/textile industrial infrastructure
Surat	Man-made fibre / synthetic textiles, textile processing and integrated textile manufacturing
Kutch / Mundra	Textile and apparel manufacturing
Valsad–Umargam / South Gujarat	Textile manufacturing and industrial activity
Navsari / Vansi	Integrated textile and apparel manufacturing – PM MITRA Park

Source: Frost & Sullivan Analysis

³⁴<https://gidc.gujarat.gov.in/Document/LinkManagment/Advertisement/eoi-for-gujarat-pm-mitra-park05092023095606.pdf?utm>

Exhibit 4.4: Existing Textile parks in Gujarat

NAME	LOCATION	STATUS
Gujarat Eco Textile Park Limited	Surat	Completed
Fairdeal Textile Park Pvt. Ltd.	Surat	Completed
Sayana Textile Park Ltd.	Surat	Completed
RJD Integrated Textile Park	Surat	Completed
Surat Super Yarn Park Limited	Surat	Completed
Amitara Green High Tech Textile Park Pvt. Ltd.	Kheda	Completed
Vraj Integrated Textile Park Limited	Ahmedabad	Completed
Mundra SEZ Textile & Apparel Park Limited	Kutch	Completed
Kejriwal Integrated Textile Park	Surat	Under implementation
Palsana ITP Park	Surat	Under implementation
Ichhapore Textile Park	Surat	Under implementation
Karanj Integrated Textile Park	Surat	Under implementation
Shahlon Textile Park	Surat	Under implementation

Source: Ministry of Textile, GIDC, Frost & Sullivan Analysis

4.2.4 Drivers of Textile industry in India

A. Exporters gaining from strong global demand

India is the world's second-largest producer of textiles and apparel and accounted for approximately 3.9% of global textile and apparel trade. India's textile and apparel exports, including handicrafts, reached INR 3,253.39 billion in FY2026, registering 1.8% growth over FY2025, with export growth recorded across more than 100 countries.³⁵ Economic Cooperation and Trade Agreements with Australia and the UAE have provided preferential market access for Indian textile and apparel exports. The India–UK Comprehensive Economic and Trade Agreement (CETA) entered into force on 15 July 2026, providing zero-duty access on 1,143 tariff lines covering textile products and eliminating the tariff disadvantage faced by Indian exporters relative to key competing suppliers such as Bangladesh, Pakistan and Cambodia.³⁶ Negotiations for the India-EU Free Trade Agreement concluded on 27 January 2026, providing for zero-duty access across textile and apparel tariff lines. However, the agreement had not been signed or entered into force as of the date of this report. In the United States, changes in tariff measures during 2025–26 have affected India's export competitiveness. The current tariff position should be viewed in the context of the evolving US trade framework rather than the earlier 2025 tariff structure.

The RoSCTL scheme for apparel and made ups has been extended until 30 September 2026, or until approval of the successor scheme for the 16th Finance Commission cycle, whichever is earlier, providing continued remission of embedded State and Central taxes and levies on eligible exports.³⁷

³⁵ <https://www.pib.gov.in/PressReleaseFramePage.aspx?PRID=2089508&lang=2®=3&utm>

³⁶ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2284878&lang=1®=+3&utm>

³⁷ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2247851&lang=1&noshow=1®=3&utm>

B. Policy support has been a key ingredient to growth

The Indian government has introduced several key initiatives to boost the textile sector's competitiveness, modernization, and export potential.

Exhibit 4.5: Highlights of Textile policy in Gujarat

Incentive	Provision under the Gujarat Textile Policy 2024
Capital subsidy	Garments, apparel, made-ups and technical textiles: 35% of eligible fixed capital investment (eFCI), up to INR 1,000 million. Weaving, knitting, dyeing and processing, texturising, twisting, specified man-made fibre spinning and embroidery: 20% of eFCI, up to INR 500 million.
Interest subsidy	Garments, apparel, made-ups and technical textiles: 7% on term loans for up to 8 years, subject to a maximum of 3% of eFCI per annum. Other eligible activities: 7% on term loans for up to 7 years, subject to a maximum of 2% of eFCI per annum.
Power tariff subsidy	INR 1 per unit for 5 years from the date of commencement of production (DoCP), for power availed from a DISCOM or renewable power through open access.
Payroll assistance	Garments, apparel and made-ups: INR 5,000 per female worker and INR 4,000 per male worker per month for 5 years. Technical textiles: INR 3,000 per female worker and INR 2,000 per male worker per month for 5 years.
Assistance to self-help groups for job work	Training assistance: INR 5,000 per member per month for 3 months. Payroll assistance: 25% of job-work value/turnover, up to INR 5,000 per member per month for 5 years.

Source: GIDC, Gujarat textile policy 2024, Frost & Sullivan Analysis

C. Foreign investment flowing into the sector

100% FDI is permitted in the textile sector. Cumulative FDI inflows in the textiles sector (including dyed and printed textiles) stood at INR 335 billion (US\$ 5,073 million) between April 2000 and March 2026. The textiles industry in India is experiencing a significant increase in collaboration between global majors and domestic companies.

4.2.5 Upcoming major Textile projects and parks in the country

The PM Mega Integrated Textile Region and Apparel (PM MITRA) Park Scheme, approved by the Union Cabinet on 6 October 2021 and notified by the Ministry of Textiles on 21 October 2021, aims to develop world-class textile parks across seven states - Tamil Nadu (Virudhunagar), Telangana (Warangal), Gujarat (Navsari), Karnataka (Kalaburagi), Madhya Pradesh (Dhar), Uttar Pradesh (Lucknow) and Maharashtra (Amravati) – with a total outlay of INR 44.45 billion over seven years to FY2027-28. These parks will include advanced infrastructure such as plug-and-play facilities, power and water supply, and common processing zones to attract cutting-edge technologies and boost both FDI and domestic investment in the textile sector. The scheme runs to FY2027-28 and targets aggregate investment of INR 700 billion. The first PM MITRA park, at Warangal in Telangana, was inaugurated on 10 May 2026. In Gujarat, 1,142 acres have been acquired for the PM MITRA park at Vansi-Borsi in Navsari district, with external infrastructure works of INR 4.96 billion sanctioned.

Exhibit 4.5A: List of upcoming major projects in the Indian textile sector

Project Name	Developer	Location	Investment / Project Cost (INR million)	Project Status
Integrated textile and apparel manufacturing complex, PM MITRA Park	Evertop Textile and Apparel Complex Pvt Ltd	Warangal, Telangana	10,510	Under implementation
PM MITRA Park (Kakatiya Mega Textile Park)	Telangana Industrial Infrastructure Corporation Ltd	Warangal, Telangana	16,955	Commissioned
PM MITRA Park (Virudhunagar)	PM MITRA Park Tamil Nadu Ltd	Virudhunagar, Tamil Nadu	18,940	Under implementation
PM MITRA Park, Vansi-Borsi	Gujarat Industrial Development Corporation	Navsari, Gujarat	4,964	Under implementation

Source: PIB, Ministry of Textile, GIDC, Frost & Sullivan Analysis

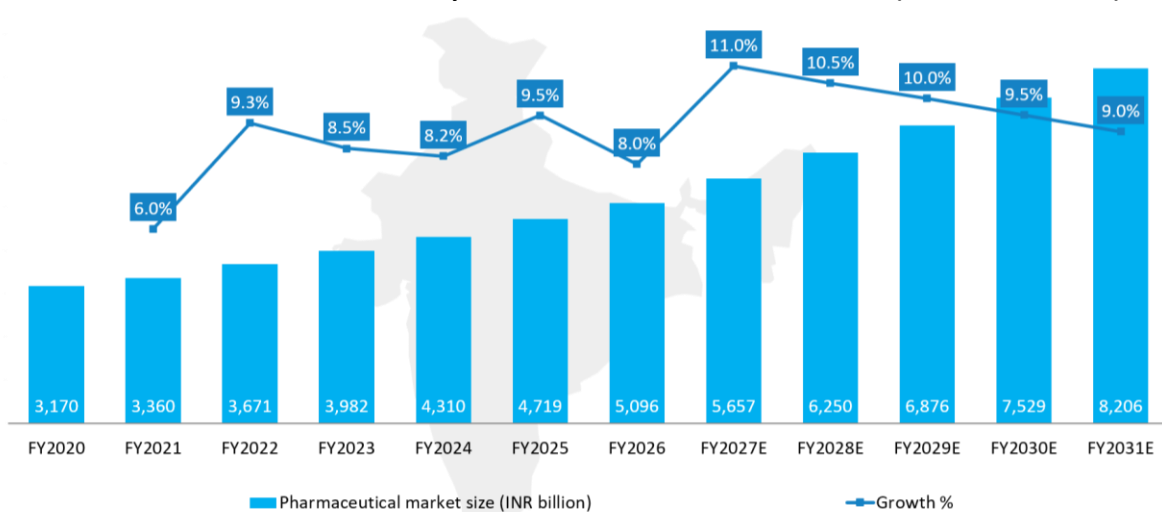
4.3 Pharmaceutical Industry

4.3.1 Introduction

India ranks 3rd worldwide for pharmaceutical production by volume and 11th by value. The country has an established domestic pharmaceutical industry comprising more than 3,000 companies and approximately 10,500 manufacturing units, together with a highly skilled resource pool. Pharmaceutical exports reached US\$ 30.5 billion in FY2025, supplying 191 countries.

The Indian pharmaceutical sector supplies approximately 20% of the global generic medicines market by volume, 60% of UNICEF's vaccine requirements, 40% to 70% of global demand for DPT and BCG vaccines and 90% of the World Health Organization's measles vaccine demand.

Exhibit 4.6: Pharmaceutical industry market size, India, FY2020 – FY2031E, (Value in INR billion)



Note: E refers to Estimate

Source: IBEF Sector report; Frost & Sullivan Analysis

The Indian pharmaceutical industry recorded turnover of INR 4,719 billion in FY2025 and is estimated at INR 5,096 billion in FY2026. On this basis the industry is projected to reach approximately INR 8,206 billion by FY2031. The Government has separately articulated an aspiration for the sector to reach US\$ 130 billion by 2030, which is a policy target rather than a forecast.

4.3.2 Major Pharmaceutical hubs in India

1. Telangana
2. Andhra Pradesh
3. Maharashtra
4. Gujarat

4.3.3 Drivers of Indian Pharmaceutical sector

A. Accessibility of medical infrastructure

India's hospital bed density stands at approximately 1.3 beds per 1,000 population against a global median of 2.9, indicating substantial headroom for capacity addition. New business models are expected to penetrate tier-2 and tier-3 cities. India's healthcare expenditure is expected to increase from

approximately 3.3% of GDP to approximately 5% of GDP by 2030, supported by increased public and private investment, expanding insurance coverage and continued additions to healthcare infrastructure.

38

B. Pradhan Mantri Bhartiya Janaushadhi Pariyojna (PMBJP)

The Pradhan Mantri Bhartiya Janaushadhi Pariyojana (PMBJP) provides quality generic medicines at approximately 50%–80% lower prices than comparable branded medicines. As of 30 June 2026, 20,149 Jan Aushadhi Kendras were operational across India, with the Government targeting 25,000 Kendras by March 2027. The PMBJP product basket comprised 2,110 medicines and 315 surgical, medical consumable and device products as of June 2026. During FY2025-26, medicines with a maximum retail price (MRP) value of INR 22.52 billion were sold under the scheme, while sales of INR 4.74 billion were recorded during the first three months of FY2026-27.³⁹

Epidemiological factors

Demand is supported by population growth, rising incomes and wider insurance coverage. New diseases and lifestyle changes are likely to boost this demand further. Increasing prevalence of lifestyle diseases are some of the other reasons driving this industry forward.

4.3.4 Upcoming Major Pharmaceutical Projects and Parks in the country

The **Promotion of Bulk Drug Parks Scheme**, approved by the Union Cabinet in March 2020, aims to establish three Bulk Drug Parks in the country to provide common infrastructure and reduce the cost of bulk drug manufacturing. Following evaluation of proposals received from 13 states, Gujarat, Himachal Pradesh and Andhra Pradesh were selected for the three parks. The scheme provides central financial assistance of up to INR 10 billion per park or 70% of the cost of common infrastructure facilities, whichever is lower; the assistance is up to 90% for Himachal Pradesh as a hilly state. The scheme has a budgetary outlay of INR 30 billion and is operational through FY2026-27.⁴⁰

The Jambusar Bulk Drug Park in Bharuch, Gujarat spans 2,015.02 acres and has a total project cost of INR 25.07 billion, including INR 14.57 billion for common infrastructure facilities. The Viksit Gujarat Industrial Policy 2026 also provides assistance of 40% of eligible fixed capital investment, up to INR 300 million, for setting up Common Boiler Projects.

Exhibit 4.6A: List of upcoming major projects in the Indian pharmaceutical sector

Project	Implementing agency	Location	Investment (INR million)	Status
Bulk Drug Park, Jambusar	Gujarat Industrial Development Corporation	Bharuch, Gujarat	25,070	Under implementation
Bulk Drug Park, Haroli	Himachal Pradesh Bulk Drug Park Infrastructure Ltd	Una, Himachal Pradesh	19,230	Under Implementation
Bulk Drug Park, Nakkapalli	Andhra Pradesh Bulk Drug Infrastructure Corporation Ltd.	Anakapalli, Andhra Pradesh	18,767	Under implementation
Common Boiler Project	Government of Gujarat	Gujarat	Up to INR 300 Mn	Policy support

Source: PIB, Dept of Pharmaceuticals, Company Disclosure, Frost & Sullivan Analysis

³⁸ <https://www.ibef.org/industry/healthcare-india?utm>

³⁹ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2290392&lang=2®=48&utm>

⁴⁰ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2224376&lang=2®=3>

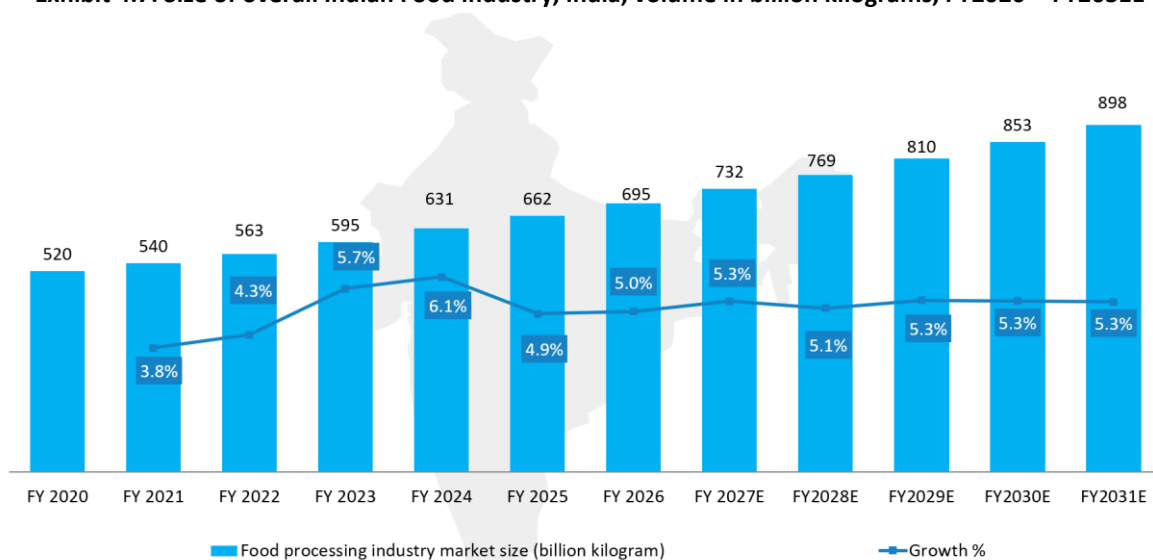
GIDC is the State Implementing Agency and has received central assistance of INR 10 billion. As of March 2026, GIDC had utilized INR 3.41 billion of central grant and INR 2.07 billion of state funds towards development of common infrastructure. Civil infrastructure works were substantially advanced, while utility facilities including the CETP, solvent recovery and treatment, storage and disposal facilities remained under execution. On 5 June 2026, the Prime Minister dedicated essential layout utilities at the Jambusar Bulk Drug Park.

4.4 Food Processing

4.4.1 Introduction

The Food Processing sector in India has a quintessential role in linking Indian farmers to consumers in the domestic and international markets. The Ministry of Food Processing Industries (MoFPI) is making efforts to encourage investments across the value chain.

Exhibit 4.7: Size of overall Indian Food industry, India, volume in billion kilograms, FY2020 – FY2031E



Note: E refers to Estimate

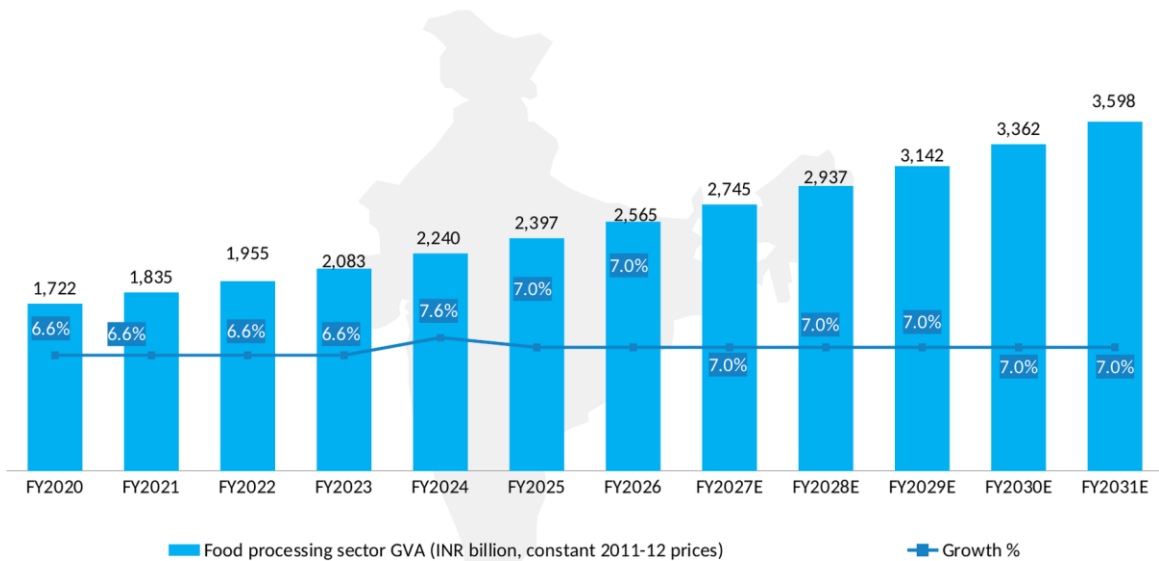
Source: IBEF Sector report; Frost & Sullivan Analysis

The food processing sector contributes approximately 32% of India's overall food market and accounted for 20.4% of India's agri-food exports in FY2025. Gross Value Added (GVA) by the food processing sector stood at INR 2,240 billion in FY2024 at constant 2011-12 prices, representing 7.93% of manufacturing GVA and 1.39% of total GVA. The sector recorded an average annual growth of 6.55% over the nine years to FY2024, compared with 6.06% for overall manufacturing.^{41 42}

⁴¹ <https://www.mofpi.gov.in/en/documents/statistics?utm>

⁴² <https://www.pib.gov.in/newsite/erecontent.aspx?lang=2®=48&relid=282027&utm>

Exhibit 4.8: Food processing sector Gross Value Added, India, FY2020 – FY2031E, (Value in INR billion at constant 2011-12 prices)



Note: E refers to Estimate

Source: MoFPI; MoSPI; Frost & Sullivan Analysis

4.4.2 Drivers of the Indian Food processing sector

A. Increasing population and changing demographics

India's growing population, rising incomes, urbanization and changing consumer preferences are supporting demand for processed and packaged foods. The food processing sector has continued to expand, with its GVA increasing from INR 1.34 lakh crore in FY2014-15 to INR 2.24 lakh crore in FY2023-24, while processed food exports accounted for 20.4% of India's agri-food exports in FY2024-25. The organised consumer food industry recorded 13% sales growth in FY2025 and was expected to grow by 13% to 15% in FY2026, supported by rising consumer affordability, modern retail and demand for convenient and premium food products.⁴³

B. Changes in consumer preferences

India's food industry is rapidly evolving to meet rising demand for convenient, healthy, and flavorful packaged foods, driven by urbanization, dual-income households, and a young, growing middle class. This shift is fueling innovation, competition, and expansion across distribution channels.

C. Changing lifestyle

India's food processing sector is witnessing steady growth, especially in breakfast cereals and baked snacks, driven by changing lifestyles and consumer preferences. This has led to rising imports of key ingredients and greater focus on product innovation.

D. Shifting demand from loose to branded packaging

Post-pandemic, consumers increasingly prefer packaged over loose products due to heightened focus on hygiene and safety. This shift is visible even in rural and small-town markets, where demand for branded, quality-assured items is rising.

⁴³ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2224667&lang=2®=3&utm>

4.4.3 Upcoming major Food processing projects and parks in the country

The Pradhan Mantri Kisan SAMPADA Yojana (PMKSY) supports the development and expansion of food-processing and preservation infrastructure, including integrated cold-chain infrastructure, agro-processing clusters and other value-addition facilities. As reported by the Ministry of Food Processing Industries in its Year End Review 2025, 1,618 projects had been approved under the various component schemes of PMKSY, of which 1,185 were operational, creating processing and preservation capacity of 270.51 lakh metric tonnes. Under the Integrated Cold Chain and Value Addition Infrastructure component, 408 projects had been approved as of 31 March 2026.⁴⁴

The Mega Food Park component of PMKSY was discontinued with effect from 1 April 2021, with provision for committed liabilities of ongoing projects. Of the 41 Mega Food Parks approved under the scheme, 25 are currently operational. Each park was eligible for grant assistance of up to INR 500 million, and the scheme envisaged fully developed plots for food-processing entrepreneurs.⁴⁵

Separately, the Production Linked Incentive Scheme for Food Processing Industry (PLISFPI), with an approved outlay of INR 109 billion for FY2021-22 to FY2026-27, had 163 applications from 127 companies across 212 project locations in 22 states as of July 2026. Incentives of INR 32.71 billion had been disbursed up to June 2026.⁴⁶

The Union Budget 2026-27 has provided INR 9.15 billion for PMKSY and INR 17.00 billion for PMFME, with specific output and outcome targets for FY2026-27. Accordingly, both schemes continue to have budgetary provision in FY2026-27.⁴⁷

The below table captures some of the upcoming notable projects in the Indian food processing sector:

Exhibit 4.9: List of upcoming mega projects in Indian Food processing sector

Project Name	Developer	Location	Cost (INR million)	Project Status
Nestlé India new manufacturing facility	Nestlé India Ltd	Khordha, Odisha	9,500	Under implementation
Amul Bengal Dairy Project	Gujarat Co-operative Milk Marketing Federation Ltd (Amul)	Howrah, West Bengal	7,000	Under implementation
Uttam Distilleries capacity expansion (40 to 160 KLPD)	Uttam Distilleries Ltd	Haridwar, Uttarakhand	1,100	Under implementation
10 LLPD greenfield dairy processing plant	Banas Dairy	Baghpat, Uttar Pradesh	3,045*	Under implementation

Source: PIB; Company Disclosure, NSE, Frost & Sullivan Analysis

4.5 Chemicals

4.5.1 Introduction

Chemicals industry in India is extremely diversified, containing more than 80,000 commercial products. It is largely classified into Bulk chemicals, Agrochemicals, Specialty chemicals, Petrochemicals, Polymers & Fertilizers. India's vicinity to the Middle East, the earth's source of petrochemicals feedstock, makes for economies of scale.

The Indian chemicals and petrochemicals industry was estimated at INR 21,508 billion (US\$ 250 billion) in FY2024 and is anticipated to reach approximately INR 39,444 billion by FY2031, consistent with the

⁴⁴ <https://www.pib.gov.in/PressReleaseIframePage.aspx?PRID=2212769&lang=2®=48&utm>

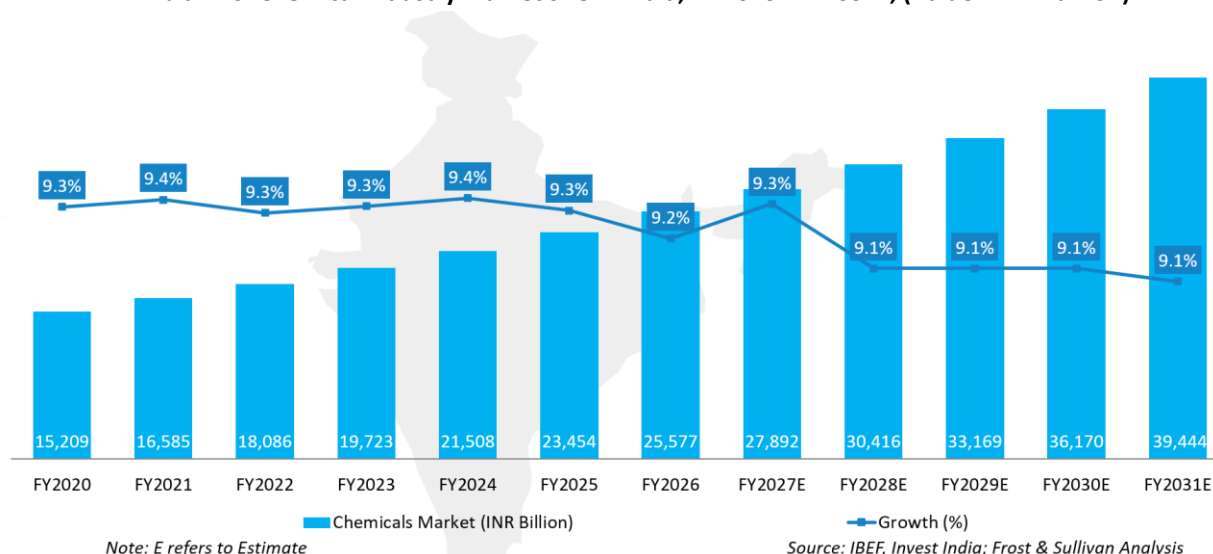
⁴⁵ <https://www.mofpi.gov.in/schemes/mega-food-parks?utm>

⁴⁶ <https://agriexchange.apeda.gov.in/Market/MarketNews/BindMarketNews?page=1&utm>

⁴⁷ https://www.indiabudget.gov.in/doc/OutcomeBudgetE2026_2027.pdf?utm

industry's stated trajectory towards US\$ 1 trillion by 2040. Growth is driven by increasing demand in the end-user segments for specialty chemicals and the petrochemicals sector. The specialty chemicals market was valued at US\$ 64.5 billion in 2024, equivalent to approximately 26% of the total chemicals market.

Exhibit 4.10: Chemical industry market size in India, FY2020– FY2031E, (Value in INR billion)



Key sectors where steam is widely consumed, such as chemicals and agrochemicals, have encountered production-related challenges in India during 2024 and 2025, driven by a combination of cyclical, geopolitical, regulatory, and structural factors. Operating conditions in FY2026 have remained broadly stable, with the sector positioned for gradual growth going forward, although performance continues to vary across sub-segments.

The chemicals and agrochemicals industry has been navigating a period of weakness since 2024, driven by a confluence of cyclical, geopolitical, regulatory, and structural factors. At the broader chemicals and petrochemicals level, production of selected major chemicals and petrochemicals reached 58.6 million tonnes in FY2025, compared with 57.9 million tonnes in FY2024. In FY2026, the sector has remained broadly stable and is positioned for gradual growth going forward..⁴⁸

The operating environment in FY2026 has also been influenced by international trade measures. The US tariff framework applicable to Indian exports changed materially during 2025–26, including the removal of the additional 25% Russia-oil-related tariff in February 2026 and subsequent changes to US tariff measures..⁴⁹

Competition from Chinese producers and global supply-demand conditions remain important factors influencing pricing and margins across chemicals and agrochemicals.

4.5.2 Major Chemical hubs in India

Gujarat is India's leading chemical and petrochemical hub, accounting for approximately 62% of India's petrochemical production and 53% of chemical production. The state hosts major chemical and petrochemical clusters, including Dahej, Vadodara, Ankleshwar and Vapi, and is home to India's first

⁴⁸ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2220980&lang=1®=1>

⁴⁹ <https://www.whitehouse.gov/presidential-actions/2026/02/modifying-duties-to-address-threats-to-the-united-states-by-the-government-of-the-russian-federation-04b2/>

operational Petroleum, Chemicals and Petrochemicals Investment Region (PCPIR) and chemical port at Dahej.⁵⁰

Gujarat also hosts major integrated refining and petrochemical assets. Reliance Industries operates the world's largest and most complex single-site refinery complex at Jamnagar, with crude processing capacity of approximately 1.4 million barrels per day and a Nelson Complexity Index of 21.1.⁵¹

Maharashtra is another major chemical manufacturing centre, with established clusters around Mumbai, Thane and the Thane-Belapur industrial belt. The state has a diversified chemical base spanning petrochemicals, specialty chemicals, pharmaceuticals and related downstream industries.

Tamil Nadu has a significant petrochemical and chemical manufacturing base, with the Manali industrial complex north of Chennai serving as a major petrochemical cluster and additional chemical manufacturing activity concentrated around Cuddalore and other industrial locations.

Odisha has emerged as an important petrochemical hub centred on Paradip. IndianOil operates a 15 MMTPA refinery at Paradip with integrated polypropylene and mono ethylene glycol facilities, while para-xylene and purified terephthalic acid projects are under implementation. IndianOil has also received approval for a ₹61,077 crore Paradip Petrochemical Complex, comprising a dual-feed cracker and downstream petrochemical units.⁵²

4.5.3 Drivers of the Indian Chemical industry

- **Manufacturing and Industrial Growth**

- Chemicals play a crucial role in sectors like textiles, pharma, automotive, construction, agriculture, and consumer goods.
- Applications include:
 - Textile chemicals for dyeing and finishing
 - Specialty chemicals for pharmaceuticals
 - Automotive chemicals like lubricants and coatings

- **Focus on Specialty Chemicals**

- Shift toward high-value specialty chemicals with niche applications
- Increasing domestic and export demand for:
 - High-performance plastics and polymers
 - Fine chemicals and intermediates for pharma and agrochemicals
 - Specialty coatings, dyes, and adhesives

- **Government Initiatives**

- Policies promoting growth and investment in the chemical sector:

⁵⁰ <https://gidm.gujarat.gov.in/sites/default/files/CoE%20Report%202024%E2%80%939325.pdf>

⁵¹ <https://www.ril.com/businesses/energy/refining-marketing>

⁵² <https://iocl.com/NewsDetails/59351>

- Make in India to attract FDI and boost local manufacturing
- Atmanirbhar Bharat to support self-reliance
- NITI Aayog's recommendations of July 2025 for the chemicals sector, including fiscal and infrastructure support to raise India's share of global chemical value chains (a National Chemical Policy has not been notified or approved)
- BHAVYA-Rasayan: In July 2026, the Union Cabinet approved the Bharat Audyogik Vikas Yojana Rasayan (BHAVYA-Rasayan) scheme to establish three dedicated chemical parks in India. The scheme has a total financial outlay of INR 30.30 billion for FY2027–FY2031E, with central assistance of up to INR 10 billion per park, subject to a minimum contribution of INR 5 billion by the respective state government. The scheme is intended to provide common infrastructure and utilities to support investment and development of chemical manufacturing clusters.⁵³

4.5.4 Upcoming major Chemical industry projects and parks in the country

India's chemical industry is witnessing significant growth, with several major projects underway to meet the rising domestic and global demand. Here are some notable upcoming initiatives:

1. Haldia Petrochemicals' Oil-to-Chemical (O2C) Project in Tamil Nadu

Haldia Petrochemicals is developing an Oil-to-Polymer (O2P) project at Cuddalore, Tamil Nadu, on land formerly associated with Nagarjuna Oil Corporation Limited. The company's FY2024-25 disclosures state that final payment for the land was made in November 2024 and freehold possession was obtained, while engineering for the cracker and site-enabling works had progressed. The company has not disclosed a definitive project cost, capacity or commissioning schedule, and no final investment decision has been announced. Accordingly, the project should be considered a development-stage project rather than a committed project with a defined commissioning date. Separately, Haldia Petrochemicals is progressing a phenol-acetone project with an investment of approximately INR 56.51 billion, targeted for commissioning in FY2027.⁵⁴

2. Bharat Petroleum Corporation Limited (BPCL) Refinery and Petrochemical Project in Andhra Pradesh

Bharat Petroleum Corporation Limited (BPCL) and Oil India Limited (OIL) signed a non-binding MoU in October 2025 to explore collaboration for a greenfield refinery and petrochemical complex near Ramayapatnam Port in Nellore district, Andhra Pradesh. BPCL disclosed an estimated investment of approximately INR 1,000 billion, a refining capacity of 9–12 MMTPA and 6,000 acres of land allocated by the Government of Andhra Pradesh. The proposed complex is expected to include a 1.5 MMTPA ethylene cracker. BPCL's procurement plans demonstrate that pre-project engineering and licensor-selection activities are progressing, including packages for the cumene, delayed coker and PVC units.⁵⁵

3. Indian Oil Corporation (IOC) Refinery Expansions

⁵³ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2288863>

⁵⁴ <https://www.haldiapetrochemicals.com/documents/Annual%20Report%20-%20FY%202023-24.pdf?utm>

⁵⁵ <https://www.bharatpetroleum.in/images/files/28102025-bpcl-press-release-bpcl-seals-trio-of-mous-at-energy-technology-meet-2025-to-power-indias-refining-petrochemical-and-green-energy-growth.pdf?utm>

Indian Oil Corporation Limited (IndianOil) is expanding its refineries at Panipat, Gujarat and Barauni. As of June 2026, the Panipat expansion from 15 MMTPA to 25 MMTPA had reached approximately 94% physical progress, the Gujarat refinery expansion from 13.7 MMTPA to 18 MMTPA had reached approximately 89%, and the Barauni expansion from 6 MMTPA to 9 MMTPA had reached approximately 92%. Indian Oil's Q1 FY2026-27 investor materials indicate that all three projects are expected to be commissioned progressively during the second half of calendar 2026, with the Gujarat project targeted for November 2026 and the Panipat and Barauni projects for December 2026.⁵⁶

4. Numaligarh Refinery Expansion by Oil India Ltd.

Numaligarh Refinery Limited (NRL), a subsidiary of Oil India Limited, is implementing a major expansion to increase refining capacity from 3.0 MMTPA to 9.0 MMTPA. The project includes a new 6 MMTPA refinery, associated crude-oil infrastructure and a cross-country crude pipeline from Paradip, Odisha to Numaligarh, Assam. NRL's current project documentation targets overall commissioning by March 2027. The approved project budget is INR 280.26 billion, while a revised estimate of INR 339.01 billion was under review by the Ministry of Petroleum and Natural Gas in the latest project document.⁵⁷

Exhibit 4.11: List of upcoming mega projects in Indian Chemical sector

Project Name	Developer	Location	Cost (INR million)	Project Status
Integrated polycarbonate complex (phenol, acetone, BPA, PC resin)	Deepak Chem Tech Ltd (Deepak Nitrite)	Dahej, Gujarat	115,000	Under implementation
Specialty fluoropolymers project	SRF Ltd	Dahej, Gujarat	7,450	Under implementation
Fourth-generation refrigerant (HFO) project	SRF Ltd	Odisha	23,000	Under implementation
Agrochemical intermediate plant (12,000 TPA)	SRF Ltd	Dahej, Gujarat	2,500	Under implementation

Source: Frost & Sullivan Analysis

4.6 Tyre

4.6.1 Introduction

The Indian tyre industry recorded turnover of approximately INR 1,000 billion in FY2025 and is estimated to reach approximately INR 1,680 billion by FY2031E, backed by timely capacity expansion across companies, improving demand and steady competitive intensity.

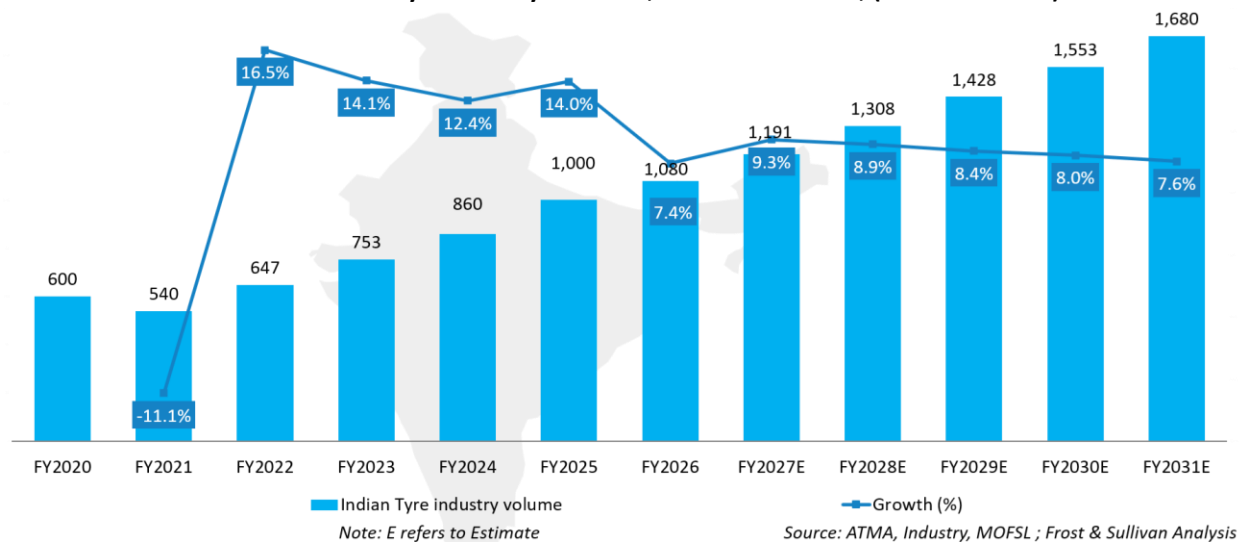
Tyre manufacturers are expected to invest approximately INR 200 billion to INR 250 billion in capacity expansion over the three years ending FY2028, according to industry estimates.

Tyre manufacturers are placing a growing emphasis on sustainability by developing tyres that are more fuel-efficient and environmentally friendly. This includes incorporating recycled materials into tyre production and creating innovative designs that lower rolling resistance, thereby reducing their overall environmental impact.

⁵⁶ <https://iocl.com/pages/conference-call-with-analysts-investors>

⁵⁷ https://www.nrl.co.in/UPLOAD/TopMenuFile/TOPSUBMENU174888MainMenuEnglishLevel-3_RefineryExpansionProject.pdf

Exhibit 4.12: India Tyre Industry Turnover, FY2020 – FY2031E, (Value in INR Bn)



4.6.2 Drivers of the Indian Tyre industry

A. Strong headroom for growth of exports from India

India's tyre exports reached an all-time high of INR 273.12 billion in FY2026, registering a 9% increase over FY2025. The United States remained the largest export destination, accounting for 15% of total export value at INR 40.82 billion in FY2026, compared with 17% in FY2025. Germany, Italy, Brazil and France were among the other key export destinations, reflecting the continued diversification of India's tyre export markets.⁵⁸

B. Growth in the automobile industry

Tyre demand in India is supported by growth in the automotive sector across passenger vehicles, commercial vehicles and two-wheelers. Rising domestic vehicle sales support original equipment tyre demand, while increasing mobility and the expansion of the vehicle base support recurring replacement demand. Increased domestic sales of passenger vehicles and two-wheelers, higher infrastructure spending and economic activity as key drivers of domestic tyre demand. It also identifies strong replacement demand for commercial vehicles, supported by freight activity and infrastructure spending.

C. Replacement market

The replacement market is a major demand channel for India's tyre industry, supported by the growing vehicle parc, vehicle utilisation and replacement cycles. Based on ATMA tyre production statistics for CY2024, the replacement/aftermarket channel accounted for approximately 58.2% of tyre sales, compared with 41.8% for original equipment sales.⁵⁹

D. Continuously improving road infrastructure and new radial capacities

Radial tyre technology adoption in the commercial vehicle segment has improved since 2020. The ATMA-PwC Vision 2047 identifies improved radial technology adoption in commercial vehicles as an achievement of the Indian tyre industry, alongside advances in tyre technology and the development of value-

⁵⁸<https://www.ibef.org/news/tyre-exports-reach-record-us-3-09-billion-in-fy26-despite-supply-chain-disruptions?utm>

⁵⁹<https://mse.ac.in/wp-content/uploads/2026/02/Working-paper-295.pdf?utm>

engineered, fuel-efficient and durable products. The continued adoption of radial technology, together with improving infrastructure and evolving tyre technology, is expected to support the modernisation of the commercial vehicle tyre fleet.⁶⁰

4.6.3 Upcoming Major Tyre Industry Projects and Parks in the country

The Indian tyre industry is undertaking investments to expand manufacturing capacity while strengthening the domestic natural-rubber supply chain. Under Project INROAD, a collaborative initiative of the Rubber Board funded by the Automotive Tyre Manufacturers' Association (ATMA), rubber plantations are being developed across the Northeast and West Bengal over 2,00,000 hectares during 2021–2026. By the 2025 planting season, plantations had been established across 1,79,376 hectares, benefiting approximately 2,07,248 growers.

Exhibit 4.13: List of upcoming mega projects in Indian Tyre sector

Project Name	Developer	Location	Cost (INR million)	Project Status
Capacity expansion programme through FY2029 (<i>OHT, on-highway tyres and carbon black</i>)	Balkrishna Industries Ltd	Bhuj, Waluj, Bhiwadi, Chopanki and other locations	680,000	Under implementation
Camso acquisition and integration programme	CEAT Ltd	India and overseas manufacturing facilities	200,000	Under implementation
Banmore Plant Phase III expansion – passenger car radial tyres	JK Tyre & Industries Ltd	Banmore, Madhya Pradesh	100,000	Commissioned
FY2027 capacity and capability expansion programme	Apollo Tyres Ltd	Multiple locations	350,000	Under implementation

Source: Frost & Sullivan Analysis

4.7 Paper and Pulp

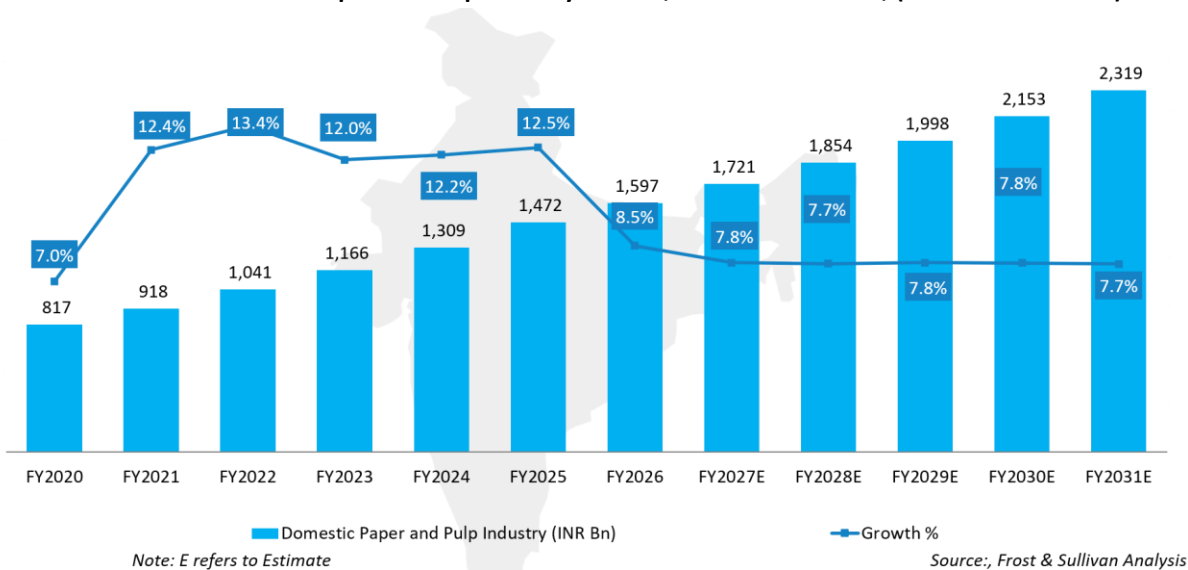
4.7.1 Introduction

India accounts for approximately 5% of global paper production and is among the fastest growing paper markets in the world. Domestic industry volumes were estimated at approximately 24 million tonnes in FY2025, and domestic demand is expected to reach nearly 30 million tonnes by 2027. Per capita consumption remains low at approximately 16 kg against a global average of 57 kg.

By FY2031, the domestic paper and paperboard market is projected to rise to approximately INR 2,319 billion, supported by underlying demand growth together with a modest recovery in realisations. Industry realisations fell in FY2024 and FY2025 and began recovering only in FY2026, and imports have become a defining feature of the market: paper and paperboard imports exceeded 2 million tonnes in FY2025, valued at approximately INR 146 billion, with China accounting for approximately 27% and the ASEAN bloc over 20% of the total.

A minimum import price of INR 67,220 per tonne on virgin multi-layer paperboard has been extended to 30 September 2026, and anti-dumping duties have been imposed following final findings against China and Chile in September 2025 and against Indonesia in June 2026. The paper industry in India looks positive as the demand for upstream market of paper products, like, tissue paper, tea bags, filter paper, light weight online coated paper, medical grade coated paper, etc., is growing up.

⁶⁰ <https://www.pwc.in/assets/pdfs/viksit-bharat-2047-vision-roadmap-indian-tyre-industry.pdf?utm>

Exhibit 4.14: Domestic Paper and Pulp industry in India, FY2020 – FY2031E, (Value in INR billion)

4.7.2 Drivers of Indian Paper and Pulp sector

A. Rise in Demand for Paper and Paper Products in India

Rising environmental awareness and industrial growth are driving increased demand for biodegradable paper products. This has led to a surge in paper mill production across sectors.

B. Packaging industry driving growth

The packaging industry plays a significant role in driving the paper and pulp sector. With the expansion of e-commerce, FMCG (Fast-Moving Consumer Goods) sector, and retail industry, there is a high demand for packaging materials like corrugated boxes, cartons, and containers, which are made from paper and pulp.

C. Availability of raw material

The industry's raw material base is dominated by recovered fibre, which accounts for 74% to 76% of furnish, with wood-based furnish at 18% to 20% and agro-residue at 6% to 8%.⁶¹ India remains fibre-deficient, with domestic availability of pulpable wood estimated at approximately 9 million tonnes per annum against industry demand of approximately 11 million tonnes per annum. More than 90% of the industry's wood requirement is sourced through industry-driven agroforestry and farm forestry, with approximately 1.25 lakh hectares brought under such plantations annually, based on industry estimates.

⁶²

D. Widening spread of education and increase in literacy rate

Rising literacy rates, enrolments and government education initiatives underpin baseline demand for textbooks, notebooks and other paper products. Growth in the sector is however concentrated in packaging rather than in writing and printing paper: packaging grades account for approximately 65% of industry volumes and grew approximately 20% by volume in FY2025, driven by e-commerce, fast-moving

⁶¹ <https://www.ibef.org/industry/paper-packaging-presentation?utm>

⁶² <https://traj.gov.in/sites/default/files/2024-11/IPMA14122018.pdf?utm>

consumer goods and pharmaceuticals, while writing and printing paper realisations fell approximately 8% in FY2025 under competition from imports.

4.7.3 Upcoming Major Paper and Pulp Industry Projects and Parks in the Country

Exhibit 4.15: List of upcoming mega projects in Indian Paper & Pulp sector

Project Name	Developer	Location	Cost (INR million)	Project Status
Sinar Mas West Coast pulp and paper project	Sinar Mas Pulp & Paper	Raigad, Maharashtra	105,000	Under implementation
Integrated greenfield pulp, paperboard and writing & printing paper project	Andhra Paper Ltd	Kadiyam, Andhra Pradesh	200,000	Announced (in-principle)
Hardwood BCTMP pulp line	JK Paper Ltd	Fort Songadh, Gujarat	5,400	Commissioned

Source: Frost & Sullivan Analysis

4.8 Industrial Parks in India

India has a broad network of industrial parks supporting manufacturing, logistics and allied economic activities. The India Industrial Land Bank (IILB), maintained by the Department for Promotion of Industry and Internal Trade (DPIIT), mapped 4,523 industrial parks across the country as of 23 December 2025. These parks covered approximately 7.70 lakh hectares, of which around 1.35 lakh hectares was available for industrial development. The parks collectively comprised more than 6.45 lakh plots, including more than 1.25 lakh vacant plots.⁶³

India boasts a vast network of industrial parks, serving as hubs for manufacturing, technology, and various industries. According to the India Industrial Land Bank (IILB), there were 4,523 industrial parks across the country as on 23 December 2025, covering 7.70 lakh hectares, of which approximately 1.35 lakh hectares remained available for development, and comprising over 6.45 lakh plots of which over 1.25 lakh were vacant.

The distribution of these parks varies significantly across states. The five states with the largest number of industrial parks – Andhra Pradesh (638), Maharashtra (523), Rajasthan (420), Karnataka (384) and Tamil Nadu (372) – together account for 2,337 parks, or approximately 52% of the national total. This concentration highlights the significant role these states play in India's industrial landscape.

Gujarat was one of the leading states making rapid strides in the development of Industrial Parks. Bestowed with an impressive shoreline, Gujarat has become the hotbed for industrial parks. With India taking strides towards becoming a global engine of economic growth, new players are making a foray into both large-scale and small-scale industrial setups.

Gujarat has one of the largest industrial-park networks in India by land area. As of 23 December 2025, the state had 285 industrial parks covering approximately 1,93,975 hectares, representing around 25% of the total industrial-park area mapped by the IILB nationally. Gujarat had the largest industrial-park land area among all states, although it ranked seventh by number of industrial parks. Of the total area, approximately 12,605 hectares was identified as available for industrial development.⁶⁴

⁶³ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2207690&lang=1®=3&utm>

⁶⁴ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2207690&lang=1®=3&utm>

Under DPIIT's Business Reform Action Plan (BRAP), states and Union Territories have been placed in performance categories rather than assigned an overall numerical rank since BRAP 2020. In the latest BRAP 2024 assessment, Gujarat was classified as an "Aspirer" under the overall BRAP including the Regulatory Compliance Burden assessment, while it was classified as a "Fast Mover" when the RCB component was excluded. Gujarat was also recognized as a Top Achiever in two individual reform areas.

⁶⁵

India has several key industrial parks across various states, serving as hubs for manufacturing, IT, automotive, pharmaceuticals, and other industries. Some of the most notable industrial parks include:

Major Multi-Sector Industrial Parks

- **Delhi-Mumbai Industrial Corridor (DMIC)** – A major industrial corridor being developed along the Western Dedicated Freight Corridor, covering Uttar Pradesh, Delhi NCR, Haryana, Rajasthan, Gujarat and Maharashtra. The National Industrial Corridor Development Corporation currently identifies four developed greenfield industrial smart cities under the programme: Dholera Special Investment Region in Gujarat, Shendra-Bidkin Industrial Area in Maharashtra, Integrated Industrial Township at Greater Noida in Uttar Pradesh and Integrated Industrial Township at Vikram Udyogpuri in Madhya Pradesh.⁶⁶
- **Sriperumbudur** - A major electronics and automotive manufacturing cluster comprising multiple SIPCOT industrial parks and SEZs. SIPCOT's Hi-Tech SEZ at Sriperumbudur covers approximately 483 acres and is focused on electronics, while the Irungattukottai and Oragadam industrial areas support automotive, electronics and related manufacturing activities. The cluster includes major manufacturing facilities such as Samsung's electronics plant and Hyundai Motor India's manufacturing facility.⁶⁷
- **Sanand Industrial Estate (Gujarat)** – A major automotive manufacturing hub that is increasingly diversifying into semiconductor manufacturing. Tata Motors completed the acquisition of Ford India's Sanand vehicle manufacturing facility in January 2023, adding manufacturing capacity of 300,000 vehicles per annum, scalable to 420,000 units⁶⁸. Micron Technology's semiconductor assembly, test and packaging facility in Sanand commenced commercial production on 28 February 2026, strengthening the cluster's role in India's emerging semiconductor manufacturing ecosystem.⁶⁹

⁶⁵ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2226026&lang=2®=48&utm>

⁶⁶ <https://nicdc.in/?utm>

⁶⁷ <https://www.sipcot.tn.gov.in/webroot/img/RTI.pdf?utm>

⁶⁸ <https://www.tatamotors.com/press-releases/tata-passenger-electric-mobility-limited-completes-acquisition-of-ford-indias-sanand-plant/?utm>

⁶⁹ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2233506&lang=1®=6&utm>

Exhibit 4.16: State/UT-wise number of Industrial Parks, Estates, and Clusters (In alphabetical order) (as on 23rd December, 2025)

Name of State	No. of Industrial Parks	Name of State	No. of Industrial Parks
Andaman & Nicobar	6	Lakshadweep	9
Andhra Pradesh	638	Madhya Pradesh	144
Arunachal Pradesh	18	Maharashtra	523
Assam	56	Manipur	7
Bihar	82	Meghalaya	9
Chandigarh	7	Mizoram	8
Chhattisgarh	114	Nagaland	6
Dadra & Nagar Haveli	5	Odisha	146
Daman & Diu	5	Puducherry	11
Delhi	68	Punjab	100
Goa	22	Rajasthan	420
Gujarat	285	Sikkim	5
Haryana	51	Tamil Nadu	372
Himachal Pradesh	64	Telangana	157
Jammu and Kashmir	137	Tripura	20
Jharkhand	158	Uttar Pradesh	286
Karnataka	384	Uttarakhand	35
Kerala	140	West Bengal	17
Ladakh	8	Total	4,523

Source: India Industrial Land Bank, DPIIT (as on 23 December 2025); Frost & Sullivan Analysis

- **Noida-Greater Noida Industrial Area (Uttar Pradesh)** – A key zone for IT, electronics and manufacturing industries. The Integrated Industrial Township at Greater Noida spans 747 acres, and construction of an outsourced semiconductor assembly and test facility by the HCL-Foxconn joint venture, with investment of over INR 37 billion, began in February 2026.

Peenya Industrial Area (Karnataka) – A large established industrial area housing small and medium enterprises across various sectors, where ABB commenced development of a new integrated motion manufacturing facility in 2026.

5 STEAM DEMAND IN INDIAN PROCESS INDUSTRIES

5.1 Derivation of Process Steam Demand in Major Steam Consuming Industries

5.1.1 Pharmaceutical

A. Current Production in India

The Government of India stated in December 2025 that India's domestic pharmaceutical market was around \$60 billion and is expected to double to approximately \$130 -140 billion by 2031. India's pharma exports are also growing: FY25 exports reached \$30.47 billion, up 9.4% year-on-year. More recently, Q1 FY27 exports rose 6.8% to \$8.1 billion.

Process steam requirement and steam cost as % of revenue

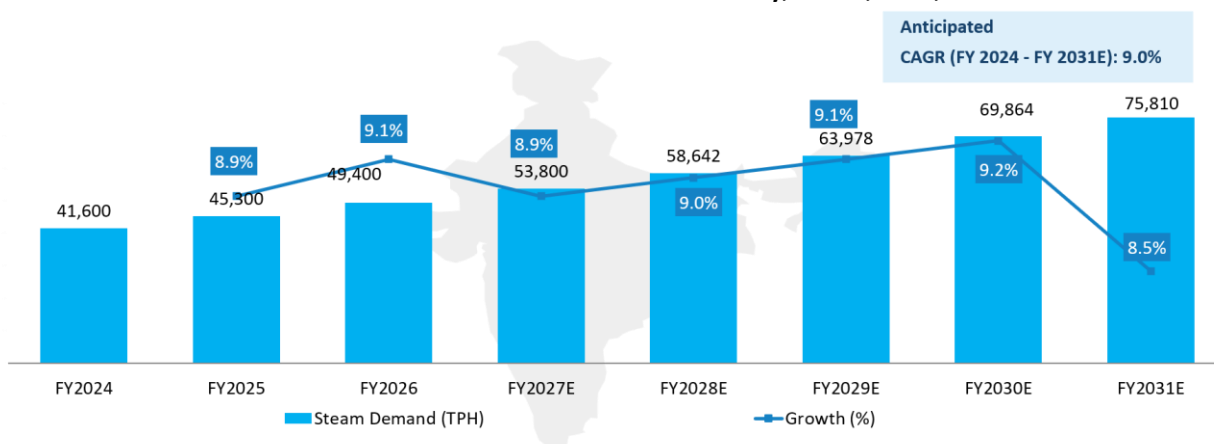
In the pharmaceutical sector, steam is essential for sterilization, purification, and drying processes, especially for producing high-quality drugs in sterile environments. Clean steam is used in making products

like eye and ear drops and supporting cell or yeast growth. Around 3–3.5 MT of steam is consumed per unit due to the heterogeneous nature of APIs and bulk drugs. Most operations require 1–2 bar pressure steam, with some needing 5–8 bar. Steam costs account for nearly 6–8% of a unit's sales revenue.

Process steam demand estimation

India's pharmaceutical market is projected to reach USD 130 -140 billion by 2031, driven by rising demand for innovative therapies. Though COVID-19 briefly slowed the sector, recovery was strong due to government and industry collaboration. Steam demand in pharma is expected to rise from 41,000–43,000 TPH in FY24, ~45,000 TPH in FY25 to 69,000–70,000 TPH by FY30 and 75,000–76,000 TPH by FY31.

Exhibit 5.1: Process steam demand of Pharmaceutical industry, in TPH, India, FY2024-FY2031E



Source: Frost & Sullivan Analysis

5.1.2 Textile

A. Current Production in India

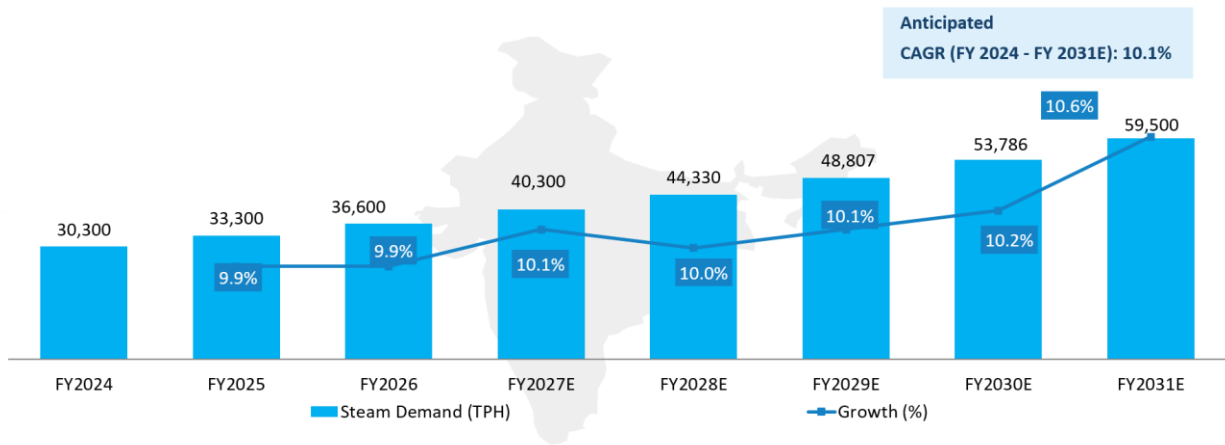
For FY2025–26, a reasonable working estimate would be around 5.5–5.7 million tonnes of spun yarn production, assuming broadly stable production with modest growth. .

B. Process steam requirement and steam cost as % of revenue

In the textile and apparel industry, steam is essential for processes like dyeing, printing, drying, and washing. About 4 kg of 2–5 bar steam is used per kg of fabric, with steam costs making up roughly 2.5–4% of the fabric's sales revenue.

C. Process steam demand estimation

The textile industry in India is particularly robust due to the wide diversity of natural and synthetic fibers and yarns. India's textile and apparel sector was approximately US\$190 billion in FY26 and is targeting US\$350 billion by 2030. The demand for steam in the textile industry has been estimated based on the industry growth trends and the demand for steam is expected to grow from ~33,000 in FY25 to 53,000–55,000 TPH in FY30E and 59,000– 60,000 TPH in FY31E.

Exhibit 5.2: Process steam demand of Textile industry, in TPH, India, FY2024 to FY2031E

Source: Frost & Sullivan Analysis

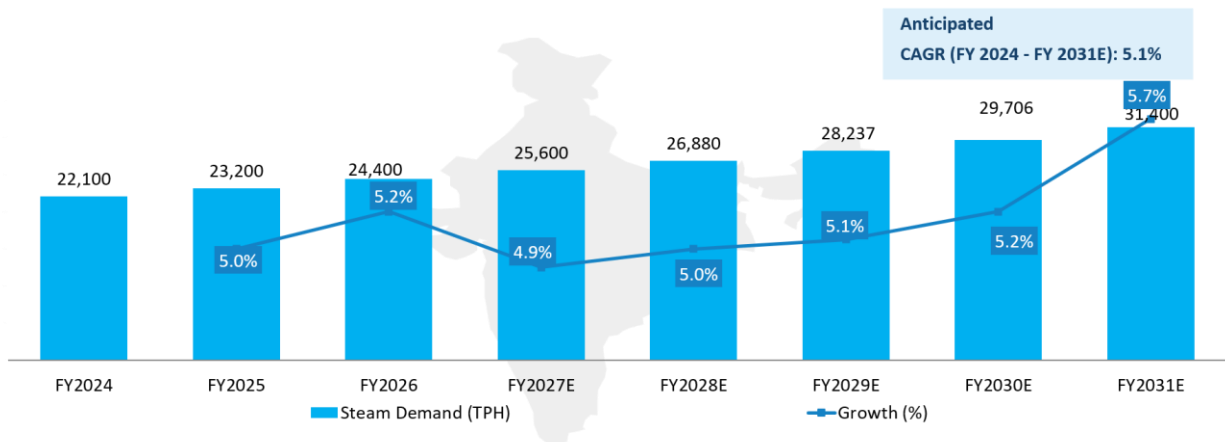
5.1.3 Food Processing

A. Current Production in India

India's food processing sector plays a key role in connecting farmers to markets and is supported by the Ministry of Food Processing Industries (MoFPI) to boost investments. The sector accounts for 12.41% of employment in registered factories, employing around 2.03 million people. Of the ~41,000 units in India, about 40% use minimal or no steam in their processes.

B. Process steam requirement and steam cost as % of revenue

Food processors typically use "clean" or "culinary" steam for direct product contact or sterilization of surfaces. Each unit consumes about 1.2–1.5 TPH of steam, with pressure ranging from 1–10 bar depending on the food type. Steam costs account for roughly 2–3% of sales revenue per unit.

Exhibit 5.3: Process steam demand of Food processing industry, in TPH, India, FY2024 to FY2031E

Source: Frost & Sullivan Analysis

C. Process steam demand estimation

The Indian food processing sector is anticipated to increase at a CAGR of 5% during the period from FY24 to FY30 and 5.1% during FY25-FY31. The industry is driven by the high-value processing of various agricultural products, increased urbanization, rising disposable incomes, the rise of nuclear families, and

the demand for convenient food. The demand for steam in the food processing industry has been estimated based on industry growth trends and the demand for steam is expected to grow from 23,000 to 24,000 TPH in FY25 to 29,000- 30,000 TPH in FY30E and to 31,000- 32,000 TPH in FY31E.

5.1.4 Rice

A. Current Production in India

The latest official estimate for FY26 (2025–26) puts India's rice production at 154.02 million tonnes, according to the Ministry of Agriculture's Third Advance Estimates released in May 2026. This is up from 150.18 million tonnes in FY25, a 2.6% increase.

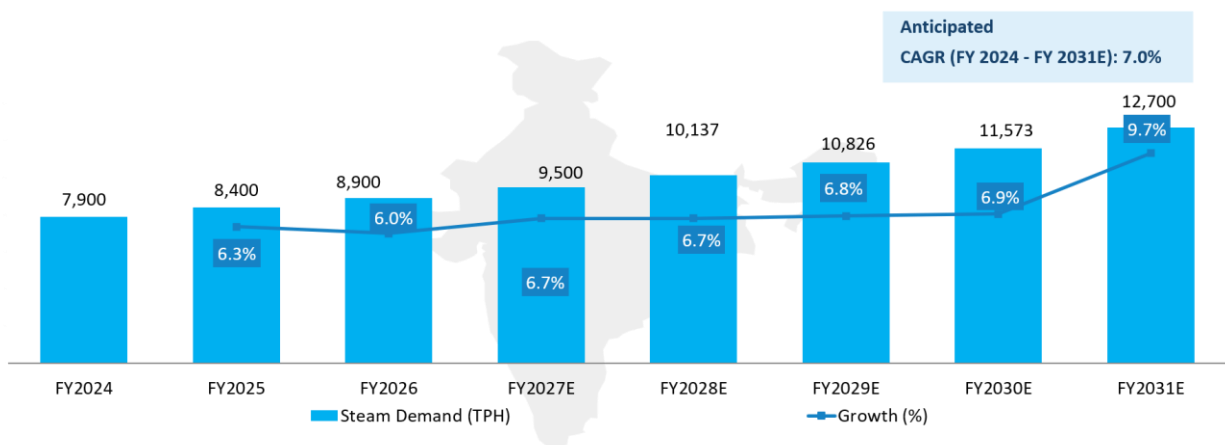
B. Process steam requirement and steam cost as % of revenue consumption norm

Rice milling processes like parboiling, steaming, and drying require significant steam generated by industrial boilers. Around 0.1–0.2 kg of 4–5 bar steam is used per kg of rice, with steam costs accounting for 2–3% of the rice's sales revenue.

C. Process steam demand estimation

The demand for steam in the rice industry has been estimated based on the industry growth trends and the demand for steam is expected to grow from 7,500 to 8,000 TPH in FY24, ~9,000 TPH in FY25 to 11,500- 12,500 TPH in FY30E and to 12,600- 13,700 TPH in FY31E.

Exhibit 5.4: Process steam demand of Rice industry, in TPH, India, FY2024 to FY2031E



Source: Frost & Sullivan Analysis

5.1.5 Dairy

A. Current Production in India

India retained its position as the world's largest milk producer, contributing around 25% of global milk output. Milk production increased to 247.9 million tonnes in FY25, up 3.6% YoY from 239.3 million tonnes in FY24. The government (estimated.) FY26 production target was 261.7 million tonnes

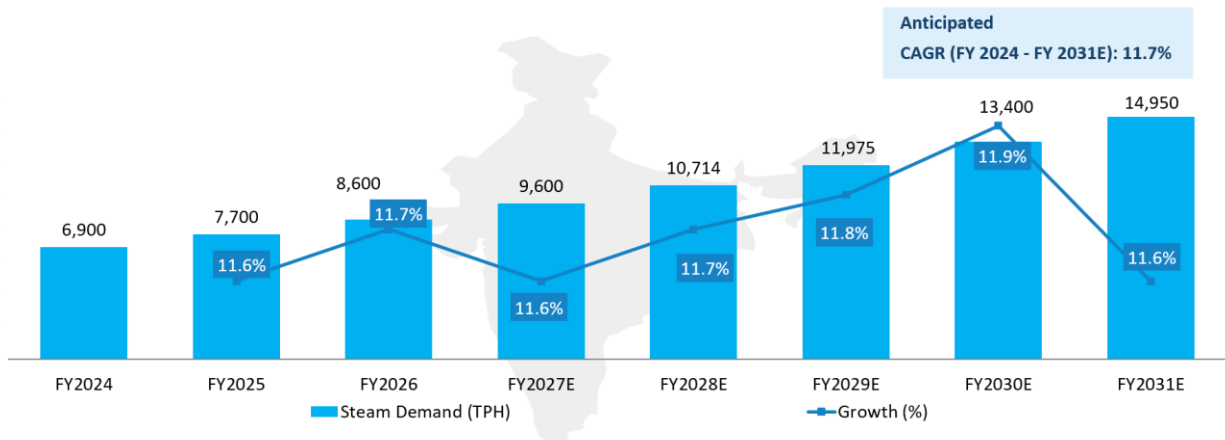
B. Process steam requirement and steam cost as % of revenue

Steam boilers are used for processing raw milk under high temperatures to ensure that it is safe for usage and other milk processing operations. Approximately 0.12 kg of steam is consumed for production of every liter of milk (based on limited industry interactions). It is estimated that cost of steam constitutes approximately 0.5 – 1% of the revenue generated from sales of every unit of dairy product.

C. Process steam demand estimation

The demand for steam in the dairy industry has been estimated based on industry growth trends and the demand for steam is expected to grow from 6,500 to 7,500 TPH in FY24, 7,700 in FY25 to 13,000-14,000 TPH in FY30E and to 14,200- 15,300 TPH in FY31E.

Exhibit 5.5: Process steam demand of Dairy Industry, in TPH, India, FY2024 to FY2031E



Source: Frost & Sullivan Analysis

5.1.6 Paper and Pulp

A. Current Production in India

India's paper production includes printing/writing papers (like copier, bond, map litho), packaging papers (like Kraft, boards), and specialty papers (like chromo and art paper). With around 600 mills, including 12 major global players, the paper and pulp market reached approximately 25.5 million metric tons in FY26.

B. Process steam requirement and steam cost as % of revenue consumption norm

Paper mills and corrugated packaging plants use rolls that are internally heated with steam. Maintaining a uniform temperature across the surface of the roll is essential for making a quality product. Since steam is a gas, it fills the entire volume of the roll and evenly distributes heat as it condenses. Approximately 1.6 to 2.2 kilogram of steam is consumed for processing one kilogram of paper (based on limited industry interactions). It is estimated that the cost of steam constitutes approximately 5 – 7% of the revenue generated from sales of every kilogram of paper.

Steam consumed
per MT
1.6 – 2.2 MT

Cost of steam as
% of revenue
5 - 7%

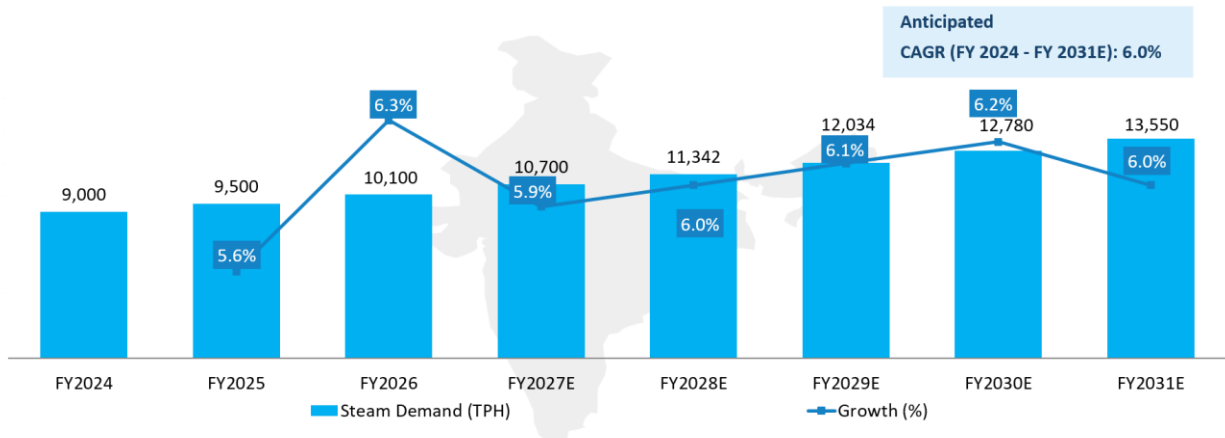
Steam demand
FY2024
9,000 TPH

Anticipated steam
demand FY2031E
~ 13,550 TPH

C. Process steam demand estimation

In view of the large potential for growth aided by a growing economy, the paper industry is expected to continue to grow in sync with economic growth recording 6% growth per annum. The demand for steam in the paper and pulp industry has been estimated based on industry growth trends and the demand for steam is expected to grow from 9,000 to 9,500 TPH in FY24, FY25 to 12,000-13,500 TPH in FY30E and to 13,000- 14,500 TPH in FY31E.

Exhibit 5.6: Process steam demand of Paper and Pulp industry, in TPH, India, FY2024 to FY2031E



Source: Frost & Sullivan Analysis

5.1.7 Distillery

A. Current Production in India

India's alcoholic beverage industry is one of the world's largest and fastest-growing markets. The market was valued at approximately US\$52.6 billion in 2025 and is projected to reach ~US\$77.8 billion by 2031-2032, implying a CAGR of ~6.7%. In FY26, industry revenues expected to have grown 8–10% to around ₹5.3 lakh crore (~US\$62 billion), supported by 5–6% volume growth, premiumisation and rising disposable incomes.

B. Process steam requirement and steam cost as % of revenue consumption norm

Steam is used as part of the sterilization step and can also be used to heat the caustic. It is also used for heating the kettle, for sanitation and sterilization, for pasteurized heating, to maintain precise temperatures and to meet production demands efficiently. Approximately 3.4 to 6.6 kilogram of 1.5 to 3.5 bar pressure steam is consumed for production of one kilogram of spirit. It is estimated that the cost of steam constitutes approximately 1 – 1.5% of the revenue generated from sales of every unit of spirit.

Steam consumed
per MT
3.4 – 6.6 MT

Cost of steam as
% of revenue
1 – 1.5%

Steam demand
FY2024
7,900 TPH

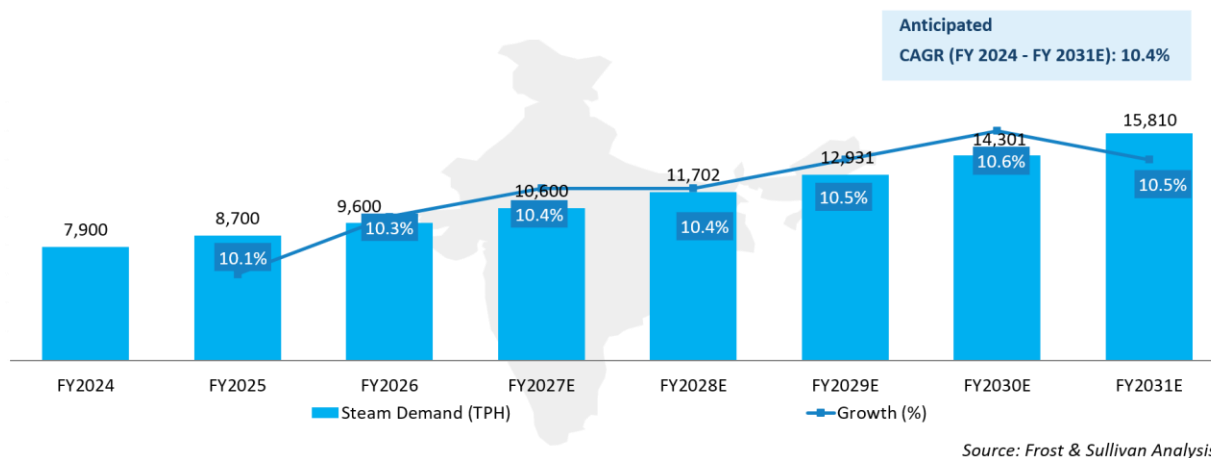
Anticipated steam
demand FY2031E
~ 15,810 TPH

C. Process steam demand estimation

The domestic spirits sector grew at a CAGR of more than 6.8%, making it one of the world's fastest-growing markets. The future for India's alcoholic drinks industry remains good, owing to favorable demographics,

a growing middle-class, rising disposable income levels, a penchant for luxury food and drink experiences, and increased societal acceptability of alcoholic beverages. The demand for steam in the distillery industry has been estimated based on the industry growth trends and the demand for steam is expected to grow from 7,500 to 8,500 TPH in FY24, 8,700 TPH in FY25 to 14,000-14,500 TPH in FY30E and to 15,500- 16,000 TPH in FY31E.

Exhibit 5.7: Steam demand of Distilleries, in TPH, India, FY2024 to FY2031E



5.1.8 Fertilizer (Urea)

A. Current Production in India

FY26 production declined from the FY24 record of 31.407 MT, mainly reflecting feedstock availability and plant operating factors. India's conventional urea production stood at approximately 29.3 million tonnes in FY26, compared with a record 31.4 million tonnes in FY24. Domestic production is supplemented by imports to meet the country's fertilizer requirements.

B. Process steam requirement and steam cost as % of revenue

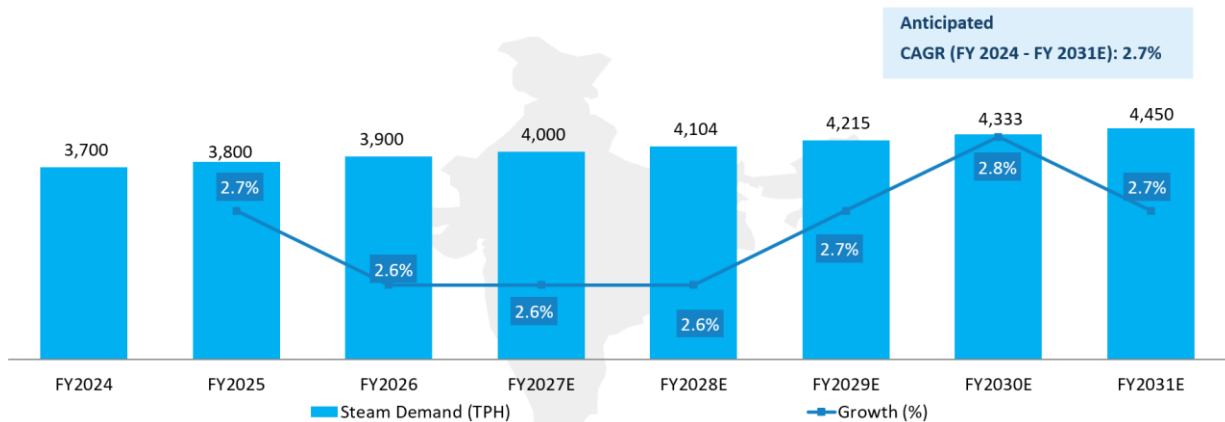
Steam is used as part of the Urea melting process and multiple other processes. Approximately one kilogram of steam is consumed for production of one kilogram of Urea. It is estimated that the cost of steam constitutes approximately 15 – 18% of the revenue generated from sales of every unit of urea.



C. Process steam demand estimation

The Indian urea market is expected to grow at approximately 2.7% CAGR from FY25 to FY30, increasing from ~37 million tonnes to ~43 million tonnes. Extending the same growth trajectory, the market could reach approximately ~44 million tonnes by FY31E. In the coming years, the demand for steam in the Urea industry has been estimated based on industry growth trends and the demand for steam is expected to grow from 3,700 to 3,800 TPH in FY24, FY25 to 4,000-4,500 TPH in FY30E and to 4,300- 4,800 TPH in FY31E.

Exhibit 5.8: Process steam demand of Urea Industry, in TPH, India, FY2024 to FY2031E



Source: Frost & Sullivan Analysis

5.1.9 Wood

A. Current Production in India

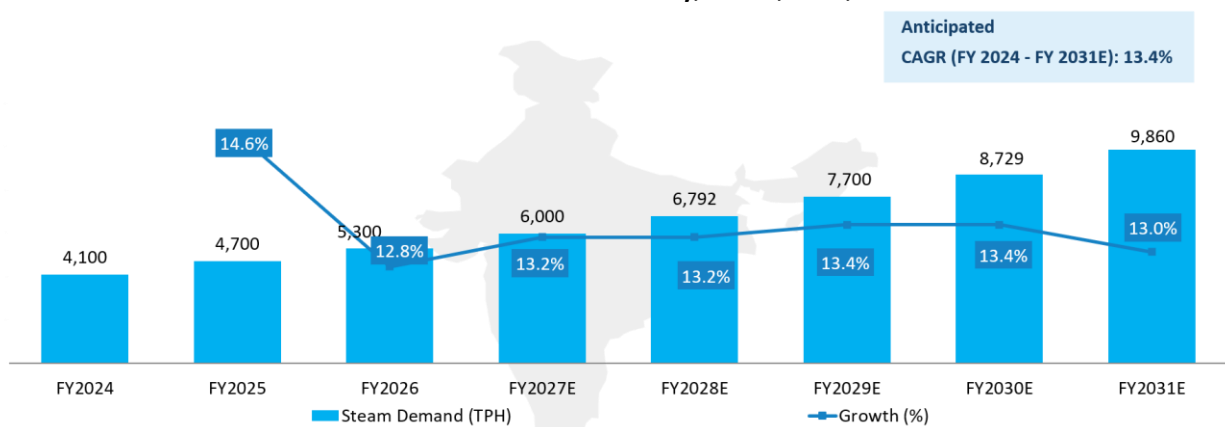
India's furniture market was valued at approximately US\$29.3 billion in 2025 and is estimated to reach US\$45.5 billion by 2031, growing at a CAGR of ~7.6%. Wood remains the largest material category, accounting for approximately 57% of the market in 2025

B. Process steam requirement and steam cost as % of revenue

Steam in the wood industry is typically seen to be used for cleaning, drying the moisture content in the wood, chips cooking, curing, sterilizing, packaging, etc. It is estimated that the cost of steam constitutes approximately 7 – 8% of the revenue generated from sales of every unit of wood.



Exhibit 5.9: Process steam demand of Wood industry, in TPH, India, FY2024 to FY2031E



Source: Frost & Sullivan Analysis

C. Process steam demand estimation

The Indian wooden furniture market has enormous opportunities for manufacturers to innovate and deal with growing demand in the wood furniture. The demand for steam in the Wood industry has been estimated based on industry growth trends and the demand for steam is expected to grow from 4,000 to 4,500 TPH in FY24, 4,700 TPH in FY25 to 8,500-9,000 TPH in FY30E and to 9,400- 10,000 TPH in FY31E.

5.1.10 Tyre

A. Current Production in India:

The Indian Tyre industry is estimated to recover from five years of weakness and be on a linear growth path of nearly 8% CAGR over the next five years, backed by timely capacity expansion across companies, improving demand, steady competitive intensity, and peak capex.

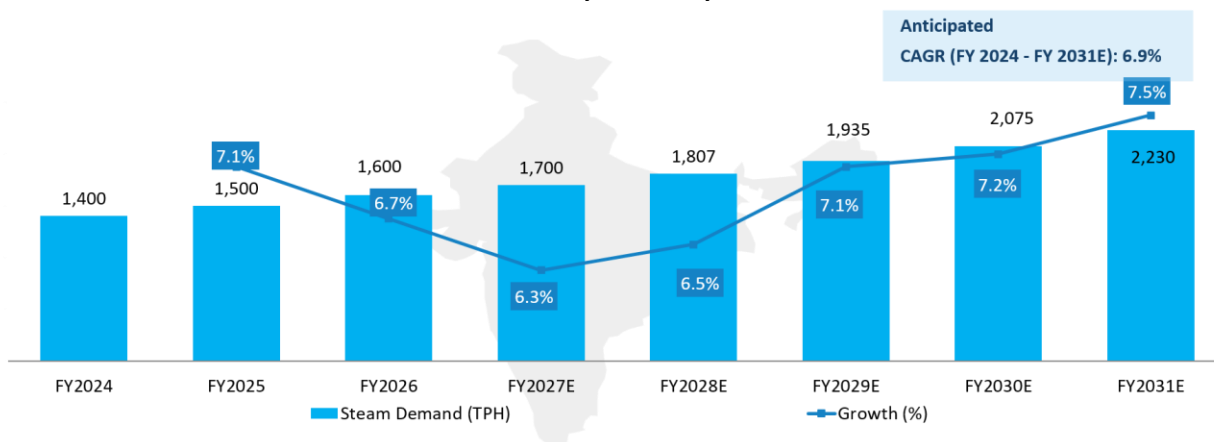
B. Process steam requirement and steam cost as % of revenue

Approximately 2 kg of steam is required per kg of rubber processed in the tyre manufacturing process, with steam costs comprising about 1–1.5% of tyre sales revenue. Reliable boiler performance is critical to avoid costly production downtime.

C. Process steam demand estimation

The Indian tyre industry is driven by tailwinds prevalent in the automotive industry. The Indian tyre market is anticipated to increase at a CAGR of ~7% during the period from FY2025 to FY2031. The demand for steam in the Tyre industry has been estimated based on industry growth trends and the demand for steam is expected to grow from 1,300 to 1,500 TPH in FY24, 1,500 TPH in FY25 to 2,000-2,500 TPH in FY30E and 2,200- 2,650 TPH in FY31E.

Exhibit 5.10: Process steam demand of Tyre industry, in TPH, India, FY2024 to FY2031E



Source: Frost & Sullivan Analysis

5.1.11 Chemical (Soda Ash and Ethanol)

A. Current Production in India

The country's chemical production (including ethanol and soda ash) is ~9.5 million MT, with India set to drive over 20% of global incremental chemical consumption in the next 20 years. Latest AMAI data shows India's soda-ash production at 3.786 MT in FY25, with installed capacity of 4.521 MT.

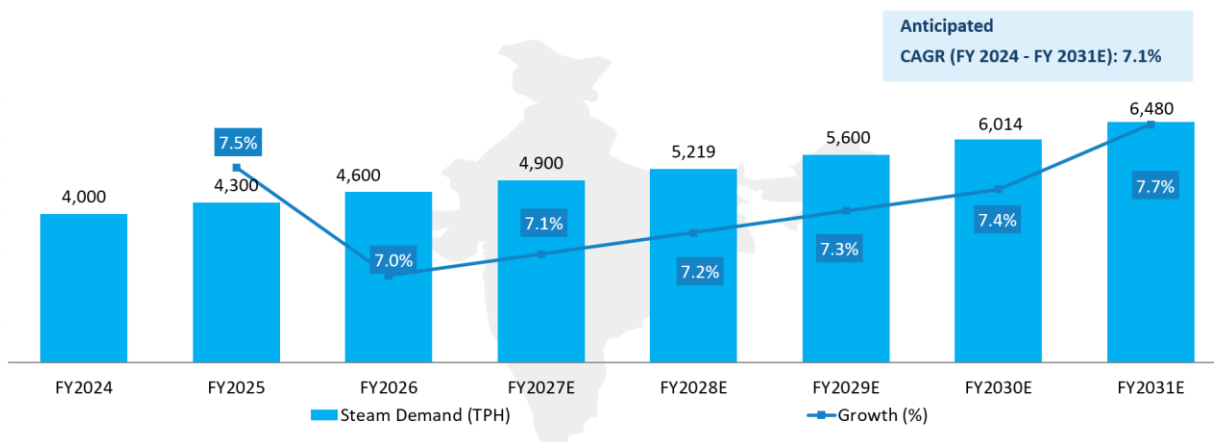
B. Process steam requirement and steam consumption as % of revenue

Steam is commonly used in the chemical process industries (CPI) for process heating, power generation, atomization, cleaning, and sterilization, moisturization and humidification, among other applications. Approximately 1.5 kg of steam is consumed for production of one kilogram of chemical (ethanol and soda ash) (based on limited industry interactions). It is estimated that the cost of steam constitutes approximately 11 -13% of the revenue generated from sales of every unit of chemical product produced.

C. Process steam demand estimation

The Chemical sector is projected to grow at a CAGR of ~7% during 2024–30 and by 7 to 10% during 2027–40—tripling its global market share by 2040. This growth is expected to be driven by a range of factors such as India is expected to account for more than 20% of incremental global consumption of chemicals over the next two decades. The demand for steam in the Chemical industry (Soda ash and Ethanol) has been estimated based on industry growth trends and the demand for steam is expected to grow from 4,000 to 4,300 TPH in FY24, FY25 to 5,500-6,500 TPH in FY30E and 6,400- 6,700 TPH in FY31E.

Exhibit 5.11: Process steam demand of Chemical industry (Soda Ash and Ethanol), in TPH, India, FY2024 – FY2031E



Source: Frost & Sullivan Analysis

5.2 Overall process steam demand estimation for India

Total process steam requirement of these 11 major industries (Pharma, Textiles, Food processing, paper & pulp, Rice, Distillery, Dairy, Urea, Wood, Tyre and Chemical) stands at approx. 150,000 TPH at the end of FY25. These industries account for approximately 80% of the overall process steam requirement in the country. Hence, overall process steam requirement of India stands at approx. 186,000 TPH.

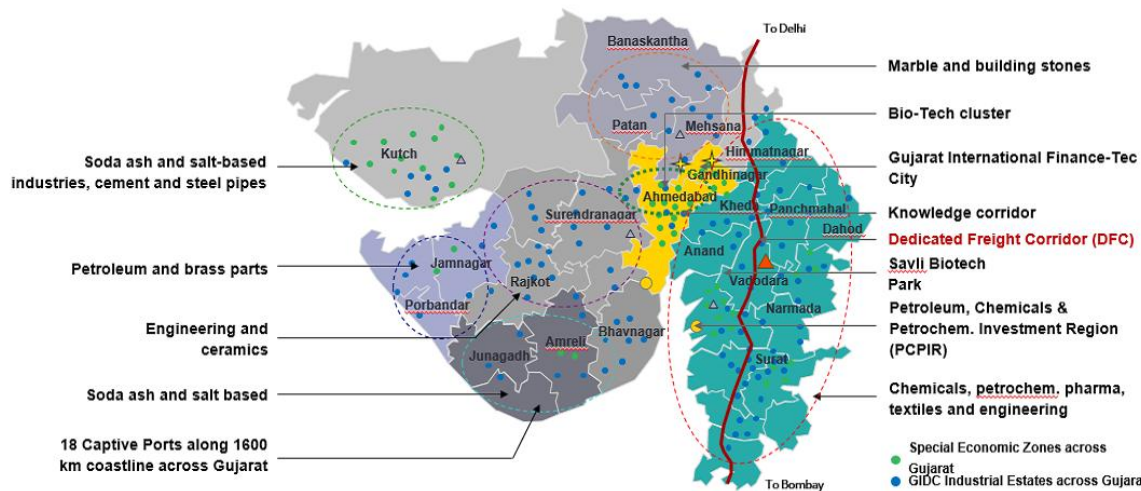
Considering individual growth in steam requirement for each industry, overall process steam requirement of the country is expected to grow from approx. 203,472 TPH in FY26 to 318,853 TPH in FY31, at a CAGR of 9.4%. This growth can also be validated from the growing demand for industrial heating equipment in various process industries. Moreover, various government initiatives such as Make in India, National Manufacturing Policy, etc. are further anticipated to spur demand for process boilers and heating equipment across the country during the forecast period. Some of the major companies operating in Indian process boiler market are Thermax Limited, Cheema Boilers Limited, Forbes Marshall, Industrial Boilers Limited, Thermodyne Engineering Systems, among others.

Exhibit 5.12: Overall process steam demand, in TPH, India, FY2024 to FY2031E

Sl. No.	Industry	2024	2025	2026	2027E	2028E	2029E	2030E	2031E	% of Revenue
1	Pharmaceuticals	41,600	45,300	49,400	53,800	58,642	63,978	69,864	75,810	6-8%
2	Textiles	30,300	33,300	36,600	40,300	44,330	48,807	53,786	59,500	2.5-4%
3	Food Processing (excl. Dairy and Rice)	22,100	23,200	24,400	25,600	26,880	28,237	29,706	31,400	2-3%
4	Paper & Pulp	9,000	9,500	10,100	10,700	11,342	12,034	12,780	13,550	5-7%
5	Rice	7,900	8,400	8,900	9,500	10,137	10,826	11,573	12,700	2-3%
6	Distillery	7,900	8,700	9,600	10,600	11,702	12,931	14,301	15,810	1-1.5%
7	Dairy	6,900	7,700	8,600	9,600	10,714	11,975	13,400	14,950	0.5-1%
8	Urea	3,700	3,800	3,900	4,000	4,104	4,215	4,333	4,450	15-18%
9	Wood	4,100	4,700	5,300	6,000	6,792	7,700	8,729	9,860	7-8%
10	Tyre	1,400	1,500	1,600	1,700	1,807	1,935	2,075	2,230	1-1.5%
11	Chemical	4,000	4,300	4,600	4,900	5,219	5,600	6,014	6,480	11-13%
12	Others (18-20%)	32,785	35,297	40,472	45,440	51,029	57,642	65,112	72,113	
TOTAL in Billion MT		1,71,685	1,85,697	2,03,472	2,22,140	2,42,698	2,65,881	2,91,673	3,18,853	
ROUNDING OFF		1,72,000	1,86,000	2,03,000	2,22,000	2,43,000	2,66,000	2,92,000	3,19,000	

Source: Frost & Sullivan Analysis

Gujarat has emerged as a key manufacturing state in India with 248 GIDC estates. The map of GIDC estates across Gujarat is as under:



5.3 Non-Government Organizations (NGOs) promoting Community Boiler

There are various Non-Government Organizations (NGOs) in India working towards promoting energy efficiency, sustainability, and industrial development. Some of these organizations are involved in supporting or advocating for the concept of community steam boilers.

A. Centre for Science and Environment (CSE)

CSE is a research and advocacy organization working on environmental issues. They undertake projects and campaigns related to sustainable energy and industrial practices.

Recommendations of CSE

- It is recommended that industrial associations, with the support of industrial development agencies like HSIIDC and RIICO, should initiate preliminary feasibility studies of installing community boilers in industrial areas.
- States should encourage and share the technical and environmental benefits of having such systems with owners and administration of industrial units.
- Community boilers should be included in the developmental plan of an industrial area at the planning stage itself as a basic necessity, and sufficient land should be allocated for such facilities in the initial development stage of the area.
- Industrial units should prefer community boilers over small boilers, should be included in industrial policy.
- Stakeholder interactions should be conducted between owners and administration of industrial units, industrial associations, boiler manufacturers, industrial development agencies and technology providers to understand the cost economics and benefits in detail.

B. World Resources Institute (WRI)

WRI India is a research organization with experts and staff who work closely with leaders to turn big ideas into action to sustain a healthy environment—the foundation of economic opportunity and human well-being.

Recommendations of WRI

- The anticipated primary solution for the ease of operations with the least air pollution and improved energy efficiency loss has a community co-generation system through which heat (in the form of steam) can be supplied to member industries.
- Introducing sustainable fuel options for heat generation would suffice to have less pollution and achieve a circular economy of heat generation for small boilers owning industrial units in industrial cluster.

C. CEE and TERI: Promoting Industrial Boiler Efficiency in India

Centre for Energy and Environment (CEE):

Boiler Best Practices Program: CEE's flagship program focuses on improving boiler operation and maintenance practices in existing industrial facilities. This includes:

- **Assessments and Audits:** Conducting boiler performance assessments and energy audits to identify operational inefficiencies, energy losses and opportunities for improvement.
- **Training and Capacity Building:** Training boiler operators, maintenance personnel and plant teams on efficient boiler operation, maintenance and energy management.
- **Dissemination of Knowledge:** Sharing best practices, technical guidelines, case studies and learnings on efficient boiler operation across industrial users.
- **Promotion of Energy-Efficient Boiler Technologies:** Encouraging adoption of energy-efficient boiler systems, technologies and operating practices to reduce fuel consumption and emissions.

- **Policy Advocacy:** Working with industry stakeholders and policymakers to promote standards, incentives and policies supporting energy-efficient industrial boiler operations.

The Energy and Resources Institute (TERI):

Industrial Energy Efficiency Programme (IEEP): TERI's IEEP is a comprehensive program that assists industries in identifying and implementing energy-saving measures across various operations, including boiler systems. This includes:

- **Energy Audits:** Assessment of industrial processes and equipment to identify energy-saving opportunities.
- **Boiler Efficiency:** Optimization of combustion, steam generation, heat recovery, insulation, and blowdown systems.
- **Waste Heat Recovery:** Identification and implementation of opportunities to recover and reuse waste heat.
- **Energy Management:** Development of energy-monitoring systems, performance benchmarks, and energy-management practices.
- **Technology Adoption:** Evaluation and deployment of energy-efficient technologies and equipment.
- **Capacity Building:** Training and technical support for the industrial personnel on energy-efficiency practices.
- **Implementation Support:** Assistance in evaluating the technical and economic feasibility of energy-saving projects and tracking resulting energy and cost savings.

5.4 Indian Companies Offering Industrial gas through distributed pipeline network

A. STEAMHOUSE INDIA LIMITED

Steamhouse India Limited is a Gujarat-based company engaged in the generation and centralized distribution of industrial gases, primarily steam and nitrogen, through a dedicated and integrated pipeline network.

B. PR ECOENERGY LIMITED

PR Ecoenergy Limited is a Gujarat-based company that manufactures steam systems, management services, heat systems, heaters, thermostats, and heating devices.

C. Detox India Private Limited

Detox India Private Limited, is a Gujarat-based company operating in the environmental sector, in waste management and remediation services.

D. Linde India

Linde India Limited, formerly BOC India, is a subsidiary of Linde Plc. It produces, supplies, and manages industrial, medical and specialist gases.

E. Ellenbarrie

Ellenbarrie Industrial Gases Ltd. is engaged in the business of oxygen and nitrogen. The Company is a manufacturer and supplier of industrial gases in the eastern and southern India, both in bulk and packaged form.

5.5 Financial Comparison of peers in the Industrial Gas segment

Financial benchmarking of key peer companies for the Financial Year 2026

Particulars	For the period ended March 31, 2026				
	Steam house India Ltd	Linde India Ltd	PR Ecoenergy Limited	Ellenbarrie	Detox India Private Limited
Revenue from Operations (₹ millions)	4,915.11	25,306.40	NA	3,415.82	NA
Revenue from Operations Growth (%)	24.40%	1.82%	NA	9.31%	NA
EBITDA (₹ millions)	834.89	9,091.18	NA	1,162.17	NA
EBITDA Margin (%)	16.99%	35.92%	NA	34.02%	NA
Profit/ (Loss) for the Year/period (₹ Millions)	386.39	5,489.65	NA	1,044.00	NA
PAT Margin (%)	7.81%	21.54%	NA	26.66%	NA
Net Cash generated from operating activities (₹ Millions)	1,004.61	7,855.03	NA	1,325.46	NA
Return on Equity (%)	22.36%	12.87%	NA	10.68%	NA
Return on Capital Employed (%)	16.06%	17.53%	NA	12.51%	NA
Net Debt to Equity (times)	1.57x	NA	NA	0.11x	NA

Source: Company Financial Statements, F&S Analytics

Financial benchmarking of key peer companies for the Financial Year 2025

Particulars	For the period ended March 31, 2025				
	Steam house India Ltd	Linde India Ltd	PR Ecoenergy Limited	Ellenbarrie	Detox India Private Limited
Revenue from Operations (₹ millions)	3,951.06	24,853.76	NA	3,124.83	1,161.54
Revenue from Operations Growth (%)	35.44%	(10.23%)	NA	15.96%	(27.00%)
EBITDA (₹ millions)	693.16	7,650.91	NA	1,097.36	(61.2)
EBITDA Margin (%)	17.54%	30.78%	NA	35.12%	(5.2%)
Profit/ (Loss) for the Year/period (₹ Millions)	311.61	4,548.45	NA	832.89	(798.86)
PAT Margin (%)	7.82%	17.81%	NA	23.90%	(67.67%)
Net Cash generated from operating activities (₹ Millions)	1070.98	5,835.95	NA	42.75	25.3
Return on Equity (%)	23.53%	11.91%	NA	16.88%	NM
Return on Capital Employed (%)	17.20%	16.39%	NA	16.92%	NM
Net Debt to Equity (times)	1.63x	(0.04x)	NA	0.49x	NM

Source: Company Financial Statements, F&S Analytics

Financial benchmarking of key peer companies for the Financial Year 2024

Particulars	For the period ended March 31, 2024				
	Steam house India Ltd	Linde India Ltd	PR Ecoenergy Limited	Ellenbarrie	Detox India Private Limited
Revenue from Operations (₹ millions)	2,917.10	27,686.69	624.27	2,694.75	1,591.19
Revenue from Operations Growth (%)	(7.55%)	(11.70%)	(1.62%)	31.38%	(37.70%)
EBITDA (₹ millions)	684.06	7,023.23	133.69	615.30	(118.42)
EBITDA Margin (%)	23.45%	25.37%	21.42%	22.83%	(7.44%)
Profit/ (Loss) for the Year/period (₹ Millions)	271.86	4,340.86	72.65	452.89	(810.70)
PAT Margin (%)	9.27%	15.25%	11.26%	15.61%	(50.05%)
Net Cash generated from operating activities (₹ Millions)	210.16	4,403.97	92.42	437.47	165.53

Particulars	For the period ended March 31, 2024				
	Steam house India Ltd	Linde India Ltd	PR Ecoenergy Limited	Ellenbarrie	Detox India Private Limited
Return on Equity (%)	26.26%	12.52%	20.55%	11.05%	223.31%
Return on Capital Employed (%)	20.24%	16.90%	18.39%	12.31%	NM
Net Debt to Equity (times)	1.77x	NM	1.06x	0.42x	NM

Source: Company Financial Statements, F&S Analytics

Notes accompanying KPIs of Steamhouse India Limited:

1. EBITDA is calculated as Profit/ (Loss) for the year/period less Other income add Finance costs, Depreciation and amortization and impairment expense and Total tax expenses
2. EBITDA Margin is calculated as EBITDA divided by revenue from operations
3. PAT for Steamhouse India Limited is Restated Profit after tax for the year/period
4. PAT Margin is calculated as profit after tax for the year/period as a percentage of total income.
5. Return on Equity is calculated as profit after tax for the year/period as a percentage of Total Equity for the year/period.
6. Return on Capital Employed is calculated as earnings before interest and tax (EBIT) divided by Capital Employed. EBIT is calculated as EBITDA add other income minus Depreciation, amortization and impairment expenses while Capital Employed is calculated as a total of Total Equity and current borrowings and non-current borrowings
7. Net Debt to Equity Ratio is calculated as Net Debt divided by total equity. Net Debt is calculated as non-current borrowings plus current borrowings less cash and cash equivalents less other bank balances.

Notes accompanying KPIs of Linde India Limited, PR Ecoenergy Limited, Detox India Private Limited, and Ellenbarrie:

1. EBITDA is calculated as Profit/ (Loss) for the year/period less Other income add Finance costs, Depreciation and amortization, Total income tax expenses, Share of profit/(loss) from Joint venture and exceptional items
2. EBITDA Margin is calculated as EBITDA divided by revenue from operations
3. PAT Margin is calculated as profit after tax for the year/period as a percentage of total income.
4. Return on Equity is calculated as profit after tax for the year as a percentage of Total Equity for the year.
5. Return on Capital Employed is calculated EBIT divided by Capital Employed. EBIT is calculated as EBITDA add other income minus depreciation & amortization expenses and impairment expenses while Capital Employed is calculated as a total of Total Equity and current borrowings and non-current borrowings
6. Net Debt to Equity is calculated as Net debt divided by Total Equity. Net Debt is calculated as total of Current borrowings and Non-current borrowings less cash & cash equivalents and other bank balances

6 CONCLUSION

6.1 Benefit of Community Boiler Over Captive Boilers

Cost Efficiency

- **Community Boiler:** Shared infrastructure reduces capital and operational expenditure for individual users.
- **Captive Boiler:** High upfront and maintenance costs borne entirely by the single user.

Space Savings

- **Community Boiler:** Centralized plant frees up valuable real estate at the user's facility.
- **Captive Boiler:** Requires dedicated space, often a constraint in urban or space-tight settings.

Operational Convenience

- **Community Boiler:** Operated and maintained by a professional third party—ensures consistent performance, compliance, and 24/7 monitoring.

- **Captive Boiler:** User must handle O&M, spares, skilled manpower, and regulatory compliance internally.

Energy Optimization

- **Community Boiler:** Can integrate waste heat recovery, renewable energy (e.g., biomass, solar steam), and advanced control systems for better efficiency across users.
- **Captive Boiler:** Limited scope for such integration unless scale and investment justify it.

Regulatory Compliance

- **Community Boiler:** Managed by specialized operators familiar with pollution norms, boiler inspections, and safety standards.
- **Captive Boiler:** Risk of non-compliance if not properly staffed or updated.

Scalability & Flexibility

- **Community Boiler:** Easy to scale up capacity with aggregated demand across industries.
- **Captive Boiler:** Any scale-up requires additional investment and downtime.

Sustainability

- **Community Boiler:** Easier to incorporate cleaner fuels (biomass, green hydrogen, solar thermal), supporting ESG goals and government mandates.
- **Captive Boiler:** Switching fuels or upgrading systems is costly and complex.

Ideal For:

- Industrial parks
- SEZs
- Food processing clusters
- Pharma, textile, or chemical hubs with steam/heat demand

The below table represents a holistic view of array of benefits that a Community Boiler offers over a captive boiler user:

Exhibit 6.1: Comparison between Captive Boiler and Community Boiler

Parameters	Captive Boiler	Community Boiler
Capex including all the accessories	INR 25-30L / TPH for a low pressure steam boiler including all accessories and softwares	For Community Boiler of 60 TPH with pressure range 45 Bar ~ INR 25-30 Cr
Area requirement	Minimum 1,500 – 2,500 sq. meters for a boiler of 6 – 10 TPH capacity	Area required for 60 TPH is 3000 Sq. Meters
Manpower requirement	10 for Boiler Upto 10 TPH	40 for Boiler upto 60TPH

Boiler efficiency	50-65% (Boilers with more than 10 years age, run at 50-55% efficiency)	80-83% efficiency achieved in community boiler
Variable cost for steam generation	INR 1.8 – INR 6.0 for generating low pressure steam up to 6 – 8 Bar. Variable cost varies depending upon boiler efficiency and types of fuel used.	INR 1.50- INR 2.25 for generating super heated steam of approx. 45 Bar. Super heated steam requires approx. 1.6 to 1.7 times extra heat than low pressure steam. Hence, equivalent variable cost for generating low pressure steam in a Community boiler would be less than INR 0.9 – INR 1.3 depending upon type of fuel used.
Pollution level	Varies from 150 – 500 mg / Nm ³ for boilers upto 10 TPH capacity	Varies from 10-50 mg/Nm ³ for boilers upto 30TPH
Technology usage	Most of the companies do not use any monitoring and efficiency improvement technology; a few of them reported usage of SCADA, Effimax 4000, etc.	Community Boiler player Steamhouse India Limited uses Monitoring and efficiency improvement technology; a few of them reported usage of SCADA, ESP etc.

6.2 Growth Potential of Community Boilers in the country

As mentioned in the Chapter 5, process steam demand in the country currently stands at approx. 203,472 TPH in FY2026 and expected to reach 318,853 TPH by FY2031.

Considering various advantages of Community Boiler model and favoring policies, based on discussions with the regulators and industry stakeholders, on a conservative basis, Community boiler has the potential to acquire 3% share of the process steam demand in the country over the next 5 years.

This translates to potential of approx. 10X increase in the installed capacity of Community Boilers in the country. On a CAGR basis, this indicates 55 – 60% CAGR in the installed capacity of community boilers in the country.

6.3 Factors Aiding Growth of Community Boiler in India

Recognizing the challenges posed by managing individual generation assets, process industries are increasingly turning to centralized generation and distributions services. The complexities, maintenance demands, and substantial capital investments linked to standalone boiler operation present significant hurdles. Community industrial gas generation and distribution systems provide a compelling solution, offering a centralized infrastructure that streamlines operations and enhances efficiency for industries. This shift is primarily driven by the potential for significant operational and financial advantages, enabling shared resources and collaborative management to alleviate the burdens of individual boiler maintenance.

6.3.1 Regulatory Push

The prevailing trends in the process boiler sector, marked by the adoption of advanced technologies like condensing systems and low NOx burners, reflect a growing emphasis on emissions reduction and enhanced energy efficiency.

Furthermore, the overarching trend across diverse process industries, from Pharma and Textiles to Food & Beverage, centers on digitalization, automation, and a concerted effort to diminish carbon footprint through energy-efficient measures and investments in renewable energy and this landscape presents a favorable opportunity to companies in the sector. The rising focus on connectivity and intelligence in process plants aligns seamlessly with the capabilities of community steam boilers, allowing plant managers to enhance efficiency significantly.

6.4 Community Boilers Threats and Challenges

Community boilers face several key threats that impact their operation and long-term sustainability.

1. Maintenance Challenges: Over time, boilers naturally experience wear and tear, which necessitates regular repairs to keep them functioning efficiently. As the infrastructure ages, the cost of maintaining or replacing these systems can become a significant financial burden, requiring ongoing attention and investment. The longer the system is in operation, the more frequent and costly repairs may become, further straining resources.

2. High Operational Costs: Inefficient systems are a major concern for community boilers, as they lead to increased fuel consumption and higher maintenance costs. As these systems become less efficient, the amount of fuel required to keep them operational rises, which directly impacts the overall cost of operation. Additionally, larger boiler systems may require specialized technicians for maintenance and repairs, further increasing service expenses..

3. Regulatory Compliance: Stricter safety and environmental regulations are another challenge for community boilers. These regulations may require expensive upgrades to meet new standards, forcing operators to invest in technology or infrastructure improvements. Non-compliance with these regulations could have serious consequences, including hefty penalties or even the complete shutdown of the system.

4. Technological Integration: Integrating modern technologies into existing community boiler systems is a complex and costly process. Retrofitting older systems with renewable energy solutions, such as solar or wind power, or installing smart meters for improved monitoring can be prohibitively expensive. Moreover, older systems may struggle to incorporate newer, more efficient technologies, which can result in lower performance or missed opportunities for optimization.

5. Fuel Supply Vulnerabilities: Fuel supply disruptions pose a significant risk to the efficiency and cost-effectiveness of community boilers. Variations in fuel prices or interruptions in supply can disrupt the system's performance, leading to increased operational costs. Moreover, if a boiler system relies on a specific fuel type, it may be exposed to long-term sustainability risks, especially if that fuel becomes more expensive.

6.5 Process Steam Boilers Threats and Challenges

Process steam boilers face several significant threats that can jeopardize their efficiency, safety, and long-term reliability.

1. Pressure Fluctuations:

Pressure fluctuations within a process steam boiler system can lead to dangerous operating conditions and potential equipment damage. Pressure inconsistencies, if not properly managed, can cause safety valves to activate unnecessarily, disrupt the system's performance, or even result in catastrophic failures.

2. Improper Boiler Water Treatment:

The proper treatment of boiler water is essential to maintaining system efficiency and preventing issues such as scale build-up and corrosion. When water treatment is inadequate or improperly executed, impurities like minerals, dissolved gases, and contaminants can accumulate in the system. These impurities can lead to the formation of harmful deposits, accelerate corrosion, and ultimately reduce the overall efficiency of steam production.

3. Fuel Quality and Supply Issues:

Inconsistent or poor-quality fuel is another threat to the proper functioning of a process steam boiler. When the fuel quality is compromised, incomplete combustion can occur, leading to inefficient energy use, poor performance, and potentially harmful emissions. Additionally, a disruption in the fuel supply can cause interruptions in steam production, which may affect overall production processes.

4. Overheating:

Overheating is a significant risk for process steam boilers, especially when the system operates continuously at high temperatures without proper maintenance or monitoring. Excessive heat can cause wear on critical components such as pressure valves, heat exchangers, and seals, potentially leading to component failures. Boilers need to be equipped with temperature controls that can monitor and regulate heat levels.

5. Control System Failures:

The control system of a process steam boiler plays a crucial role in regulating critical parameters like water levels, pressure, and temperature. A malfunction in the control system can result in improper regulation, leading to hazardous conditions such as low water levels, excessive pressure, or overheating. In such situations, the safety of the boiler and its operators can be at risk, potentially causing system failures or accidents. Regular testing, calibration, and maintenance of control systems are necessary to prevent these failures and ensure the safe and efficient operation of the boiler.

6.6 Potential Business Opportunities for Community Boilers

6.6.1 Large Capacity Community Boilers for the Upcoming Industrial parks

India's rapid industrial development, highlighted by the growth of over 4,500 industrial clusters and large-scale parks—particularly in Gujarat, which is among India's leading states in terms of ease of doing business, having been classified as a 'Top Achiever' in DPIIT's BRAP 2020 assessment —presents a strong opportunity for the expansion of community boilers as a centralized, efficient energy solution. The Gujarat model, backed by proactive governance and environmental compliance, serves as a benchmark for other

regions like Delhi-NCR, where similar implementation through state-industrial agencies such as HSIIDC and RIICO is encouraged. This shift aligns with CPCB guidelines and supports sustainable industrialization by replacing smaller, inefficient boilers. Additionally, community boiler service providers can diversify revenue through avenues such as co-generation of electricity, ash utilization in construction, flue gas and chilled water sales, nitrogen provision, steam pipeline advertising, and partnerships for steam resale or rental, creating a robust, eco-friendly ecosystem for industrial energy needs.

6.6.2 Community Steam's Growth Through Innovative Technologies in India

India's push toward a sustainable energy future presents significant opportunities for the growth of community boilers through the integration of innovative technologies. Green hydrogen, derived from solar and wind energy, offers a clean fuel alternative, while microwave plasma technology enables efficient, low-emission combustion. Incorporating Concentrated Solar Power (CSP) can supplement heat generation and reduce fossil fuel dependence, cutting operating costs. Additionally, utilizing exothermic reactions allows for cost-effective and customizable heat generation. As India invests in these transformative solutions, community boilers are set to play a key role in advancing the country's renewable energy goals.

6.7 Critical Success Factors

To succeed as a community boiler player in India, companies like Steamhouse must focus on several critical factors that ensure both strong market positioning and long-term sustainability. A key starting point is understanding market demand by assessing the specific heating or steam requirements of target communities, identifying inefficiencies in current systems, and delivering a compelling value proposition. Building robust infrastructure—including well-designed boiler plants, distribution networks, and storage facilities—is essential for reliable operations. Prioritizing fuel efficiency and environmental sustainability by integrating advanced technologies, such as efficient boilers, renewable energy, and waste heat recovery systems, not only reduces environmental impact but also offers cost benefits that can attract customers.

Cost-effectiveness, service reliability, and stakeholder engagement further contribute to a successful business model. Competitive pricing, transparent billing, and flexible payment options improve affordability and customer satisfaction. Reliability in steam or heat delivery, backed by strong maintenance protocols, emergency response systems, and responsive customer support, ensures consistent service quality. Additionally, cultivating strong partnerships with local communities, government agencies, fuel suppliers, and industry bodies enhances credibility and operational resilience. Lastly, embracing continuous innovation and remaining adaptable to market trends and technological advancements enables community boiler providers to evolve with changing customer needs, ensuring long-term relevance and growth.