



# Industry Assessment: Indian Heat Exchanger Industry

12<sup>th</sup> August 2024

Commercial in Confidence



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## Global Macroeconomic Scenario

The global economy, estimated at 3.1% in 2023, is expected to show resilience at 3.1% in 2024 before rising modestly to 3.2% in 2025. Between 2021 – 2022, global banks were carrying a historically high debt burden after COVID-19. Central banks took tight monetary measures to control inflation and spike in commodity prices. Russia's war with Ukraine further affected the global supply chains and inflated the prices of energy and other food items. These factors coupled with war-related economic sanctions impacted the economic activities in Europe. Any further escalation in the war may further affect the rebound of the economy in Europe.

While China, the largest manufacturing hub of world, was facing a crisis in the real estate sector and prices of properties were declining between 2020 - 2023, with the reopening of the economy, consumer demand is picking up again. The Chinese authorities have taken a variety of measures, including additional monetary easing, tax relief for corporates, and new vaccination targets for the elderly. The Chinese Government took several steps to help the real estate sector including cracking down on debt-ridden developers, announcing stimulus for the sector and measures to encourage the completion and delivery of unfinished real estate projects. The sector is now witnessing investments from developers and demand from buyers.

Global headline inflation is set to fall from an estimated 6.8% in CY 2023 to 5.8% in CY 2024 and to 4.4% in CY 2025. This fall is swifter than anticipated across various areas, amid the resolution of supply-related problems and tight monetary policies. Reduced inflation mirrors the diminishing impact of price shocks, particularly in energy, and their subsequent influence on core inflation. This decrease also stems from a relaxation in labour market pressure, characterized by fewer job openings, a slight uptick in unemployment, and increased labour availability, occasionally due to a significant influx of immigrants.

## Global GDP Growth Scenario

The global economy started to rise from its lowest levels after countries started to lift the lockdown in 2020 and 2021. The pandemic lockdown was a key factor as it affected economic activities resulting in a recession in the year CY 2020, as the GDP growth touched -3.3%.

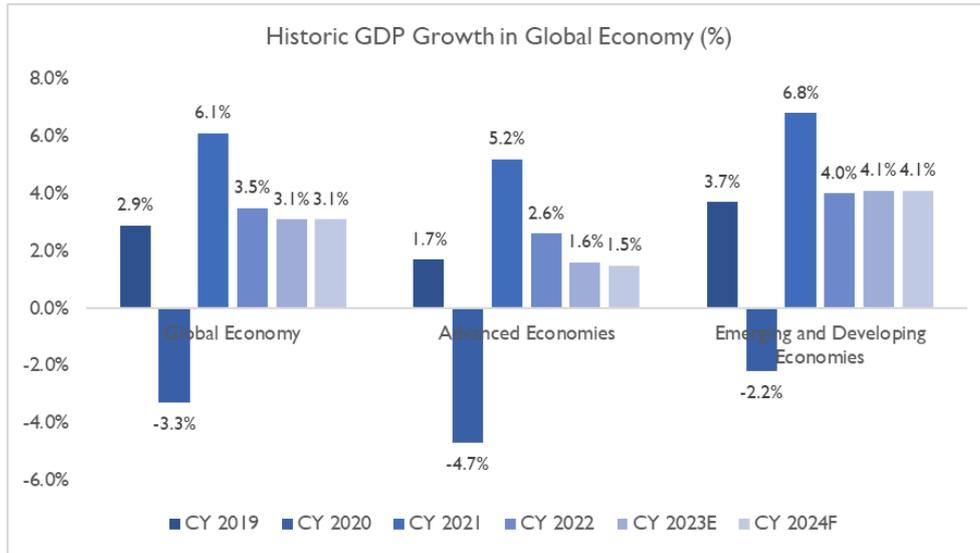
In CY 2021 disruption in the supply chain affected most of the advanced economies as well as low-income developing economies. The rapid spread of Delta and the threat of new variants in mid of CY 2021 further increased uncertainty in the global economic environment.

Global economic activities experienced a sharper-than-expected slowdown in CY 2022. One of the highest inflations in decades, seen in 2022, forced most of the central banks to tighten their fiscal policies. Russia's invasion of Ukraine affected the global food supply resulting in a further increment in the cost of living.

Further, despite initial resilience earlier in 2023, marked by a rebound in reopening and progress in curbing inflation from the previous year's highs, the situation remained precarious. Economic activity lagged behind its pre-pandemic trajectory, particularly in emerging markets and developing economies, leading to widening disparities among regions. Numerous factors are impeding the recovery, including the lasting impacts of the



pandemic and geopolitical tensions, as well as cyclically-driven factors such as tightening monetary policies to combat inflation, the reduction of fiscal support amidst high debt levels, and the occurrence of extreme weather events. As a result, global growth declined from 3.5% in CY 2022 to 3.1% in CY 2023.



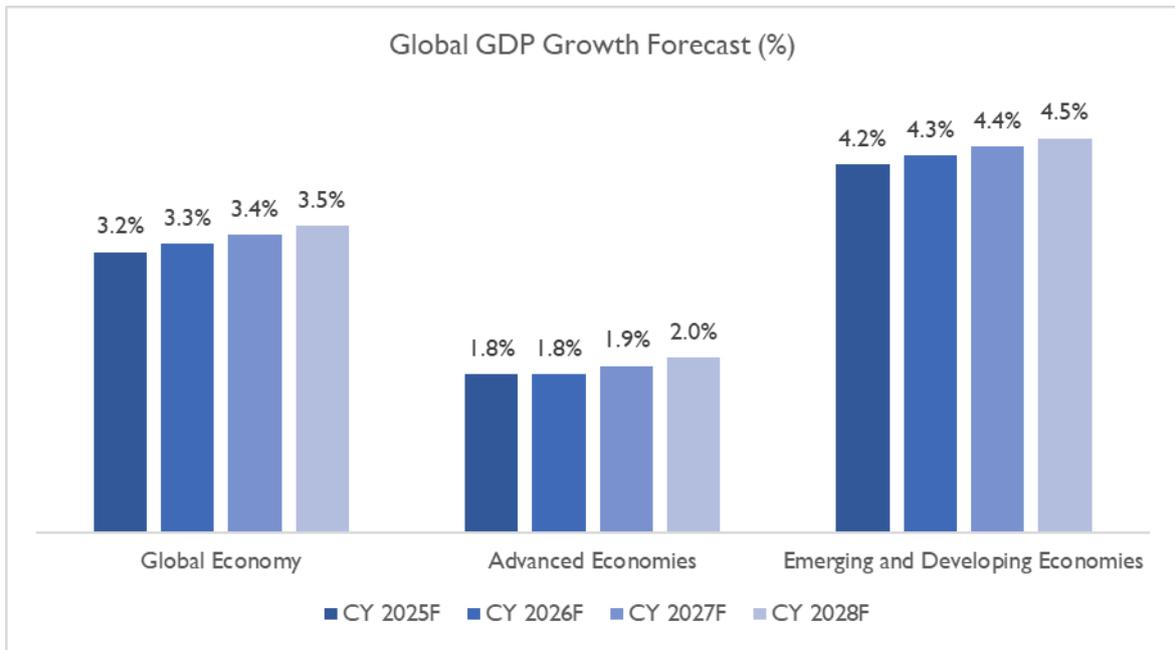
Source – IMF Global GDP Forecast Release 2024

Note: Advanced Economies and Emerging & Developing Economies are as per the classification of the World Economic Outlook (WEO). This classification is not based on strict criteria, economic or otherwise, and it has evolved over time. It comprises of 40 countries under the Advanced Economies including the G7 (the United States, Japan, Germany, France, Italy, the United Kingdom, and Canada) and selected countries from the Euro Zone (Germany, Italy, France etc.). The group of emerging market and developing economies (156) includes all those that are not classified as Advanced Economies (India, China, Brazil, Malaysia etc.)

In the current scenario, global GDP growth is estimated to have recorded a moderate growth of 3.1% in CY 2023 as compared to 3.5% growth in CY 2022. While high inflation and rising borrowing costs are affecting private consumption, on the other hand, fiscal consolidation is affecting government consumption.

Slowed growth in developed economies will affect the GDP growth in CY 2024 and global GDP is expected to record a flat growth of 3.1% in CY 2024. The crisis in the housing sector, bank lending, and industrial sectors are affecting the growth of global GDP. Inflation forced central banks to adopt tight monetary policies. After touching the peak in 2022, inflationary pressures slowly eased out in 2023. This environment weighs in for interest rate cuts by many monetary authorities.

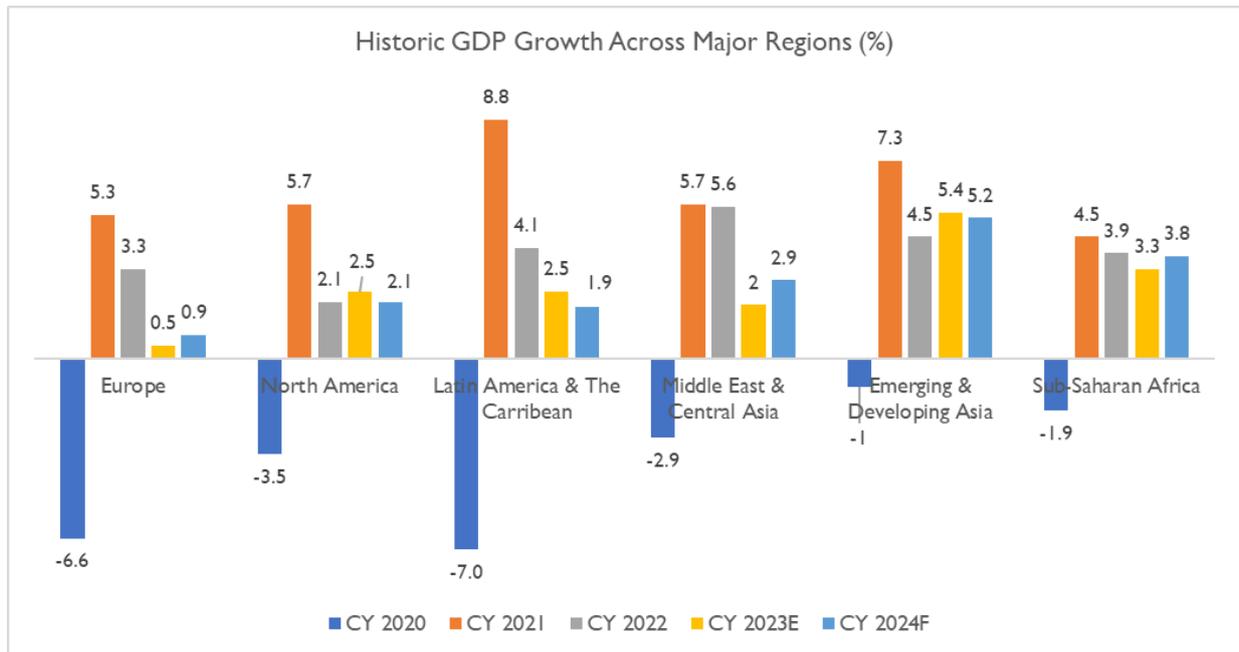




Source – IMF Global GDP Forecast Release 2024, D&B Estimates

### GDP Growth Across Major Regions

GDP growth of major regions including Europe, Latin America & The Caribbean, Middle East & Central Asia, and Sub-Saharan Africa, were showing signs of slow growth and recession between 2020 – 2023, but leaving Latin America & The Caribbean, 2024 is expected to show resilience and growth. Meanwhile, GDP growth in Emerging and Developing Asia (India, China, Indonesia, Malaysia etc.) is expected to decrease from 5.4% in CY 2023 to 5.2% in CY 2024, while in the United States, it is expected to decrease from 2.5% in CY 2023 to 2.1% in CY 2024.

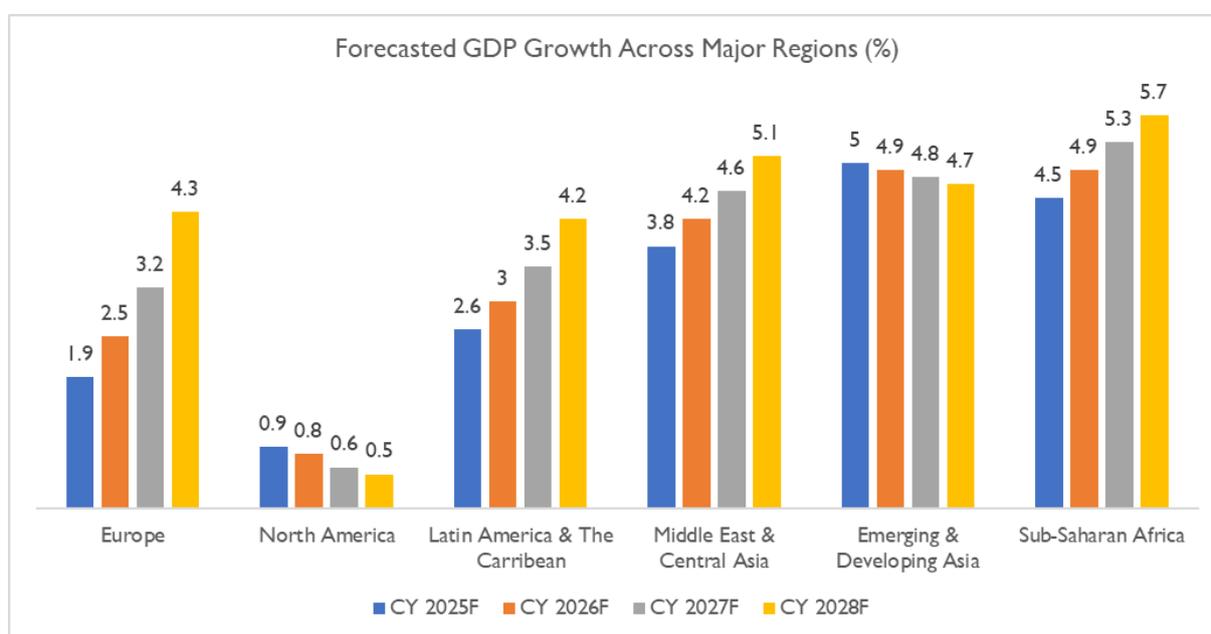


Source-IMF World Economic Outlook January 2024 update



Except for Emerging and Developing Asia, Latin America & The Caribbean and the United States, all other regions are expected to record an increase in GDP growth rate in CY 2024 as compared to CY 2023. GDP growth in Latin America & The Caribbean is expected to decline due to negative growth in Argentina. Further, growth in the United States is expected to come down at 2.1% in CY 2024 due to lagged effects of monetary policy tightening, gradual fiscal tightening, and a softening in labour markets slowing aggregate demand.

Although Europe experienced a less robust performance in 2023, the recovery in 2024 is expected to be driven by increased household consumption as the impact of energy price shocks diminishes and inflation decreases, thereby bolstering real income growth. Meanwhile, India and China saw greater-than-anticipated growth in 2023 due to heightened government spending and robust domestic demand, respectively. Sub-Saharan Africa's expected growth in 2024 is attributed to the diminishing negative impacts of previous weather shocks and gradual improvements in supply issues.



Source-IMF, OECD, and World Bank, D&B Estimates

## Global Economic Outlook

We are more optimistic about the global economy's prospects than we were at the onset of last year – and for good reason. The global economy avoided a widely anticipated recession in 2023 and will likely not see one in 2024. Looking at the current inflation trajectory, no one is guessing how much higher interest rates will go from here, which is a good outcome for both businesses and policymakers. Instead, financial markets are now betting on the timing and magnitude of rate cuts – and this is where we recommend caution for businesses. There are a few things to consider; first, rate cuts will likely follow an evident deterioration in economic conditions, i.e., after the economic damage is visible in data, which usually comes with a lag. By that logic, rate cuts by themselves may not be a positive outcome but only a means to offer relief from economic pain. Second, for most central banks that have been grappling with high inflation, higher expectations of rate



cuts from financial markets will make them harder and riskier to deliver. Loosening too soon risks reversing the inflation trajectory and if key central banks get their inflation projections wrong for a second time, it will only spell more trouble.

The violence that began in the Middle East on October 7 continues to escalate. Apart from Israel and the Palestinian territories, Yemen, Syria, Iraq, Jordan, Iran, and Pakistan have all become embroiled in some form of violence over the past four months, including cross-border fire. This can be largely attributed to the heavy presence of militias and terrorist groups in these countries. Consequently, security threat levels are elevated across the region and business operations are difficult. The most obvious impact on commercial activity has been on shipments passing through the Red Sea, which have been forced to re-route under attacks from Houthi rebel groups, elevating shipping costs and stretching delivery timelines. It has also added to volatility in the global energy markets. More importantly, the escalating conflict has reversed the gains made on global supply-side normalization and remains the biggest risk to hard-earned global disinflation – the two big economic accomplishments of 2023. Dun & Bradstreet's Global Supply Chain Continuity Index captured this dynamic as it fell 6.3% for Q1 2024, with suppliers' delivery time and delivery cost indices both deteriorating. In this context, for the global economy, a lot is riding on the ceasefire discussions that are currently underway between Israel and Hamas.

February marked the second anniversary of the start of the Russia-Ukraine conflict, which, at present, seems to be at a stalemate. From a business impact standpoint, events outside the zone of action, particularly in the EU, have gained more prominence than the conflict itself. These impacts range from immediate concerns about manufacturing performance, the cost of living, and energy security in the largest European economies, and go on to cover longer-term themes such as the bloc's first serious attempt at expansion in years, which includes Ukraine's bid for membership.

Geopolitical rumblings are also on the rise in the Asia-Pacific region, with North Korea issuing fresh threats, in words and in actions. Incessant saber-rattling may not necessarily lead to a conflict, but such posturing is unhelpful for the business and investment climates. In summary, geopolitics remains the biggest risk to the global economy today, dampening investments, disrupting supplies, and weakening the fight against inflation. There is one silver lining in all of this. High geopolitical temperatures around the world seem to have raised the stakes of stability for the U.S. and Mainland China. This was evidenced in their willingness to diffuse the Middle East, in keeping North Korea in check, and in Beijing's relatively muted reaction to a Democratic Progressive Party (DPP) victory in Taiwan Region's January 2024 polls. Mainland China may be keen to hold on to this new equilibrium until its economy fully stabilizes. As for the U.S., the outcome of the nomination races and the presidential election in November 2024 will be the key determinant of its foreign policy direction.



## India Macroeconomic Analysis

### GDP Growth Scenario

India's economy showed resilience with GDP growing at estimated 7.8% in CY 2023. The GDP growth in CY 2023 represents a return to pre pandemic era growth path. Even amidst geopolitical uncertainties, particularly those affecting global energy and commodity markets, India continues to remain one of the fastest growing economies in the world.

Country	Real GDP Growth (CY 2023)	Projected GDP Growth (CY 2024)
India	7.8%	6.8%
China	5.2%	4.6%
Russia	3.6%	3.2%
Brazil	2.9%	2.2%
United States	2.5%	2.7%
Japan	1.9%	0.9%
Canada	1.1%	1.2%
Italy	0.9%	0.7%
France	0.7% <sup>1</sup>	0.7%
South Africa	0.6%	0.9%
United Kingdom	0.1%	0.5%
Germany	-0.3%	0.2%

Source: The International Monetary Fund

Countries considered include - Largest Developed Economies and BRICS (Brazil, Russia, India, China, and South)

Countries have been arranged in descending order of GDP growth in 2023).

There are few factors aiding India's economic recovery – notably its resilience to external shocks and rebound in private consumption. This rebound in private consumption is bringing back the focus on improvements in domestic demand, which together with revival in export demand is a precursor to higher industrial activity. Already the capacity utilization rates in Indian manufacturing sector are recovering as industries have stepped

<sup>1</sup> European Commission

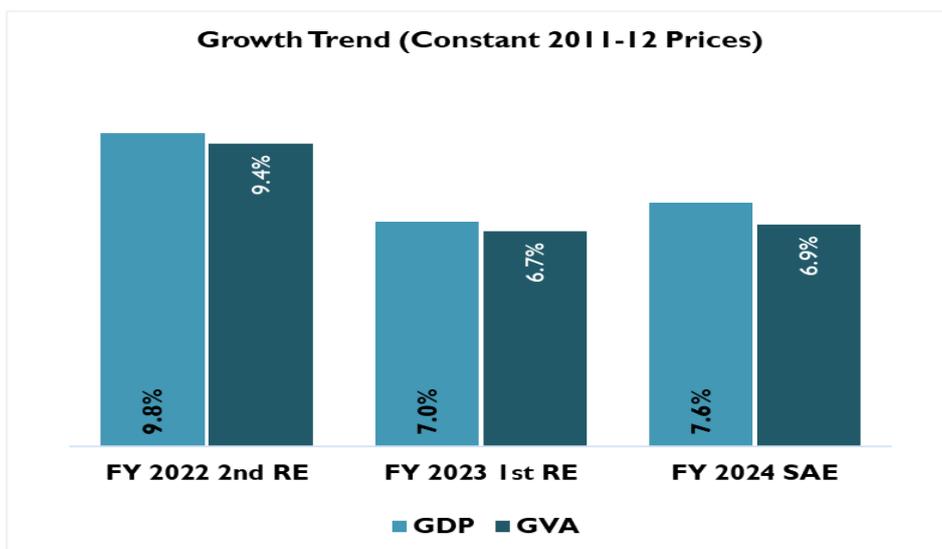


up their production volumes. As this momentum sustains, the country may enter a new capex (capital expenditure) cycle. The universal vaccination program by the Government has played a big part in reinstating confidence among the population, in turn helped to revive private consumption.

Realizing the need to impart external stimuli, the Government stepped up its spending on infrastructure projects which in turn had a positive impact on economic growth. The capital expenditure of central government increased by 37.4% increase in capital expenditure (budget estimates), to the tune of INR 10 trillion in the Union Budget 2023-2024. The announcement also included 30% increase in financial assistance to states at INR 1.3 trillion for capex. The improvement was accentuated further as the Interim Budget 2024-2025 announced an 11.1% increase in the capital expenditure outlay at INR 11.1 trillion, constituting 3.4% of the GDP. This has provided the much-needed confidence to private sector, and in turn attracted private investment.

On the lending side, the financial health of major banks has witnessed an improvement which has helped in improving the credit supply. With capacity utilization improving, there would be demand for credit from corporate sector to fund the next round of expansion plans. Banking industry is well poised to address that demand. Underlining the improving credit scenario is the credit growth to micro, small and medium enterprise (MSME) sector as the credit outstanding to the MSME sector by scheduled commercial banks in the financial year FY 2023 grew by 12.3% to INR 22.6 trillion compared to FY 2022. The extended Emergency Credit Linked Guarantee Scheme (ECLGS) by the Union Government has played a major role in improving this credit supply.

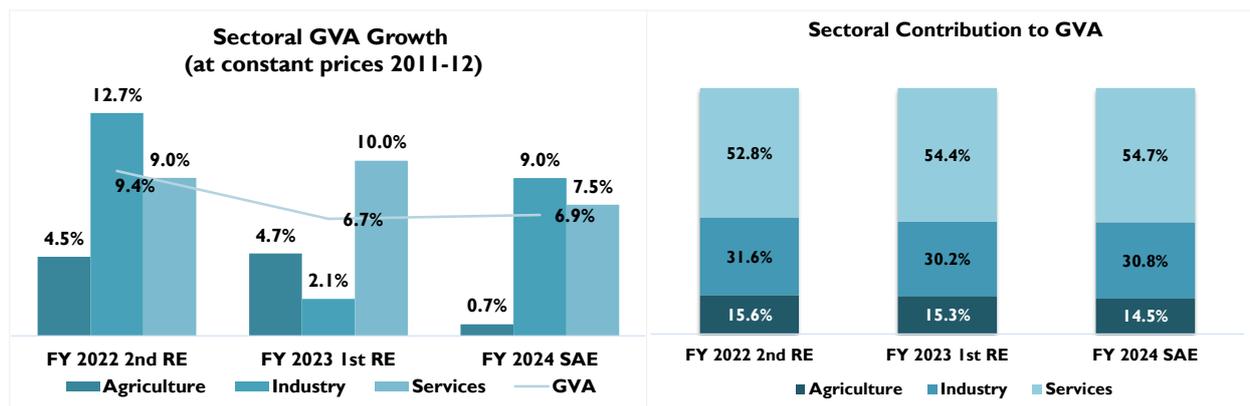
As per the second advance estimates 2023-24, India's GDP in FY 2024 grew by 7.6% compared to 7.0% in the previous fiscal on the back of solid performances in manufacturing, mining, and construction sectors. The year-on-year increase in growth rate is also partly due to by a strong growth in investment demand led by public capital expenditure.



Source: Ministry of Statistics & Programme Implementation (MOSPI), National Account Statistics, 2023-24  
RE stands for Revised Estimates, SAE stands for Second Advance Estimates



## Sectoral Contribution to GVA and annual growth trend



Source: Ministry of Statistics & Programme Implementation (MOSPI)

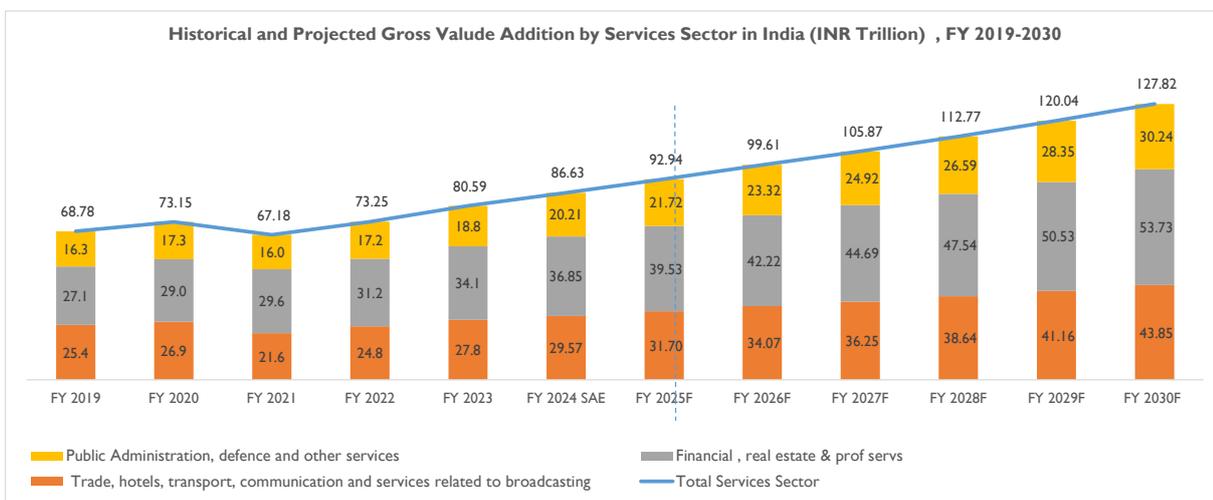
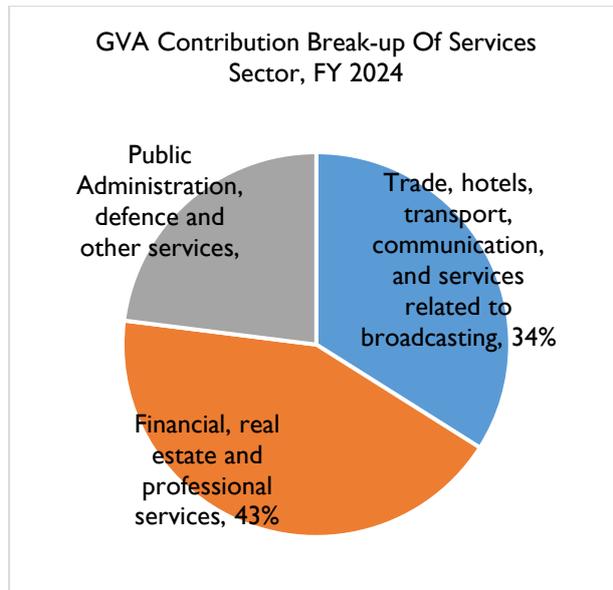
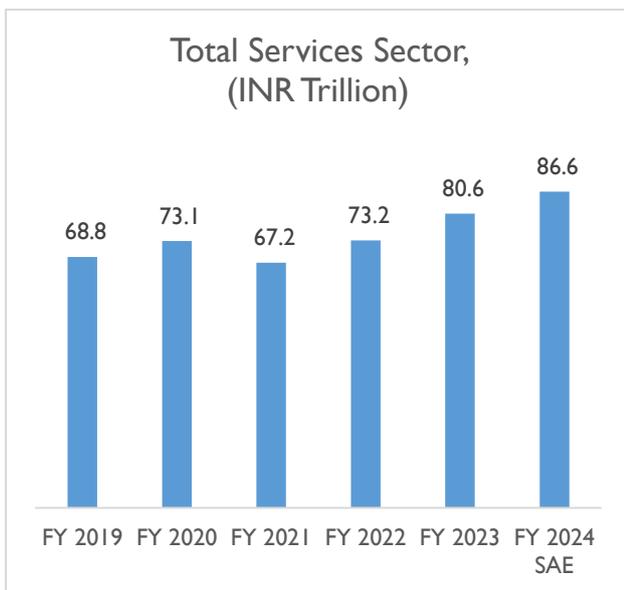
Sectoral analysis of GVA reveals industrial sector recovered sharply registering 9% y-o-y increase in FY 2024 against 2.1% in the previous fiscal. In the industrial sector, growth across major economic activity such as mining, manufacturing, construction sector rose significantly and it registered a growth of 8.1%, 8.5% and 10.7% in FY 2024 against a growth of 1.9%, -2.20%, and 9.44% in FY 2023, respectively. Utilities sector observed a marginal moderation in y-o-y growth to 7.5% against a 10% in the previous years.

Talking about the services sectors performance, with major relaxation in covid restriction, progress on covid vaccination and living with virus attitude, business in service sector gradually returned to normalcy in FY 2023. Economic recovery was supported by the service sector as individual mobility returned to pre-pandemic level. The trade, hotel, transport, communication, and broadcasting segment continued to strengthen in FY 2023 and grow in FY 2024.

### Expansion in Service Sector

Services sector is a major contributor to the country's overall economic growth. In absolute terms, services sector GVA has increased from INR 68.78 trillion in FY 2019 to INR 86.6 trillion in FY 2024 (as per the second advance estimates), registering a CAGR of nearly 5%. Within Services sector, the GVA by financial, real estate and professional services-the largest contributing segment observed 6.3% CAGR while Public Administration, defence and other services<sup>2</sup> observed 4.4% CAGR and Trade, hotels, transport, communication, and services related to broadcasting witnessed 3.1% CAGR between FY 2019-24.

<sup>2</sup> Other services include Education, Health, Recreation, and other personal services.



Sources: MOSPI, CMIE Economic Outlook and Dun & Bradstreet Research Estimates<sup>3</sup>

By FY 2030, the service sector GVA is projected to reach INR 127.82 trillion, witnessing a 6.7% CAGR between FY 2024-2030 while GVA of trade, hotel, transport, communication, and services related to broadcasting is estimated to grow at 6.8% CAGR during the above period.

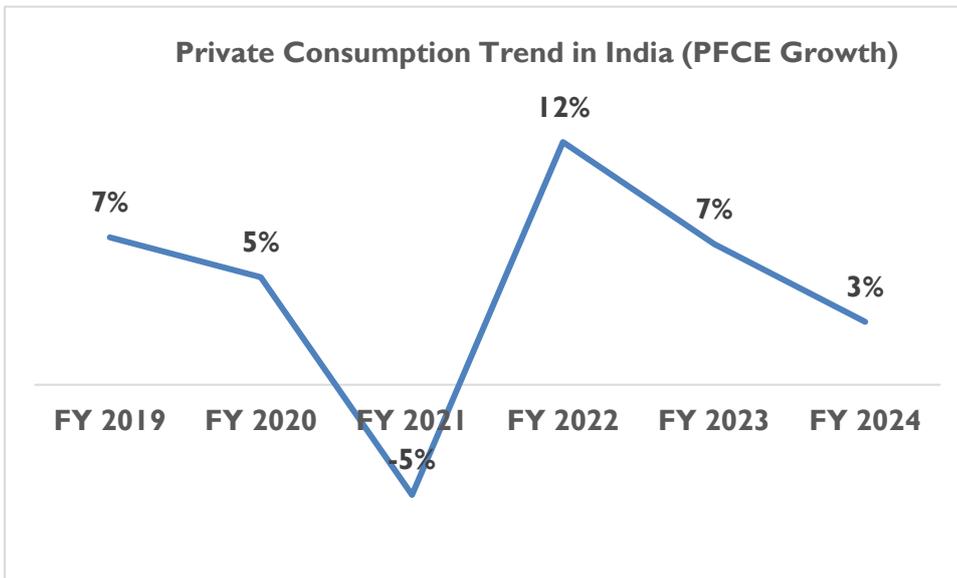
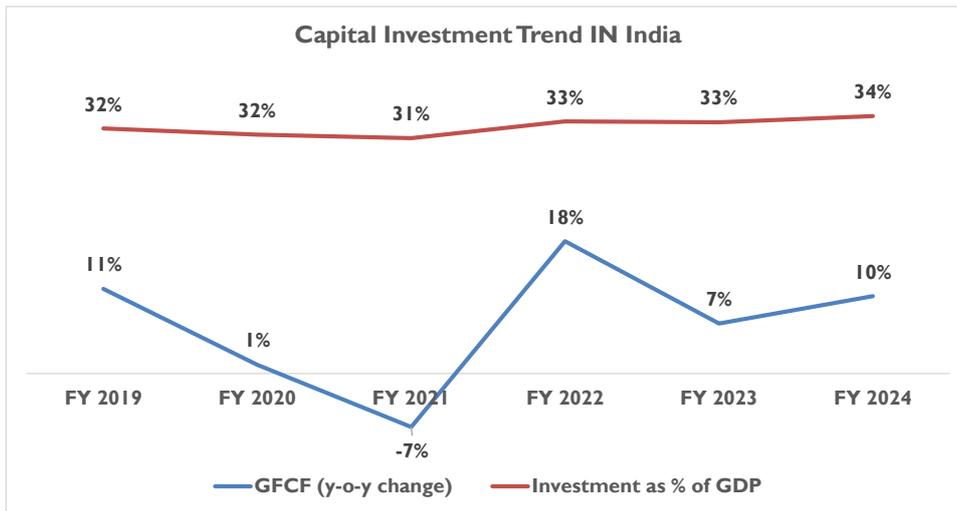
India's HSBC Services Purchasing Managers' Index, an important indicator to track service sector performance, increased to 61.4 in May 2024 from 60.8 in the previous month. Since August 2021, the services sector has consistently remained above the threshold of 50, which distinguishes growth from contraction.

### Investment & Consumption Scenario

Other major indicators such as Gross fixed capital formation (GFCF), a measure of investments, gained strength during FY 2024 as it grew by 10% on y-o-y basis against 7% yearly growth in the previous fiscal, while GFCF to GDP ratio measured all time high settled higher at 34%.

<sup>3</sup> Projection as Based on CMIE Growth rate till FY 2029 and FY 2030 is based on Dun & Bradstreet assumption.





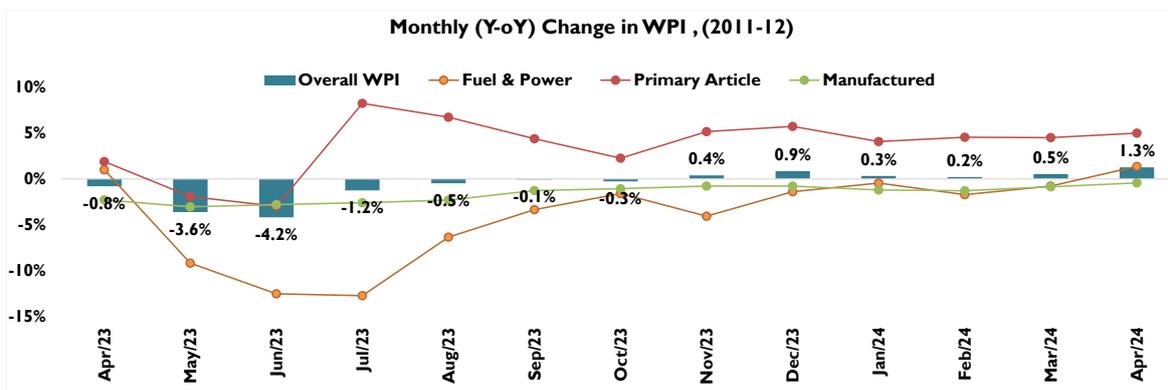
Sources: MOSPI

Private Final Expenditure (PFCE) a realistic proxy to gauge household spending, observed decelerated and registered 3.1% y-o-y growth in FY 2024 which is less than half of the previous year indicating sustained weakness in consumer spending.

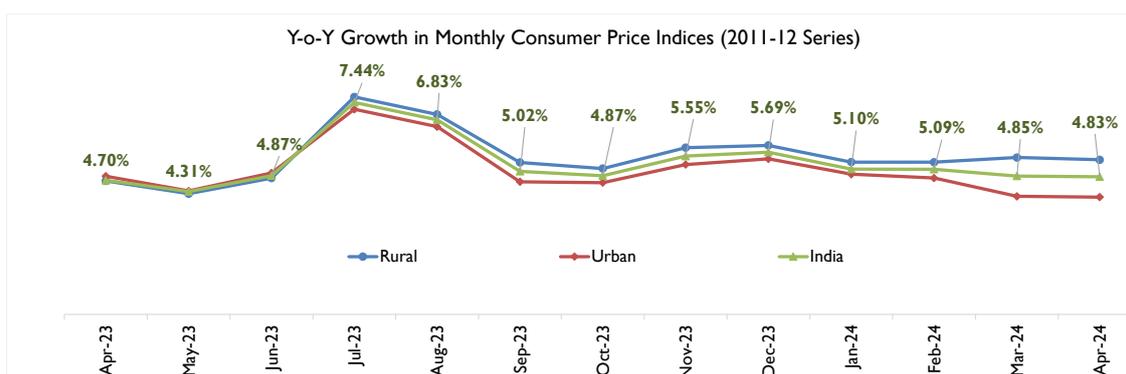
#### Inflation Scenario

The inflation rate based on Wholesale Price Index (WPI) exhibited rose to 1.3% in the month of April 2024 on the back of steady growth in the prices of primary article which grew by 5% in April 2024 on y-o-y bases. Increasing prices of food articles and energy prices contributed to increasing inflation.





Source: MOSPI, Office of Economic Advisor.



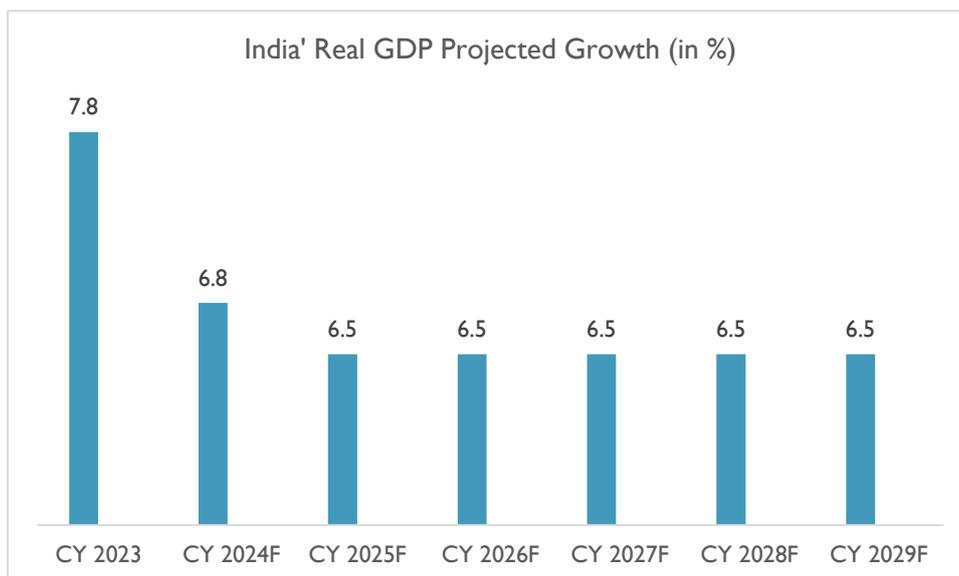
Source: CMIE Economic Outlook

Retail inflation rate (as measured by Consumer Price Index) eased to 4.83% in April 2024 as compared to 4.85% in March 2024. The CPI inflation for rural and urban for the month of April 2024 was 5.43% and 4.11% against 5.51% and 4.14% respectively in March 2024. Retail inflation moderated during FY 2024 after the peak of 7.4% in July 2023 and it fluctuated between 4.85%-6.83%. CPI measured below 6% tolerance limit of the central bank since September 2023. As a part of anti-inflationary measure, the RBI has hiked the repo rate by 250 bps since May 2022 to current 6.5% while it has been holding the rate at 6.5% since 8 Feb 2023.

### India's Economic Growth Outlook

Looking ahead to 2024, India's projected GDP growth of 6.8% in 2024 stands out as the fastest among major emerging markets, significantly outpacing China's 4.6%, and Brazil's 2.2%. This robust growth trajectory is expected to sustain at 6.5% annually from 2025 to 2029, reflecting strong economic fundamentals and continued momentum.





Source: IMF

This decent growth momentum in near term (CY 2024) is accompanied by a slowdown in inflation, as well as various other factors in the medium to long term that will support the economy. These include enhancements in physical infrastructure, advancements in digital and payment technology, improvements in the ease of doing business and a higher quality of fiscal expenditure to foster sustained growth.

On the demand side, improving employment conditions and moderating inflation are expected to stimulate household consumption. Further, the investment cycle is gaining traction, propelled by sustained government capital expenditure, increased capacity utilization and rising credit flow. Additionally, there are positive signs of improvement in net external demand, as reflected in the narrowing merchandise trade deficit. Despite the supply disruptions, exports clocked positive y-o-y growth in December 2023 and January 2024.

From uplifting the underprivileged to energizing the nation's infrastructure development, the Government has outlined its vision to propel India's advancement and achieve a 'Viksit Bharat' by 2047 in the interim budget announced on 1<sup>st</sup> Feb 2024. Noteworthy positives in the budget include achieving a lower-than-targeted fiscal deficit for FY2024 and setting a lower-than expected fiscal deficit target for FY2025, proposing dedicated commodity corridors and port connectivity corridors, providing long-term financing at low or nil interest rates to the private sector to step up R&D (Research & Development) in the sunrise sectors.

Achieving a reduced fiscal deficit of 5.8% in FY2024 and projecting a lower than-anticipated fiscal deficit of 5.1% in the interim budget in February 2024 for the current fiscal year (FY 2025) are positive credit outcomes for India. This showcases the country's capability to pursue a high-growth trajectory while adhering to the fiscal glide path. There has been a significant boost to capital expenditure for two consecutive years; capital expenditure – which is budgeted at 3.4% of GDP (INR 11.1 trillion/USD 134



billion) for fiscal year 2024-25 – is at a 21-year high (3.3% of GDP in fiscal year 2023-24). The enhancement of port connectivity, coupled with the establishment of dedicated commodity corridors (energy, mineral and cement), is poised to enhance manufacturing competitiveness. This strategic move aims to fulfil India's export targets and reduce logistics costs.

However, headwinds to external demand emanate from recession in key exporting partners - the UK and Germany (which collectively account for over 5% of India's export portfolio) - and the spiralling effect it will have on other European countries. Supply disruptions posed by the conflict in the Red Sea, leading to rerouting of shipments through Africa, are impacting sectors exposed to exports to Europe, running on thin margins, especially small businesses. Although headline inflation moderated to 5.1% in January 2024, a three-month low, volatility in crude prices and uncertainties about food inflation are likely to keep the central bank cautious in the near term.

India's optimistic economic outlook is underpinned by its demographic dividend, which brings a substantial workforce that boosts labor participation and productivity. The burgeoning middle class and urbanization contribute to increased domestic consumption, driven by rising incomes and purchasing power. Extensive investments in infrastructure, encompassing roads, railways, ports, and digital connectivity, are enhancing productivity and efficiency, with government initiatives like the Smart Cities Mission and PM Gati Shakti creating a conducive growth environment. This digital transformation, catalyzed by initiatives such as Digital India, is fostering a tech-driven economy marked by enhanced internet penetration, digital payments, and e-governance, thereby fueling growth in sectors like fintech, e-commerce, and digital services. The push to position India as a global manufacturing hub through Make in India and PLI (Production Linked Incentive) schemes is further boosting industrial output, exports, and domestic production capabilities. Compared to other major emerging markets facing demographic and economic challenges, India's combination of demographic strengths, policy reforms, and strategic initiatives positions it as a standout performer and a significant driver of global economic growth in the foreseeable future.

[Some of the key factors that would propel India's economic growth.](#)

### **Strong Domestic Demand**

Domestic demand has traditionally been one of the strong drivers of Indian economy. After a brief lull caused by Covid-19 pandemic, the domestic demand is recovering. Consumer confidence surveys by Reserve Bank / other institutions points to an improvement in consumer confidence index, which is a precursor of improving demand. India has a strong middle-class segment which has been the major driver of domestic demand. Factors like fast paced urbanization and improving income scenario in rural markets are expected to accelerate domestic demand further. This revival is perfectly captured by the private final consumption expenditure (PFCE) metric. PFCE as a percentage of GDP increased to 58% during FY 2022 and FY 2023 while in FY 2024 it settled at 56%. There are two factors that are driving this domestic demand: One the large pool of consumers and second the improvement in purchasing power. As per National Statistics Office (NSO), India's per capita net national income (at constant prices) stood at INR 1.06 lakhs in FY 2024 against

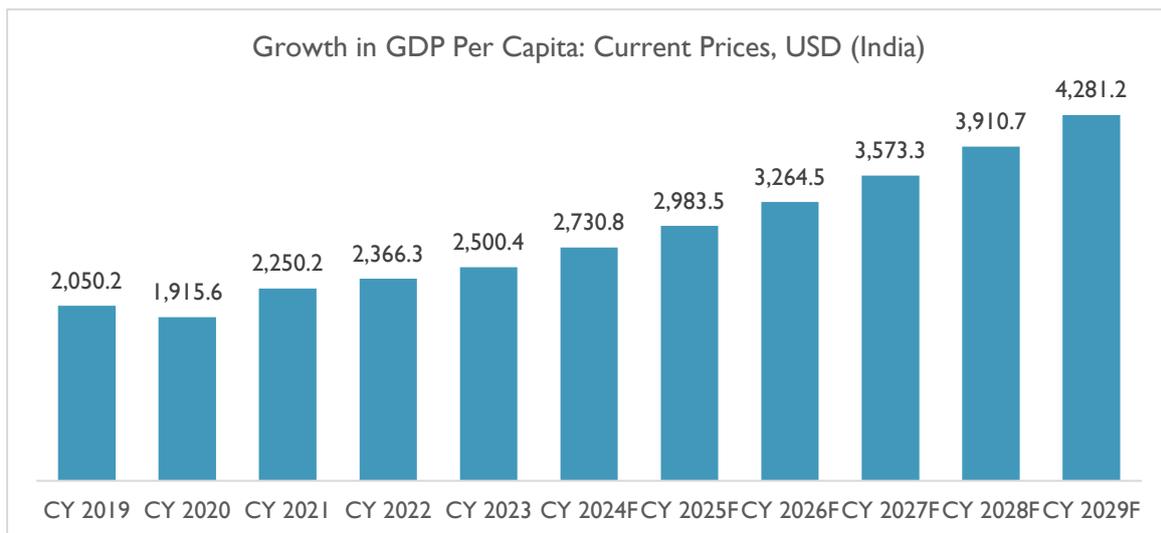


99,404 in FY 2023 and 87,623 in FY 2018. This increase in per capita income has impacted the purchasing pattern as well as disposable spending pattern in the country. Consumer driven domestic demand is majorly fuelled by this growth in per capita income.

**India’s Per capita GDP trends**

India is poised to become the world's third-largest economy with a projected GDP of USD 5 trillion within the next three years, driven by ongoing reforms. As one of the fastest-growing major economies, India currently holds the position of the fifth-largest economy globally, following the US, China, Japan, and Germany. By 2027-28, it is anticipated that India will surpass both Germany and Japan, reaching the third-largest spot. This growth is bolstered by a surge in foreign investments and a wave of new trade agreements with India’s burgeoning market of 1.4 billion people. The aviation industry is witnessing unprecedented orders, global electronics manufacturers are expanding their production capabilities, and suppliers traditionally concentrated in southern China’s manufacturing hubs are now shifting towards India.

To achieve its vision of becoming the world’s third-largest economy by 2027-28, India will need to implement transformative industrial and governmental policies. These policies will be crucial for sustaining the consistent growth of the nation's per capita GDP over the long term.



Source: IMF

From CY 2024-29, India’s per capita GDP is projected to grow at a compound annual growth rate of 9.4%. This growth will be driven by the service sector, which now accounts for over 50% of India's GDP, marking a significant shift from agriculture to services.

**Digitization Reforms**

Ongoing digitization reforms and the resultant efficiency gains accrued would be a key economic growth driver in India in the medium to long term. Development of digital platforms has helped in the seamless roll out of initiatives like UPI (Unified Payments Interface), Aadhaar based benefit transfer programs, and streamlining of GST (Goods and Services Tax) collections. All of these have contributed to improving the economic output in the country. Some of the key factors that have supported the digitization reforms include



– the growth in internet penetration in India together with drop in data tariffs, growth in smartphone penetration, favorable demographic pattern (with higher percentage of tech savvy youth population) and India’s strong IT (Information Technology) sector which was leveraged to put in place the digital ecosystem. All these factors are expected to remain supportive and continue to propel the digitization reforms in India. Increased adoption of digital technology and innovation, inclusive and sustainable practices, business-friendly and transparent regulations, and heightened corporate research and development (R&D) investments will further bolster the country’s growth. These factors will collectively support employment growth across both private and public sectors, including micro, small, and medium enterprises (MSMEs).



## Heat Exchanger

### Product Profile

Heat exchangers transfer thermal energy from one fluid to another, while ensuring that the fluids do not mix. This process is facilitated by conduction, enabling the heat exchanger to heat or cool a substance. Heat exchangers provide a means of regulating temperature, enhancing efficiency, averting overheating, and mitigating other potential hazards, resulting in an improvement in safety standards. Heat exchangers are considered more efficient and reliable in operations wherein some parameters, like temperature differential, flow rate and installation guidelines, are evaluated successfully.

Being an efficient source of energy saving, heat exchangers find applications across a broad range of domestic and industrial applications such as steam power plants, chemical processing plants, food processing, HVAC systems, mining, pulp & paper, metallurgy etc. Heat exchangers typically are suitable for deployment in areas which have ample spaces such as industrial complexes, commercial space, hospitals, educational institutes etc. These systems are not generally preferred or feasible for smaller capacities, especially residential, as the economies of scale are difficult to overcome.

### Types of Heat Exchanger

#### Shell and Tube Heat Exchangers

A shell and tube heat exchanger (STHE) are a heat exchanging device made up of a large cylindrical enclosure, or shell, that has bundles of perfectly spaced tubing compacted in its interior. Shell & tube products are generally used in applications that require transfer between two liquids, between liquids & gases or between two gases and a wide temperature and pressure range. Their properties of managing fluids at high temperature and pressure makes them suitable for various applications such as chemical and petrochemical plants, oil & gas and power sectors among others. These type of heat exchangers have a simple structure and are ideal for heat transfer from steam to water.

Three types of commonly used shell and tube heat exchangers are-

#### 1. Fixed Tube Sheet Heat Exchanger

In this type of exchanger, the tube sheet is welded to the shell. This leads to a simple and economical structure, and the cleaning of tube bores can be performed mechanically or chemically. However, the outer surface of the tubes is inaccessible other than chemical cleaning. Rear headers are usually of L, M, and N types.

#### 2. U- Tube Heat Exchanger

In a U-Tube exchanger, any type of front header may be used, and the rear header is typically M-Type. U-tubes allow unlimited thermal expansion. Also, the tube bundle can be eliminated for cleaning, and a small bundle to shell clearances can be obtained. Since it is difficult to clean inside the tubes with mechanical tools, it is normal to use this type only where the fluids on the tube side are clean.



### 3. Floating Head Heat Exchanger

In the floating head exchanger, the tube sheet is not welded to the shell at the rear header end but is permitted to move or float. The tube sheet at the front header has a larger diameter than the shell and is sealed in a manner similar to that applied in the fixed tube sheet design. The tube sheet at the rear header end of the shell is somewhat smaller in diameter than the shell and allows the bundle to be drawn through the shell.

The application of a floating head means that thermal expansion is allowed, and the tube bundle can be eliminated for cleaning purposes. Several types of rear headers can be utilized, but the S-Type Rear Head is the most common.

The three flow types of shell and tube heat exchangers are parallel, counter, and cross. Due to design considerations and the applications of heat exchangers, it is rare that a heat exchanger be only one of these flow types, usually they are a combination of several flow types e.g. counter cross flow.

- Parallel flow is when the shell and tube sides enter the heat exchanger at the same end and flow directly to the opposite end. The temperature change is the same for each fluid and increases or reduces by the same amount.
- Counter flow is when the fluids are flowing in opposite directions, enter the heat exchanger at opposite ends, and discharge at opposite ends. The counter flow is the most popular and efficient type of heat exchanger.
- In a cross-flow shell and tube heat exchanger, the fluids flow perpendicular to each other at a 90-degree angle. One of the fluids in a cross-heat exchanger changes state (just as in a steam system condenser where cooling water absorbs the steam), then is absorbed by the fluid that has remained in its liquid state.

The operation of a shell and tube heat exchanger is based on the thermal exchange and flow of two different fluids. One fluid flows through the tubes while the other flows through the shell, which is divided into two sections: the shell side and the tube side.

The allocation of hot and cold fluids is a critical decision when working with a shell and tube heat exchanger. The shell side is designed to handle low-pressure fluids, while the tubes are intended for high-pressure fluids.

Shell and tube heat exchangers are used in various cooling applications and are particularly effective at cooling hydraulic fluid and oil in engines, transmissions, and hydraulic power packs. Additionally, with the appropriate choice of materials, they can be used to cool or heat other fluids, such as swimming pool water or charge air.

One of the key benefits of shell and tube heat exchangers is their ease of maintenance, particularly when a floating tube bundle is available. Due to the cylindrical design of the housing, they are capable of withstanding high pressure, making them suitable for a wide range of pressure applications.



## **Finned Tube Heat Exchanger / Fin and Tube Type Heat Exchanger**

Finned tube heat exchanger has fins attached to the end of tubes. Such a construction increases the heat transfer area, which in turn helps in increasing the heat transfer rate. Typically, a dense liquid which is capable of transporting heat efficiently and a fluid with very little density (like gas or air) are used as heat transfer mediums. The flow pattern of fluids in this type of heat exchangers is primarily cross flow, with fluids travelling perpendicular to each other. Since air is one of the fluids used to transfer heat, finned tube heat exchanger is also called air cooled heat exchanger or air fin coolers.

Some of the advantages finned tube heat exchanger enjoys over other variants include increased heat transfer coefficient (due to higher heat transfer surface area), reduced equipment size, and compatibility with a range of materials (like copper, aluminum, carbon steel, stainless steel, and titanium).

A finned tube heat exchanger is used when air / gas is the preferred fluid used to heat up or cool down the working fluid. The presence of fins increases the overall surface area available for heat transfer. Because of this the total number of tubes required for a particular application can be lower which in turn reduces the equipment size. This enables creating heat exchanger of smaller size making it ideal for mobile refrigeration applications.

Some of the commonly used type of finned tube / air cooled heat exchanges:

1. **Forced Draft Air Cooled Heat Exchanger:** In this type, a mechanical draft fan is used to force air over the heat transfer surface of the exchanger. The fans are set below the tube bundles and push air across the tube surface. This design allows for better accessibility for maintenance and fan blade adjustment. As a result, it needs less structural support, it can have a longer mechanical life and it can lower the capital costs.
2. **Induced Draft Air-Cooled Heat Exchanger:** In this type, the air is drawn through the exchanger by an induced draft fan placed on the outlet side of the heat exchanger. Since the fans are located above the bundle, the air is pulled across the finned tube surface. This arrangement provides a more even distribution of air due to lower air velocity. Additionally, an induced draft air-cooled exchanger is less likely to recirculate exhaust air and is less susceptible to sudden temperature changes since only a portion of its surface is exposed to the elements.
3. **Natural Draft Air Cooled Heat Exchanger:** This type of exchanger relies on the natural buoyancy of hot air to move it upwards, creating a natural draft to draw cooler air in at the bottom of the exchanger. However, there may be a chimney above the tube bundle that creates the draft that drives air through the tube bundle.

## **Plate Heat Exchangers (PHEs)**

A Plate Heat Exchanger is a heating device that facilitates the transfer of heat between two fluids that are separated by a thin metal plate, and are typically used for liquid-liquid exchange at low to medium pressures. This method allows for a high rate of heat transfer in a compact space, making it useful for a variety of



applications where space is at a premium. With their compact size, high heat transfer rates, and low maintenance requirements, plate heat exchangers are becoming increasingly popular in many industries., especially in the food industry as they have multiple plates inside the frame, reducing or eliminating microbial, thereby making the product safe for consumption.

There are 4 main types of PHEs-

1. **Gasketed plate heat exchangers** – These exchangers use high-quality gaskets and designs to seal plates together and prevent fluid from leaking out. Plates can easily be removed for cleaning, expansion, or replacing purposes.
2. **Brazed plate heat exchangers** – Brazed plate heat exchangers use a process called brazing to bond the plates together. This creates a more durable and compact heat exchanger that can withstand higher pressures and temperatures than Gasketed plate heat exchangers. Used in many industrial and refrigeration applications, these exchangers can be very efficient and compact. This tends to make them a highly economic choice. A stainless-steel plate with copper brazing can be highly resistant to corrosion.
3. **Welded plate heat exchangers** – These are very similar to gasketed heat exchangers but the difference is the Welded plates can be attached together. They are very durable and are ideal when it comes to transferring fluids with high temperatures or corrosive materials. Since the plates can be welded together, cleaning the plates isn't possible compared to cleaning plate heat exchangers.
4. **Semi-Welded plate heat exchangers** – These are a combination of welded and gasket plates. The two plates are welded together and gasketed to other pairs within the heat exchanger. This results in an easy to service heat exchanger and you're able to transfer more fluids throughout the system. Semi-Welded heat exchangers are great for transferring expensive materials due to their low risk of fluid loss.

The plates in a plate heat exchanger are typically made of metal, such as stainless steel or titanium, and are corrugated to increase the surface area available for heat transfer.

When the hot and cold fluids enter the plate heat exchanger, they flow through the alternating channels between the plates. As they flow through the channels, they exchange heat through the thin metal walls of the plates, without coming into direct contact with each other. This heat exchange process continues as the fluids flow through the channels and eventually exit the heat exchanger.

The flow of the hot and cold fluids in a plate heat exchanger can be arranged in different ways, depending on the application and performance requirements. The most common flow arrangement is counterflow, where the hot and cold fluids flow in opposite directions, which maximizes the temperature difference between the two fluids and provides the highest heat transfer rates.

In addition to this, the plate heat exchanger can also be designed with different types of channels to optimize the flow of the fluids. The most common types of channels are herringbone, chevron, and straight.



Herringbone and chevron channels are designed to create turbulence in the fluid flow, which increases the heat transfer rate. Straight channels are designed for applications where low-pressure drop is important.

A plate heat exchanger comes with a compact design and offers a lower cost option wherever stainless steel is required. One of the biggest advantages of plate exchangers is the efficiency that accompanies their compact design. These heat exchangers are created with several corrugated plates on the frame of the equipment, essentially creating a design that uses the entire body during the heat transferring process.

Modern plate heat exchangers use pressed plates, which are less expensive than the welded plates and are also more resistant to corrosion and chemical reactions that weaken the product and hence require frequent maintenance or replacement.

### Spiral Tube Heat Exchangers

Spiral tube heat exchangers have excellent heat exchanger properties because of far compact and high heat transfer efficiency. The heat transfer rate associated with a spiral tube is higher than that for a straight tube. Spiral tube heat exchangers consist of one or more spirally wound coils which are, in circular pattern, connected to header from which fluid is flowed. This spiral coil is installed in a shell another fluid is circulated around outside of the tube, leads to transfer the heat between the two fluids.

Spiral tube heat exchangers use single channel technology i.e. both fluids occupy a single channel, which allows fully counter-current flow. The working of this technology includes one fluid (hot fluid) entering the centre of the unit and flowing towards the periphery whereas the other fluid (cold fluid) enters the unit at the periphery and moves towards the centre. Spiral tube heat exchangers are generally used for pasteurization, heat recovery, digester heating, effluent cooling, and pre-heating.

### Types of Materials Used

A wide range of metals is used in heat exchangers, depending upon the nature of the fluids handled. The type of metals used ranges from steel to rare metals like Zirconium. Some of the common materials used include carbon steel, stainless steel, aluminum, copper, and copper-nickel. The end use application of heat exchanger has a huge bearing on the type of material selected.

Type of Heat Exchanger	Common materials used
Shell & Tube	Carbon steel, stainless steel, brass, and titanium
Finned Tube/ Air cooled	Duplex stainless steel, carbon steel, aluminum, copper
Plate Heat Exchanger	Stainless steel, Titanium

Both copper and aluminium are commonly used as materials for fins in heat exchangers, and they offer various advantages.



Aluminum based Fins and Tubes	Copper based Fins and Tubes
<p><b>High Thermal Conductivity:</b> Aluminium has excellent thermal conductivity, making it an efficient material for heat transfer.</p> <p><b>Lightweight:</b> Aluminium is a lightweight material compared to alternatives such as copper or steel.</p> <p><b>Cost Effective:</b> Aluminium is relatively more cost effective than other materials like copper or stainless steel. The lower cost of aluminium fins can contribute to overall cost savings in heat exchanger manufacturing. Heat exchanger manufacturers save 20-25% on material costs.</p> <p><b>Corrosion Resistance:</b> Aluminium has natural corrosion resistance, especially when exposed to air. This property helps protect the fins from oxidation and corrosion, extending the lifespan of the heat exchanger. No galvanic corrosion between fin and tube. Aluminium based tubes can be used in ammonia systems, while copper tubes are not recommended for such applications.</p> <p><b>Recyclability:</b> Aluminium is a highly recyclable material, making it environmentally friendly.</p>	<p><b>Excellent Thermal Conductivity:</b> Copper has one of the highest thermal conductivities among metals, making it an ideal choice for heat transfer applications.</p> <p><b>Corrosion Resistance:</b> Copper exhibits excellent resistance to corrosion, particularly in non-acidic environments. This corrosion resistance helps protect the fins from degradation and extends the lifespan of the heat exchanger.</p> <p><b>High Strength and Durability:</b> Copper is a strong and durable material, offering mechanical strength and structural integrity to withstand high operating pressures and stresses.</p> <p><b>Compatibility with Different Fluids:</b> Copper tubes are compatible with a wide range of fluids, allowing for versatile use in heat exchangers across various industries.</p> <p><b>Longevity and Low Maintenance:</b> Copper tubes have a long service life and require minimal maintenance. Copper's corrosion resistance, durability, and mechanical strength contribute to the longevity of the heat exchanger, resulting in reduced downtime and maintenance costs.</p> <p><b>Formability and Ease of Fabrication:</b> Copper is highly malleable and ductile, allowing for easy fabrication of fins with various shapes, sizes, and configurations.</p>

### Key Applications & End-Use Industries

Heat exchangers find applications in various industries where there is a requirement of transferring heat from one medium to another. Heat exchangers help to maintain the desired temperature, reduce energy consumption, and increase the efficiency of the overall process.



Different types of heat exchangers are used in different industries based on the application and requirements. The widespread use of heat exchangers in various sectors has made them an essential component of modern industrial processes.

Below are the key applications of heat exchangers across different end-use industries-

- **Chemical Processing:** Heat exchangers are used in the chemical processing industry to transfer heat between fluids in different stages of a chemical reaction. This can help to maintain temperature control and prevent unwanted reactions or changes in the properties of the fluid. In some cases, heat exchangers may also be used to recover energy from the chemical reaction.
- **Oil and Gas Industry:** Heat exchangers are used in the oil and gas industry for heating and cooling fluids during production, transportation, and processing operations. In this case scenario, heat exchangers may be used to heat crude oil to make it more viscous and easier to transport, or to cool gas after compression to reduce the risk of explosions.
- **Power Generation:** Heat exchangers are used in power generation systems, such as nuclear and fossil fuel power plants, to transfer heat from the working fluid to the environment. This helps to increase the efficiency of the power generation process. There are two types of heat exchangers commonly used in power generation systems: boilers, which produce steam by heating water, and condensers, which transfer heat from the steam to the environment.
- **HVAC Systems:** Heat exchangers are used in HVAC systems to transfer heat between the air being circulated and the fluid in the system. For example, in a heating system, the heat exchanger will transfer heat from the hot water or steam circulating in the system to the air in the building. In a cooling system, the heat exchanger will transfer heat from the air in the building to the refrigerant in the system.
- **Food and Beverage Processing:** Heat exchangers are used in the food and beverage industry for heating and cooling processes. For example, in pasteurization, heat exchangers are used to heat the product to a specific temperature and hold it there for a specific amount of time to kill bacteria and extend the shelf life of the product. In sterilization, heat exchangers are used to heat the product to a higher temperature to kill all microorganisms. In cooling, heat exchangers are used to rapidly cool the product to prevent spoilage.
- **Refrigeration:** Heat exchangers are used in refrigeration systems to transfer heat from the refrigerant to the surrounding environment. This is how refrigeration systems cool the space or object being refrigerated. There are two types of heat exchangers commonly used in refrigeration systems: evaporators, which absorb heat from the surrounding environment, and condensers, which release heat into the surrounding environment.
- **Aerospace and Defence:** Heat exchangers are used in aerospace and defence applications for a variety of purposes, such as in aircraft and spacecraft cooling systems, hydraulic systems, and fuel systems. In an aircraft cooling system, heat exchangers are used to transfer heat from the engine and



other components to the surrounding air to prevent overheating. They are also used in spacecraft thermal control systems to regulate the temperature of the spacecraft and its equipment.

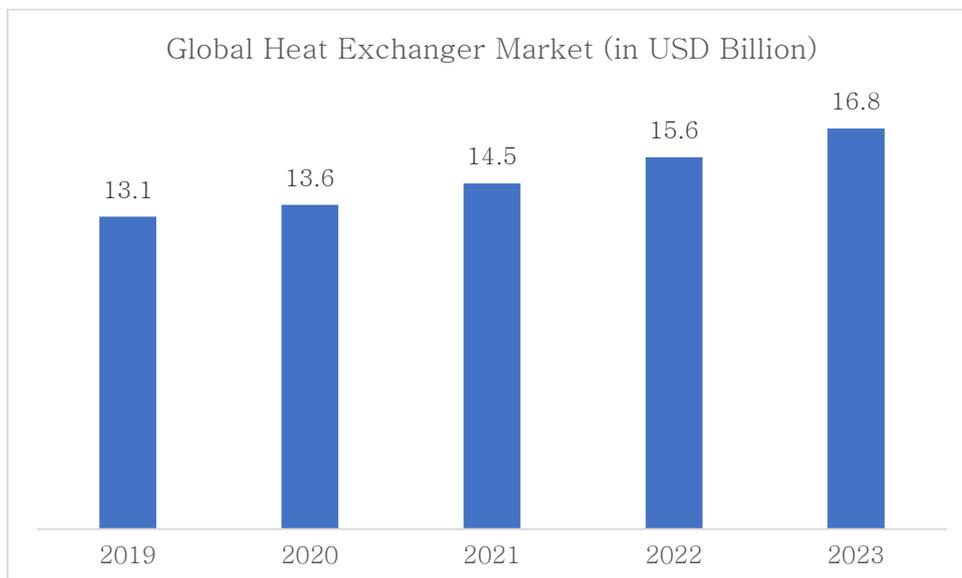
- **Automotive Industry:** Heat exchangers are used in the automotive industry for cooling the engine, transmission, and other vehicle components, as well as for heating and cooling the passenger compartment. They are used in components such as radiators, intercoolers, and oil coolers. In an engine cooling system, heat exchangers are used to transfer heat from the engine to the surrounding air or to the coolant in the system.
- **Renewable Energy:** Heat exchangers are used in renewable energy systems, such as solar thermal and geothermal systems, to transfer heat from the source to the working fluid. For example, in a solar thermal system, heat exchangers are used to transfer heat from the solar collector to the water or other fluid being heated. In a geothermal system, heat exchangers are used to transfer heat from the underground heat source to the fluid being circulated.
- **Pharmaceutical Industry:** Heat exchangers play a vital role in the pharmaceutical industry, where they are used for processes such as sterilization, evaporation, and crystallization. They are used in applications such as drug manufacturing, bioreactors, and vaccine production.
- **Industrial waste heat recovery:** Industrial waste heat recovery captures hot gases as they exit industrial equipment to use the heat energy. Some of these gases can be extremely hot and need specialist heat exchangers to handle them effectively. These gases can be corrosive.



## Global Heat Exchanger Market

The global heat exchanger market is valued at USD 16.8 billion in 2023<sup>4</sup>, with the industry experiencing a robust CAGR of 6.4% from 2019 to 2023. This growth is primarily driven by the increasing global demand for sustainable, low-energy consumption solutions that are also cost-effective. As industries worldwide invest in technologies and processes aimed at reducing costs and enhancing operational efficiency, they are paving the way for the next stage of industrial evolution—Industry 4.0, which emphasizes the integration of digital technologies.

This shift has spurred significant innovation in both the products and systems used within the industry. For heat exchangers, this innovation is focused on developing superior designs that enhance thermal efficiency, thereby reducing energy costs and minimizing carbon footprints. The push towards more efficient and environmentally friendly solutions is shaping the future of the global heat exchanger market, aligning with broader goals of sustainability and technological advancement.



Primary Research, D&B Estimates

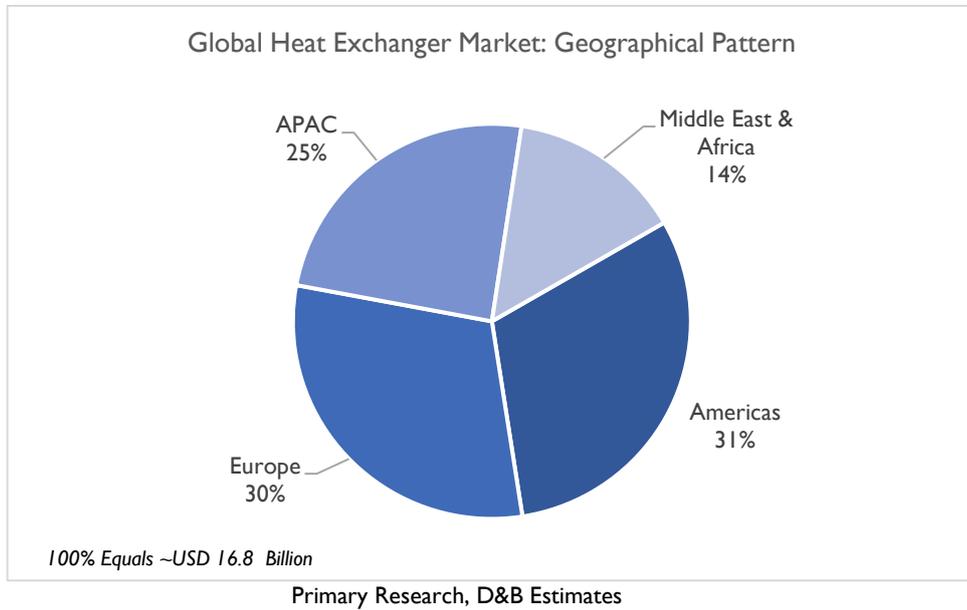
Traditionally, North America and Europe have been the strongest markets for heat exchangers, driven by their well-established industrial bases and rapid pace of innovation in manufacturing. However, the global landscape is shifting as manufacturing and industrial activities increasingly move from developed markets to emerging economies like China and India. This transition has positioned the Asia-Pacific (APAC) region as a key market for heat exchangers.

Large-scale industrialization in China, India, and Southeast Asian nations has led to a surge in demand for energy and infrastructure development, driving the need for heat exchangers across various sectors such as power generation, oil and gas, and chemical processing. The robust manufacturing base in these countries, coupled with expanding industrial sectors and significant public and private investments, has created a

<sup>4</sup> Calendar year 2023

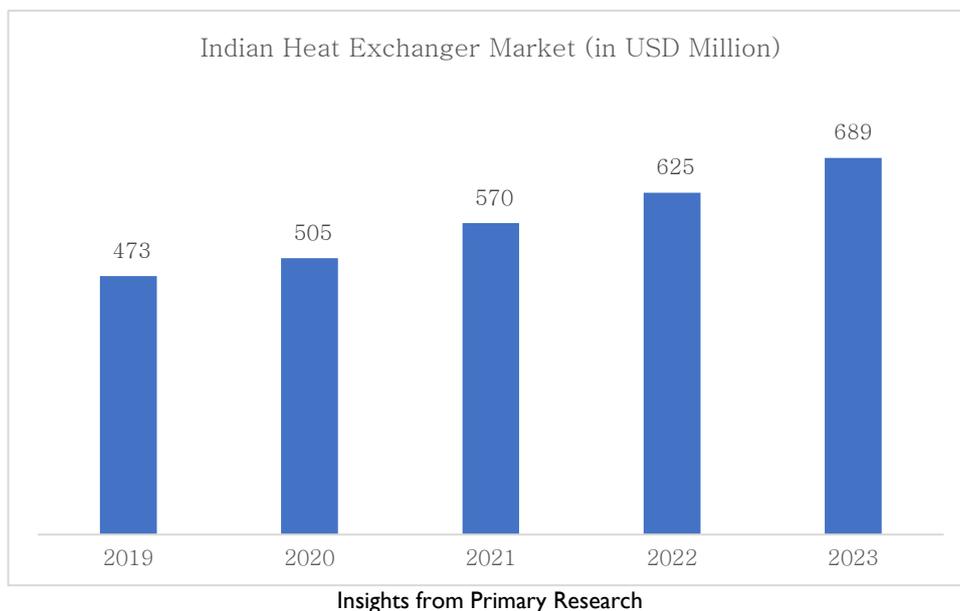
favorable market environment for heat exchangers in the APAC region, reshaping the global market dynamics.

This transformation has made APAC the fastest growing heat exchanger market. Between 2019 and 2023, the APAC heat exchanger market witnessed a compounded annual growth rate of 7.3%, higher than the growth that was registered in Americas and Europe.



## Indian Heat Exchanger Industry

The Indian market for heat exchanges reached USD 689 million per annum in 2023, the annual industry turnover increasing by a CAGR of 10% between 2019 and 2023. The heat exchanger industry too was impacted by the spread of the Covid-19 pandemic, as annual revenue growth in the industry slowed to 6% in 2020. Demand has recovered in the subsequent years, helping the industry grow its revenue by an average of 11% per annum in 2021, 2022 and 2023.



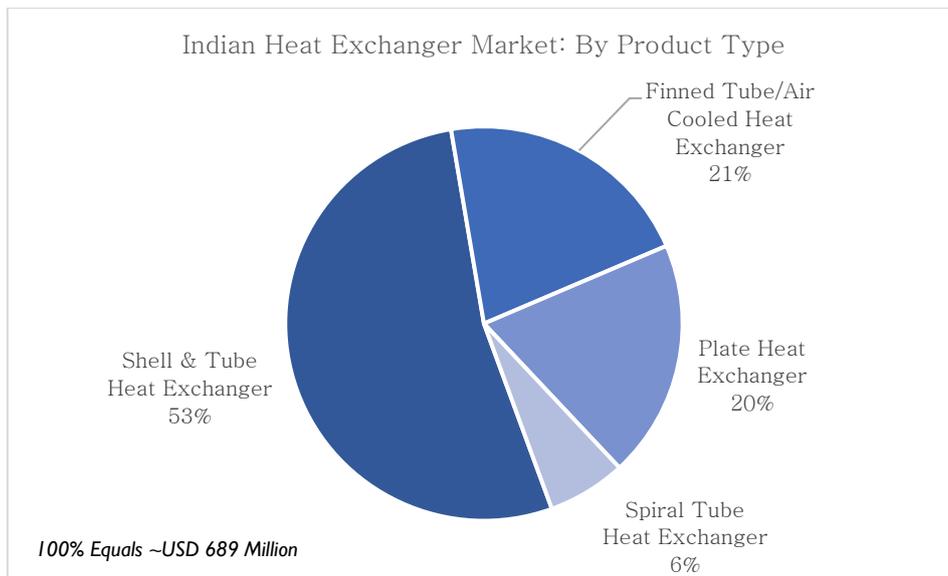
The demand for heat exchangers has been accelerated by rapid industrialization, urbanization, and a strong push for infrastructure development. These factors have contributed to significant annual revenue growth in the industry. The widespread application of heat exchangers across major industry segments ensures that increased industrial activity and positive economic sentiment directly boost demand for the product.

Beyond these direct demand drivers, the growing emphasis on efficient energy usage to reduce carbon emissions is emerging as a crucial indirect driver. Heat exchangers, with their ability to facilitate efficient heat transfer, play a key role in optimizing energy consumption. Given the predominant reliance on hydrocarbon energy sources, improvements in energy efficiency directly contribute to lower carbon emissions. As a result, heat exchangers are poised to play a vital role in India's journey towards sustainable development.

### By Type of Heat Exchanger

Shell & tube heat exchanger, followed by finned tube heat exchanger is two of the largest product segments in Indian heat exchanger industry in 2023. Shell & tube heat exchangers accounted for nearly 53% of the total industry revenue while finned tube heat exchangers accounted for nearly 21%. Between 2020 and 2023, revenue growth in shell & tube exchangers and finned tube heat exchangers has grown by a CAGR of approximately 11.4% and 10.7%.



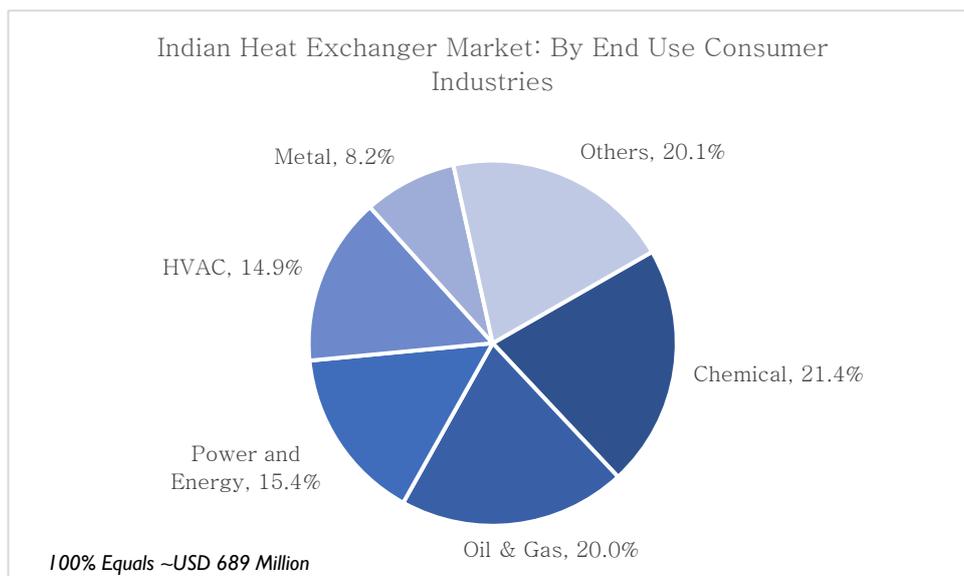


Insights from Primary Research

### By End Use Industries

Chemical manufacturing and oil & gas industries are the two largest consumers of heat exchangers in India, with each accounting for nearly one-fifth of total industry turnover in 2023. Other key end-use consumers are power & energy, HVAC, and metallurgy. Together, these five industries contributed to 80% of the heat exchanger industry revenue in 2023.

High demand for heat exchangers within the chemical industry as chemical industry frequently involves processes that necessitate precise temperature control, efficient cooling, and heat transfer. Therefore, heat exchangers play a crucial role in facilitating these operations. In addition, after COVID 19 chemical and pharmaceutical industry expanded significantly which in turn have helped generate demand for heat exchangers.

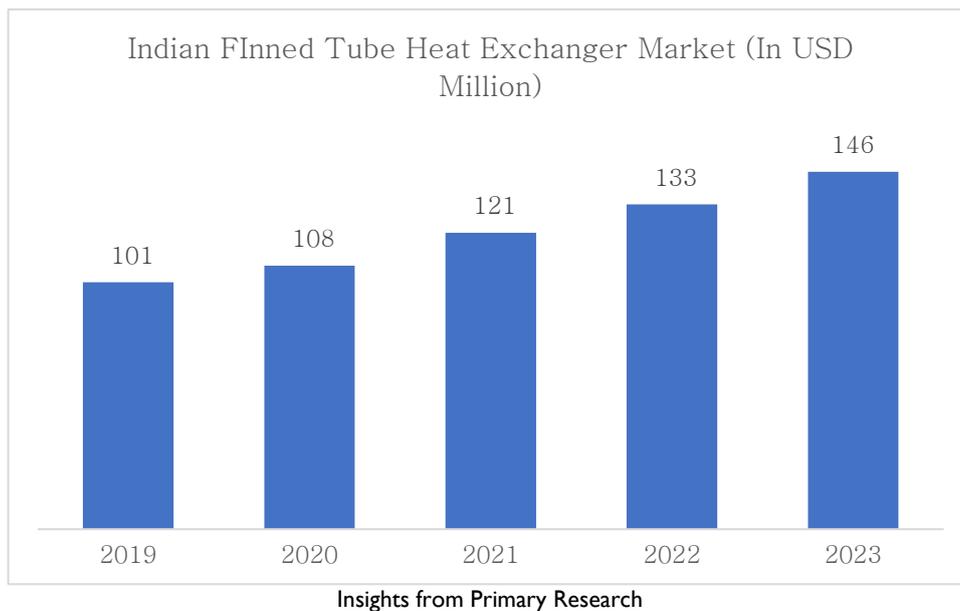


Primary Research, D&B Estimates, Others – food & beverage and paper & pulp are the notable inclusions.



## Finned Tube Heat Exchanger

Finned tube heat exchanger is the second largest product segment in the Indian heat exchanger market, accounting for nearly one fifth of the overall industry revenue. In 2023, finned tube heat exchanger segment realized an annual revenue of USD 146 million, increasing by a CAGR of nearly 10.7% between 2020 and 2023. The increasing demand for energy efficient cooling applications is one of the key factors that is driving the demand for finned tube heat exchanger. Moreover, the compact nature of finned tube heat exchanger is also an added advantage – because of the lower space requirement and lower cost, when compared to other product types.



Copper finned tubes are the preferred material used in finned tube heat exchangers that are used for heat exchanger applications like condensers, evaporators, chillers, oil coolers etc – mainly for all kind of cooling & heating applications. The preference for copper material is because of its superior heat transfer rate, resulting in faster cooling.

Heating, Ventilation, air conditioning (HVAC) and refrigeration are the key end use applications that are driving the demand for finned tube heat exchangers in Indian market. In refrigeration applications, heat exchangers are used as condensers or evaporators, with finned tube and plate heat exchangers finding usage. Finned tube heat exchangers are the most commonly used heat exchangers in HVAC systems, where it is used to exchange heat between air and the refrigerant / coolant. In addition, shell & tube type heat exchangers and tube-in-tube heat exchangers also find application in HVAC segment.

### Heat Exchanger Usage in HVAC Systems

Heat exchangers are an integral part of the refrigeration cycle in a HVAC system. Heat exchangers, being a cold source of the central refrigeration system, can be used on the heat condenser cycle or in the evaporation refrigeration cycle. Typically, a refrigerant system comprises of one compressor, one condenser, one expansion valve and one evaporator: wherein the condenser and evaporator both act as heat exchangers. In



the evaporator the refrigerant absorbs the heat of the water, so that it remains chilled. On the other hand, in the condenser the refrigerant rejects that heat and the compressor heat to other media which is usually air or water.

The efficiency of the whole system can be increased by integrating heat exchangers with other refrigeration equipment. For example, reducing energy consumption of condensers by feeding the condensers with refrigerating fluids and gasses reduced in temperature.

Applications of heat exchangers for refrigeration can be found across diverse sectors wherever cooling or heating of different mediums such as water, coolant, gases and ammonia is required. For example, in the food industry heat exchangers are generally used for preserving the quality and for sanitizing processes. They are used to heat water to sterilize food or increase their temperature to decontaminate them or improve the longevity by quick freezing process. In the metallurgical industry, heat exchangers are used for optimizing the processes related to change in water temperature as it is used to cool the water metal molds and presses which release high levels of heat.

The Indian refrigeration equipment market is undergoing rapid development on the back of increasing household income, lower penetration, rapid urbanization and gradual shift towards nuclear families among others. It is further supported by introduction of innovative models and easy availability of consumer financing for home appliances. Advanced technology related to frost free, inverters, energy saving capabilities etc. is playing an important role in the purchasing decision of the consumer. Presence of well-established domestic and international players have led to intense competition leading to a wide range of options for the consumer. Further, the convenience of buying has become easier with heavy discounts and festive offers on e-commerce platforms.

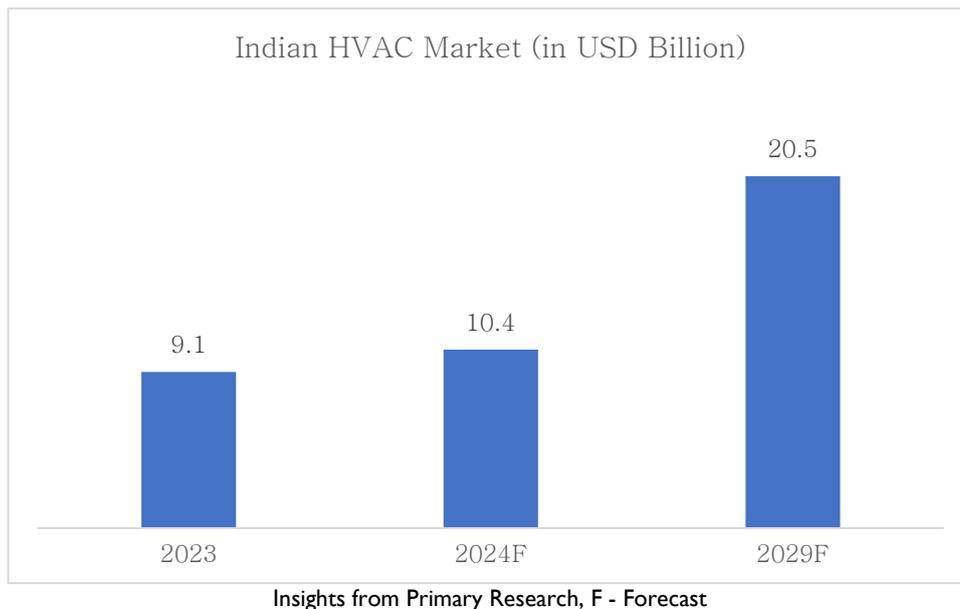
## Demand from HVAC Segment

In HVAC segment, heat exchangers are used for heating, cooling, heat recovery, dehumidification, and moisture control. The focus on creating energy efficient buildings and systems has magnified the importance of heat exchangers in a HVAC system, as deploying of heat exchangers is one of the preferred techniques to reduce energy usage as well as cut back on greenhouse gas emissions. Thus, heat exchanger finds application across HVAC industry, from residential HVAC systems to large scale industrial HVAC systems.

## Indian HVAC Market

Indian HVAC market generated an annual turnover of approximately USD 9.1 billion in 2023 and it is expected to grow by a CAGR of 14.5% till 2029 to reach USD 20.5 billion. Traditionally, commercial, and industrial applications used to lead the HVAC industry in the country. However, beginning 2000 the usage of HVAC system in residential segment, and mobile / transport application has started becoming mainstream. Substantial increase in income levels and aspirational changes drove HVAC demand in residential / retail consumer segment. Meanwhile in traditional industrial and commercial segments, the rapid expansion in office space as well as industrialization ensured the demand for HVAC remain strong.





The HVAC market in India experienced a shift towards energy-efficient systems, driven by rising energy costs and environmental concerns. The government's initiatives to promote energy efficiency, such as the Energy Conservation Building Code (ECBC) and the Standards and Labelling (S&L) program, played a crucial role in driving the adoption of energy-efficient HVAC systems.

Additionally, there is a growing awareness of indoor air quality and the need for improved ventilation and air purification, leading to increased demand for HVAC systems that can address these concerns. The industry is witnessing a shift towards technologically advanced HVAC solutions, including smart controls, remote monitoring, and energy management systems, providing enhanced comfort and energy efficiency.

The sectors that employ HVAC systems most in India include commercial buildings, hospitals, hospitality (hotels and restaurants), retail spaces, educational institutions, and industrial facilities. These sectors require efficient HVAC systems to maintain comfortable and healthy indoor environments for occupants.

The Indian government's focus on infrastructure development, smart cities, and sustainable building practices further boosts the demand for HVAC systems. Initiatives like Make in India, promoting domestic manufacturing, have also contributed to the growth of the HVAC industry by encouraging local production and reducing dependency on imports.

### Emerging Trends in Indian HVAC Industry & Impact on Heat Exchangers

The HVAC market in India is on a strong growth trajectory, fueled by rapid urbanization, rising disposable incomes, and the increasing need for energy-efficient solutions amidst changing climatic conditions. The shift towards smart HVAC systems is becoming a key trend, with consumers prioritizing intelligent solutions that offer enhanced controls, real-time monitoring, and IoT integration. This is further amplified by technological advancements, such as variable refrigerant flow (VRF) systems and predictive maintenance driven by machine learning, which are enhancing energy efficiency, reducing operational costs, and contributing to sustainability in both residential and commercial segments.



Government initiatives like the 'Make in India' campaign, Atmanirbhar Bharat, and Production Linked Incentive (PLI) schemes are bolstering local manufacturing, reducing import dependency, and supporting the nation's goal of achieving carbon neutrality by 2070. Moreover, the significant government investment of USD 1.45 trillion in infrastructure over the next five years is expected to drive unprecedented growth in the sector. The projected increase in the number of Indian cities with populations exceeding one million by 2030, alongside the anticipated construction boom, underscores the vast potential for the HVAC market. The growing emphasis on green building certifications like LEED and GRIHA further creates opportunities for the adoption of energy-efficient HVAC systems. Additionally, the rise of aftermarket services, including maintenance, retrofitting, and upgrades, presents new avenues for HVAC service providers and contractors, making the Indian HVAC market a compelling landscape for both local and international players.

### Demand for HVAC system from Infrastructure Expansion

The rapid expansion of infrastructure in India, including the construction of 80 new airports and the significant growth in office spaces, shopping malls, and hotels, is set to dramatically increase the demand for HVAC systems. This surge in infrastructure projects, driven by key investments from major players like DLF, Parikh, Blackstone, Lulu Group, and ITC, underscores the growing need for advanced MEP (Mechanical, Electrical, and Plumbing) systems. Mega projects such as the 1 million square feet office space for Standard Chartered, the DLF Downtown project in Chennai, and the 2.5 million square feet mall in Gurugram are just a few examples highlighting this trend.

Moreover, with the Government of India's commitment to investing INR 6,209.2 Crores for airport infrastructure development by 2030, the demand for HVAC systems is poised to grow substantially. India's 131 operational airports, along with the planned additions, will require extensive HVAC systems to meet the increasing air travel demand, thereby boosting the market for essential components like heat exchangers. As these systems are crucial for efficient heating, cooling, and ventilation, the ongoing and future infrastructure developments in the commercial and airport sectors will be pivotal in driving the HVAC market forward in India.



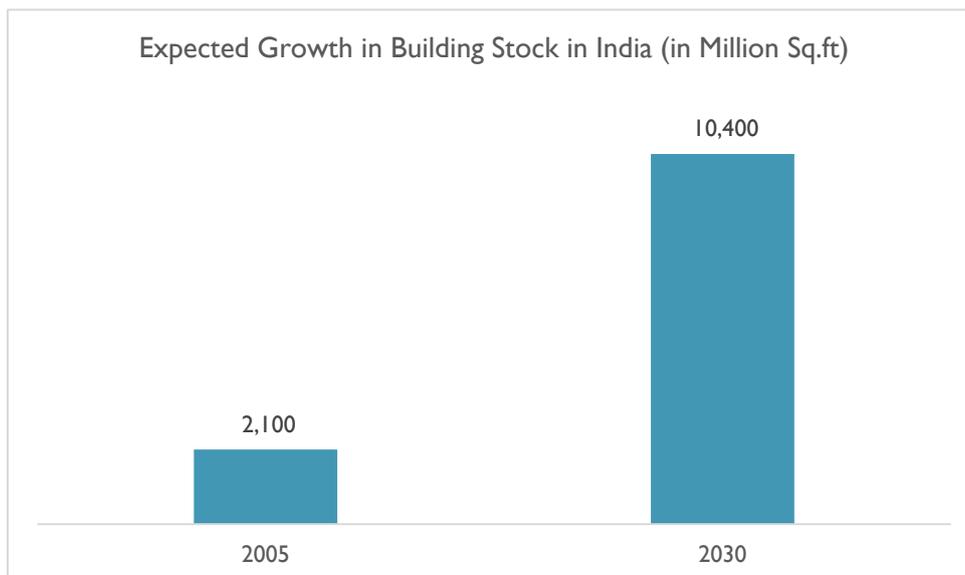
## Demand for HVAC system from Building Segment

Building sector is the key demand driver for HVAC systems, with adoption level spread across residential, commercials, industrial and infrastructure sub sectors. Apart from ensuring comfortable conditions, HVAC usage is also gaining traction because of the need to improve energy efficiency. Thus, a growth in building stock - backed by regular addition of new building - plays a direct role in promoting the demand for HVAC system. At present buildings account for approximately 20% of energy usage in India, with the share as high as 31% in commercial buildings. With Indian Government promoting efficient energy usage, the need for installing HVAC system that optimise energy usage has become important now. Against this rising demand, the current penetration of HVAC system in Indian building sector is less than 5%.

Such a low penetration of HVAC system in Indian building segment, along with pressing need to optimize energy usage in building sector points towards an aggressive growth in HVAC adoption in the coming years. It is this scenario that has promoted many industry players and associations to paint an optimistic growth forecast - with several stakeholders predicting a compounded growth rate in the range of anywhere between 15 to 30% during this decade. This optimistic demand scenario bodes well for finned tube heat exchanger, which is the most prominent heat exchanger used by the HVAC industry.

### Growth in Building Stock in India:

The total building stock in India (residential & commercial) which stood at nearly 2,100 million square meters in 2005 is expected to reach approximately 10,400 million square meters by 2030, increasing by a CAGR of 6.6%<sup>5</sup>. This growth in overall building stock is expected to translate into higher demand for HVAC. The demand will be driven not only by the growth in volume of building stock, but by the increasing need for developing energy efficient buildings. This growth in building stock would be driven by aggressive growth in office space (commercial segment), and residential segment.



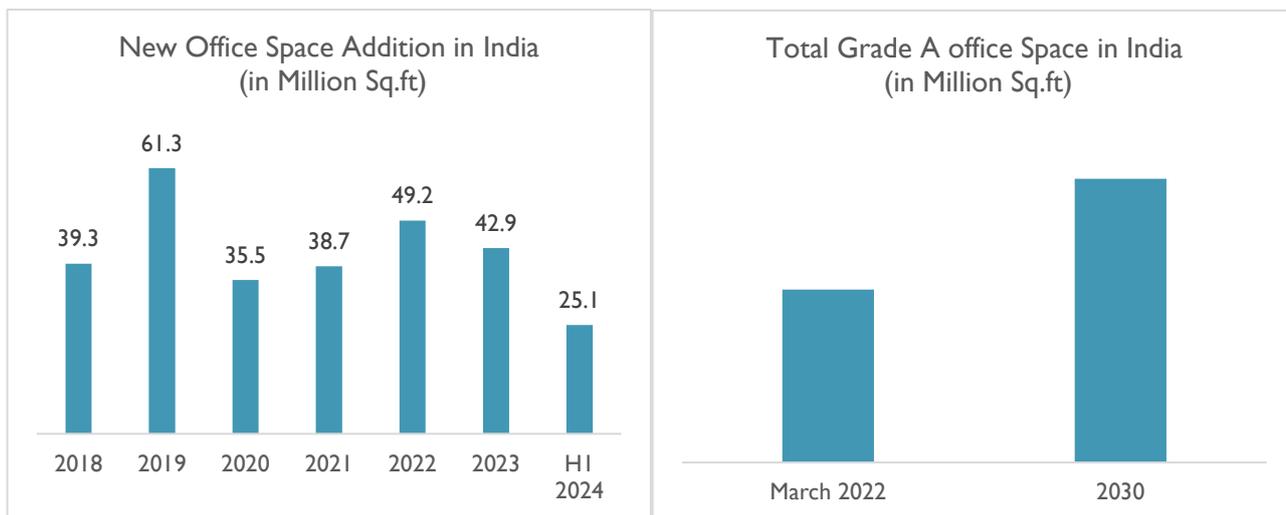
<sup>5</sup> Findings by PACE-D TA Program

Although both these segments would drive the growth in building stock, the commensurate demand for HVAC will be mostly come from commercial segment. This is because, energy usage for heating & cooling application accounts for nearly 30% of energy usage in commercial building while it is less than 10% in the case of residential building. As a result, the need for superior HVAC system to improve energy efficiency would be higher in commercial real estate sector.

### Indian Commercial Real Estate: Current Scenario & Growth Prospect

Indian commercial real estate space is dominated by office space, and absorption of office space sets the tone for demand in Indian commercial real estate market. HVAC system is an integral part of modern office space, and any expansion in office space (in terms of new addition) will create a direct demand for HVAC systems.

It is estimated that HVAC systems account for nearly 30% of energy consumed by a commercial building. Given the ongoing focus on optimizing energy usage & reducing carbon footprint, there is an increasing demand from the commercial real estate segment for superior HVAC systems.



Industry Sources (Knight Frank, JLL)

In 2023, 42.9 million sq. ft of office space were completed, marking a 13% decrease compared to the previous year. However, the second half of 2023 saw improvement, with 24.8 million sq. ft delivered, reflecting a 7% year-over-year growth. The growth was particularly remarkable in 2022, with approximately 49.4 million sq. ft of office space added across the top 8 cities in India, a 27% increase from 2021. After a significant decline in new capacity additions in 2020 due to pandemic-induced disruptions, construction activity in the commercial real estate segment almost normalized in 2022. As the corporate sector gradually shifts from work-from-home to hybrid and eventually to regular office-based work, the demand for office space is picking up.

This surge is driven by the returning workforce, increased economic activity, and positive growth forecasts, which have heightened the demand for innovative office spaces. Following the decline in office space additions in 2023, the trend reversed in 2024. In the first half of the year, 25.1 million sq. ft of office space were added,



representing a 39% increase compared to the same period in 2023. According to JLL, Grade A office space<sup>6</sup> in India is expected to reach 1.2 billion square feet by 2030, up from nearly 732 million squares feet in 2022.

The strong growth in office space construction in 2023 has directly driven robust demand for HVAC systems. This development is promising for finned tube heat exchangers, the preferred type used in HVAC systems. Furthermore, the anticipated strong growth in Grade A office spaces points to stable long-term demand for HVAC systems, and consequently, finned tube heat exchangers, from the commercial real estate sector.

The increasing workforce, along with the influx of multinational corporations (MNCs) and Global Capability Centers (GCCs), will further impact the commercial real estate market. As more companies establish and expand their offices, the demand for high-quality office spaces will rise. This, in turn, will lead to increased construction activity, driving further demand for HVAC systems. The expanding workforce and presence of MNCs and GCCs will thus play a crucial role in sustaining and boosting the demand for HVAC systems and finned tube heat exchangers in the commercial real estate market.

### **Indian Residential Real Estate: Current Scenario & Growth Prospect**

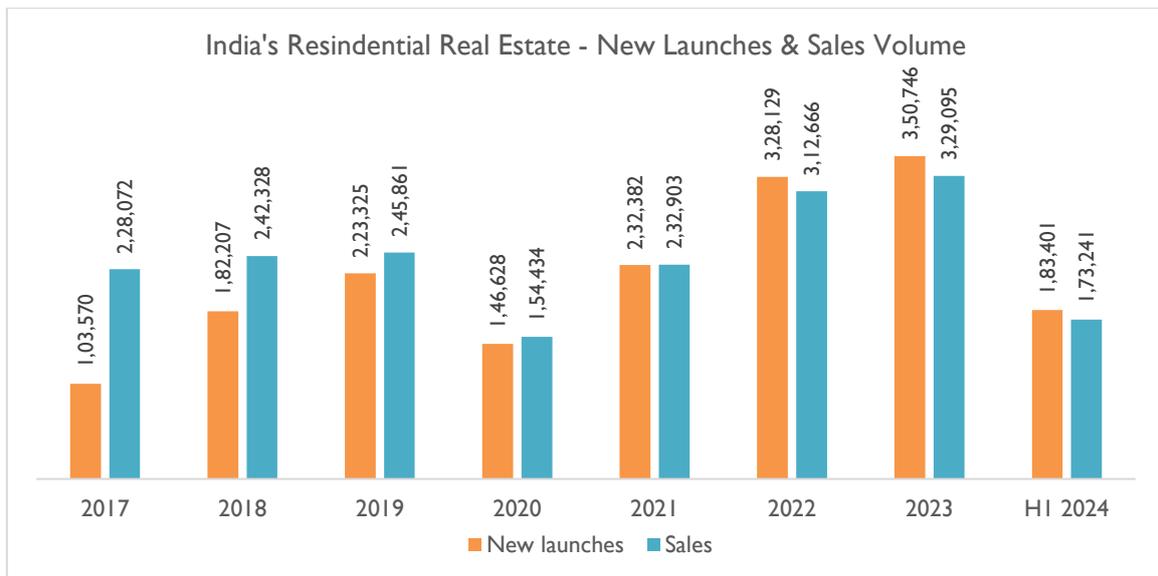
For India's real estate sector, 2023 was the year of a new high. Both home sales and new launches improved significantly, and this strong momentum will most likely last through 2024, with sales doing even better than in 2022, which were higher than in 2014. The year 2023 (January-December) witnessed unprecedented growth in residential sales in India and recorded 3,59,746 launches of housing units and sales of 3,29,097 units. This shows a y-o-y increase of whopping 7% and 5% respectively. Of the total sales of residential units in 2023, 61% were dominated by three cities: Mumbai, NCR and Bengaluru. The trend is similar in H1 of 2024 as 183,401 of housing units have launched and sales for the same period was 173,241 units both sales and launches increased by 6% and 11% from H1 2023 respectively.

During 2021, 232,382 new residential units were launched across the top 8 cities, highest since 2016, registering a robust growth of 58.5% y-o-y. During the year, number of residential units sold reached 232,903, up by 50.8% compared to previous year.

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<sup>6</sup> Most sought-after office space, mostly new or recently developed in key business locations.





Source: Knight Frank Report on Indian Real Estate Sector (Statistics for Top 8 Cities in India)

Increased savings during lockdowns, minimal income disruptions for mid and high-income brackets, and a robust economic growth forecast have fuelled demand in India's residential real estate market. Additionally, the upward trend in house prices since 2021 has created a positive sentiment among prospective buyers, boosting sales. The resurgence in demand has accelerated residential development, with both half-yearly and annual volumes of units launched reaching ten-year highs. Notably, launch volumes in 2022 and 2023 exceeded sales for their respective periods, a rare occurrence that has only happened three times in the past decade.

The residential market continues to strengthen, with sales volumes at a ten-year high, unaffected by underlying fundamentals. Sales levels remained resilient despite concerns over growing inflation, high interest costs, and slowing economic growth. The industry is consolidating, with residential developments increasingly being managed by stronger developers who have weathered the economic challenges posed by the pandemic.

**For heat exchanger & HVAC segment, the demand from residential segment arises from the cooling / temperature control requirements. Most of the new apartments coming up in metros have extensive HVAC systems built in. Depending upon the building / apartment, HVAC system could be either centralized or decentralized. These HVAC systems are responsible for regulation of heat, airflow, air conditioning, and ventilation in apartments. Hence a growth in build up space in residential real estate segment would convert to market opportunities for HVAC system (and by extension finned tube heat exchanger).**

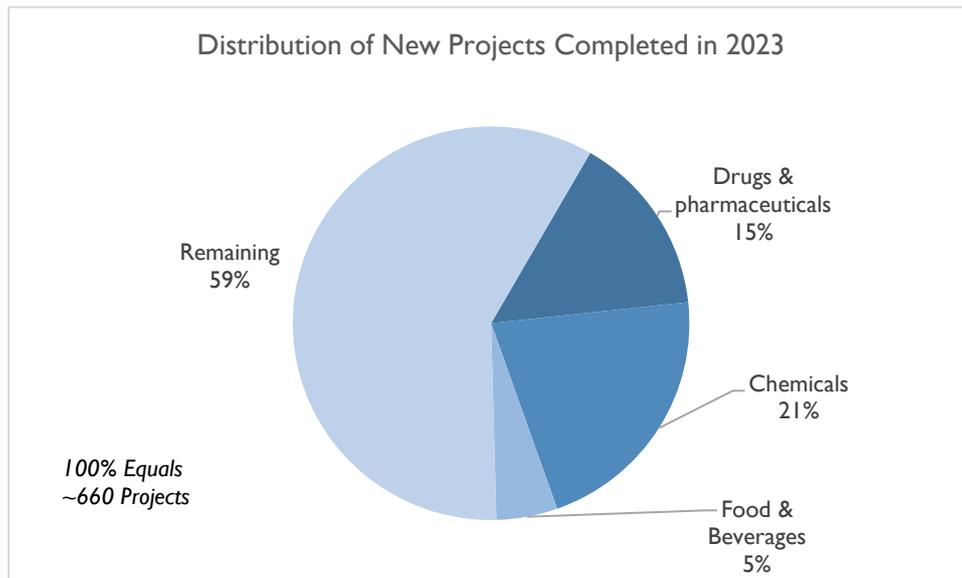
#### Demand for HVAC system from Industrial & Segment

In a manufacturing plant, HVAC system is used for controlling humidity, temperature, and air quality – for improving the working condition of employees as well as maintaining the optimum ecosystem that supports the manufacturing process (especially in industries like pharmaceuticals etc). Industrial air conditioning is most



crucial in sectors like pharmaceuticals, food & beverage, electronic manufacturing, and medical equipment manufacturing.

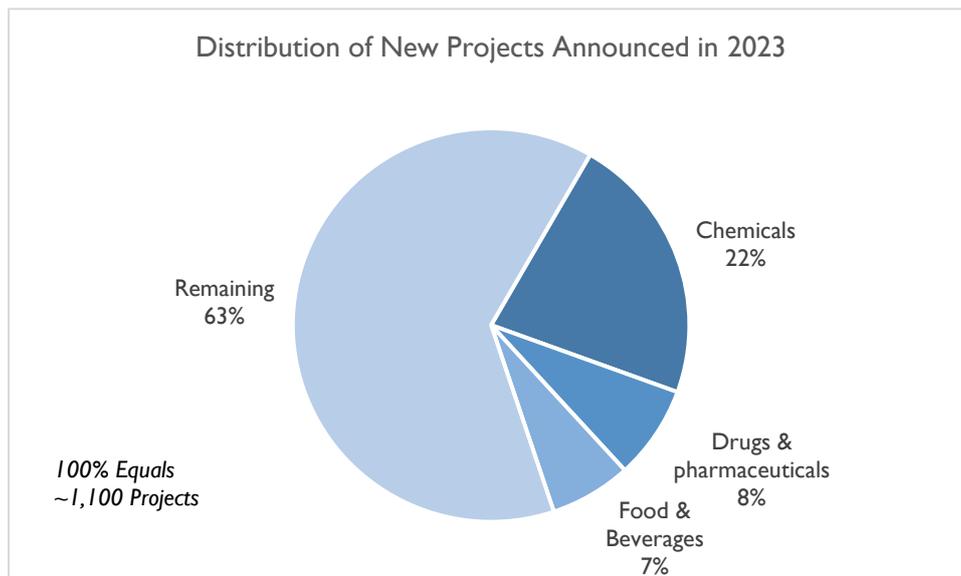
The capex growth in manufacturing – which indicates the new projects coming up in the space – is a key indicator of HVAC demand emerging from manufacturing sector. In 2023, nearly 660 projects were completed in manufacturing sector – ranging from setting up pharmaceutical plants to agriculture machinery manufacturing unit. Of these Pharmaceuticals and chemicals – two of the sectors where HVAC deployment is crucial – accounted for nearly 36% (approximately 175) projects. Such a strong capacity addition in pharmaceutical and chemical manufacturing space have benefitted the HVAC industry.



Center for Monitoring Indian Economy Database

Approximately 1,100 new projects have been announced in the manufacturing sector with nearly 390 - 400 projects coming up in chemical manufacturing, drugs & pharmaceuticals and food & beverage space alone. All these projects were announced in 2023, and its execution is expected to happen in the coming years. These upcoming projects is an indication of new capacity (in the form of brownfield & greenfield facilities) coming up in manufacturing space. Since setting up of a new space is accompanied by the deployment of HVAC, the strong project pipeline indicates a stable growth demand forecast for HVAC system from industrial segment.





Center for Monitoring Indian Economy Database

Indian manufacturing landscape is witnessing a rapid transformation, especially on the infrastructure front. Through a series of policy measures – like Make in India, and Production Linked Incentive (PLI) scheme – Indian Government is attractive corporate sector to set up manufacturing facilities in India. The attractive regulatory policy measures are designed to attract both domestic and multinational industrialists. As these policy measures gains traction, there would be a commensurate increase in the number of new manufacturing plants coming up in the country, which bodes well for HVAC demand emerging from industrial segment.

**Hence, apart from existing pipeline of new projects, supportive policy measures like Make in India, and PLI scheme is expected to enrich the new project pipeline. This would translate into a stable long-term demand for HVAC systems from industrial segment.**

### **Demand from Pharmaceutical Sector**

Indian pharmaceutical industry is ranked as the third largest in the world, in terms of volumes of drugs manufactured and thirteenth largest, in terms of value. The country holds a dominant position as the world's largest provider of generic medicines, accounting for 20% of the global supply by volume, and is also the leading vaccine manufacturer worldwide. Additionally, the pharma companies have been expanding their footprint in global markets. Strategic acquisitions, partnerships, and compliance with international quality standards have enabled Indian firms to increase their exports, thereby enhancing their revenue streams. Increased investment in research and development (R&D), innovation in drug formulations, and the development of new therapeutic segments have also driven industry growth. The focus on biopharmaceuticals, vaccines, and biosimilars has opened new revenue channels.

India's strong position in generic drug manufacturing has been a major growth driver for the pharmaceutical industry. With patents expiring on several blockbuster drugs globally, Indian pharmaceutical companies have capitalized on the opportunity to produce and export cost-effective generic alternatives, boosting turnover. Between FY 2019 – FY 2024, annual turnover in the Indian Pharmaceutical Industry increased at a CAGR of

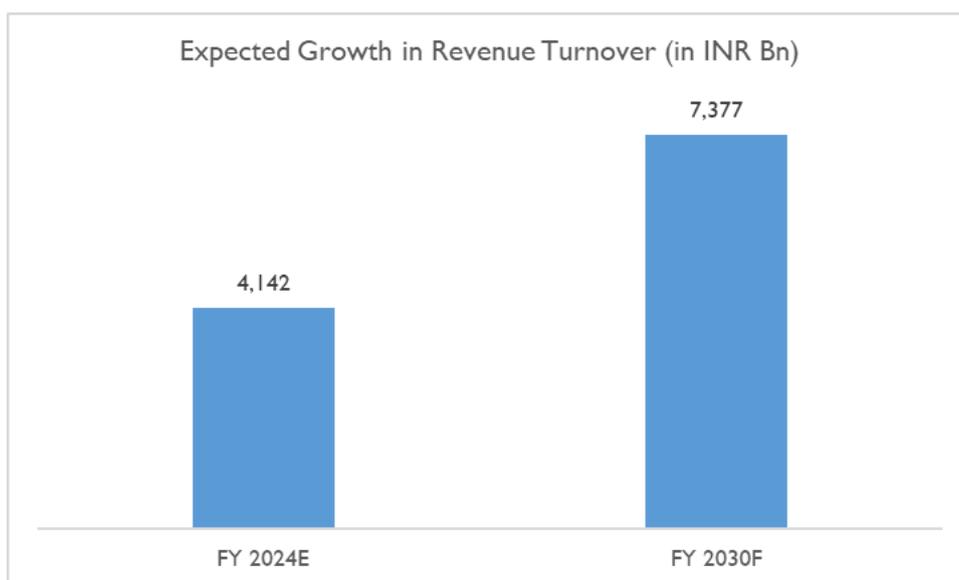


9.9% to grow to INR 4,142 Bn in FY 2024 and is projected to grow at CAGR of 10% till FY 2030 to reach INR 7,377 Bn. As a major global exporter, India serves over 200 countries with its pharmaceutical products. The country holds a dominant position as the world's largest provider of generic medicines, accounting for 20% of the global supply by volume, and is also the leading vaccine manufacturer worldwide.

India boasts the highest number of US-FDA compliant pharmaceutical plants outside the United States and is home to more than 3,000 pharmaceutical companies. This robust industry is supported by a vast network of over 10,500 manufacturing facilities and a highly skilled workforce.

Moreover, India is actively working towards establishing a comprehensive policy framework that encompasses various aspects, including intellectual property rights, technology commercialization, government procurement, and scientific research. For instance, in response to the COVID 19 pandemic, the Department of Biotechnology and the Biotechnology Industry Research Assistance Council (BIRAC) collaborated to establish the 'DBT BIRAC COVID 19 Research Consortium. This initiative supports indigenous research solutions for combating COVID 19. Additionally, the 'Mission COVID Suraksha - The Indian COVID 19 Vaccine Development Mission' was introduced as part of the Atmanirbhar Bharat 3.0 stimulus package. Its objective is to promote Indian vaccine research and development, enhancing the nation's capacity to address pandemic challenges and achieve self-sufficiency. This effort includes increasing the production of essential drugs like Remdesivir, vitamins, minerals, and other supplemental products, as well as manufacturing made in India vaccines to fight COVID 19.

By FY 2030 the annual turnover in Indian pharmaceutical industry is expected to reach USD 130 billion. The growth in pharmaceutical industry would be driven by an increase in production of bulk drugs, key starting materials, and formulations. The expansion in production capacity, together with upgradation of manufacturing capability would create strong demand for capital goods, including heat exchangers.



Industry Sources



## **Demand from Food & Beverage Segment**

Food & beverage (F&B) industry in India contributes to nearly 3% of nation's GDP and is an integral part of Indian economy. F&B sector underwent a transition, with demand shifting to packaged & processed food. This shift in demand created the necessity to set up state of the art F&B manufacturing plants. Over the past decade, India has witnessed a rapid growth in the number of products units dedicated for manufacturing a whole variety of food products. These new plants range from large units to small units in MSME sector. Apart from domestic demand, the growth in export of processed foods has also helped in this growth of manufacturing infrastructure.

The domestic food processing segment is projected to grow from USD 261 billion in FY 2021 to USD 470 billion by FY 2025. The F&B industry contributes 3% to India's GDP and represents approximately two-thirds of the country's overall retail market. By 2027, the market size is anticipated to reach nearly USD 504.92 billion. Additionally, the F&B sector supports the livelihoods of more than 7.3 million people, making it the single-largest employment space in India.

This growth in F&B manufacturing infrastructure in India has helped in stimulating demand for HVAC system, which is integral to create a sanitized space to produce food products. As the production of processed food & beverages increased, so did the demand for refrigeration & cold chain equipment. In addition, F&B manufacturing workspace also need to maintain superior air quality, which requires the necessity of air filtration, controlled ozone treatment, and other similar processes. Thus, HVAC system plays a huge part in ensuring both air quality, and refrigeration conditions required to manufacturing F&B products.

## **Demand from Chemical Manufacturing:**

Heat exchangers are used in the chemical processing industry on account of their properties such as design flexibility and high corrosion resistance which provide them with the ability to handle a variety of fluids. Heat exchangers are necessary for nearly every process that involves solvent condensation, hydrocarbons cooling and reactor heating and cooling in the manufacturing of chemicals and petroleum. These products are now becoming highly efficient, and the need for sophisticated heat exchangers that can improve efficiency is gaining pace.

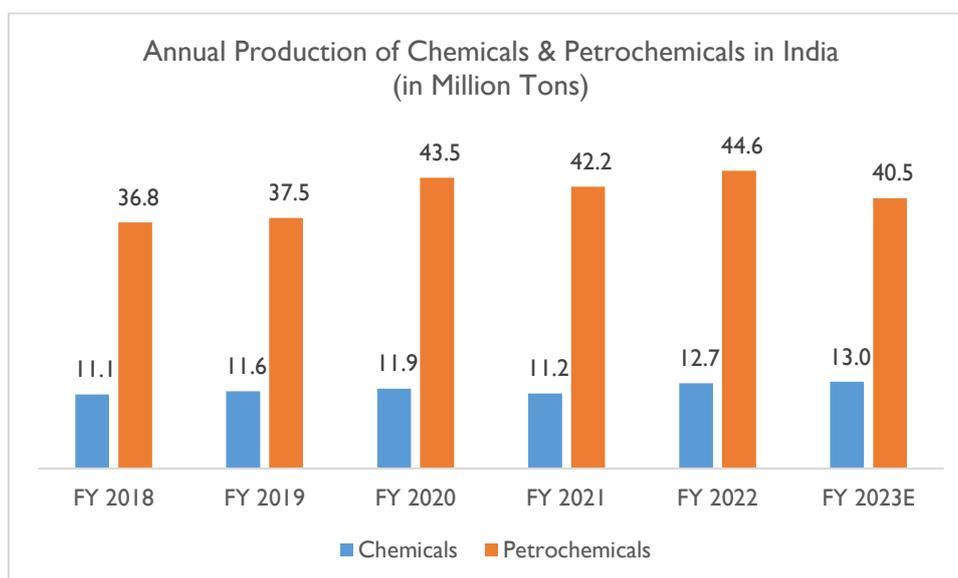
Indian chemical market holds a prominent position globally and is ranked sixth worldwide, in terms of the global sales of chemicals. India's chemical sales account for 2.5% of the global market with exports reaching over 175 countries. According to the Indian Chemical Council, India is expected to account for more than 20 percent of the incremental global consumption of chemicals over the next two decades. Moreover, with an increasing domestic output which is projected to rise from USD 232.8 billion in 2022 to USD 304 billion in 2025 and eventually reaching USD 1,000 billion by 2040.

The strong industry dynamics is playing out in petrochemical sector too. Rapid industrialization has created strong demand for almost all the petrochemical products. Polymers, which forms an integral part of the



petrochemical industry, is witnessing a demand boom – on the back of higher demand for consumer and industrial end use applications.

In FY 2023, approximately 13 million tons of chemicals were manufactured in India while the volume of petrochemicals manufactured were nearly 40.5 million tons. During FY 2018 – 23 period, volume of chemicals and petrochemicals manufactured in India grew by a CAGR of nearly 3% and 2% respectively



Primary Research, D&B Estimates

Private and public players are investing heavily in the petrochemical sector. In 2021 Nayara Energy announced plans to establish 15-20 new petrochemical plants in India within a decade, aiming to meet the growing demand for raw materials in the plastics and textiles industries. Additionally, Bharat Petroleum Corporation (BPCL) expressed its intention to invest USD 4.05 billion in enhancing petrochemical capacity and refining efficiencies over the next five years. An estimated investment of INR 8 lakh crore (USD 107.38 billion) is projected for the Indian chemicals and petrochemicals sector by 2025.

Moreover, the government of India has set a vision for 2034 actively pursuing opportunities in the petrochemical sector. With the projected growth of the petrochemical market in India, there will be a significant increase in the demand for heat exchangers in the forthcoming years as heat exchangers play a crucial role in various stages of the petrochemical industry, including heat recovery systems and the production of final petrochemical products.

#### Demand from Warehousing: Cold Storage

In logistics sector, heat exchangers find application in HVAC system that are deployed in storage as well as transport infrastructure. The requirement is highest in cold chain industry (comprising of temperature-controlled storage as well as temperature-controlled truck/ transport vehicles).

The total warehousing stock in India, including Grade A and B, across eight major cities reached 371 million sq. ft by the end of 2023, up from 329 million sq. ft the previous year. This represents a 15% year-on-year



growth in warehousing space in these top cities. Notably, more than half of this warehousing stock is concentrated in the three largest cities—Delhi NCR, Mumbai, and Bengaluru. India's warehouse stock is projected to grow at a CAGR of 12% over the next three years, reaching 595 million sq. ft by 2027.



There are nearly 8,653 cold storage facilities in India, with capacity of 394.17 Lakh MT and nearly 36% having storage capacity less than 1,000 tons. Meanwhile the demand for cold storage facilities is nearly ten times the existing infrastructure. The increasing focus on agro processing industry and growing demand for food products is creating this demand. According to the Ministry of Food Processing Industries, as on 31<sup>st</sup> Dec 2022, cold storage capacity of 8.38 lakh MT has been created under the Scheme for Integrated Cold Chain and Value Addition Infrastructure.

Apart from the deficit in capacity, the existing cold chain infrastructure in India is also skewed. Nearly 60% of capacity is concentrated in two states (Uttar Pradesh & West Bengal) while 75% of total capacity is dedicated to a single commodity (Potatoes)<sup>7</sup>. Thus, there is a strong requirement for expanding the capacity of the cold chain infrastructure as well as modernize it to make it suitable for storing the wide range of vegetables, horticulture, and meat products produced in the country.

As of June 2024, the Ministry of Food Processing Industries has approved 399 integrated cold chain projects, with 376 projects in various stages of implementation. Out of these, 269 projects are completed, and 107 are underway. The National Horticulture Board (NHB) supports this expansion through the 'Capital Investment Subsidy for Construction/Expansion/Modernization of Cold Storages and Storages for Horticulture Products' scheme, offering a credit-linked subsidy of 35% for general areas and 50% for

<sup>7</sup> Report by Ministry of Food Processing Industries, Confederation of Indian Industry & Yes Bank



Northeast, hilly, and scheduled areas for constructing cold storage facilities ranging from 5,000 MT to 10,000 MT.

Additionally, the Ministry of Food Processing Industries (MOFPI) administers the 'Scheme for Integrated Cold Chain, Value Addition, and Preservation Infrastructure' under the 'Pradhan Mantri Kisan Sampada Yojana.' This scheme aims to reduce post-harvest losses by providing financial assistance covering 35% of the project cost in general areas and 50% in Northeast and Himalayan states. For value addition and processing infrastructure, the grant rate is 50% and 75%, respectively, with a maximum grant-in-aid of ₹10 crore per project for setting up integrated cold chain projects, including irradiation facilities.

The robust policy-driven growth in cold chain infrastructure directly benefits the HVAC industry, which plays a crucial role in maintaining controlled temperatures. The ongoing large-scale additions in cold storage facilities indicate a sustained demand for HVAC systems, underscoring their importance in the expanding cold chain sector.

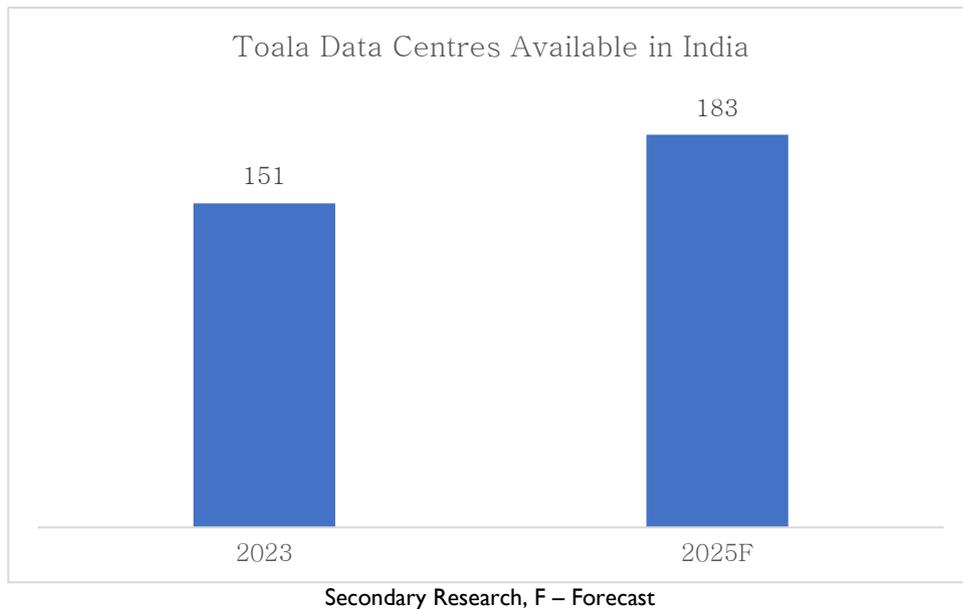
### Demand from Data Centers

Data centers are critical components of the information technology industry as voluminous amount of data is stored and distributed at regular intervals. However, the energy consumption of these data centers has increased rapidly with the advancements of high density and high-power large servers. It is estimated that cooling systems account for nearly 40% of energy consumption in a data center.

Globally nearly 1.3% of electricity consumption is accounted by data centers, with bulk of it going towards maintaining ambient temperature & air quality inside the premises. Consequently, efficient thermal management as emerged as a key factor in managing the cost and operations of the data centres. Heat exchangers enable HVAC system is used in data centers to ensure ambient temperature in the premise, which is integral to the smooth functioning of a data center.

As of 2023, India is currently the 14<sup>th</sup> largest data center market in the world, with nearly 151 data centers in operation. Penetration of internet, growth in internet subscribers, and large-scale digitization initiatives are all driving the demand for data centers. It is estimated that by 2025, the total number of data center in operation in the country will reach to 183. Such a strong growth would transform into higher demand for HVAC systems & heat exchangers used in HVAC systems.





The demand is primarily being driven by large players such as Amazon web services, Google, Microsoft, Facebook, IBM, Uber etc. that are outsourcing their storage needs to third party DC providers. Further, major Indian players such as Adani and Hiranandani are building data centre infrastructure with the help of technology partners through the co-location or colo model; in which the data centre players construct the various elements namely the building, power supply, cooling, physical racks, security and other support measures and the clients bring their own IT hardware and expertise. With high level of involvement from all major stakeholders i.e. government, Indian and global players, the future of data centre seems promising thus supporting the demand for heat exchangers in the coming years.

### **Demand from Transportation Segment**

Over the past nine years, the country has seen a significant expansion in its transportation infrastructure, reflecting a broader commitment to economic development. The national highway network has expanded by 60% to 145,240 km, with ambitious plans to reach 200,000 km by 2025. The Indian Railways has significantly upgraded its capacity, with new trains such as Vande Bharat and a dramatic increase in railway track construction from 1,452 km/year to 5,243 km/year. Air travel has also surged, with the number of airports planned to increase to 220 airports by 2025. Additionally, the government's focus on operationalizing 23 waterways by 2030 and developing 35 Multi-Modal Logistics Parks underscores its commitment to enhancing transportation infrastructure.

The transportation sector's growth is supported by substantial investments, with the Union government allocating 3.3% of the GDP towards infrastructure in FY24. The India Investment Grid (IIG) database highlights around INR 69 lakh crore worth of projects, predominantly in roads and highways, followed by railways and urban public transport. Private sector involvement is significant, with Build-Operate-Transfer (BOT) and Hybrid Annuity Mode (HAM) projects through Public-Private Partnerships (PPP) accounting for around 27% of the National Monetization Pipeline (NMP).



This massive expansion in transportation infrastructure will directly drive demand for HVAC systems. Modern transportation facilities such as airports, railways, and logistics parks require advanced HVAC solutions to maintain optimal conditions for both passengers and cargo. The growth in the aviation sector, with a projected increase in air passengers from 144 million in 2019-20 to 400 million by 2025-26, will further boost the demand for sophisticated HVAC systems in new and upgraded airports. Similarly, the significant investments in metro rail and railway network expansions will necessitate enhanced HVAC systems to ensure comfort and efficiency in transportation hubs and rolling stock.

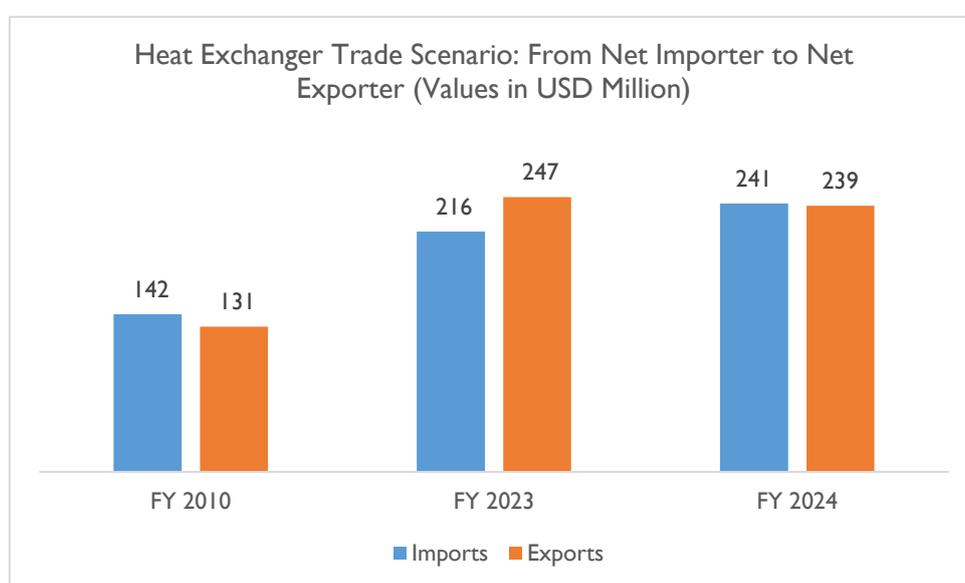
In summary, the ongoing transformation in India's transportation sector is set to drive substantial growth in the HVAC market, as modern infrastructure demands advanced temperature control solutions to support expanding passenger and cargo volumes.



## Trade Scenario<sup>8</sup>

India has historically been a net importer of capital goods, including heat exchangers. However, in recent years, the country has made notable progress in enhancing its domestic production capabilities. This improvement in technical and production capabilities allowed India to transition from being a net importer to a net exporter of heat exchangers, a status it maintained consistently for three financial years—2021, 2022, and 2023.

Despite this progress, fluctuations in import and export numbers are common. As of FY 2024, India has experienced a reversal and is once again a net importer of heat exchangers. This shift underscores the ongoing volatility in the market and the need for continued balance between domestic production and import requirements.



Source: Directorate General of Foreign Trade

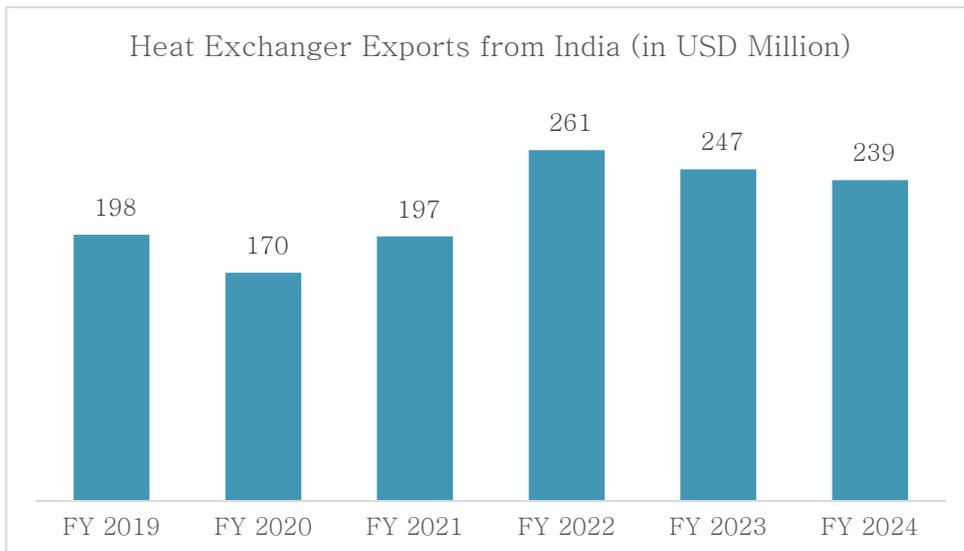
## Exports

Annual export of heat exchangers from India reached USD 239 million in FY 2024. This includes shell & tube type, plate type, and spiral type heat exchangers. Between FY 2019 and 2024, the value of heat exchangers exported from India increased by a CAGR of 4%. Compared to FY 2023, the value of heat exchangers exported from India dropped by nearly 3.3%. Muted demand growth in key export markets contributed to this decline in exports.

In FY 2024, nearly 43% of heat exchanger exports from India were concentrated in 5 markets, namely the USA, China, UAE, Singapore, and Brazil. Among these USA was the largest export market for the Indian heat exchanger industry, accounting for nearly 16% of total exports. Outside of these five markets, the Indian heat exchanger industry has made rapid strides into the African market and Middle east regions.

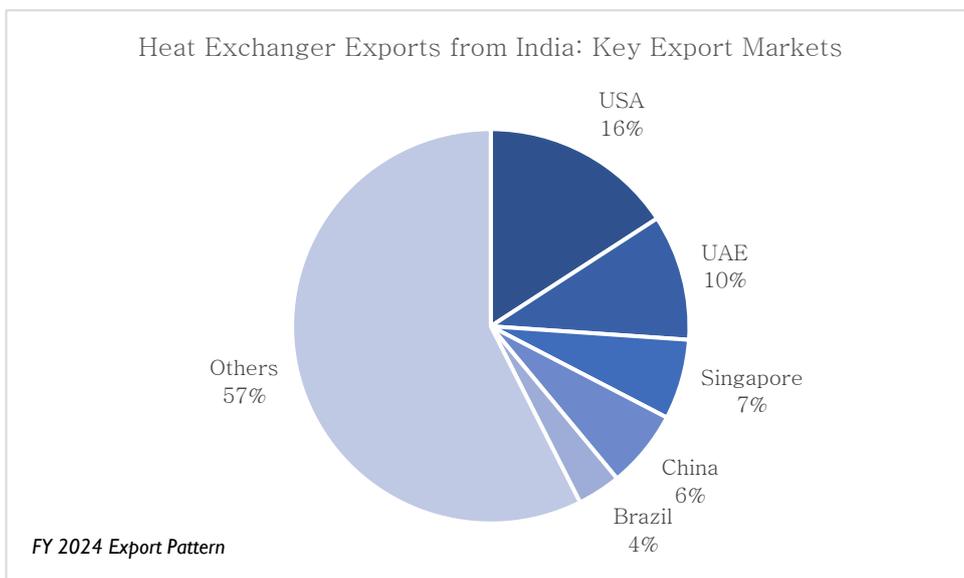
<sup>8</sup> HS Codes 84195011, 84195012, 84195013, 84195019, 84195091, 84195092, 84195093, 84195099

Although India is yet to become a key player in the global heat exchanger market, the domestic industry has made rapid strides in the global market – penetrating developed markets as well as developing markets alike.



This highlights the unique capability of the industry to develop products that meet global quality standards at a competitive price. The lower cost of production, while adhering to global quality standards has helped several industries in India to penetrate global market, and heat exchangers to appear to be benefitted by this model.

Source: Directorate General of Foreign Trade

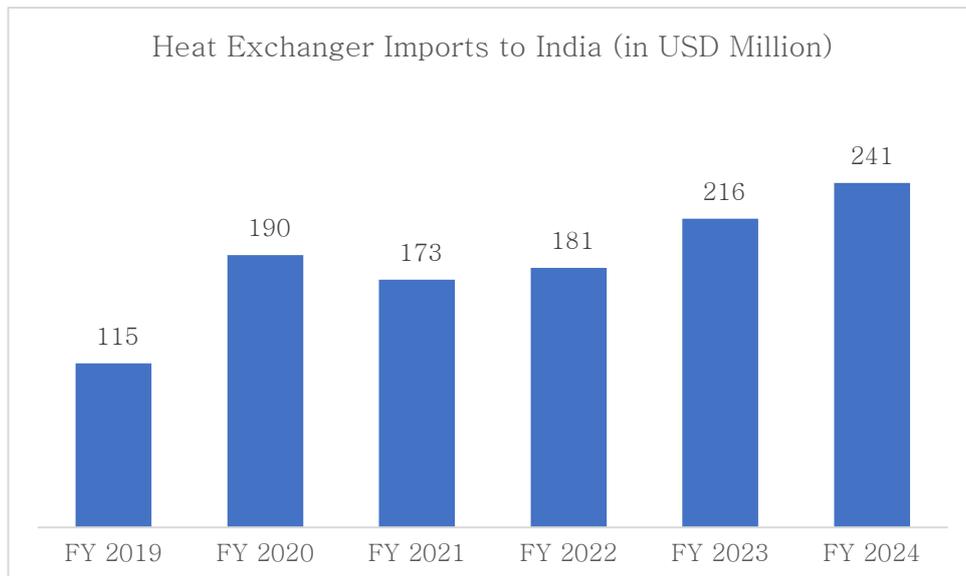


Source: Directorate General of Foreign Trade

### Imports

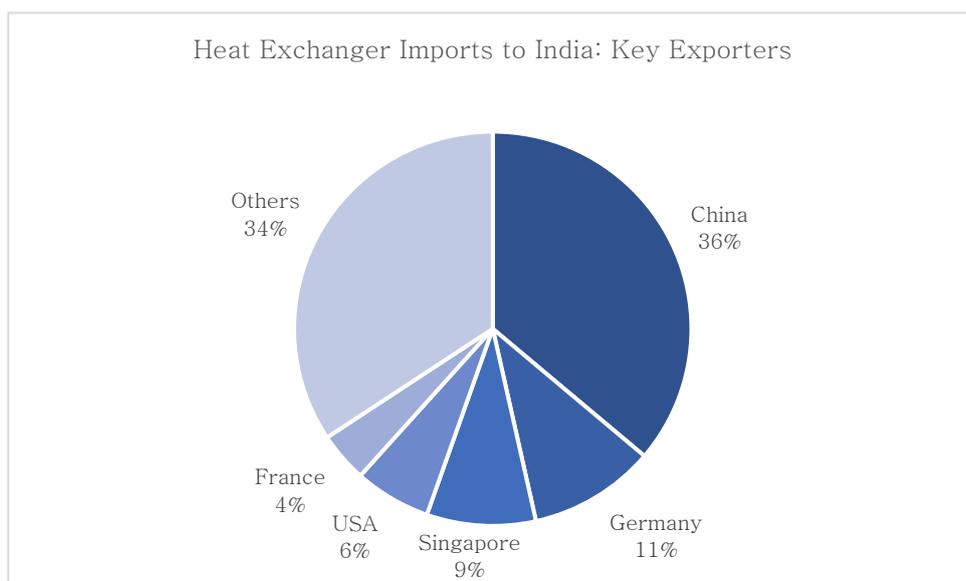
Approximately USD 241 million worth of heat exchangers were imported to India in FY 2024. Heat exchangers import from India has increased from approximately USD 142 million in FY 2010, the annual value of heat exchangers imported to India dropped to nearly USD 100 million in FY 2018 before reaching USD 241 million in FY 2024.





Source: Directorate General of Foreign Trade

Nearly 66% of value of heat exchangers imported to India in FY 2024 came from five markets – China, USA, Germany, Singapore and France. Among these China was the largest exporter, accounting for nearly 36.2% of total heat exchanger imports.



Source: Directorate General of Foreign Trade



## Emerging Trends & Challenges in Indian Heat Exchanger Industry

### Trends

- **Hybrid heat exchangers:** There is also the growing trend of adopting hybrid heat exchangers which are more efficient and flexible than the traditional models. These are based on a multi-flexible configuration platform and designed to operate under extreme conditions where other heat exchanger technologies can fail or reduce operational efficiency. They are designed for easy cleaning as the fouling medium can flow through the tube side, which is accessible for mechanical cleaning. Heavy-duty or customized heat exchangers are generally utilized by large industrial consumers whereas portable heat exchangers generally cater to the residential or small commercial establishments.
- **Better energy efficient models:** With a growing emphasis on energy conservation and sustainability, heat exchangers have seen advancements in energy efficiency. This includes improved designs, better fluid dynamics, and the integration of advanced heat transfer technologies to minimize energy consumption and optimize heat recovery. Further, technological advancements such as tube inserts in heat exchangers and advances to improve energy efficiency, life cycle cost, durability, compactness and other features will complement the growth of the market.
- **Advancement heat exchanger design & technology:** The heat exchanger market in India is witnessing significant growth, primarily driven by technological advancements that have transformed traditional designs into highly efficient systems. Modern heat exchangers now incorporate advanced fluid dynamics and modular designs, providing flexibility, scalability, and ease of maintenance. These innovations optimize flow paths and maximize heat recovery, significantly improving energy efficiency. Material advancements, such as the use of new alloys and composites, have enhanced corrosion resistance and heat transfer properties, making heat exchangers more durable and effective in various industrial applications.
- **Modular heat exchanger:** Such designs have gained popularity due to their flexibility and ease of installation. Modular units can be combined and customized to suit specific heat transfer requirements, enabling scalability and easier maintenance.
- **Usage of new materials:** Advancements in materials science, including the use of new alloys and composites materials that offer greater corrosion resistance, higher strength, and better heat transfer properties.

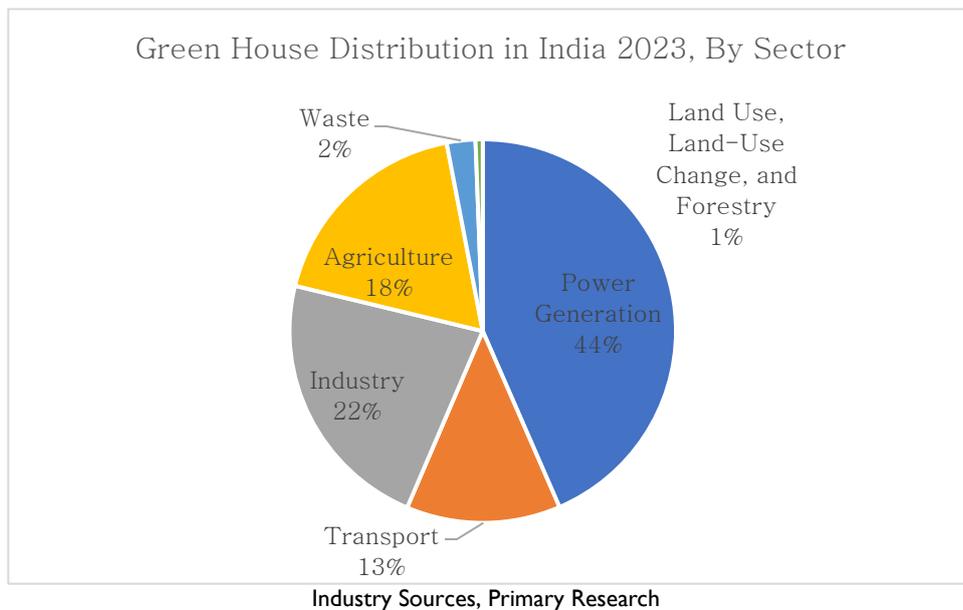


## Challenges

Fouling on heat exchangers reduces heat transfer efficiency, leading to higher energy consumption and greenhouse gas emissions, which could hamper the growth of the heat exchanger market in India in the upcoming years. Raw material price fluctuations could also affect the growth of the heat exchanger market due to economic conditions, exchange rates, and supply chains.

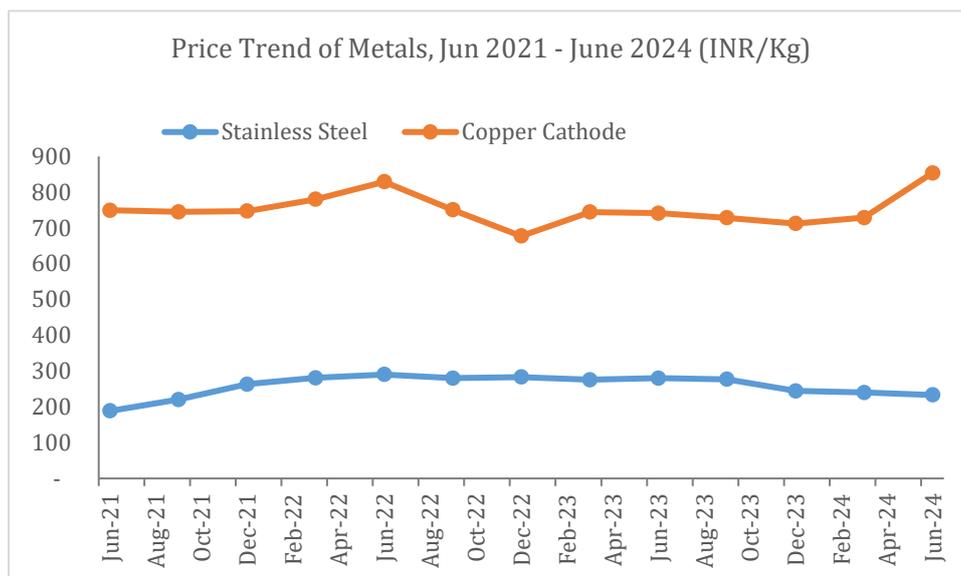
## Environmental Impact of Fouling on Heat Exchangers

Fouling in heat exchangers is a critical issue that arises from various factors, including the properties of the fluids being processed, temperature and pressure conditions, the presence of impurities, and the overall design and operation of the heat exchanger. This fouling reduces heat transfer efficiency, leading to increased energy consumption, often sourced from fossil fuels, which in turn results in higher greenhouse gas emissions. Additionally, the need for more frequent cleaning and maintenance due to fouling requires extra resources such as water, energy, and cleaning equipment, further exacerbating the environmental impact, and potentially hindering the growth of the Indian heat exchanger market.



## Fluctuation in Raw Material Prices

The heat exchanger industry in India is also significantly affected by the fluctuating prices of essential raw materials like copper, aluminium, steel, and other metals. These price volatilities are driven by a range of factors, including economic conditions, exchange rates, and supply chain dynamics, which can negatively impact manufacturers. Such fluctuations can lead to delays or even cancellations of large capital projects, posing a risk to the growth and stability of the heat exchanger market in the country.



Source: CMIE Industry Outlook  
 Stainless Steel; Average price of stainless steel coil SA 240 Type 204 has been taken as a reference

### Tightening of Capital Investment Sentiments

The demand for heat exchanges is closely tied to the capital investment sentiment prevalent in the industrial sector. An optimistic sentiment with a supportive credit environment is critical for the industry. On the one hand the optimistic scenario creates a demand while on the other hand a favourable credit environment address the challenge of high capex requirement that is required for putting up heat exchangers. At present the business environment as well credit scenario in India is favorable. However, any deterioration of these external environment will have an impact on the overall demand scenario.



## Regulatory Landscape

### Capital Goods

The phasing out of concessional import duty on a wide range of capital goods and project imports in the Union Budget 2022-23 is a boost for the domestic capital goods industry by protecting it from low-cost imports and in turn help in creating a level playing field for domestic manufacturers. Additionally, import concessions for select raw materials will make it easier for the domestic manufacturers to access input materials in a cost-effective manner.

Continued investment on infrastructure development, anchored by PM Gati Shakti Master Plan would create strong demand for a wide range of capital and engineering goods from various sectors, especially from roads, railways, and waterways, where capacity expansion programs announced would trigger a demand for construction equipment and heavy machinery. The proposed battery swapping policy could create demand for specialized capital goods from electric mobility ecosystem, for which domestic manufacturing capability is nascent, and thus, such demand would be largely met through imports in near-term, supported by the continuation of exemption on import of specialized machinery. However, given the long-term demand generating potential of the industry, the domestic capital goods industry will have to invest in expanding its technical capabilities.

### National Goods Policy 2016

National Capital Goods Policy, released in 2016, is considered to be the major policy measure that would shape capital goods sector in the coming years. This policy is in line with the Government's objective of increasing the contribution of capital goods to manufacturing output from the current 12% to 20% by 2025. Achieving this objective would result in the value of production of capital goods increased from the current level of INR 230 thousand crores to INR 750 thousand crores by 2025.

### Atmanirbhar Bharat Abhiyan

According to the announcement by Prime Minister Narendra Modi, the Atmanirbhar Bharat economic package is worth INR 20 lakh crore, equivalent to nearly 10% of the country's GDP. The policy focuses on five key aspects: economy, infrastructure, system, vibrant demography, and demand. The core theme of the package is to be vocal about local products by promoting consumption of local products as well as making them global. The package has five phases, with each phase focusing on specific sector/ aspect. Phase I focuses on MSMEs, Phase II on migrants & poor, phase III on agriculture, phase IV on new growth horizons and phase V on government reforms & enablers.

The primary objective of this economic policy is to make India self-reliant. It could be termed as an extension of the Make in India program, which again was focusing on attaining self-sufficiency in the manufacturing sector

The phase IV of the economic package includes governance measures like fast tracking of investment clearances, ranking of states in terms of investment attractiveness, and ranking of industrial parks. These



measures are expected to showcase the investment potential to foreign investors and help facilitate investments in the country. The anticipated impact of the measures outlined in this phase is a pick-up in capital investment, which in turn would trigger economic growth. The easing of investment norms and clearances would help revive corporate investments, which in turn would be a key factor in driving up the demand for capital goods.

### Key Regulations

**The Indian Boiler Regulations (IBR):** The Indian Boiler Regulations (Administered by the Central Boiler Board (CBB), IBR sets guidelines for the design, construction, operation, and maintenance of boilers and pressure vessels, which includes heat exchangers. Compliance with IBR is mandatory for heat exchangers operating above specified pressure and temperature limits.

**Bureau of Indian Standards (BIS):** BIS is the national standards body responsible for the formulation and implementation of various Indian standards Relevant standards for heat exchangers in India include:

- IS 4503: Indian Standard for shell and tube heat exchangers.
- IS 10787: Indian Standard for plate heat exchangers.
- IS 6034: Indian Standard for air cooled heat exchangers.

### Energy Conservation Act (EC Act)

The EC Act and the associated Bureau of Energy Efficiency (BEE) regulate energy efficiency in India Heat exchangers may need to comply with BEE's energy efficiency labelling requirements or specific energy saving guidelines to promote energy conservation.

### EN 12255

EN12255 is the European standard that provides guidelines for the design, construction, and testing of shell and tube heat exchangers. It covers both the mechanical and thermal aspects of heat exchanger design, including materials, pressure, temperature, dimensions, and performance.

### Tubular Exchanger Manufacturers Association (TEMA)

TEMA standards are recognized as the authoritative source for the design and manufacturing of shell and tube heat exchangers. The TEMA standards are classified into three categories -

- Class B: For Chemical Process Service
- Class C: For General Commercial Application
- Class R: For Severe Requirements of Petroleum Processing

### ASME Section VIII

- The American Society of Mechanical Engineers (ASME) publishes the Boiler and Pressure Vessel Code, which includes ASME Section VIII. The specifications for pressure vessel design, fabrication, inspection, testing, and certification are set out in Section VIII. Under ASME Section VIII, Division



I the construction of heat exchangers falls under the general requirements for pressure vessels; this specifies design and construction details for heat exchangers, including tube sheets, tubes, headers, and other components, are covered within the appropriate sections and subsections of Division I.

- The design of tube sheets is typically addressed in UG 34 of ASME Section VIII, Division I which covers the requirements for tube sheets, flanges, and tube sheet joints.
- UHX-1 UW-2 provides guidelines for the design, construction, welding of heat exchangers.

### **Pressure Equipment Directive (PED)**

The Pressure Equipment Directive (PED) applies to various types of pressure equipment, including heat exchangers. Heat exchangers are considered pressure equipment under the PED if they operate with a maximum allowable pressure greater than 0.5 bar and meet the criteria defined by the directive.

Heat Exchanger under PED should Consider -

- **Design and Manufacturing:** Heat exchangers must be designed and manufactured in accordance with the essential safety requirements (ESRs) outlined in the PED. These requirements cover aspects such as design calculations, material selection, fabrication methods, welding procedures, and non-destructive testing.
- **Conformity Assessment:** Heat exchangers must undergo a conformity assessment procedure to demonstrate compliance with the PED. The assessment typically involves the involvement of a Notified Body, which is a third-party organization designated by an EU Member State.
- **Documentation and Technical File CE Marking:** Manufacturers of heat exchangers must prepare a technical file that includes all relevant documentation related to the design, manufacture, and conformity assessment of the equipment. This file should be kept available for inspection by the authorities. Moreover, after heat exchanger successfully completes the conformity assessment and complies with the PED's requirements, it can be affixed with the CE marking.

### **AD-2000**

AD-2000 is not a specific standard for heat exchangers but a German technical regulation that provides guidelines for the design and fabrication of pressure equipment, including heat exchangers. AD-2000 provides detailed requirements for materials, design calculations, manufacturing processes, testing, and certification of pressure equipment, including heat exchangers.

### **Central Pollution Control Board (CPCB)**

CPCB is responsible for regulating environmental aspects related to industrial processes, including heat exchangers. Compliance with CPCB guidelines for emissions, effluents, and waste management is crucial to ensure environmental protection.



## **ISO 9001: 2015**

ISO 9001 2015 is a globally acknowledged standard that defines the requirements for establishing, implementing, maintaining, and continuously improving a robust quality management system (QMS) within an organization.



## Competitive Landscape

Heat exchanger industry is capital and technology intensive, which creates a steep entry barrier. The industrial landscape in India (and across the globe) is changing at a fast pace as digital technology are integrating into mainstream manufacturing. This has created the need for superior capital goods & industrial machinery which can fit into this evolving landscape as well as delivery superior output. In the case of heat exchanges, the demand is for superior efficiency and heat capture. Hence, now more than ever, the manufacturers need to invest in R&D to improve their manufacturing capability. This exercise translates into higher capex, which deters new entrants.

Even among existing players, there is a high pressure to innovate and widen their product offering. As conventional manufacturing techniques make way to newer methods, consumers are increasingly demanding better products which can deliver tangible results. To stay relevant heat exchanger manufacturer will have to engage with their consumers, identify the emerging trend, and devise a future growth strategy. These developments are changing the nature of the industry, making it more dynamic. Under this changing scenario, existing players must invest in capital, skill / talent, and innovation to stay relevant and maintain / increase market share.

### Key Global Players

Company	Profile
Alfa Laval AB	Alfa Laval is a Sweden based capital goods manufacturer. The Company manufactures & sells boilers, decanters, water treatment systems, fluid handling systems, and heat exchangers. The Company focuses primarily on energy, environment, food, and marine industry. Globally, the Company has nearly 37 manufacturing units.
Kelvion Holdings GmbH	Kelvion is one of the leading manufacturers of heat exchangers in the world. The Company manufactures compact fin heat exchangers, shell & tube heat exchangers, and plate heat exchangers. In addition, Kelvion also supplies transformer cooling system, and diesel & gas engine cooling.

## Indian Landscape

Key Factors	Level	Description
<b>Supplier's Power</b>	Low	Supplier power is low in the Indian heat exchanger market as OEMs can easily source necessary raw materials from numerous local suppliers; thus, not creating a supplier monopoly in the market.
<b>Entry Barriers</b>	High	High entry barriers exist in the heat exchanger industry owing to the significant capital investment required for manufacturing facilities, machinery, and equipment procurement, along with the requirement of vast sales and service network to penetrate the market.
<b>Buyer's Power</b>	High	India has numerous companies that offer heat exchangers. Multiple suppliers provide similar products, thereby offering buyers a wide range of options at competitive prices. As a result, buyers have a high bargaining power in the market.
<b>Substitutes</b>	Moderate	The threat of substitutes in the market is moderate since cooling towers and heat pumps could be used as alternatives. However, these substitutes cannot completely replace the use of heat exchangers.
<b>Competitive Rivalry</b>	High	Competition is intense in the market due to the presence of numerous international players, along with well-established players such as Alfa Laval, Danfoss, Heatex Industries Limited, and HRS Process Systems Ltd among others.

## Key Players in India

Company	Profile
Alfa Laval India Private Limited	Wholly owned subsidiary of Sweden based Alfa Laval AB. The Indian arm, established in 1937, manufactures and sells industrial boilers, heat exchangers, decanters, separators and other related industrial equipment. The Company has two manufacturing plants (in Pune & Satara).



	<p>In heat exchanger segment, their product offerings include: Shell &amp; tube type, plate type, finned type, and tube in tube type.</p> <p>Alfa Laval India cater to HVAC, pharmaceuticals, power generation, food &amp; beverages, marine &amp; transportation, and steel sector.</p> <p>Annual installed manufacturing capacity of heat exchangers is estimated to be nearly 10,000 units per year.</p>
REX Heat Exchanger Private Limited	<p>The Company is based in Vadodara Gujarat and sells industrial products like pressure vessels, condensers, oil coolers, apart from heat exchangers.</p> <p>In heat exchangers, the Company manufactures air cooled, U tube bundled, double pipe, and shell &amp; tube type heat exchangers.</p> <p>The key consumer segment catered to include power generation, oil &amp; gas, and chemical manufacturing.</p>
Danfoss Power Solutions India Private Limited (Danfoss India)	<p>The Company is a wholly owned subsidiary of Denmark based Danfoss. In India the Company manufactures and sells power solutions, climate solutions for heating &amp; cooling, and drivers. Heat exchangers are sold under the climate solutions for heating &amp; cooling vertical.</p> <p>The Company manufactures Brazed, welded, gasketed, and micro channel heat exchangers. They cater to HVAC, food &amp; beverage, and industrial refrigeration segment.</p> <p>Danfoss India has the capacity to manufacture nearly 2,500 heat exchangers per annum.</p>
Kelvion India Private Limited (Kelvion India)	<p>Kelvion India is the subsidiary of Germany based Kelvion Holdings GmbH. The Indian subsidiary, based in Mumbai, manufactures a wide range of heat exchangers – brazed, shell &amp; tube, compact fin, single tube, and exhaust heat exchangers.</p> <p>In India, Kelvion supplies heat exchangers primarily to oil &amp; gas, petrochemicals, food &amp; beverage, and HVAC industries.</p> <p>Annual production capacity of Kelvion – specific to heat exchangers – is approximately 2,500 units per annum</p>



Prijai Heat Exchanger Private Limited	Prijai Heat Exchangers Pvt Ltd was incorporated in 1993 in Thane, Maharashtra. The Company operates manufacturing facilities in Thane, Dadare and MIDC Rabale. Prijai manufactures condenser & cooling coils, air-cooled condensing units, and copper fittings & systems.
Spirotech Heat Exchangers Private Limited	Spirotech Heat Exchanges, which was founded in 1994, became a part of the LU-VE Group in 2016. The company, based in Bhiwandi Rajasthan is a manufacturer of static heat exchanger components, and supplies to refrigeration, air conditioning and household appliances market. Spirotech is also a leading exporter of heat exchanger components, exporting to the US and Europe.

### Financial Indicators of Key Players

#### Alfa Laval India Private Limited

Particulars (INR Mn)	FY 2021	FY 2022	FY 2023
Total Income	12,171	13,778	17,284
Revenue from Operations	11,638	13,211	16,873
Growth in Revenue Y o Y	-14.1%	13.5%	27.7%
EBITDA	2,551	3,300	3,097
EBITDA Margin	21.0%	24.0%	17.9%
Growth in EBITDA Y o Y	-18.2%	29.3%	-6.2%
Profits After Tax	1,915	2,215	2,102
PAT Margin	15.7%	16.1%	12.2%
Growth in PAT Y o Y	-.58%	15.7%	-5.1%

#### Danfoss Power Solutions India Private Limited

Particulars (INR Mn)	FY 2021	FY 2022	FY 2023
Total Income	3,482	4,360	4,583
Revenue from Operations	3,488	4,336	4,517



Growth in Revenue Y o Y	27.6%	24.3%	4.2%
EBITDA	486	695	653
EBITDA Margin	13.9%	15.9%	14.3%
Growth in EBITDA Y o Y	18.6%	43.1%	-6.0%
Profits After Tax	213	403	350
PAT Margin	6.1%	9.2%	7.6%
Growth in PAT Y o Y	22.1%	89.6%	-13.2%

### Kelvion India Private Limited

Particulars (INR Mn)	FY 2021	FY 2022	FY 2023
Total Income	1,843	3,346	2,922
Revenue from Operations	1,815	3,261	2,908
Growth in Revenue Y o Y	-49.1%	79.7%	-10.8%
EBITDA	-1,092	73	176
EBITDA Margin	-59.3%	2.2%	6.0%
Growth in EBITDA Y o Y	-107.8%	-106.7%	140.1%
Profits After Tax	-871	-75	-202
PAT Margin	-47.3%	-2.2%	-6.9%
Growth in PAT Y o Y	7.1%	-91.4%	169.5%

### Prijai Heat Exchangers Private Limited

Particulars (INR Mn)	FY 2021	FY 2022	FY 2023
Total Income	738	1,324	1,883
Revenue from Operations	734	1,314	1,874
Growth in Revenue Y o Y	-23.7%	79.1%	42.6%
EBITDA	22	102	131
EBITDA Margin	3.0%	7.7%	7.0%
Growth in EBITDA Y o Y	-56.2%	357.4%	29.4%



Profits After Tax	-14	42	54
PAT Margin	-1.9%	3.2%	2.9%
Growth in PAT Y o Y	-313.7%	-404.8%	29.9%

### Rex Heat Exchangers India Private Limited

Particulars (INR Mn)	FY 2021	FY 2022	FY 2023
Total Income	2.8	7.1	8.7
Revenue from Operations	2.7	7.1	8.2
Growth in Revenue Y o Y	78.8%	160.8%	16.3%
EBITDA	0.4	1.4	1.1
EBITDA Margin	16.0%	19.2%	12.4%
Growth in EBITDA Y o Y	-140.9%	210.3%	-21.7%
Profits After Tax	0.1	0.8	0.6
PAT Margin	2.6%	11.4%	6.9%
Growth in PAT Y o Y	-105.2%	1021.5%	-25.6%

### Spirotech Heat Exchangers Private Limited

Particulars (INR Mn)	FY 2021	FY 2022	FY 2023
Total Income	3,031	4,279	4,402
Revenue from Operations	3,002	4,257	4,358
Growth in Revenue Y o Y	-8.6%	41.8%	2.4%
EBITDA	667	593	492
EBITDA Margin	22.0%	13.9%	11.2%
Growth in EBITDA Y o Y	0.4%	-11.2%	-17.0%
Profits After Tax	427	319	244
PAT Margin	14.1%	7.5%	5.6%
Growth in PAT Y o Y	-2.9%	-25.2%	-23.5%



## Growth Forecast:

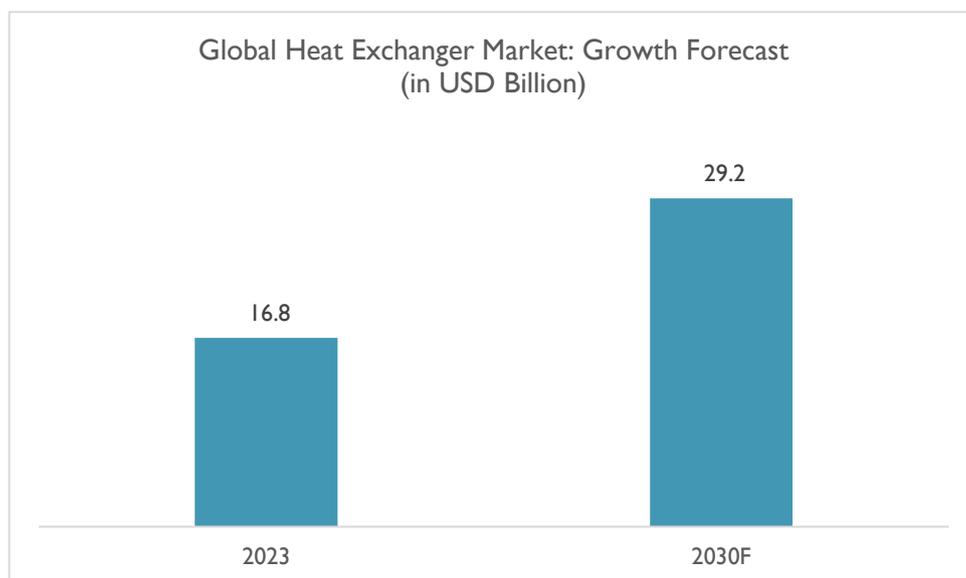
Heat exchanger is one of the widely used machinery within the broader capital goods industry, finding application across a broad range of process industries. Due to this ubiquitous nature of the product, its demand is closely linked to the industrial activity happening in an economy, as well as the capital investment landscape. Hence, capital expansion projects in the manufacturing sector as well as industrial activity tends to be a good barometer to identify the demand for heat exchangers.

## Global Scenario

Consolidated capital expenditure spending of S&P 500 companies grew by nearly 20% in 2022, over the previous year. For the year 2023, the capex spending by this segment is expected to be nearly 6%, with the lower growth rate attributed to the evolving uncertainties and recessionary fears across key developed economies. Despite this, the long-term outlook with respect to capital spending appears to be optimistic. Factors like transition to clean energy, increase in automation in manufacturing, and integration of digital technologies to industrial sector are all expected to favour capital spending.

Capital investment pattern in the coming years, specifically in developed markets, would be characterized by upgradation in manufacturing infrastructure. Capital spending is expected to be strongest in Asia Pacific market, led by increased spending in China and India.

By 2030, the global heat exchanger market is expected to reach USD 29.2 billion, up from the current size of USD 16.8 billion. This translates into a CAGR of 8%, higher than the historical growth that was recorded during 2017 – 2019. Growth would be strongest in the APAC market, which is expected to increase by a CAGR of nearly 9.6%.



D&B Analysis, Insights from Primary Survey

## India Scenario

Indian economy recovered strongly from the impact of Covid-19 during the second half of FY 2022, and this recovery continued in FY 2023. The Country has once again become one of the fastest growing economies in the world. Although there are recessionary fears arising across major developed economies, the economic growth story in India is expected to continue.

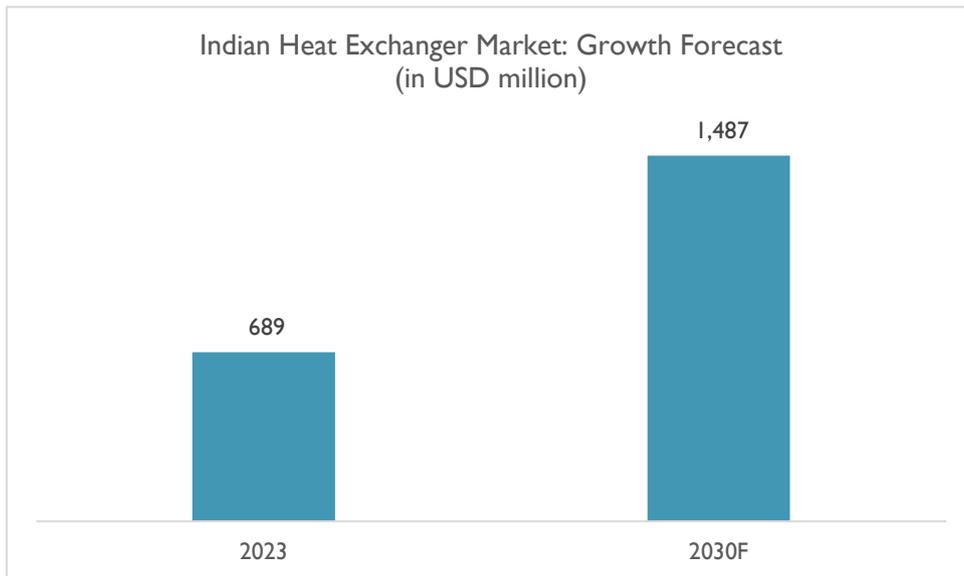
Economic growth in India in the coming years would be underpinned by following factors – Government focus on improving the manufacturing infrastructure, and improvement in credit availability for the corporate sector. In addition, the revival in demand – for consumer & industrial products – post Covid-19 pandemic would further accelerate economic growth. All these factors are expected to strengthen the industrial activity and encourage capital spending.

### **Government focus on improving manufacturing capability**

Indian Government is taking steps to modernize and develop the domestic manufacturing capability, with the intention of increasing its contribution to GDP, from the current 15% to 25% by FY 2025. Flagship schemes like Make in India, Production Linked Incentive (PLI) scheme and Atmanirbhar Bharat was launched with the intention of meeting this goal.

The primary objective of these policies to import substitution (substituting imports with domestically manufactured goods), and later on become an export hub. This would involve substantial expansion in domestic manufacturing capabilities – across a wide range of industries. Schemes like Make in India and PLI is focused on multiple industries, hence the capacity expansion anticipated would be industry wide and not concentrated in select sectors.

These developments, together with improvement in capital investment scenario is expected to translate into modernization & expansion of domestic manufacturing capability. This expansionary phase would create demand for a wide range of capital goods, and heat exchangers – because of its ubiquitous application in process industries – is one of the major product segments to benefit. These developments would help the domestic heat exchanger market to increase from its current size of USD 689 million to USD 1,487 million by 2030. This would translate into a compounded growth rate of 11.6%.

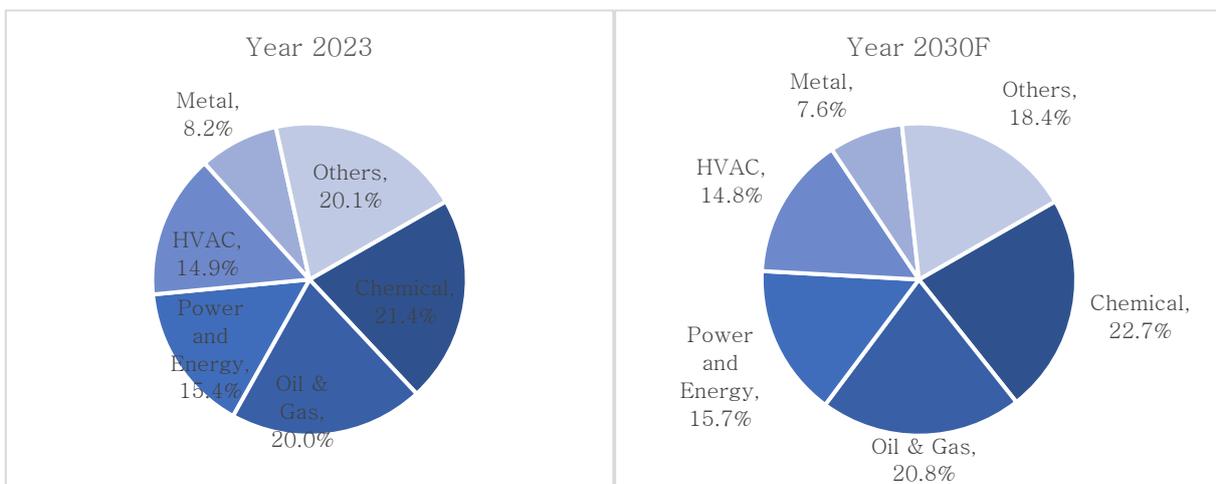


D&B Analysis, Insights from Primary Survey

### By End Use Industry

Chemical manufacturing is the predominance consumer of heat exchanger in India, followed by oil & gas industry. Chemical industry is expected to remain the largest consumer of heat exchangers, as the ambitious capacity expansion programs planned in chemical industry would translate into higher demand for heat exchangers. India already possess a strong chemical manufacturing hub – from basic chemicals to petrochemicals to specialty chemicals. The Government is focusing on strengthening India’s position as a global chemical manufacturing hub and increase the country’s share in global chemical trade. Multiple policies targeted various segments of the chemical industry – pharmaceuticals/specialty chemicals – has been announced and the coming years would witness strong activity in terms of capacity expansion.

Backed by these factors, the value of heat exchangers consumed by the Indian chemical industry is expected to reach nearly USD 337.6 million in 2030, translating into a CAGR of 12.8%.



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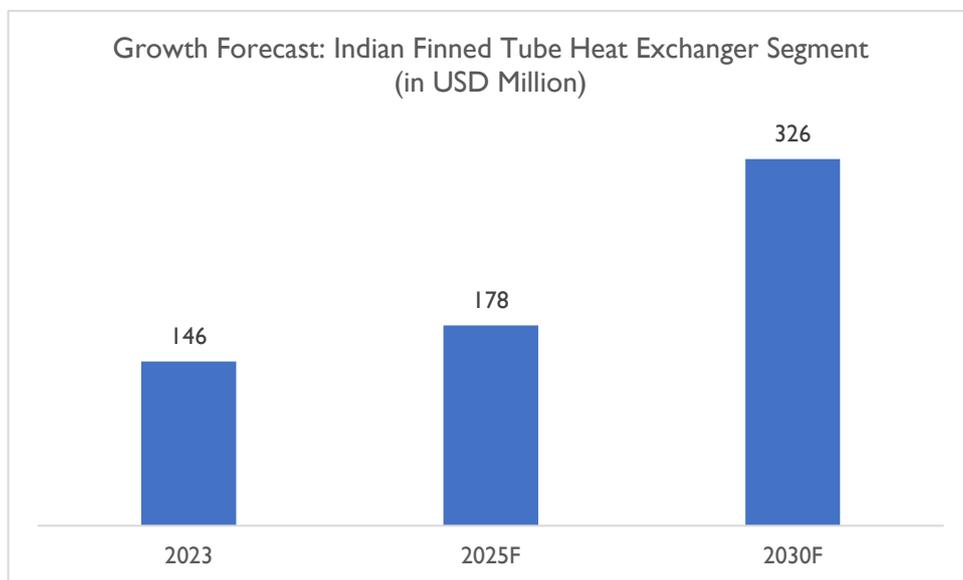


## Growth Forecast in the Indian Finned Tube Heat Exchanger Market

HVAC applications is expected to play a key role in expanding the demand for finned tube heat exchangers in India. The emerging landscape in real estate construction, manufacturing, warehousing, and transportation all points to a continuation of HVAC demand. It is the strong demand from these sectors that is expected to drive the annual turnover in Indian HVAC market from USD 9.1 billion in 2023 to nearly USD 23.5 billion in 2029.

This demand growth would translate into an increase in the production of HVAC equipment, creating demand for all the components & accessories used. Since heat exchanger is an integral part of HVAC equipment, the growth in production of HVAC systems would be most favourable for heat exchanger industry.

On the back of this supportive demand landscape, the annual turnover in finned tube heat exchanger, the annual turnover is set to increase from USD 146 million in 2023 to nearly USD 326 million in 2029, more than doubling in size by growing at a CAGR of 12.6%.



D&B Analysis, Insights from Primary Survey